U.S. GEOLOGICAL SURVEY FEDERAL-STATE COOPERATIVE WATER-RESOURCES PROGRAM

FISCAL YEAR 1994

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Open-File Report 95-332

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by B.K. Gilbert

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Reston, Virginia
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by Bruce K. Gilbert

ABSTRACT

The Federal-State Cooperative Program is a major U.S. Geological Survey (USGS) activity for the collection, analysis, and reporting of information on the quantity, quality, and use of the Nation's water resources. The fundamental characteristic of the program is that most of the work is undertaken by the USGS through joint-funding agreements, with State, regional, and local agencies providing at least one-half the funds. The main objectives of the program are (1) to collect, on a systematic basis, data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources; and (2) to appraise the availability and the physical, chemical, and biological characteristics of surface and ground water through data analysis and interpretive water-resources investigations and research. During fiscal year (FY)1994, Cooperative Program activities were underway in offices in every State, Puerto Rico, and several territories in concert with about 1,100 cooperating agencies. In FY 1994, Federal funding of $63.5 million was matched by cooperating agencies, which also provided more than $25 million unmatched for a total program of about $152 million. This amounted to nearly 40 percent of the total funds for the USGS's water-resources activities. This report presents examples of FY 1994 investigations, as well as updated information on hydrologic data collection activities.

INTRODUCTION

Reliable supplies of suitable quality water are necessary to the health and well-being of America's people, cities, and businesses. Numerous Federal, State, regional, and local agencies share keen interests in appraising the Nation's water resources and seeking solutions to water-related problems. Because of their varying missions and areas of responsibility, these many agencies hold diverse perceptions of approaches, needs, and priorities. The U.S. Geological Survey's (USGS) Federal-State Cooperative Program accommodates this diversity through joint planning and funding (50:50 matching) of systematic studies of water quantity, quality, and use on a national basis. The Cooperative Program has contributed to water-resources knowledge for 100 years. From its earliest days, the Program has been responsible directly for the development of procedures for streamgaging, concepts of surface-water and ground-water flow, and analytical techniques for investigations of water quality.

Most areas are experiencing increasing demands on water supplies because of population growth, industrial expansion, or additional irrigation of cropland. Many places are subject to floods, and many parts of the country have been affected severely by drought, if not by chronic water shortages. In some locations, deteriorating quality of surface water and, especially, ground water is of major concern. Shifts in population, changes in land use, and transformations in mineral and food-production activities are placing new demands on existing water supplies. Competition for currently available supplies of water of acceptable quality has heightened dramatically among domestic, industrial, and agricultural users. As a result, a growing need exists for reliable hydrologic data to facilitate planning, development, and management of the resource.

The first USGS cooperative water-resources investigation was with the State of Kansas in 1895. In 1905, Congress appropriated funds specifically for cooperative studies, marking the official beginning of the program. In 1928, Congress gave formal recognition to the Federal-State partnership and limited the Federal financial contribution for cooperative water-resources studies to no more than 50 percent of the total funds for each investigation.

During fiscal year (FY) 1994, hydrologic data collection, interpretive investigations, and research were conducted under the provisions of the Cooperative Program by USGS Water Resources Division (WRD) personnel in offices in every State, in Puerto Rico, and in several territories in concert with about 1,100 cooperating agencies (see appendix A). The locations of principal WRD offices are shown in figure 1. State, county, and municipal agencies participate in the program, as do interstate-compact organizations, State universities, conservation districts, sanitary districts, drainage districts, flood-control districts, and other similar organizations. In FY 1994, Federal funding of $63.5 million was matched by non-Federal cooperating agencies, which also provided more than $25 million unmatched funding, for a total of about $152 million. This total constituted nearly 40 percent of the total funds for the USGS's program of water-resources activities (figure 2). The USGS Federal Program, funded by appropriations by Congress, amounts to about 30 percent, and reimbursements from other Federal agencies, collectively referred to as the USGS Other Federal Agency Program, amounts to about 31 percent.

This report has been prepared to describe some aspects of the Federal-State Cooperative Program, and to provide information on selected accomplishments in FY 1994. The report presents examples of recent investigations as well as updated information on hydrologic data-collection activities.

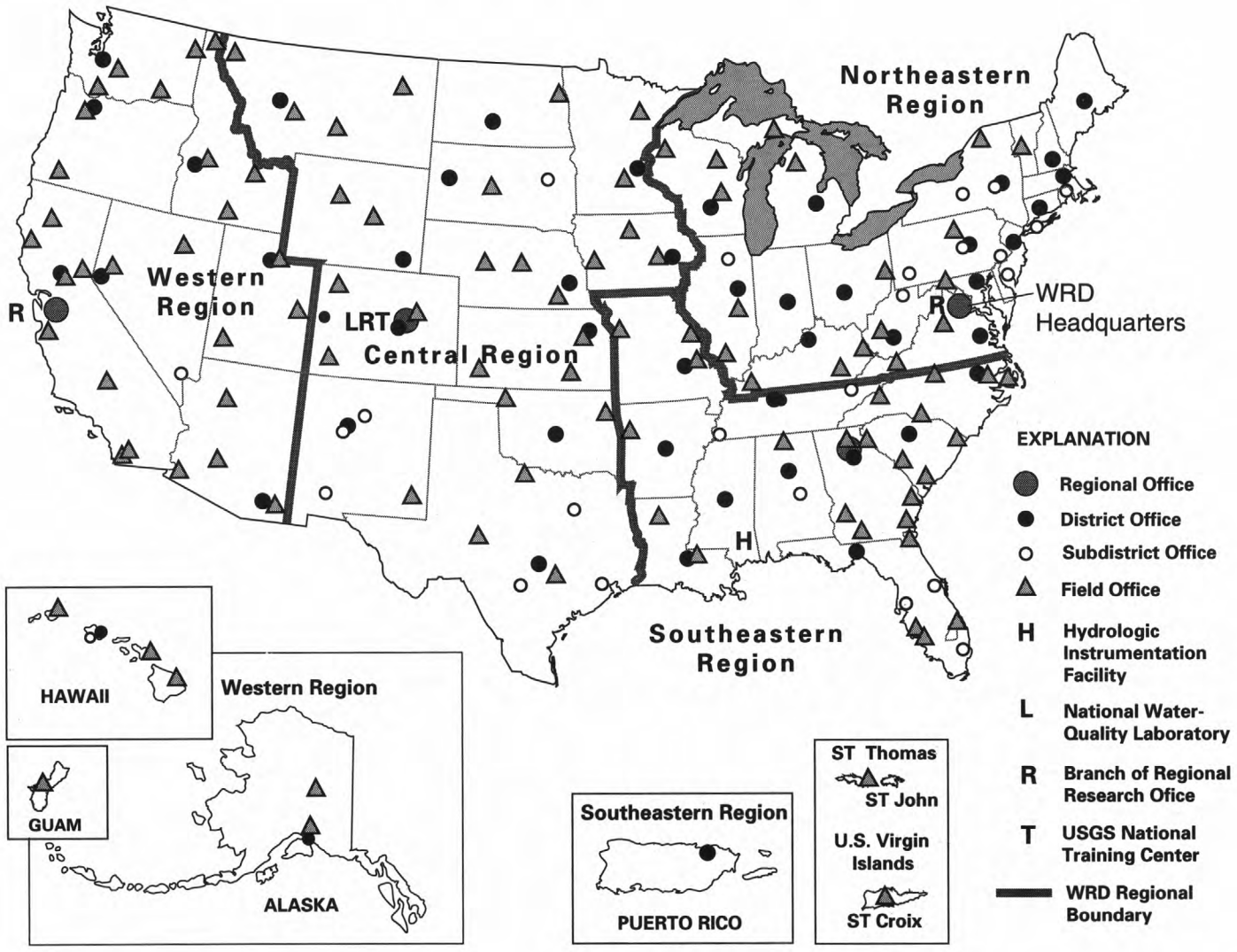
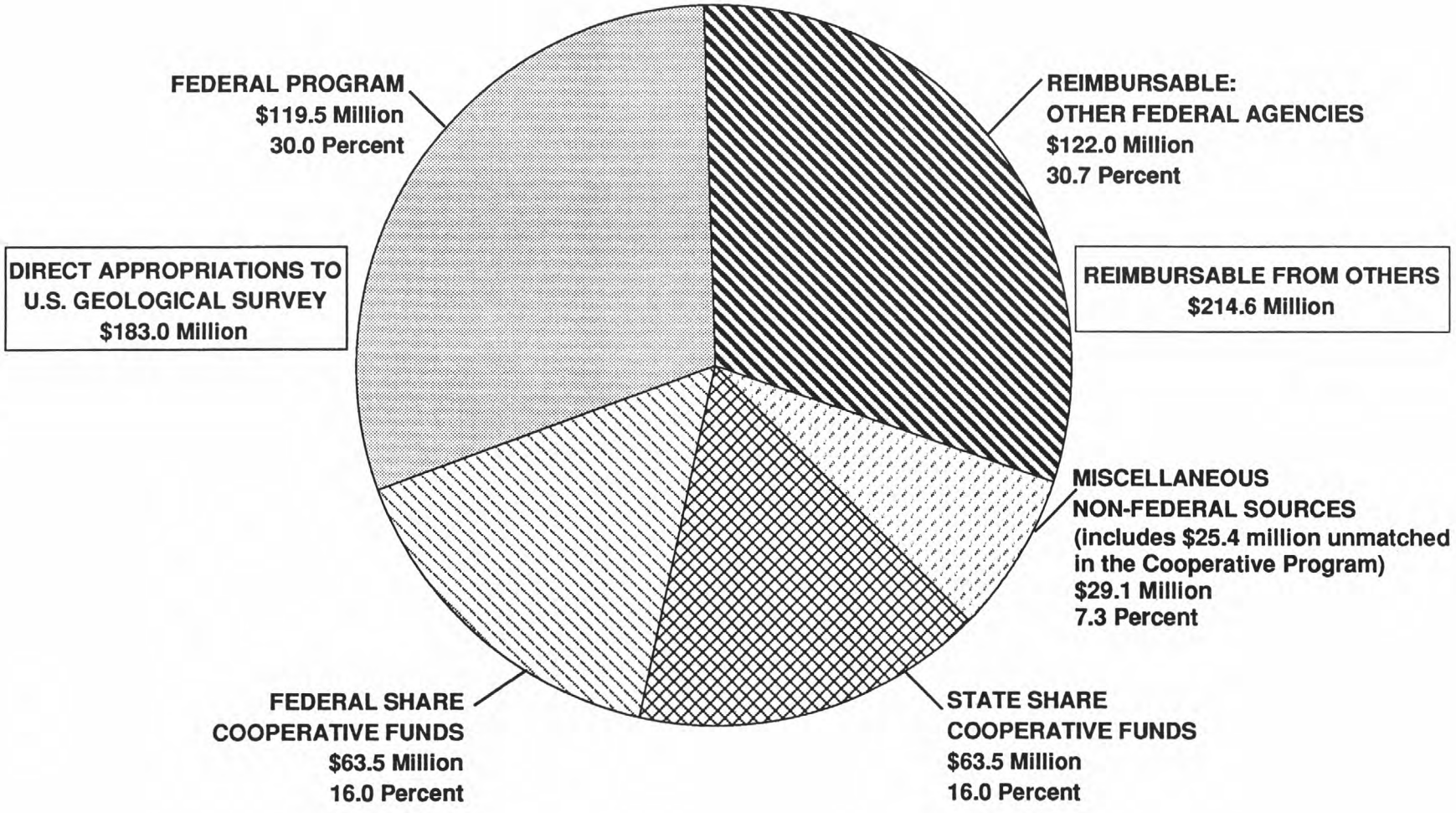


Figure 1. U.S. Geological Survey Water Resources Division regional boundaries and location of principal offices in fiscal year 1994



FY 1994 TOTAL $397.6 MILLION

Figure 2. Actual obligations of the U.S. Geological Survey Water Resources Division, fiscal year 1994 (Excludes $5.8 million in grants administered as part of the State Water Resources Research Institutes Program).

