BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To The Chairman, Subcommittee On Commerce, Transportation And Tourism Committee On Energy And Commerce House Of Representatives

Federal And State Efforts To Protect Ground Water

Ground water is the primary source of drinking water for about 50 percent of our population. The nature and scope of groundwater contamination is unknown. However, information GAO collected from 15 states, the Environmental Protection Agency (EPA), and other sources shows that hazardous waste disposal, petroleum leaks and spills, road salt storage and spreading, and oil exploration activities have caused significant groundwater contamination. Although groundwater contamination is viewed as a nationwide problem, sources of contaminants vary from region to region. As a result, a uniform national solution to these problems may not be possible.

Responsibility for protecting ground water is controversial because it involves the question of states' rights versus federal control. A comprehensive national groundwater protection policy does not exist; however, six federal laws address specific contamination problems. The 15 states GAO contacted favored a federal role, primarily in the areas of funding and research and development, but generally opposed strong federal regulatory controls. EPA's January 1984 draft groundwater protection strategy places responsibility for groundwater protection and management on the states. The Congress is currently considering establishing a commission to assess the problems and roles of federal, state, and local governments on the matter.

GAO/RCED-84-80
FEBRUARY 21, 1984

Request for copies of GAO reports should be sent to:

U.S. General Accounting Office
Document Handling and Information
Services Facility
P.O. Box 6015
Gaithersburg, Md. 20760

Telephone (202) 275-6241

The first five copies of individual reports are free of charge. Additional copies of bound audit reports are $3.25 each. Additional copies of unbound report (i.e., letter reports) and most other publications are $1.00 each. There will be a 25% discount on all orders for 100 or more copies mailed to a single address. Sales orders must be prepaid on a cash, check, or money order basis. Check should be made out to the "Superintendent of Documents".

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

RESOURCES, COMMUNITY,
AND ECONOMIC DEVELOPMENT
DIVISION

FEBRUARY 21, 1984

B-210829

The Honorable James J. Florio
Chairman, Subcommittee on Commerce,
Transportation and Tourism
Committee on Energy and Commerce
House of Representatives

Dear Mr. Chairman:

As requested in your January 21, 1983, letter and our subsequent discussions with your office, this report discusses federal and state efforts to protect the nation's groundwater supplies. The report provides information on the nature and scope of groundwater contamination, adequacy of federal and state authority and resources to deal with groundwater contamination, and the federal government's role in formulating, administering, and supporting a national groundwater protection policy.

Unless you publicly release its contents earlier, we will make this report available to other interested parties 30 days after the issue date. At that time copies of the report will be sent to appropriate congressional committees; the Administrator, Environmental Protection Agency; and the Director, Office of Management and Budget.

Sincerely yours,

J. Dexter Peach
Director

GENERAL ACCOUNTING OFFICE
REPORT TO THE CHAIRMAN,
SUBCOMMITTEE ON COMMERCE,
TRANSPORTATION AND TOURISM
HOUSE COMMITTEE ON ENERGY
AND COMMERCE

FEDERAL AND STATE EFFORTS TO PROTECT GROUND WATER

D I G E S T

About 50 percent of the nation's population depends on ground water as a drinking water supply. Groundwater use has nearly tripled in the last three decades. This valuable resource has gained considerable attention recently in light of the increasing number of severe groundwater contamination problems occurring throughout the nation.

Concerned about the nation's groundwater contamination problems, the Chairman, Subcommittee on Commerce, Transportation and Tourism, House Committee on Energy and Commerce, asked GAO to examine (1) the nature and scope of present and future groundwater contamination problems, (2) state and federal authority and resources to deal with ground water on a comprehensive basis, and (3) the nature of the federal role in formulating, administering, and supporting a national groundwater protection policy.

The chairman also requested that GAO review (1) EPA's actions under the Safe Drinking Water Act to test water quality at the water source rather than at the point of consumption and (2) the extent to which EPA controls toxic chemicals contaminating ground water.

NATURE AND SCOPE OF GROUNDWATER CONTAMINATION

Although groundwater contamination is a significant and widespread problem, the extent of contamination is unknown because no comprehensive national data base or monitoring program exists. However, limited studies by the Environmental Protection Agency (EPA) and others conclude that groundwater contamination, particularly as a result of hazardous waste, is a serious national problem.