FUNCTIONS OF THE COOPERATIVE PROGRAM

In fulfilling its water-resources mission, the USGS performs four principal functions:

- It collects data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.

- It conducts analytical and interpretive appraisals to describe the occurrence, availability, and physical, chemical, and biological characteristics of surface and ground water.

- It conducts research in hydraulics, hydrology, and related scientific and engineering fields.

- It disseminates water data and the results of investigations and research.

The Federal-State Cooperative Program, a partnership between the USGS and State and local agencies, provides information that forms the foundation for many of the Nation's water-resources management and planning activities. In addition, the information may function as an early warning of emerging water-related problems. The fundamental characteristic of the Program is that local and State agencies provide at least one-half the funds, but the USGS does most of the work. Having the USGS do the work results in consistency of data-collection methodology and archival, and storage of the information in a common data base readily available to all. The knowledge gained in the studies is published and added to the growing body of information about the hydrology of the region or area.

Most work in the Cooperative Program is directed toward potential and emerging long-term problems, such as water supply, waste disposal, ground-water quality, floods, droughts, environmental protection. Data collected by USGS and the results of its studies are accepted by parties on both sides of disputes and furnish the basis required for interstate and international compacts, Federal law and court decrees, congressionally mandated studies, regional and national water-resources assessments, and planning activities.

A comprehensive and forward-looking program of hydrologic data collection and investigations is needed to provide the information necessary for the wise development and use of the Nation's water resources. The jointly planned and funded Cooperative Program provides assurance that the information needed to meet national and local needs will be produced and shared. Because rivers and aquifers cross jurisdictional lines, studies and data collected in one county or one State can have great value in adjacent counties or States. Having one agency involved in these studies provides compatible information that can be shared and compared from one jurisdiction to the next.

Within the Cooperative Program, typically about half of the funds support the collection of hydrologic data; the remaining half support hydrologic investigations and research. During FY 1994, the USGS was involved in about 490 investigations as part of the Cooperative Program. Investigations encompass areas that range in size from less than a square mile to multistate regions. In these investigations, USGS scientists compile and integrate information to define, characterize, and evaluate the areal extent, quality, and availability of the water resource. Since the early 1970's, there has been a large increase in the number of investigations that have emphasized water-quality issues,

such as aquifer contamination, river quality, storm runoff quality, and the effects of acidic rain, mining, urbanization, and agricultural chemicals and practices on the hydrologic system.

In 1977, the Congress of the United States recognized the need for uniform, current, and reliable information on water use and directed the USGS to establish a National Water-Use Information Program to complement the USGS data on the availability and quality of the Nation's water resources. As a result, the National Water-Use Information Program became part of the USGS's Federal-State Cooperative Program. As of 1994, all 50 States and Puerto Rico participate in the program at various levels of involvement.

PROGRAM PRIORITIES

Program priorities are developed in response to mutual Federal, regional, State, and local requirements. Thus, the USGS and cooperating agencies work together in a continuing process that leads to adjustments in the Program each year. Through the pooling of support, the USGS is able to conduct studies that lead to an improved understanding of the Nation's water resources to the mutual benefit of all levels of government--at substantial financial savings. The number of requests for scientific and technical assistance continues to grow especially from State agencies responsible for ground-water protection and for controlling and mitigating ground-water contamination. State offerings typically exceed Federal matching funds by as much as $20 million or more each year (almost $28 million in FY 1994), reflecting the increasing emphasis on water-quality issues as well as other concerns regarding the availability, distribution, and use of water resources.

The strong linkage between the Cooperative Program, the Federal Program, and the Other Federal Agency Program is clearly reflected in the program priorities identified for FY 1995. The National Water-Quality Assessment (NAWQA) Federal Program, for example, will continue to build on water-quality information developed over many decades within the Cooperative Program. Data collection supported by the Federal Program and by other Federal agencies provides additional information. Ground-water contamination studies funded by military and civilian Federal agencies are providing valuable hydrologic information and research in basic physical processes. These are but a few examples of the interdependence among programs.

The following topics have been identified as highest priority in developing the FY 1995 Cooperative Program:

WATER QUALITY--The need to define the quality of the Nation's water resources remains among the highest Cooperative Program priorities. An improved knowledge of ground-water processes, such as flow dynamics, solute transport, and the geochemical and biological reactions that alter, add, or remove constituents is needed to enhance the evaluation of and capability to predict the effects of human activities on ground-water resources. In some areas, additional studies to characterize and map aquifers are needed to define present ground-water quality conditions against which future changes can be evaluated and to protect water supplies from contamination.

The quality of the Nation's streams continues to be a high-priority concern of the Cooperative Program. Additional water-quality information is needed to evaluate the effects of land use--especially agricultural and urban land use--and ground-water discharge on overall stream quality, fluvial and bed-sediment chemistry, and stream biota. Investigations of the effects of nonpoint sources, particularly those related to agriculture and urbanization, are of special interest. River-basin models that simulate the physical, chemical, and biological processes occurring in the basin are needed to quantify these effects, to evaluate management alternatives, and otherwise support State watershed-management programs.

WATER SUPPLY AND DEMAND--The future health and economic welfare of the Nation's population depends upon a continuing supply of uncontaminated freshwater. Many existing sources of water are being stressed by increasing withdrawals, use, diversion, and demands for instream flow. More comprehensive water-use data and analyses are needed to quantify the stress on existing supplies and to model and evaluate possible demand management options to supplement the traditional supply

approaches. Improved flow-system definition and simulation also are needed for the management of many aquifers that are important local or regional sources of water supply and to manage and support watershed ecosystems.

WETLANDS, LAKES, RESERVOIRS, AND ESTUARIES--These valuable ecosystems merit special attention because of their importance as fish and wildlife habitat, recreational areas, and sources of water supply. Wetlands, in particular, are areas where important water-treatment and purification processes can occur naturally. Despite their relative sensitivity to human activities, these areas continue to be subject to developmental pressures. Studies that improve our understanding of the physical, chemical, and biological processes of these ecosystems and their watersheds are needed to evaluate development and management alternatives.

HYDROLOGIC DATA--The hydrologic-data program constitutes the foundation for watershed and aquifer management and for many other WRD programs. Large amounts of data and specialized interpretation often are required by State and Federal agencies to manage water resources and determine water-rights. Enhancement of the hydrologic-data program, improved accessibility to available information, and coordination of program activities with those of other agencies continue to be high-priority activities.

HYDROLOGIC HAZARDS--Economic losses from floods, lake level changes, mud and debris flows, sedimentation, land subsidence and other hydrologic hazards can amount to several billions of dollars annually. Studies of the basic processes underlying these hazards are needed to improve the ability to forecast probabilities of occurrence and the likely magnitudes of hydrologic hazards.

INDIAN WATER RIGHTS--The USGS has a long history of assisting in appraisals of the water resources of Indian lands. The protection and management of the Indian Tribe's natural resources are major elements of the trust responsibility of the Secretary of the Interior. Cooperative activities that concern these resources should continue to merit high-priority consideration.

EXAMPLES OF CURRENT INVESTIGATIONS

Many Cooperative Program activities provide information necessary for making water-management decisions. Investigations are undertaken in response to a specific need but produce information and/or techniques that are applicable to other situations in related settings. Several examples follow.

- CALIFORNIA--Contaminant Transport in Fractured Rock of the Penn Mine

The USGS is conducting a study, in cooperation with the California State Water Resources Control Board and the East Bay Municipal Utility District, to verify ground-water flow paths and quantify ground-water flow in the fractured-rock aquifer that connects unlined mining waste-water ponds to Camanche Reservoir; to quantify the water-rock interactions that control the geochemistry of the ground-water system; and to quantify transport of major chemical constituents and trace elements along paths of ground-water flow from the mine to the reservoir. This study represents one of the first attempts at modeling contaminant transport in fractured rock and will serve to advance the understanding of fractured-rock hydrogeology. This knowledge will be used to solve contamination problems in other fractured-rock environments.

- DELAWARE, MARYLAND, AND VIRGINIA--Bridge-Site Scour Studies

The undermining (scouring) of bridge-pier and abutment foundations by erosive action of water can result in structural failure of bridges. The numerous equations that have been developed to predict streambed scour produce a wide range of estimates for the same set of conditions. However, field data to test the validity of these equations are sparse. The USGS, in cooperation with State Highway Departments in Delaware, Maryland, and Virginia, is developing techniques for measuring scour continuously at bridge piers to improve the predictive equations. The results of these and other similar USGS studies are being used by engineering firms, State departments of transportation, and the Federal Highway Administration to determine the risk of and to prevent bridge failure. Bridges identified as having high risk for destructive streambed scour are investigated in detail by private or State engineers who devise ways to safeguard the bridge.

- FLORIDA--Development of Flow Models for Wetlands, Dade County

The USGS has developed numerous computer techniques to simulate ground-water flow and surface-water flow. These models are now in use by State and local agencies, consulting firms, and universities throughout the Nation. The USGS, in cooperation with the South Florida Water Management District, is investigating methods of linking the capabilities of ground-water flow and surface-water flow models to study the effects of water-management alternatives in ecologically sensitive wetlands that commonly are in direct hydraulic connection with the ground-water system. Hydrologic data collected in Dade County are being used to construct and calibrate models that simulate surface- and ground-water flows by representing the interactions between these flow systems and wetlands. These modeling efforts are helping to improve the understanding of hydrologic relations in the South Florida Everglades area and will provide improved analytical tools to the water-resources community.