GAO/RCED-84-80
FEBRUARY 21, 1984

All of the 15 states[1] GAO visited had developed some data on contamination. Of the 15 states, only Georgia, Texas, and Nevada did not view groundwater contamination as a problem.

Fourteen of the 15 states had one or more of the following sources of groundwater contamination:

--hazardous waste sites (9 states);

--landfills, lagoons, dumps, and junkyards (9 states);

--petroleum products spills and leaks, including underground gasoline storage tanks (9 states); and

--industrial sites resulting in solvent and chemical contamination (6 states).

In December 1982, EPA's Office of Solid Waste published the results of its nationwide review of 929 hazardous waste sites with known or suspected groundwater contamination problems showing their effects on ground water, surface water, and air. The sites contained 1,722 waste disposal facilities. Hazardous waste sites were found to have the greatest effect on ground water. Landfills, followed by storage treatment containers, surface impoundments, storage treatment tanks, and open dumps, were the facilities most responsible for contaminating ground water. The study showed that groundwater contamination existed at 320 sites and was suspected at 326 other sites. EPA found contaminated drinking water at 128 sites.

Of the 15 states GAO reviewed, 14 share one or more aquifers with other states and 1 state was uncertain whether aquifers extended over state boundaries. All of the states that share an aquifer told us that they had no water quality problems specifically identified with interstate aquifers. (See pp. 5 to 10.)

---

[1]Arizona, Arkansas, California, Florida, Georgia, Illinois, Kentucky, Maine, Massachusetts, Michigan, Nevada, New Mexico, Ohio, Rhode Island, and Texas.

FEDERAL AND STATE AUTHORITY AND RESOURCES

Although no federal legislation is directed toward comprehensive groundwater protection, the federal government has passed six laws that address specific sources of groundwater contamination. These laws are (1) the Clean Water Act, directed toward surface water pollution, (2) the Safe Drinking Water Act, directed toward ensuring that water provided to the public is safe to drink, (3) the Resource Conservation and Recovery Act, directed toward the safe disposal of discarded materials and regulation of hazardous waste management, (4) the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, providing for liability, compensation, cleanup, and emergency response for hazardous waste contamination, (5) the Surface Mining Control and Reclamation Act, directed toward protecting the environment from adverse effects of coal mining, and (6) the Uranium Mill Tailings Radiation Control Act, concerned with the impact of uranium or thorium wastes on the environment, including waterways and ground water. These laws demonstrate congressional intent to protect the nation's ground waters, particularly as a source of drinking water.

Because no federal funds are specifically designated for comprehensive groundwater protection activities, it is difficult to determine how much EPA has spent on groundwater protection. However, EPA estimated that during fiscal years 1980 through 1982 the states spent at least $14.2 million for groundwater activities through two EPA grant programs. These programs funded such activities as classifying groundwater aquifers, developing state plans for managing groundwater supplies, and identifying ground water used for drinking water.

Testing requirements for drinking water

The primary objective of the Safe Drinking Water Act is to insure that water provided the public is safe to drink. Basically, testing under the drinking water regulations is performed at the treatment plant or at various points in the drinking water distribution system, rather than at the water supply source.

EPA has not yet established drinking water standards and testing requirements for many organic chemicals contaminating ground water, but has set standards and testing requirements for six pesticides and trihalomethanes--organic chemicals, including chloroform, a carcinogen frequently found in drinking water. EPA plans to propose recommended health standards for nine toxic chemicals in March 1984; however, EPA does not anticipate establishing final, enforceable standards and testing requirements for these chemicals until September 1985.

State authority and resources

Because groundwater protection is primarily viewed as a state responsibility, the states have acted according to their individual needs. This accounts for the differences GAO saw in the 15 states in terms of activity, resources, and general concern. All 15 states were conducting some groundwater protection activities, although these varied widely in nature and progress. State efforts included developing groundwater protection strategies, mapping aquifers and land use in the vicinity of aquifers, and developing hydrology data.

The 15 states said that they currently have sufficient authority to protect ground water and that additional authority could be obtained in the future, if needed. For example, Rhode Island passed legislation in May 1983 that assigned primary responsibility for ground water to a single agency. Massachusetts recently passed legislation appropriating $10 million to acquire land or land rights and easements to land over aquifer recharge zones. The 15 states' estimates of the amounts of federal and state funds spent between 1977 and 1983 for groundwater protection totaled about $39 million. (See pp. 11 to 16.)