- ILLINOIS--Improved Techniques for Predicting Flood Risks

Understanding the relation between rainfall and resulting runoff is important for accurate prediction of the risk of flooding. Many computer-based models have been developed to simulate this relation, but they need significant improvement to better describe how factors such as land use, soil properties, and rainfall amount and distribution affect runoff. The USGS, in cooperation with the Illinois Department of Transportation, is using geographic information system technology to improve the way that models handle the

various factors involved. These model simulations will provide improved predictions of runoff and enable forecasters to provide increasingly accurate flood information.

Damage caused by floods is especially acute in highly urbanized watersheds. Yet the predictive tools used to estimate the potential effects of flooding are least accurate in urban areas because of rapidly changing land-use activities. The USGS, in cooperation with DuPage County and the Illinois Department of Water Resources, is improving statistical methods used to estimate peak flood levels and volumes in densely populated, rapidly changing areas around Chicago. The methods will provide improved information for protecting existing structures and for planning future development.

These studies and similar work nationwide have resulted in a USGS report that provides the means by which to estimate the magnitude and frequency of floods at ungaged sites on streams. The equations in this report are widely used by consulting engineers and government agencies for flood prediction.

- IOWA, KANSAS, MINNESOTA, MISSOURI, NORTH AND SOUTH DAKOTA, AND NEBRASKA--Midwest Floods, 1993

During the 1993 Mississippi River floods, USGS field personnel made more than 2,000 visits to streamgaging stations in the flood-affected areas to verify that the instruments were working properly, to make repairs as needed, and to make direct measurements of streamflow. Approximately 70 percent of the USGS streamgaging stations were operated in cooperation with various State and local agencies. The data from the gaging stations were provided continuously to the National Weather Service and the U.S. Army Corps of Engineers and formed the basis for flood forecasts so that people could be evacuated and personal property could be relocated from areas about to be inundated. It also enabled the Corps of Engineers and others to focus flood-fighting activities where they were most needed. The USGS was able to move staff from other States into the disaster area. These hydrologists and technicians were already familiar with the equipment and procedures so they could begin work immediately upon arrival. Without the long-standing streamgaging station network and well-developed communications systems, accurate forecasts could not have been made and loss of life and damage to property would have been far greater than it was (47 lives were lost, and property damages totaled $16 billion). This same experience with the real-time use of USGS streamgaging data is repeated several times each year as catastrophic floods strike various sections of the Nation. In addition, the hydrologic information is used by transportation planners to design safe bridges and roadways and to establish valid zoning and insurance regulations that can protect people and property during floods.

- KANSAS--Effects of Soil- and Cropping-Management on Atrazine Movement

Contamination of surface water by atrazine and other herbicides may pose a serious problem for public water supplies. Experiments conducted at the Kansas River Valley Experimental Field near Topeka, Kansas, as part of a USGS-Kansas State University cooperative study, reveal that some simple improvements in farming techniques can greatly reduce the transport of herbicides from fields. A farming technique that results in considerable reduction in herbicide concentrations in runoff from cultivated fields is the incorporation of the herbicide into the soil. Runoff from experimental plots in which the herbicides were incorporated into the soil during application had initial concentrations of herbicides 10 to 100 times less than initial concentrations in runoff from plots in which the herbicides were applied directly to the soil surface. Other experiments showed that encapsulated herbicides help reduce herbicide transport, especially when incorporated into the soil. These findings are significant in light of a common farming practice of spraying herbicides on the surface of minimum-tilled fields. The additional crop residue on the surface of such fields reduces soil erosion, but the surface application of the

herbicides clearly is a source of a large amount of herbicides that enter surface water. This study brought together the University's expertise in agricultural systems and soils with the USGS capability in water-quality monitoring and organic chemistry. The information produced by the study is of great help to the Nation's agricultural community in making decisions with respect to techniques for herbicide application.

- LOUISIANA--Flooding on the Lower Pearl River

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 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 river flow at the Interstate Highway I-10 crossing of the Pearl River near Slidell. The USGS developed a mathematical model to simulate flow conditions through the existing bridge openings. The model also can be used to simulate conditions without I-10 in place, the effects of alternative bridge designs, or modifications to the existing bridge. After further development, the model has been adopted by the Federal Highway Administration, many State departments of transportation, and consulting engineers to analyze complex streamflow situations at existing or proposed bridge crossings. The information from the model can increase the safety and cost effectiveness of bridge design.

- MISSISSIPPI--Susceptibility of Aquifers to Contamination

The USGS, in cooperation with the Mississippi Office of Pollution Control and the Mississippi Department of Agriculture and Commerce, is conducting an investigation to describe the relative susceptibility of major aquifers in Mississippi to surface and shallow-source contamination. A geographic information system is being used to integrate and analyze data describing the various geologic, hydrologic, and physiographic features that affect the susceptibility of aquifers to these types of contamination. The analysis for one multicounty study area has been completed and the results published. The investigative techniques and the methods of presenting the results will be useful in evaluating aquifer susceptibility in other areas throughout the Nation.

- NEVADA--Water Resources of Spanish Springs Valley

A USGS investigation in cooperation with the Nevada Division of Water Resources and Washoe County is evaluating and refining estimates of the water budget and sustained yield of the ground-water system in Spanish Springs Valley. Because of its proximity to the Reno-Sparks area, Spanish Springs Valley is experiencing rapid population growth and as a result, planners anticipate land-use changes, specifically from rural and agricultural to suburban designations. For over a century, flow from the Truckee River has been diverted for agricultural use to Spanish Springs Valley via the Orr Ditch. Approximately 85 percent of the total annual recharge to the basin occurs as seepage of flow in the Orr Ditch directly to the ground-water system. The effects on the sustained yield of the basin from a decrease or removal of irrigation seepage are as yet unknown but must be defined to ensure effective planning and management decisions. The USGS study will include determining the effects of changes in surface-water importation on the availability of ground water in the basin.

- NEW YORK--Hydrologic Effects of Retsof Salt Mine Collapse

The USGS, in cooperation with the Livingston County Department of Health, is assessing hydrologic conditions associated with the partial collapse of the Retsof Salt Mine in the Genesee River Valley. This mine, which has been in operation for 110 years and is about 1,100 feet below land surface, supplies road-deicing salt to 14 States in the Northeast. It is the largest salt mine in the Western Hemisphere and includes an underground area that is roughly the size of Manhattan (about 11 square miles). Along

with its supporting industries, the mine is the largest employer in Livingston County. Two underground rooms near the southern end of the mine near Cuylerville collapsed during March and April 1994. Two large, circular collapse features have developed above the two collapsed mine rooms. The northernmost feature, which is about 700 feet in diameter, includes a central area that is about 200 feet wide that has subsided up to 30 feet. The southernmost feature, which is about 900 feet in diameter, includes a central area that is about 700 feet wide that has subsided about 70 feet. Since March, ground water draining from overlying aquifer systems has been progressively flooding the mine at inflow rates averaging about 18,000 gallons per minute. This drainage from aquifers has reduced the yield of a number of local supply wells, some of which have gone dry. The USGS is operating a ground-water-level monitoring network to observe the rate, magnitude, and extent of aquifer drainage related to the mine collapse, and is constructing a mathematical model to analyze the long-term effects of the collapse on the regional ground-water flow system.

- OREGON--Water-Quality Modeling in the Tualatin River Basin

In 1990, the USGS was requested to evaluate water-quality problems in the Tualatin River basin and to determine the potential effectiveness of proposed best management practices (BMPs). Differing interests among regulatory agencies, land- and water-resource agencies, and environmental concerns had derailed the scientific debate. At issue was whether $500 million of planned BMPs were properly targeted to bring the Tualatin River back into compliance with water-quality standards. To address this question, USGS cooperated with the Unified Sewerage Agency (USA) of Washington County to develop a mathematical model of the Tualatin River. This model has shown that many of the proposed BMPs are unnecessary. According to the USA, the cooperative study has saved local taxpayers more than $200 million since 1993. In addition, the model is currently being used by USA and regulatory agencies to develop new remediation strategies that are environmentally sound and cost effective.

- SOUTH CAROLINA--Rates of Petroleum Hydrocarbon Degradation

The USGS, in cooperation with the South Carolina Water Resources Commission, is investigating an extensively contaminated shallow water-table aquifer underlying a fuel-tank farm in Hanahan, South Carolina. Data collected to date have revealed that petroleum hydrocarbons in the aquifer are being degraded in a complex pattern of zones dominated by chemically distinct conditions that change dynamically in time and space. Future studies are planned to determine relative rates of hydrocarbon degradation under these conditions and how degradation rates are affected by changes in conditions. This information will benefit the evaluation and design of low-cost bioremediation strategies at this and similar sites nationwide.

- TEXAS--Areas of High Risk from Contamination, Edwards Aquifer

The USGS, in cooperation with the Edwards Underground Water District in San Antonio, Texas, mapped outcrops of the Edwards aquifer in northern Bexar, Comal, and Hays counties. The Edwards aquifer is the sole source of water for 1.5 million people in San Antonio and the surrounding area. The resulting hydrogeologic maps indicate areas of the aquifer most susceptible to contamination by surface sources, such as spills and stormwater runoff from residential or commercial development on or adjacent to the aquifer outcrops. This information is essential for land-use planning to protect the Edwards aquifer in the rapidly urbanizing outcrop area. In addition, the hydrogeologic maps are useful for determining relative fault displacement, which, when combined with the defined "most sensitive to pollution" areas, aids in inferring the path of ground-water flow from the outcrop into the aquifer. USGS investigations of the Edwards aquifer led to enactment of a Federal law to protect aquifers that are the sole source of public water supplies.

- WASHINGTON--Potential for Pesticide Contamination of Public Water Supply Wells Without adequate justification to exempt Washington's water utilities from extensive testing for pesticides in drinking-water supplies from ground-water sources, millions of dollars per year would be required for such tests starting in 1995. The USGS, in cooperation with the Washington State Department of Health, designed and conducted a Statewide sampling and analysis program to identify the likelihood of pesticide contamination to public supply wells. Based on this information, a program was designed and implemented that required more testing in areas vulnerable to contamination and less testing elsewhere. Savings to the water utilities, and ultimately to the consumers, are estimated to be $6 to $18 million per year.

Because knowledge of surface water and ground water in the United States is essential to ensuring the well-being of its people and the viability of its economy, hydrologic data collection is a necessary role of government. The USGS maintains a nationwide system of streamgaging stations, ground-water observation wells, and water-quality sampling locations for ground and surface waters. USGS funding support for the hydrologic data program is derived from three major sources: the USGS Federal Program, the Federal-State Cooperative Program, and reimbursements from other Federal agencies. The sources of funds for operation of continuous surface-water discharge stations are shown in figure 3. A wide variety of agencies furnish support to the Survey, and activities at a single data-collection site commonly are funded by a combination of sources. More than 600 Federal, State, and local agencies provide funding to the USGS for continuous-record streamgaging stations.