FEDERAL ROLE IN PROTECTING GROUND WATER

Groundwater contamination is viewed as a nationwide problem, but the sources of contamination vary from region to region. Contamination from oil and gas production is concentrated in the south, road salt problems in the north, hazardous waste in industrial

states, and pesticides and herbicides in agricultural states. As a result, no readily apparent uniform nationwide solution to these problems exists. The groundwater issue has involved a level of concern and debate, principally because it directly involves the question of states rights versus federal control.

States' views

Although the federal role in protecting ground water has not yet been defined, all 15 states favored a federal role in formulating, administering, and supporting a national groundwater protection program. However, their views differed on the nature of the role and the level of regulatory control and oversight needed. Nine states believed that some form of national criteria was needed for basic data collection such as recording contamination incidents and mapping aquifers. Ten states saw EPA's overall role as providing general guidance to states, coordinating groundwater activities, and disseminating information to the states.

All 15 states said that research or technical assistance to support their groundwater programs was one of their greatest needs. The states' need for research and technical assistance generally focused on quality of the ground water. Eight states needed information on safe levels of contaminants; six wanted information on how various chemicals affect groundwater quality; and four needed technical assistance on various related matters, such as groundwater monitoring and sampling, surface water and groundwater interaction, and laboratory analysis techniques. Eleven states considered federal funding to be one of their primary needs in developing and implementing their groundwater protection programs.

EPA efforts

EPA has drafted several versions of a groundwater protection policy over the past 3 years but has not issued a final policy. In 1982 the Secretary of the Interior, who chaired the Cabinet Council on Natural Resources and the Environment, opposed the EPA draft policy because he believed that it would establish federal control over ground water. In January

1984, EPA released a draft groundwater protection strategy which proposes to (1) strengthen state groundwater programs, (2) review the need to control unaddressed groundwater problems, (3) create a policy framework for guiding EPA programs, and (4) strengthen EPA's groundwater management organizations.

Congressional action

Congressional concern over groundwater contamination has prompted the proposal of a National Ground Water Commission. Under a bill passed by the House in November 1983, the commission would undertake an extensive data accumulation and assessment effort of 21 separate facets of the groundwater issue, including assessing (1) the need to protect ground water from degradation caused by contamination, (2) how land use patterns affect groundwater quality, (3) the monitoring methods the states and federal government use, and (4) the roles of federal, state, and local governments in managing groundwater quality and quantity. The work would be reported to the Congress by October 30, 1985, and would cost $7 million. No similar bill was introduced in the Senate. (See pp. 17 to 23.)

Contents

ABBREVIATIONS

ADHS	Arizona Department of Health Services
ADWR	Arizona Department of Water Resources
DBCP	dibromochloropropane
EPA	Environmental Protection Agency
GAO	General Accounting Office
NDEP	Nevada Division of Environmental Protection
NDWR	Nevada Division of Water Resources
OTA	Office of Technology Assessment

RCRA	Resource Conservation and Recovery Act
TCE	trichloroethylene
UIC	underground injection control
USGS	United States Geological Survey

CHAPTER 1

INTRODUCTION

About 50 percent of the nation's population depends on ground water as a drinking water supply. Groundwater use has nearly tripled in the last three decades. The value of this resource has gained considerable attention recently in light of the increasing number of severe contamination problems throughout the nation caused by hazardous wastes and other toxic substances.

Ground water is subsurface water that completely saturates spaces between soil particles or rocks. Layers of sand, gravel, or rocks bearing ground water are called aquifers. The United States Geological Survey estimates that the nation's aquifers may contain as much as 16 times the volume of water in the Great Lakes. About 70 percent of the total ground water used in 1980 was for irrigation.

Unlike rivers and streams, ground water moves extremely slowly, and its rate of flow and direction are affected by factors such as gravity and the composition of the subsurface. The slow movement of ground water causes contaminants to remain in concentrated areas for long periods of time rather than dissipating as happens in more rapidly moving surface water. Contamination of ground water in one area of an aquifer may take decades to move through other areas of the aquifer, which could hinder early detection. Once contaminated, aquifers can be extremely difficult and expensive to restore to their original quality.

FEDERAL, STATE, AND LOCAL GOVERNMENT LAWS

Although protecting ground water is primarily a state and local responsibility, various federal laws that address surface water contamination or specific sources of contamination also relate to ground water. These laws, established in response to specific problems, demonstrate congressional intent to preserve the quality of ground water, recognizing it as an important source of our nation's water supply.

The Clean Water Act of 1972 (33 U.S.C. 1251 et seq.), although primarily directed toward surface water pollution, contain several provisions that relate to ground water. For example, grants to states for pollution control programs could be used for monitoring ground water. The Safe Drinking Water Act of 1974 (42 U.S.C. 300f et seq.) has the objective of insuring that water leaving public water treatment facilities and wells supplied by ground water is safe to drink.

The nation's concern about the impact of hazardous and solid waste on ground water is reflected in two laws. The Resource Conservation and Recovery Act of 1976, as amended, (42 U.S.C. 6901 et seq.) relates to the safe disposal of discarded materials and

requires regulation of hazardous waste management. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, (42 U.S.C. 9601 et seq.), commonly known as the Superfund Act, provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous waste disposal sites.

The Surface Mining Control and Reclamation Act (30 U.S.C. 1201 et seq.) is concerned with the protection of the environment from adverse effects of mining of coal. The Uranium Mill Tailings Radiation Control Act (42 U.S.C. 7901 et seq.) is concerned with the impact of uranium or thorium residue or wastes on the environment, including waterways and ground water.

States and local governments have the primary responsibility for protecting ground water. State laws vary in scope and nature, generally in relation to the extent to which the state depends on ground water as a drinking water resource. Local governments implement state laws through ordinances that generally control or restrict certain activities that impact ground water.

OBJECTIVES, SCOPE, AND METHODOLOGY

In a January 21, 1983, letter, the Chairman, Subcommittee on Commerce, Transportation, and Tourism, House Committee on Energy and Commerce, expressed concern about the Environmental Protection Agency's (EPA's) lack of activity in the direction of groundwater policy and assessment. The chairman requested that we examine the following issues:

--The nature and scope of present and future groundwater contamination problems with particular emphasis on those caused by hazardous wastes.

--The adequacy of state and federal authority and resources to deal with ground water on a comprehensive basis, including an examination of interstate groundwater problems.

--The nature of the federal role in formulating, administering, and supporting a national groundwater protection policy.

The chairman's office subsequently requested that we also determine the actions EPA is taking under the Safe Drinking Water Act concerning the testing of water quality at the source, as contrasted to testing water quality at the point of consumption, and the extent to which toxic chemicals contaminating ground water are controlled by EPA under the act.

To meet these objectives, we performed work at EPA headquarters and at five EPA regional offices--I (Boston, Massachusetts), IV (Atlanta, Georgia), V (Chicago, Illinois), VI (Dallas, Texas), and IX (San Francisco, California). We selected the five EPA

regional offices on the basis of general geographical distribution. We selected three states within each of the five EPA regions. First, we selected the state within each region that had the largest population served by ground water. Then, using an EPA listing of states that had a groundwater strategy, we selected, from the remaining states within each region, one state that had a strategy and one that did not. The states selected were Arizona, Arkansas, California, Florida, Georgia, Illinois, Kentucky, Maine, Massachusetts, Michigan, Nevada, New Mexico, Ohio, Rhode Island, and Texas. About 48 percent of the total population of the 15 states depends on ground water as a drinking water supply.

Our general approach to addressing the first three issues was to have the states provide us with data. We asked the states to designate the office or offices which had primary groundwater protection responsibility. These contacts often directed us to other state offices or organizations. We then obtained data, studies, records, reports, legislation, and funding. We did not verify the information. After completing the data gathering and discussions with the 15 states, we summarized the information and requested that the main state contact verify the accuracy and the adequacy of the content of our summaries. All states reviewed and returned our summaries, and some suggested revisions. We incorporated the suggested changes where appropriate and, as requested by the chairman's office, have included the 15 state summaries in appendices II through XVI.

The Office of Technology Assessment (OTA) is performing a review of groundwater technology for the Senate Committee on Public Works and Transportation. OTA is primarily developing information on the technology available and used by the states to measure, monitor, and mitigate groundwater contamination. We met with OTA staff during our review to discuss the scope and objectives of our review and the results of our work.