The USGS currently collects data at many sites (table 1): more than 12,000 surface-water stage and discharge stations, about 32,000 wells where ground-water level and (or) pumpage data are collected annually or more frequently, and approximately 3,100 surface-water stations and 6,900 wells where water-quality data are collected.

Table 1. Number of USGS data-collection stations operated in 1994, by source of funds

Types of Stations	Federal Program	Federal-State Cooperative Program	Other Federal Agency Program	Combined Support	Total
SURFACE WATER					
Discharge	638	6,419	2,219	964	10,240
Stage-Only--Streams, Lakes, & Reservoirs	47	968	850	183	2,048
Quality	778	1,666	426	228	3,098
GROUND WATER					
Water Levels	2,344	27,029	2,421	237	32,031
Quality	691	4,602	1,347	216	6,856

Surface Water Data

Surface-water discharge (flow) data were collected by the USGS at 10,240 stations in 1994. Continuous discharge was computed at 7,426 of these stations, meaning that the flow could be determined for any moment of any day at any station. Partial discharge records were collected at 2,814 other streamflow stations. For example, at stations where there is an interest only in peak flows, data are collected and recorded only above a predetermined stage (water-surface elevation). At all stations where discharge was computed, a record of the stage was maintained either continuously or during certain events at partial-record stations. In addition, information on stage only was collected by the USGS at 991 stream stations. Stage data also were collected at 1,057 stations at

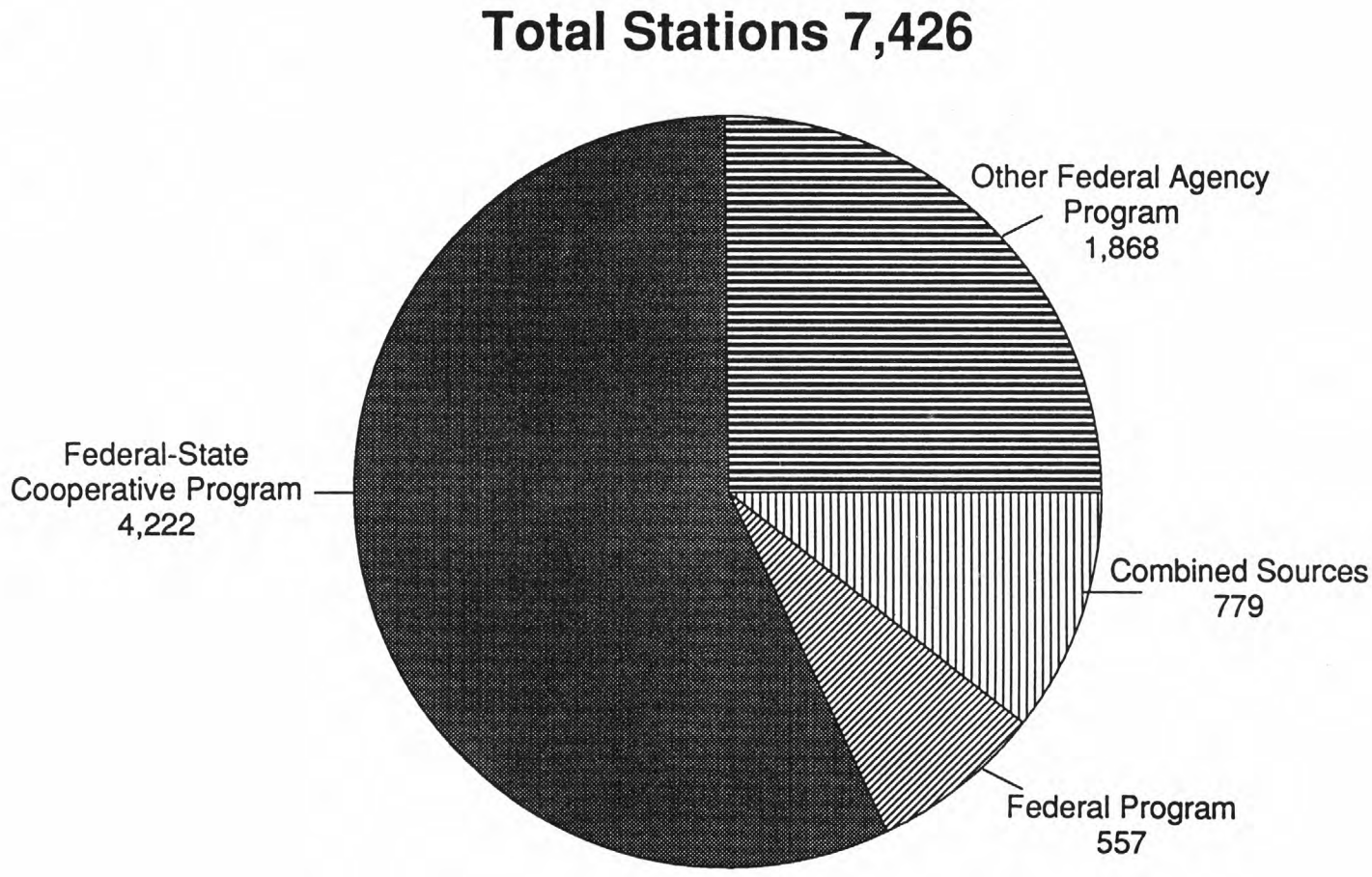


Figure 3. Number of continuous-record surface-water discharge stations operated by the USGS and sources of funding support in 1994

lakes and reservoirs. In 1994, the Federal-State Cooperative Program served as the sole source of funding for the operation of more than 4,200 continuous surface-water discharge stations and partially funded an additional 650 continuous surface-water discharge stations.

In 1994, stream and lake samples were collected at 3,098 stations nationwide and analyzed for water-quality characteristics, including almost 1,900 stations in the Cooperative Program. The types of water-quality characteristics measured vary from site to site. Water-quality data were collected as part of a scheduled, long-term operation at 2,018 stream sites. Samples were collected for short-term projects at 1,080 stations.

Ground-Water Data

Water-level fluctuations are indicators of the stresses placed on aquifers, the ability of aquifers to yield water, and the quantity of water stored in aquifers beneath the earth's surface. The USGS collected information on ground-water levels at 32,031 sites in 1994; more than 27,000 sites were monitored under the Cooperative Program. Ground-water level data were collected at 26,303 sites to assess long-term trends. When special areal studies were conducted, some water-level data were collected on a short-term basis to supplement the information available in the area from the long-term sites. In 1994, ground-water level data were collected at 5,728 sites for these investigations.

The quality of water was sampled and analyzed at 6,856 ground-water and spring sites in 1994. To maintain information on the changes in quality of critical aquifers, water samples were collected at 2,756 sites as part of a scheduled, long-term operation. Ground-water-quality data also were collected at 4,100 stations to provide information needed for short-term studies. The Cooperative Program provided support for water-quality data collection at about 4,800 well and spring sites.

Uses of Water Data

Streamgaging stations provide information to assist water managers in making daily operational decisions on water requirements for municipal, industrial, and agricultural use; for hydroelectric power generation; and for space in reservoirs for flood control. For example, data from many USGS gaging stations are used by the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, and others to operate more than 2,000 flood-control, navigation, and water-supply reservoirs, and more than 3,000 of the stations operated by the USGS are used in the National Weather Service's flood-forecasting system.

Today, more than one-half of currently operating streamgaging stations use automated earth-satellite telemetry equipment to transmit data from the collection site. Data are transmitted around the clock by means of two geostationary satellites operated by the National Oceanic and Atmospheric Administration and are received by the USGS and other users. The automated telemetry provides water-data users with provisional near real-time information that meets water-management needs. This system gives the USGS the capability to monitor the operation of the hydrologic stations continuously so that visits to the stations (for maintenance, instrument calibration, and selective data collection) can be planned with maximum effectiveness.

Surface-water, ground-water, and water-quality data commonly are closely related. For example, water-quality sampling and analysis provide information on the concentrations of chemical constituents in the water. Some water-quality sampling is done only within

pre-specified ranges of discharge as determined by streamgaging stations. These stations also generate the flow data needed to convert concentrations to loads (the total amount of the material transported by the water), which is required to characterize the movement and fate of the material in the stream. Because ground water at times either discharges to or is recharged by streams, knowledge of the overall hydrologic system is necessary to the understanding of water quality in that system. A few specific examples of uses of ground-water and water-quality data are:

- Water levels are measured semiannually at more than 1,000 wells in west-central Florida to document the potentiometric surface of the Floridan aquifer. This information is used to update ground-water flow models used by the Florida Water Management Districts.

- Water-quality stations are operated in the Delaware River estuary to monitor the location of the freshwater/saltwater interface. This information is used to protect the water supplies of southwestern New Jersey.

- Utilities in South Carolina and other States use real-time water temperature and conductance data to manage the release of effluent from power-generation plants.

- Specific conductance and chloride concentrations are measured at many coastal and inland locations to monitor the movement of saltwater into freshwater aquifers.

QUALITY ASSURANCE AND CREDIBILITY OF DATA

The USGS cooperates with State and local governments and other Federal agencies in conducting investigations and research on the availability, quality, and utilization of surface-water and ground-water resources. Work in this regard depends on the systematic nationwide program of data collection, analysis, and dissemination. Over the years, the Water-Data Program has achieved a high degree of credibility because the resulting information has been used and tested by many organizations and individuals in government and private sectors. In large measure, this credibility is the result of continuous efforts to ensure that data are collected, analyzed, and disseminated through thoroughly proven methods and techniques under rigorous standards of quality control.

Viewed from today's perspective of environmental concerns, technologic change, resource depletion, and population stress, the USGS Water-Data Program is the foundation for many decisions involving water and related resources. The success of the Program in anticipating and responding to changing priorities and emergencies stems directly from its effective blending of Federal, State, and local inputs. The Program shares with Federal and non-Federal cooperators both the cost and the responsibility for the design and management of the system. As a result of these and other characteristics, the Water-Data Program has acquired an unusual record of scientific objectivity, which is especially significant in assessing the environmental and legal aspects of water-resource development and control measures.

REPORTING AND AVAILABILITY OF DATA

The USGS publishes hydrologic data in a series of annual reports for each State and catalogs these reports in a monthly list of USGS publications. Beginning with the 1990 water year, water-data reports also are available on Compact Disk-Read Only Memory (CD-ROM). The water data reports and the CD-ROM are distributed to participating

agencies and to libraries; they are also available for sale by the Books and Open-File Reports Section of the USGS in Denver, Colorado[1]. Beginning in 1994 the USGS has been making more of these data accessible on-line virtually instantaneous and free, over the Internet.