To obtain information relating to the nature and scope of groundwater contamination, we met with and obtained reports and data from officials of EPA's Offices of Drinking Water, Toxic Substances, Research and Development, and Solid Waste. We also obtained and reviewed other groundwater contamination studies, including a January 1981 report prepared by the Council on Environmental Quality; a December 1982 draft report by EPA's Office of Drinking Water, entitled "Surface Impoundment Assessment - National Report;" a June 1983 draft report by the Congressional Research Service, entitled "Groundwater Contamination by Toxic Substances: A Digest of Reports;" and a September 1983 publication by the Environmental Assessment Council of the Academy of Natural Sciences, Philadelphia, Pennsylvania, entitled "Groundwater Contamination in the United States." We also obtained information from the National Water Well Association, the Chemical Manufacturers Association, and the private groundwater consulting firm of Geraghty and Miller, Annapolis, Maryland. Appendix I contains a list of all the studies and publications we reviewed.

To obtain information on the adequacy of federal authority and resources to deal with ground water, we reviewed data of EPA and two other federal agencies that relate to ground water. We obtained data on EPA groundwater protection resources from EPA headquarters program offices and the EPA Kerr Environmental Research Laboratory, Ada, Oklahoma. We also obtained groundwater resource data from the Department of Agriculture's Agricultural Stabilization and Conservation Service and the Department of the Interior's U.S. Geological Survey (USGS).

To provide information on state resources, state representatives prepared estimates on federal and state funds expended for groundwater protection efforts. The amount of state funds expended were in most cases rough estimates because states do not record expenditures by specific federal grant program. We did not evaluate the reasonableness of these estimates.

Representatives of the 15 states provided us with information as to whether the states were experiencing interstate groundwater problems and their views on the nature of the federal role in formulating, administering, and supporting a national groundwater protection policy.

To obtain information on water testing requirements and the control of toxic chemicals under the Safe Drinking Water Act, we held discussions with EPA's Office of Drinking Water and reviewed EPA's national primary drinking water regulations, Federal Register notices, and other documents relating to the drinking water program.

Our work was conducted from January through August 1983. Except as noted above, our review was performed in accordance with generally accepted government auditing standards.

CHAPTER 2

THE NATURE AND SCOPE OF GROUNDWATER CONTAMINATION

The nature and scope of groundwater contamination nationally is unknown. Various studies, however, have documented significant contamination caused by a variety of sources, including hazardous waste. All 15 states we reviewed had some data, such as the number of hazardous waste sites, petroleum products spills, and industrial sites, indicating how widespread certain contamination problems are. However, only 1 state had summarized the extent of contamination by all the known sources of contamination within the state. Of the 15 states, 12 said that groundwater contamination was a problem. Specifics about the nature and scope of groundwater contamination in each of the states we reviewed is included in appendices II through XVI.

THE NATURE OF CONTAMINATION

While the full nature of groundwater contamination is unknown, significant contamination has resulted from many sources. Hazardous waste disposal is a major source. Other major sources include leaking underground gasoline storage tanks, crude oil bulk storage and pipeline leakages, road salt storage and spreading, and oil and gas exploration brines. Knowledge concerning the nature of groundwater contamination is a result of special studies by EPA, states, and private firms.

EPA data on nature of contamination

EPA has developed data on the nature and sources of contamination of ground water by means of a nationwide survey of hazardous waste sites and a survey of potential groundwater contamination by synthetic organic chemicals.

In December 1982, EPA's Office of Solid Waste published the results of its nationwide review of 929 hazardous waste sites with actual or suspected groundwater contamination problems showing their effects on ground water, surface water, soil, and air. The sites contained 1,722 waste disposal facilities. Hazardous waste sites were found to affect ground water more than the other media. In addition to hazardous waste sites, landfills followed by storage treatment containers, surface impoundments, storage treatment tanks, and open dumps were the facilities most responsible for contaminating ground water.

In June 1982, EPA's Office of Drinking Water published the results of its survey of groundwater contamination from synthetic organic chemicals. This survey analyzed 466 randomly selected water systems--285 small and 181 large--and 479 nonrandomly selected systems--324 small and 155 large. The nonrandom systems were selected by the states primarily because contamination problems

were suspected but had not been documented. The random sample analysis showed that detectable levels of chemicals were present in about 17 percent of the small systems and in 29 percent of the large ones. The percentages for the nonrandom sample were higher--about 23 percent for the small water systems and 37 percent for large ones.