The data are stored in the USGS National Water Data Storage and Retrieval System (WATSTORE), which includes a Daily Values File that contains 300 million daily observations of streamflow, water-quality, sediment-discharge, and ground-water level data; a Water Quality File containing 4.1 million surface-water and ground-water analyses; a Peak Flow File contains nearly 600,000 observations of annual peaks of streamflow and river-stage; and a Ground Water Site Inventory File contains information for more than 1.4 million wells.

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1. U.S. Geological Survey
Earth Science Information Center
Open-File Reports Section
Box 25286, MS 517
Denver Federal Center
Denver, Colorado 80225.

SUMMARY AND CONCLUSIONS

The USGS's Federal-State Cooperative Program has responded to national needs for hydrologic information since 1895. During FY 1994, water-resources data collection, investigations, and research were conducted in cooperation with about 1,100 State, regional, and local agencies in every State, Puerto Rico, and several Territories. Cooperative Program funding in FY 1994 totaled about $152 million and accounted for nearly 40 percent of the total obligations for the USGS's Water Resources Division. The Cooperative Program provides much of the information required by those responsible for water-resources planning and management, water-supply development, and environmental improvement through hydrologic data collection, investigations, and research. The program is a unique activity in that the cooperating agencies provide more than half the funds, but the USGS performs most of the work. The program is also a primary source for knowledge concerning techniques for collecting and analyzing data on the quantity, quality, use, and flow of surface water and ground water.

The availability of water of acceptable quality is a fundamental limiting factor to economic growth and people's health, safety, and comfort. The Nation needs a comprehensive and forward-looking program of hydrologic data collection and investigations to provide the information necessary to manage water resources. The job is too large to be supported at the Federal or State level alone. The overwhelming success of the jointly planned and funded Cooperative Program provides convincing assurance that the work done by the USGS is of high quality and meets national and local needs.

Appendix A. Cooperators by State, Fiscal Year 1994

Alabama:
- Alabama Department of--
  - Economic and Community Affairs
  - Emergency Management
  - Environmental Management
  - Highways, Departments Nos. 1, 2, and 6
- Anniston, City of
- Auburn University
- Baldwin County Commission
- Birmingham, City of
- Blountsville, Town of
- Coffee County Commission
- Geological Survey of Alabama
- Greenville, City of
- Huntsville, City of
- Jefferson County Commission
- Mobile, City of
- Parrish, Town of
- Prattville, City of
- Sumter, County of
- Tuscaloosa, City of

Alaska:
- Alaska Department of--
  - Community & Regional Affairs--
    - Div. of Energy
  - Environmental Conservation
  - Fish and Game
  - Natural Resources--
    - Div. of Mining & Water Mgmt
  - Transportation
- Alaska Energy Authority
- AK Industrial Dev. & Export Authority
- Anchorage, Municipality of
- Cordova, City of
- DCRA, Division of Energy
- Juneau, City and Borough of
- Kenai Peninsula Borough
- Sitka, City and Borough of
- University of Alaska, Fairbanks

Arizona:
- Arizona Department of--
  - Environmental Quality
  - Game and Fish
  - Water Resources
- Central AZ Water Conservation District
- Cochise County Flood Control District
- Gila Valley Irrigation District
- Gila Water Commissioner, Office of
- Havasupai Tribe
- Hualapai Indian Tribe
- Hopi Tribe Department of Natural Resources
- Maricopa County--
  - Flood Control District
- Metropolitan Water Dist. of Southern California
- Navajo Nation
- Pima County Board of Supervisors
- Safford, City of, Water, Gas, & Sewer Dept.
- Salt River Project
- Show Low Irrigation Company

Arizona--continued
- Tohono O'Odham Nation, Water Res. Dept.
- Tucson, City of
- University of Arizona--
  - Research Lab for Riparian Studies
- Yavapi Tribe

Arkansas:
- Arkansas Department of--
  - Parks and Tourism
  - Pollution Control
- Arkansas Game & Fish Commission
- Arkansas Geological Commission
- Arkansas Soil & Water Conservation Comm.
- Arkansas State Highway Commission
- Arkansas-Oklahoma: Arkansas River Compact Comm.
- Drew, County of
- Fort Smith, City of
- Independence, County of
- Little Rock--
  - Municipal Water Works
  - Public Works Department
- University of Arkansas--
  - at Fayetteville
  - at Little Rock

California:
- Alameda County--
  - Flood Control & Water Cons. Dist. (Hayward)
  - Water District
- Antelope Valley-East Kern Water Agency
- Atherton, City of
- California Department of--
  - Conservation
  - Fish and Game
  - Parks and Recreation
  - Water Resources
- California Water Resources Control Board
- California Reg. Water Quality Control Board
- Calaveras County Water District
- Carpinteria County Water District
- Casitas Municipal Water District
- Coachella Valley Water District
- Contra Costa County Flood Control & Water Conservation District
- Contra Costa Water District
- Desert Water Agency
- East Bay Municipal Utility District
- Eastern Municipal Water District
- Georgetown Divide Public Utility District
- Goleta County Water District
- Hetch Hetchy Water and Power
- Hoopa Valley Tribe
- Hopland Band of Pomo Indians
- Humboldt Bay Municipal Water District
- Imperial County Department of Public Works
- Imperial Irrigation District
- Lompoc, City of
- Los Angeles, County of

California--continued
- Madera Irrigation District
- Marin Municipal Water District
- Mendocino County Water Agency
- Menlo Park, City of
- Merced Irrigation District
- Mojave Water Agency
- Mono, County of
- Montecito Water District
- Monterey County Water Resources Agency
- Monterey Peninsula Water Mgmt. District
- Morongo Band of Mission Indians
- Orange County Water District
- Palmdale, City of
- Pechanga Indian Reservation
- Riverside County Flood Control & Water Conservation District
- Sacramento Reg. County Sanitation District
- San Benito County Water Control & Flood Control District
- San Bernardino Environmental Public Works Flood Control District
- San Bernardino Valley Municipal Water District
- San Diego County Department of Public Works
- San Francisco Water Department
- San Gorgonio Pass Water Agency
- San Luis Obispo County Engng. Department
- San Mateo County Dept. of Public Works
- Santa Barbara, City of, Dept. of Public Works
- Santa Barbara County--
  - Flood Control & Water Conservation Dist.
  - Water Agency
- Santa Clara Valley Water District
- Santa Cruz, City of
- Santa Cruz County Flood Control & Water Conservation District
- Santa Maria Valley Water Conservation District
- Santa Ynez River Water Conservation District
- Scotts Valley Water District
- Sonoma County--
  - Planning Department
  - Water Agency
- Tulare County Flood Control District
- Turlock Irrigation District
- United Water Conservation District
- University of California-Davis
- Ventura, City of
- Ventura County Public Works Agency
- Water Master--Santa Margarita River Watershed
- Water Replenishment District of So. California
- Woodbridge Irrigation District
- Yolo County Flood Control & Water Conservation District
- Yuba County Water Agency

Colorado:
- Arapahoe County Water & Wastewater Auth.
- Arkansas River Compact Administration
- Aurora, City of
- Black Hawk, City of
- Boulder, City of
- Boulder, County of--
  - Dept. of Public Works

Colorado--continued
- Breckenridge, Town of
- Centennial Water and Sanitation District
- Center Soil Conservation Dist.
- Cherokee Metropolitan District
- Clear Creek Board of County Commissioners
- Colorado Department of--
  - Agriculture
  - Health
  - Transportation
- Colorado Division of--
  - Parks & Outdoor Recreation
  - Wildlife
- Colorado Office of the State Engineer
- Colorado River Water Conservation District
- Colorado Springs, City of--
  - Dept. of Public Utilities
  - Engineering Division
- Crested Butte, Town of
- Delta County Board of Commissioners
- Denver Board of Water Commissioners
- Eagle County Board of Commissioners
- East Cherry Creek Valley Water & Sanitation District
- East Grand, County of
- Englewood, City of
- Evergreen Metropolitan District
- Fort Collins, City of
- Fountain Valley Authority
- Fremont Sanitation District
- Garfield, County of
- Glendale, City of
- Glenwood Springs, City of
- Greenwood Village, City of
- Gunnison, County of
- Lakewood, City of
- Lamar, City of
- Las Animas, City of
- La Plata County
- Littleton-Englewood Bi-City Wastewater Treatment Plant
- Longmont, City of
- Loveland, City of
- Lower Fountain Water-Quality Mgmt. Assn.
- Meeker, Town of
- Metropolitan Wastewater Reclamation District
- Moffat, County of, Commissioners
- Mt. Crested Butte Water/Sanitation Dist.
- Northern Colorado Water Conservation District
- Pueblo Board of Water Works
- Pueblo, City of, Department of Utilities
- Pueblo, County of
- Pueblo West Metropolitan District
- Purgatoire River Water Conservation Dist.
- Rio Blanco, County of
- Rio Blanco Water Conservancy District
- Rio Grande Water Conservation District
- Rocky Ford, City of
- Routt, County of
- St. Charles Mesa Water District
- Southern Ute Indian Tribe
- Southeastern Colorado Water Cons. Dist.
- Southwestern Colorado Water Cons. District
- Steamboat Springs, City of

Colorado--continued
- Teller-Park Soil Conservation District
- Thornton, City of
- Trinchera Water Conservation District
- Uncompahgre Valley Water Users Association
- Upper Arkansas Council of Governments
- Upper Arkansas River Water Cons. District
- Upper Eagle Regional Water Authority
- Upper Gunnison River
- Upper Yampa Water Conservancy District
- Urban Drainage and Flood Control District
- Vail Valley Consolidated Water Authority
- Westminster, City of
- Yellow Jacket Water Conservancy District

Connecticut:
- Connecticut Department of--
  - Environmental Protection
  - Transportation, Bureau of Hydraulics & Drainage
- Fairfield, Town of, Conservation Department
- Lake Waramaug Interlocal Commission
- New Britain, City of, Board of Water Commissioners
- South Central CT Regional Water Authority
- Torrington, City of
- Woodbury, Town of

Delaware:
- Delaware River Basin Commission
- Geological Survey
- University of Delaware

District of Columbia:
- Department of--
  - Consumer & Regulatory Affairs, Environmental Control Div.
  - Public Works
- Univ. of the District of Columbia