Other studies on the nature of contamination

Other studies concerning the nature of groundwater contamination provide an indication of the multiple types and sources of contamination. A January 1981 Council on Environmental Quality study also showed that major groundwater contamination problems in many states were caused by synthetic organic chemicals resulting from industrial and manufacturing processes. Also, a joint EPA/state survey of waste disposal sites showed groundwater problems from impoundments of industrial, municipal, agricultural, mining, and other types of wastes.

State experience as to the nature of contamination

The states we reviewed cited a number of sources of contamination, including hazardous waste sites. Fourteen of the 15 states had one or more of the following sources of groundwater contamination:

--hazardous waste sites (9 states);

--landfills, lagoons, dumps, and junkyards (9 states);

--petroleum products spills and leaks, including underground gasoline storage tanks (9 states); and

--industrial sites resulting in solvent and chemical contamination (6 states).

Agricultural activities were sources of contamination in eight states and include the use of pesticides and herbicides, animal feedlot wastes, irrigation, and fertilizer usage. Nine states had contamination caused by septic systems, seven states had contamination from oil and gas production brines, and four states had contamination as a result of road salting and road salt storage.

THE EXTENT OF CONTAMINATION

EPA has acknowledged groundwater contamination as a significant and widespread problem. However, the extent of contamination on a national level is unknown because no comprehensive national data base or monitoring program exist to collect such information. Limited studies performed by EPA and other organizations have concluded that groundwater contamination, particularly as a

result of hazardous waste, is a serious national problem. All 15 states we visited had developed some data on contamination in their state, 1 state had summarized the extent of contamination by all the known sources of contamination within the state, 9 states had various forms of summary data for certain types of contamination, and 5 states had no summary data. Twelve of the 15 states told us that contamination was a problem.

EPA data on extent of contamination

Although the extent of groundwater contamination is not known, EPA has developed information which shows that contamination, especially that caused by hazardous waste, is a significant problem. The December 1982 Office of Solid Waste report of 929 hazardous waste sites nationwide showed that groundwater contamination existed at 320 sites and was suspected at 326 other sites. Contamination of drinking water supplies was documented at 128 of the 929 sites and suspected at 213 other sites.

The Director of EPA's Office of Emergency and Remedial Response, the office responsible for administering EPA's "Superfund" program, stated in October 1983 that 410 of the 546 hazardous waste sites designated for priority cleanup under the program had groundwater contamination problems.

The June 1982 report by EPA's Office of Drinking Water showed that trace levels of one or more synthetic organic chemicals were found in about 17 percent of the 285 small and 29 percent of the 181 large water systems randomly selected. In addition, detectable levels of one or more organic chemicals were found in about 23 percent of the 324 small and 37 percent of the 155 large water systems nonrandomly selected.

Other studies on the extent of contamination

In a January 1981 study, the Council on Environmental Quality reported that information it had gathered from the EPA regional offices and states showed major groundwater contamination problems from synthetic organic chemicals in at least 34 and possibly as many as 40 states. The information showed that major contamination problems existed in all the states east of the Mississippi River and in several non-industrialized states, such as Arizona and Idaho.

A joint EPA/state survey of waste disposal sites (the Surface Impoundment Assessment) underway since 1978 included about 80,300 sites containing about 181,000 impoundments for industrial, municipal, agricultural, mining, and other types of wastes. About 31,400 sites were examined to assess their effects on ground water. In a December 1982 draft report, EPA reported the following:

--Nearly 50 percent of all sites were located over earth layers that were either very thin or very permeable. Such

siting, given improper design, construction, and/or operation, allows leachate to percolate rapidly into an aquifer. Only 22 percent of all sites were located in areas where the earth layers afforded good protection to the underlying aquifer.

--Over 15 percent of all sites (excluding oil and gas) contained waste which the survey considered as potentially hazardous. In the industrial category, about a third of the sites contained potentially hazardous waste.

--About 30 percent of the industrial sites, 20 percent of the municipal sites, and 15 percent of the agricultural sites had some type of liner. No correlation existed between the type of waste, the siting characteristics, and the use of liners.

Recognizing the need for additional information on ground water contamination, the U.S. Geological Survey in fiscal year 1982 initiated its Toxic Waste--Ground Water Contamination Program. One program aspect is to determine the existing quality of ground water and the extent of chemical contamination of the nation's groundwater supplies. The program coordinator told us that the Survey had originally planned to determine groundwater quality on a state-by-state basis; however, after performing work in eight states, it found that data on contamination did not exist, or where the data did exist, the quality of the data was uncertain. Consequently, the Survey decided to approach groundwater quality from a regional basis and to rely on land use surveys and sampling to develop groundwater quality data. The coordinator told us that the regional effort will begin during fiscal year 1984.

State data on the extent of contamination

Only Michigan had developed comprehensive summary data on groundwater contamination, but the other 14 states had accumulated some data on contamination. Nine of the states had some form of summary data for certain types of contamination, while five states had not summarized contamination data. Twelve of the 15 states expressed concern that groundwater contamination was a problem. Georgia, Texas, and Nevada did not view groundwater contamination as a problem.

Michigan generates comprehensive groundwater summary data, including the specific status of individual sites, because about 50 percent of its population depends on ground water for drinking and state representatives believe that groundwater contamination is a significant problem. An assessment of groundwater contamination in July 1982 showed there were 441 known contamination sites, 456 suspected sites, and thousands of potential sites. The following table shows the number of known and suspected sources of groundwater contamination in Michigan as of July 1982.

Source	Known		Suspected	
	Number	Percent	Number	Percent
Petroleum products storage, including underground gasoline storage tanks	171	38.8	29	6.4
Industrial, including both heavy and light industry	120	27.2	83	18.2
Surface and subsurface waste disposal, including landfills and illegal dumps	57	12.9	215	47.1
Salt storage and salting	33	7.5	86	18.9
Other[a]	60	13.6	43	9.4
Total	441	100.0	456	100.0

[a]Includes oil and gas exploration, agricultural fertilizers and pesticides, municipal waste water, laundromats, and chemical spills during transportation or fires.

Florida is an example of a state that accumulates limited summary data for certain types of contamination. A Florida State Legislative Task Force on Ground Water Pollution, as of August 1982, had documented 42 cases of groundwater contamination. Five of these cases were in the Miami-Dade County area. Widespread problems of contamination from surface impoundments, improperly designed drainage wells discharging water and wastewater directly into potable water aquifers, industrial storage tanks, and agricultural chemicals were also identified by the task force. For example an industrial drum recycling facility in Miami deposited washings from the drums into an unlined pit on its property for 14 years. The disposal pit is located 750 feet from a newly developed water supply for the city of Miami. Groundwater samples showed contamination from high concentrations of industrial organic solvents.

Massachusetts is an example of a state that has accumulated data on various sources of groundwater contamination, although the data is not summarized. The Director, Water Supply, Planning and Development Section, Department of Environmental Quality, informed us that, in addition to contamination from hazardous waste and road salting, leaking gasoline storage tanks are becoming an increasing problem in the state as well as the nation. For example, Cape Cod, which relies almost completely on ground water

as a drinking water source, has experienced considerable problems with leaking underground tanks. The director told us that leaking gasoline tanks will continue to be a problem because many service stations were built during the road-construction boom in the 1950's and early 1960's. Thousands of steel storage tanks were installed beneath the surface during this era and these tanks are now rusting.

INTERSTATE AQUIFERS

Of the 15 states we reviewed, 14 share one or more aquifers with other states and the remaining state was uncertain whether aquifers extended over state boundaries. All of the states that shared an aquifer told us that there were no water quality problems specifically identified with interstate aquifers. Some of the states stressed that there are quantity problems with some interstate aquifers. For example, the Ogallala Aquifer, which stretches from the northern edge of the Pecos River Valley in west Texas into southern South Dakota and which is the largest aquifer in the world by volume, contained about 420 million acre-feet of water in 1980 and hydrologists estimate that by the year 2000 this will be reduced to 363 million acre-feet based on current usage.

CHAPTER 3

FEDERAL AND STATE GROUNDWATER PROTECTION AUTHORITY AND RESOURCES

Although no federal legislation is directed toward comprehensive groundwater protection, various laws EPA administers address specific sources of groundwater contamination and EPA has provided states with some funding relating to groundwater protection activities. One such law--the Safe Drinking Water Act--authorizes the EPA Administrator to set quality standards and testing requirements for ground and surface water used for drinking water. However, EPA has yet to set such standards or testing requirements for organic chemicals found frequently in ground water.

The 15 states we contacted stated that they had sufficient authority for groundwater protection and could obtain additional authority, if needed. All the states were conducting groundwater protection activities to some extent, using both state and federal funds. None of the states identified interstate aquifer problems. The 15 state authorities and resources to protect ground water are summarized by state in appendices II through XVI.