Florida:
- Bay County Utilities
- Boca Raton, City of
- Bradenton, City of
- Broward, County of--
- Cape Coral, City of
- Century, City of
- Cocoa, City of, Utilities and Public Works
- Daytona Beach, City of
- Deerfield Beach, City of
- Dunedin, City of
- Florida Department of--
  - Environmental Protection
  - Transportation
- Florida Keys Aqueduct Authority
- Fort Lauderdale, City of
- Hallandale, City of
- Highland Beach, Town of
- Hillsborough, County of
- Hollywood, City of
- Jacksonville, City of, Dept. of Public Utilities
- Jacksonville Electric Authority
- Lake, County of, Water Authority
- Lee, County of

Florida--continued
- Manatee County--
  - Environmental Action Commission
- Metropolitan Dade County
- Miami-Dade Water and Sewer Department
- North Port Water Control District
- Northwest Florida Water Management District
- Orange County
- Orlando, City of
- Perry, City of
- Pinellas, County of
- Pompano Beach, City of
- Reedy Creek Improvement District
- Sarasota, City of
- Sarasota, County of
- South Florida Water Management District
- South Indian River Water Control
- Southwest Florida Water Management District
- St. Johns River Water Management District
- St. Petersburg, City of
- Stuart, City of
- Suwannee River Water Management District
- Tallahassee, City of--
  - Electric Department
  - Water Quality Laboratory
- Tampa, City of
- Tampa Bay Regional Planning Council
- Volusia, County of
- Walton, County of
- West Coast Regional Water Supply Authority

Georgia:
- Albany, City of
- Albany Doughterty Planning Commission
- Albany Water, Gas, and Light Commission
- Athens-Clarke County
- Attapulgus, City of
- Bibb, County of
- Blairsville, Town of
- Brunswick, City of
- Chatham, County of
- Cherokee County Water & Sewerage Authority
- Clayton County Water Authority
- Covington, City of
- Dekalb County Water & Sewer Department
- Douglas, County of
- Georgia Department of--
  - Natural Resources--
    - Water Quality Management Program
    - Water Resources Mgmt. Program
    - Geologic Survey
  - Transportation--
    - at Atlanta
    - at Forest Park
- Georgia Forestry Commission
- Gwinnett, County of, Dept. of Transportation
- Helena, City of
- Henry, County of
- Macon Water Authority
- Monroe Water, Light, and Gas Commission
- South Florida Water Municipal Department
- Springfield, City of
- St. Johns River Water Municipal Department
- Thomaston, City of

Georgia--Continued
- Thomasville, City of
- Tift County Commission
- Tifton, City of
- Valdosta, City of

Hawaii:
- Hawaii, County of, Dept. of Water Supply
- Hawaii Department of--
  - Agriculture
  - Land and Natural Resources--
    - Comm. on Water Resources Mgmt.
    - Div. of Forestry & Wildlife
  - Transportation
- Honolulu, City and County of--
  - Board of Water Supply
  - Department of Public Works
- Kauai, County of, Department of Water Supply
- Maui, County of, Department of Water Supply
- National Tropical Botanical Gardens

Idaho:
- Ada County Highway District
- Boise, City of, Public Works Dept.
- Idaho Department of--
  - Health and Welfare, Div. of Environmental Quality
  - Water Resources
- Nez Perce Indian Tribe
- Salmon River Canal Co., Ltd.
- Shoshone, County of
- Southwest Irrigation District
- Teton, County of, Board of Commissioners
- Water District No. 01 (Idaho Falls)
- Water District No. 31 (Dubois)
- Water District No. 32D (Dubois)
- Water District No. 65 (Payette)

Illinois:
- Bloomington and Normal Sanitary District
- Champaign, City of
- Cook County Forest Preserve District
- Danville Sanitary District
- Decatur, City of
- Dekalb, City of, Public Works Department
- DuPage County Forest Preserve, Planning & Development Section
- DuPage County Department of Environmental Concerns
- Illinois Department of--
  - Conservation
  - Energy and Natural Resources--
    - State Water Survey
  - Transportation--
    - Division of Highways
    - Division of Water Resources
- Illinois Environmental Protection Agency
- Kane, County of
- Kankakee Soil and Water Conservation District
- Lake County Stormwater Mgmt. Commission
- McHenry County Conservation District
- Monticello City of
- Oak Brook, Village of
- Otter Creek Lake Utility District

Illinois--continued
- Springfield, City of
- University of Illinois
- Urbana, City
- Winnebago, County of, Dept. of Public Works

Indiana:
- Carmel, Town of, Utilities
- Elkhart, City of, Water Works
- Indiana Department of--
  - Environmental Management
  - Natural Resources, Division of Water
  - Transportation
- Indianapolis, City of, Dept. of Public Works
- Purdue University
- St. Joseph County Drainage Board

Iowa:
- Ames, City of
- Cedar Rapids, City of
- Clinton, City of
- Coralville, City of
- Davenport, City of
- Des Moines, City of
- Fort Dodge, City of
- Geological Survey Bureau
- Institute of Hydraulic Research
- Iowa City, City of
- Iowa Department of--
  - Transportation, Highway Division
- Iowa State University
- Muscatane Water and Light Board
- Sioux City, City of
- University of Iowa--
  - Hygienic Laboratory

Kansas:
- Arkansas River Compact Administration
- Brazos River Authority
- Emporia, City of, Department of Public Works
- Equus Beds Groundwater Mgmt. District No. 2
- Harvey County Conservation District
- Hays, City of
- Iowa Tribe of Kansas and Nebraska
- Johnson, County of, Dept. of Public Works
- Kansas Geological Survey
- Kansas Highway Commission
- Kansas St. Board of Ag., Div. of Plant Health
- Kansas State Conservation Commission
- Kansas State University Dept. of Agronomy
- Kansas University Center for Research, Inc.
- Kansas Water Office
- Kickapoo Tribe of Kansas
- Lake Region Res. Conservation Council, Inc.
- Prairie Band Potawatomie Tribe
- Riley, County of
- Sac and Fox Tribe of Missouri
- Topeka, City of
- Wichita, City of

Kentucky:
- Bullitt, County of
- Campbellsville Municipal Water
- Carrollton, City of

Kentucky--continued
- Crab Orchard, City of
- Cumberland-Green River RC&D
- Elizabethtown, City of
- Georgetown, City of
- Glasgow Water Company
- Kentucky Department of--
  - Health Services
  - Natural Resources & Environmental Protection Cabinet
- Kentucky State University
- Madison County Conservation District
- Metropolitan Sewer District
- Middleboro, City of
- University of Louisville

Louisiana:
- Amite River Basin River Commission
- Capital-Area Groundwater Comm.
- East Baton Rouge Parish
- Governor's Office of Coastal Activities
- Louisiana Department of--
  - Environmental Quality
  - Natural Resources
  - Transportation and Development
    - Bridge Hydraulics
    - Office of Public Works
- Louisiana Office of Emergency Preparedness
- Sabine River Compact Administration
- St. John the Baptist Parish
- West Monroe, City of

Maine:
- Aroostock County Water & Soil Mgmt. Board
- Greater Portland Council of Governments
- Jay, Town of
- Maine, Department of--
  - Environmental Protection
  - Human Services
  - Transportation
- Maine Geological Survey
- North Kennebec Valley Reg. Planning Comm.
- Northern Maine Regional Planning Comm.
- Paris Utility District
- University of Maine at Orono

Maryland:
- Baltimore, City of, Water Quality Management
- Calvert County Soil Conservation
- Delaware Geological Survey
- Hyndman, Borough of
- Interstate Commerce Commission
- Maryland Department of Environment--
  - Water Mgmt. Administration
- Maryland Geological Survey
- Maryland State Highway Administration
- Prince Georges County Government--

Maryland--continued
  - Dept. of Environmental Resources
- University of Maryland

Massachusetts:
- Burlington, Town of
- Dedham-Westwood Water District

Masachusetts--continued
- Massachusetts Department of--
  - Environmental Management--
    - Div. of Resource Conservation
    - Div. of Water Supply
  - Environmental Protection--
    - Division of Watershed Management
    - Division of Water Supply
- Massachusetts Highway Department
- Massachusetts Water Resources Authority
- Metropolitan District Commission--
  - Parks, Engng. and Construction Division
  - Watershed Management Division

Michigan:
- Adrian, City of
- Ann Arbor, City of
- Antrim County Drain Commission
- Battle Creek, City of--
  - Board of Public Utilities
- Bay Mills Indian Community
- Cadillac, City of, Wastewater Treatment Plant
- Clare, City of
- Coldwater, City of
- Delta Charter Township
- Elsie, Village of, Department of Public Works
- Flint, City of--
  - Water Plant
  - Div. of Water & Waste Services
- Huron-Clinton Metropolitan Authority
- Huron County Board of Commissioners
- Imlay, City of
- Kalamazoo, City of, Dept. of Public Works
- Lansing Board of Water & Light
- Macomb, County of
- Michigan Department of--
  - Natural Resources
    - Land & Water Division
  - Transportation
    - Design Division
- Negaunee, City of, Water & Wastewater Treatment Plant
- Norway, City of
- Oakland County Drainage Commission
- Otsego County Road Commission
- Portage, City of
- Portland, City of
- Sault Ste. Marie Tribe of Chippewa Indians
- Southeast Michigan Council Governments
- Sturgis, City of
- Tri-County Regional Planning Commission
- Wayne, County of, Div. of Environ. Health
- Ypsilanti Community Utilities Authority

Minnesota:
- Beltrami County Soil & Water Cons. District
- Boris Forte Lake Superior Band
- East Otter Tail Soil & Water
- Elm Creek Cons. Mgmt. & Planning Comm.
- Grand Portage--Chippewa Indians Natural Resources Dept.
- Hubbard County Conservation District
- Lower Red River Watershed Mgmt. Board
- Minnesota Department of--

Minnesota--continued
- Natural Resources
- Transportation
- Minnesota Pollution Control Agency
- Moorehead Public Service
- Pine County Soil & Water District
- Prairie Island Indian Community
- Rochester, City of
- Shakopee Mdewakanton Sioux Community
- Snake River Watershed Planning Committee
- Todd County Soil & Water Conservation
- University of Minnesota, Dept. of Soil Science
- Upper & Lower Sioux Indian Community
- Upper Sioux Indian Community
- Wadena Soil & Water Conservation
- Wilkin County Soil & Water Conservation

Mississippi:
- Harrison County of
- Jackson, City of
- Jackson County Port Authority
- Jackson County Board of Supervisors
- Mississippi Department of--
  - Agriculture and Commerce
  - Environmental Quality--
    - Office of Land and Water Resources
    - Office of Pollution Control
  - Transportation
- Mississippi Soil & Water Conservation Comm.
- Pat Harrison Waterway District
- Pearl River Basin Development District
- Pearl River Valley Water Supply District
- Yazoo MS Delta Joint Water Mgmt. Dist.

Missouri:
- Cass County Soil and Water Cons. District
- Clean Water Commission
- Columbia, City of, Dept. of Public Works
- Illinois Environmental Protection Agency
- Independence, Water Department
- Jefferson City Division of Health
- Mid-America Regional Council
- Missouri Department of--
  - Conservation
  - Natural Resources--
    - Division of Geology & Land Survey
- Missouri Div. of Parks, Recreation, & History
- Missouri Highway & Transportation Comm.
- Springfield, City of, City Utilities, Engng. Dept.
- St. Francois County Environmental Corp.

Montana:
- Blackfeet Nation
- Fort Peck Indian Reservation
- Greenfield Irrigation District
- Helena, City of
- Helena Valley Irrigation District
- Lewis & Clark City-County Health Dept.
- Montana Bureau of Mines and Geology
- Montana Department of--
  - Fish and Game
  - Health and Environmental Sciences
  - Natural Resources and Conservation
  - State Lands

Montana--continued
- Montana Highway Comission
- Northern Cheyenne Tribe
- Ravalli County Commissioners
- Salish & Kootenai Tribes
- Two Leggings Water Users Association
- Wyoming State Engineer

Nebraska:
- Blue River Compact Administration
- Central Platte Natural Resources District
- Lincoln, City of
- Lower Elkhorn Natural Resources District
- Lower Platte North Natural Resources District
- Lower Platte South Natural Resources District
- Lower Republican Natural Resources District
- Middle Republican Natural Resources District
- Nebraska Department of--
  - Environmental Quality
  - Water Resources
- Nebraska Natural Resources Commission
- Nemaha Natural Resources District
- North Platte Natural Resources District
- Omaha, City of
- Papio-Missouri River Natural Resources Dist.
- South Platte Natural Resources District
- Twin Platte Natural Resources District
- Univ. of Nebraska, Conservation & Survey Div.
- Upper Big Blue Natural Resources District
- Upper Loup Naural Resources District
- Upper Niobrara-White Natural Resources Dist.

Nevada:
- Carson City Dept. of Public Works
- Carson Water Subconservancy District
- Churchill, County of
- Clark County Regional Flood Control District
- Clark County Sanitation District
- Douglas, County of
- Duck Valley Reservation
- Henderson, City of
- Las Vegas Valley Water District
- Nevada Bureau of Mines and Geology
- Nevada Department of--
  - Conservation and Natural Resources--
    - Division of Environmental Protection
    - Division of Water Resources
  - Transportation
  - Wildlife
- Pyramid Lake Paiute Tribal Council
- Southern Nevada Waer Authority
- Summit Lake Paiute Tribe
- Tahoe Regional Planning Agency
- University of Nevada-Reno
- Walker River Paiute Tribe
- Washoe, County of

New Hampshire:
- Keene, City of
- New Hampshire Department of--
  - Environmental Services

New Jersey:
- Atlantic Highlands, Borough of
- Bergen, County of
- Brick Township Municipal Utility Authority
- Gloucester County Planning Commission
- Hackensack Meadowlands Dev. Comm.
- Medford, Township of
- Mercer County Park Commission
- Morris County Municipal Utility Authority
- New Brunswick, City of
- New Jersey Department of--
  - Environmental Protection and Energy
  - Transportation
- New Jersey Water Supply Authority
- North Jersey District Water Supply Comm.
- Passaic Valley Water Commission
- Pinelands Commission
- Rutgers State Univ., Dept. of Rad. & Environment
- Somerset County Board of Chosen Freeholders
- Washington Township Municipal Utility Auth.
- West Windsor, Township of

New Mexico:
- Albuquerque, City of
  - Public Works Department--
    - Hydrology Division
    - Water Utility Division
    - Waste Water Utility
- Albuquerque Metro. Arroyo Flood Control Auth.
- Arizona Department of Environmental Quality
- Canadian River Water Authority
- Costilla Creek Compact Commission
- Elephant Butte Irrigation District
- City of El Paso, County Water Quality
- Jornada Research, Conservation & Develop.
- La Cienega Acequia Association
- Las Cruces, City of--
  - Water Department
- New Mexico Department of--
  - Environment
  - Highways
- New Mexico State University, Bd. of Regents
- Office of the State Engineer
- Pecos River Commission
- Pueblo of Isleta
- Pueblo of Laguna
- Pueblo of Picuris
- Pueblo of Zuni
- Raton, City of
- Rio Grande Compact Commission
- Rio San Jose Flood Control District
- Ruidoso, Village of
- Santa Rosa, City of
- Texas Water Development Board

New York:
- Amherst, Town of, Engineering Department

New York--continued
- Auburn, City of
- Chautauqua, County of, Dept. of Plan. & Dev.
- Cheektowaga, Town of
- Clifton Park Water Authority
- Cornell University
- Cortland County Planning Department
- Eric County
- Hudso--n-Black River Regulating District
- Livingston County Dept. of Health
- Monroe County Department of Health
- Nassau County Department of Public Works
- NY City Environmental Protection Admin.--
  - Bureau of Water Supply & Wastewater
- New York State Department of--
  - Environmental Conservation, Planning & Restoration--
    - Bureau of Monitoring & Assessment
  - Transportation
- New York State Power Authority
- Nyack, Village of, Bd. of Water Commissioners
- Onondaga, County of--
  - Department of Drainage & Sanitation
  - Water Authority
- Onondaga Lake Management Conference
- Orange County Water Authority
- Saratoga Springs, City of
- Seneca Nation of Indians
- State Univ. at Syracuse--
  - Dept. Environmental Sciences & Forestry
- Suffolk, County of--
  - Department of Health Services
  - Water Authority
- Syracuse, City of
- Tompkins County Dept. of Planning
- Ulster, County ofal Health and Safety
- Victor, Village of

North Carolina:
- Asheville, City of
- Bethel, Town of
- Brevard City of
- Chapel Hill, Town of
- Charlotte, City of
- Danville, VA, City of
- Durham, City of
- Greensboro, City of
- Jackson, County of
- Lexington, City of
- Lumber River Council of Governments
- Mecklenburg, County of
- Morganton, City of
- North Carolina Coop. Extension Service Dallas & Raleigh
- North Carolina State Department of--
  - Environment, Health, & Natural Resources
  - Transportation
- Raleigh, City of
- Rocky Mount, City of
- Triangle Area Water Supply Monitoring, Project Steering Comm.
- Western Piedmont Council of Governments

North Dakota:
- Devils Lake Sioux Tribe
- Dickinson, City of
- Lower Heart Water Resources District
- Minot, City of
- Nelson City Water Resources District
- North Dakota Department of--
  - Game and Fish
  - Health, Water Supply, & Pollution Control
  - Parks and Recreation
  - Transportation
- State Water Commission
- Three Affiliated Tribes

Ohio:
- Akron, City of
- Canton, City of
- Columbus, City of
- Cuyahoga River Commission
- Eastgate Development Company
- Franklin, County of
- Fremont, City of
- Geauga County
- Lima, City of
- Madison, County of
- Miami Conservancy District
- N.E. Ohio Regional Sewer District
- Ohio Department of--
  - Natural Resources
  - Transportation
- Ohio State University, Dept. of Agronomy
- Pickaway, County Commissioners
- Ross, County of
- Summit, County of
- Washington, County Commissioners

Oklahoma:
- Cheyenne and Arapaho Tribes
- McGee Creek Authority
- Oklahoma City, City of--
  - Public Works Dept.
  - Treatment Division
- Oklahoma Conservation Commission
- Oklahoma Department of--
  - Agriculture
  - Health
- Oklahoma Geological Survey
- Oklahoma State Univ.--
  - Div. of Agri. Sciences & Natural Resources
- Oklahoma Water Resources Board
- Ponca Tribe
- Sac and Fox Nation

Oregon:
- Albany, City of
- Ashland, City of
- Bend, City of
- Coos, County of
- Coos Bay-North Bend Water Board
- Douglas, County of
- Eugene, City of, Water & Electric Board
- Gresham, City of
- Jackson, County of
- Jefferson County Commission
- McMinnville, City of

Oregon--continued
- Oregon Assoc., Clean Water Agencies
- Oregon Department of--
  - Energy
  - Environmental Quality
  - Human Resources, State Health Division
  - Transportation, Highway Division
  - Water Resources
- Portland, City of--
  - Bureau of--
    - Environmental Services
    - Water Works
- Unified Sewerage Agency
- Warm Springs Tribal Council
- Washington State Dept. of Ecology

Pennsylvania:
- Allentown, City of, Engineering Department
- Bethlehem, City of
- Bucks, County of
- Chester, County of, Water Resources Authority
- Cumberland, Maryland, City of
- Delaware County Solid Waste Authority
- Delaware River Basin Commission
- Doylestown Township Municipal Authority
- Fairfax County Water Authority
- Harrisburg, City of, Dept. of Public Works
- Hazelton City Authority Water Department
- Joint Planning Comm., Lehigh-Northampton Counties
- Letort Regional Authority
- Media Borough Water Department
- New York State Dept. of Environmental Cons. Planning & Restoration
- North Penn Water Authority
- North Wales Water Authority
- Philadelphia, City of, Water Department
- Pennsylvania Department of--
  - Environmental Resources--
    - Bureau of--
      - Mining and Reclamation
      - Soil & Water Conservation
      - Topographic & Geologic Survey
      - Water Supply & Community Health
  - Transportation
- Pennsylvania State University
- Somerset Conservation District
- Sunbury, City of, Municipal Authority
- Susquehanna River Basin Commission
- Tinicum, Township of
- University Area Joint Authority
- University of Delaware, Geological Survey
- Warwick Township
- West Bradford, Township of
- Williamsport, City of

Rhode Island:
- Narragansett Bay Water Quality Commission
- Providence, City of, Water Supply Board
- Rhode Island State Dept. of Environ. Mgmt--
  - Division of Water Resources
  - Division of Water Supply
- State Water Resources Board

South Carolina:
- Beaufort-Jasper County Water & Sewer Auth.
- Camden, City of
- Charleston Harbor Project
- Charleston Public Works
- Clarendon/Sumter Soil & Water Conservation District
- Clemson Univ., Dept. of Fertilizer & Pesticides
- Greer Commission of Public Works
- Mt. Pleasant Water Works & Sewer Comm.
- Myrtle Beach, City of
- Oconee County Sewer Commission
- South Carolina State--
  - Department of Health & Environ. Control
  - Department of Transportation
  - Dept. Natural Resources--
    - Water Resources, Div.
    - Wildlife & Freshwater Fisheries Div.
  - Public Service Authority
- Spartanburg Sanitary Sewer District
- Spartanburg Water Works
- University of South Carolina--
  - Dept. of Environmental & Health Services
- Waccamaw Regional Planning & Dev. Council
- Western Carolina Regional Sewer Authority

South Dakota:
- Area II Minnesota River Basin
- Belle Fourche Irrigation District
- Cheyenne River Sioux Tribe
- Custer State Park Division
- East Dakota Water Development District
- Lake Kampeska Water Project District
- Lower Brule Sioux Tribe
- Mellette, County of
- Oglala Sioux Tribe
- Pelican Lake Water Project District
- Rapid City, City of
- Roberts, County of
- Rosebud Sioux Tribe
- Sioux Falls, City of--
  - Utility Dept.
- Sisseton-Wahpeton Sioux Tribe
- South Dakota Department of--
  - Environment and Natural Resources--
    - Environmental Regulation Division
    - Geological Survey Division
    - Water Rights Division
  - Game, Fish and Parks
  - Transportation
- South Dakota School of Mines and Technology
- South Dakota State University
  - Civil Engineering Department
- Spearfish, City of
- Stanley County Conservation District
- Watertown, City of
- West Dakota Water Development District
- West River Water Development District
- Wyoming State Engineer

Tennessee:
- Alcoa, City of
- Athens Utility Board
- Camden, City of

Tennessee--continued
- Crossville, City of
- Dickson, City of
- Eastside Utility District
- Franklin, City of
- Germantown, City of
- Grundy County Soil Conservation District
- Hamilton County
- Harriman Utility Board
- Harpeth Valley Utility District
- Hixson Utility District
- Johnson City, City of, Public Works Dept.
- Knoxville, City of
- Memphis, City of, Light, Gas, & Water Division
- Memphis State University
- Metropolitan Governments, Nashville, City of, & Davidson, County of
- Murfreesboro, City of, Water & Sewer Dept.
- Oneida Water System
- Red Boiling Springs, Town of
- Rogersville, Town of
- Sevierville, City of
- Shelby County
- Shelby County Soil Conservation District
- Tennessee Department of--
  - Agriculture
  - Environment & Conservation, Office of Water Programs
  - Transportation--
    - Division of Structures
- Tennessee Wildlife Resources Agency
- Tullahoma Utilities Board
- Upper Duck River Development Agency
- Town of Wartrace

Texas:
- Abilene, City of
- Arlington, City of
- Austin, City of
- Barton Springs/Edwards Aquifer Conservation District
- Bexar-Medina-Atascosa Counties
- Brazos River Authority
- Canadian River Water Authority
- Central Texas Council of Governments
- Coastal Water Authority
- Colorado River Municipal Water District
- Corpus Christi, City of
- Dallas, City of
- Dallas, City of, Public Works Department
- Edwards Underground Water District
- Fort Bend Subsidence District
- Fort Worth, City of
- Gainesville, City of
- Galveston, County of
- Georgetown, City of
- Graham, City of
- Greenbelt Municipal & Industrial Water Auth.
- Guadalupe-Blanco River Authority
- Harris, County of, Flood Control District
- Harris-Galveston Coastal Subsidence District
- Houston, City of
- Houston-Galveston Area Council
- Lavaca-Navidad River Authority

Texas--continued
- Lower Colorado River Authority
- Lower Neches Valley Authority
- Lubbock, City of
- Nacogdoches, City of
- North Central Texas Council of Governments
- North Central Texas Municipal Water Authority
- North Texas Municipal Water District
- North East Texas Municipal Water District
- Nueces River Authority
- Orange, County of
- Pecos River Commission
- Sabine River Authority of Texas
- Sabine River Compact Administration
- San Angelo, City of
- San Antonio, City of--
  - Public Service Board
- San Antonio River Authority
- San Antonio Water System
- San Jacinto River Authority
- Somerville County Water District
- Tarrant, County of, Water Control & Improvement District No. 1
- Texas Soil and Water Conservation Board
- Texas State Dept. of Hwys. & Transportation
- Texas Water Commission
- Texas Water Development Board
- Titus, Co. of, Fresh Water Supply Dist. No. 1
- Trinity River Authority
- University of Texas at Austin
- Upper Guadalupe River Authority
- Upper Neches River Municipal Water Authority
- West Central Texas Municipal Water District
- Wichita, Co. of, Water Improvement Dist. No. 2
- Wichita Falls, City of

Utah:
- AZ Dept. of Water Resources
- Bear River Commission
- Central Utah Water Conservation District
- Kane County Water Conservancy
- Nephi, City of
- NV Dept. Conservation & Natural Resources--
  - Div. of Water Resources
- Ogden River Water Users Association
- Salt Lake, County of
- St. George, City of
- Tooele, City of
- Utah Department of--
  - Environmental Health, Div. Water Quality
  - Natural Resources--
    - Geological & Mineral Survey
    - Oil, Gas and Mining Division
    - Water Resources Division
    - Water Rights Division
- Weber Basin Water Conservancy District
- Weber River Water Users Association

Vermont:
- Agency of Transportation
- Department of Environmental Conservation

Virginia:
- Accomack-Northampton Planning Dist. Comm.
- Alexandria, City of
- Danville, City of
- Delaware GeologicalSurvey
- Hampton Roads Planning District Commission
- James City, County of
- Maryland, Department of--
  - State Highway Administration
- Newport News, City of
- Northern Virginia Planning District Commission
- Prince William Public Works
- Roanoke, City of
- Southeastern Public Service Authority of VA
- University of Virginia, Dept. of Environmental Sciences
- Virginia Department of--
  - Conservation & Reclamation
  - Transportation

Washington:
- Aberdeen, City of
- Bellevue, City of
- Chelan, County of, Public Utility District No. 1
- Clallam County Dept. Community Develop.
- Cowlitz, County of
- Douglas, County of, Public Utility District No. 1
- Hoh Indian Tribe
- Kent, City of
- King, County Department of Public Works
- Lewis, County of, Board of Commissioners
- Lower Elwha Tribal Council
- Makah Indian Tribe
- Muckleshoot Indian Tribe
- Nisqually Indian Tribe
- Oregon Department of Fish and Wildlife
- Pacific County Commissioners
- Pierce, County of, Public Works Dept.
- Port Townsend, City of
- Quileute Tribal Council
- Quinault Indian Business Committee
- Seattle, City of, Light Dept.
- Skagit County Department of Public Works
- Snohomish, County of--
  - Board of Commissioners
  - Public Utilities
- Tacoma, City of, Department of--
  - Public Utilities
  - Public Works
- Thurston County Department of Public Works
- Umatilla Tribal Council
- Washington Department of--
  - Community Services
  - Ecology
  - Fisheries & Wildlife
  - General Administration
  - Health
  - Natural Resources
  - Transportation
- Yakima Tribal Council

West Virginia:
- Morgantown, City of, Utility Board
- New Martinsville, City of

West Virginia--continued
- West Virginia Dept. Abandoned Mines & Reclamation
- West Virginia Division of--
  - Environmental Protection
  - Highways
  - Natural Resources
- West Virginia Geological & Economic Survey

Wisconsin:
- Alma/Moon Lake District
- Auburn, Town of
- Balsam Lake Protection & Rehab. District
- Barron, City of
- Beaver Dam, City of
- Big Muskego Lake District
- Brookfield, City of
- Cedar Lake, Town of
- Dane, County of--
  - Department of Public Works
  - Lakes and Watershed Management
  - Regional Planning Commission
- Darboy Sanitary District No. 1
- Delavan, Town of
- Druid Lake Inland Protection & Rehab. District
- Eagle Spring Lake Management
- Elkhart Lake Improvement Association
- Fond Du Lac, City of
- Fontana Walworth Water Pollution Control Comm.
- Fowler Lake Management District
- Geological Survey
- Green Bay Metropolitan Sewerage District
- Green Lake Sanitary District
- Hillsboro, City of
- Kansasville, Town of
- Kaukauna Electric and Water Utilities
- Kimberly Water Works Department
- Lac Du Flambeau Indians
- Lake Keesus Management District
- Lake Nebagamon, Village of
- Lauderdale Lakes Lake Management District
- Little Arbor Vitae Protection & Rehab. District
- Little Chute, Village of
- Little Green Lake Protection & Rehab. District
- Little Muskego Lake District
- Little St. Germain Lake District
- Madison Engineering Department
- Madison Metropolitan Sewerage District
- Marinette County Land Conservation Dept.
- Mead, Township of
- Menasha, Town of, Sanitary District No. 4
- Menominee Indian Tribe of Wisconsin
- Muskego, City of
- Norway, Town of
- Oconomowoc Lake, Village of
- Okauchee Lake Management District
- Oneida Tribe of Indians of Wisconsin
- Park Lake Management District
- Peshtigo, City of
- Potters Lake Rehabilitation & Protection Dist.
- Powers Lake Management District
- Pretty Lake Management District
- Rock County Public Works Department

Wisconsin--continued
- St. Germain, Town of
- Southeastern Wisconsin Regional Planning Commission
- Sparta, City of
- Stockbridge-Munsee Indians
- Summit, Town of
- Thorp, City of
- Troy, Town of
- Upper Nemahbin Lake Management District
- Waterford, Town of
- Waupun, City of
- Whitewater-Rice Lake Management District
- Wind Lake Management District
- Wisconsin Department of--
  - Justice
  - Natural Resources
  - Transportation
- Wisconsin Regional Planning Commission
- Wittenberg, Village of
- Wolf Lake Management District

Wyoming:
- Alaska Dept. of Natural Resources
- Cheyenne, City of
- Cheyenne Board of Public Utilities
- Colorado State University
- Evanston, City of
- Freemont County Weed and Pest District
- Joint Business Council
- Lincoln, County of
- Midvale Irrigation District
- Sheridan Water Supply Board
- Star Valley Conservation District
- Teton, County of
- Teton County Natural Resources District
- Water Development Commission
- Water Resources Center
- Wind River Environmental Quality Commission
- Wyoming Department of--
  - Agriculture
  - Environmental Quality
  - Game and Fish
  - Highways
- Wyoming State Engineer

American Samoa:
- Environmental Protection Agency of American Samoa
- Power Authority

Guam:
- Guam, Government of, Environmental Protection Agency

Puerto Rico:
- Puerto Rico Aqueduct and Sewer Authority
- Puerto Rico Dept. of Health
- Puerto Rico Department of Natural & Environmental Resources
- Puerto Rico Electric Power Authority
- Puerto Rico Environmental Quality Board
- Puerto Rico Industrial Development Company
- Virgin Islands Dept. of Planning & Natural Resources

Trust Territory of the Pacific Islands:
- Commonwealth Utilities Corp., Saipan
- Northern Mariana Islands, Commonwealth of--
  - Division of Environmental Quality
  - Municipality of Tinian
- Office of the Governor, Saipan
- Pohnpei State Government
- Government of Palau

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