FEDERAL AUTHORITY

As discussed in chapter 1, six federal laws are applicable to ground water quality. These laws demonstrate congressional intention to protect the nation's ground waters, particularly as a source of our nation's drinking water supply.

No comprehensive federal legislation exists, however, whose focus is on ground water and which recognizes groundwater quality's relationship to adequate supply and considers the use of ground water for agriculture and industrial uses as well as for drinking water.

Testing requirements for drinking water

The chairman's office requested in May 1983 that we determine the actions EPA was taking under the Safe Drinking Water Act concerning the testing of water quality at the source (aquifer) as contrasted to testing water quality at the point of consumption and the extent to which toxic chemicals contaminating ground water are controlled by EPA under the act.

The Safe Drinking Water Act of 1974 directed the EPA Administrator to establish national drinking water standards to protect public health. Drinking water regulations that EPA has issued established water quality standards for coliform bacteria; turbidity (cloudiness); inorganic and organic chemicals; man-made and naturally occurring radioactive materials; and trihalomethanes, a group of organic chemicals which includes chloroform,

a carcinogen frequently found in drinking water. The regulations also prescribe how often drinking water supplies must be tested for each contaminant and steps water owners or operators must take to notify EPA or the state and water users when a standard is exceeded or required testing is not performed.

The primary objective of the drinking water program is to insure that water provided the public is safe to drink. Basically, testing required by the drinking water regulations is performed at the treatment plant or at various points in the drinking water distribution system rather than at the water source.

EPA has not yet established drinking water standards and testing requirements for organic chemicals contaminating ground water. EPA has established drinking water standards and testing requirements for six pesticides and trihalomethanes--organic chemicals which include chloroform. In March 1982, EPA issued an Advanced Notice of Proposed Rulemaking requesting public comments on controlling synthetic organic chemicals in ground water. Specifically, EPA asked for comments on issues such as (1) the significance of synthetic organic chemical contamination of drinking water, (2) the monitoring requirements that should be established for the chemicals, (3) criteria that should be considered in determining the health basis for any standard for the chemicals, (4) how factors of human exposure, potential human health risks, and cost of treatment should be balanced in determining the level of any standards, and (5) the treatment techniques available to reliably remove the chemicals at a reasonable cost. The notice identified 14 chemicals most frequently found in ground water.

According to the Deputy Director, Criteria and Standards Branch, EPA Office of Drinking Water, EPA plans to propose in March 1984, health standards for 9 of the 14 synthetic organic chemicals listed in the March 1982 notice. However, because of the time involved in receiving and evaluating agency comments and the regulatory process involved in issuing the standards, EPA estimates that it will be September 1985 before it issues final, enforceable drinking water standards and testing and reporting requirements for the nine chemicals. The Criteria and Standards Branch Deputy Director told us that the lack of health effects data and concern over the validity of the analytical techniques used to develop data on the other five chemicals is preventing EPA from proposing standards for these chemicals.

FEDERAL PROGRAM RESOURCES

Because no federal funds are specifically designated for comprehensive groundwater protection activities, it is difficult to determine how much EPA has spent on groundwater protection. However, EPA estimated that during fiscal years 1980 through 1982 the states expended at least $14.2 million through two EPA grant programs related to groundwater activities. These programs are

the Clean Water Act's section 208 areawide planning program and the Safe Drinking Water Act's underground injection control program. The underground injection control program funds were used primarily to identify ground water used as drinking water supplies, while section 208 funded a variety of groundwater activities, including classifying groundwater aquifers, determining the extent of groundwater contamination, and developing state plans for managing ground water supplies. Other EPA programs, including state grants under the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act, provide funds for groundwater activities and research, but no estimates were available as to the amount. Various other federal agencies devote resources to ground water. The Department of Agriculture's Agricultural Stabilization and Conservation Service administers an experimental Rural Clean Water Program, which provides financial and technical assistance for projects addressing water quality problems. In 1981 about $6.8 million was directed to three projects specifically addressing groundwater quality issues.

The Department of the Interior's Geological Survey has also devoted resources to ground water. During fiscal year 1983, the Survey was funding about 800 projects, totaling about $40 million, with ground water as the predominant activity. Of these projects, 256 involved specific aspects of ground water protection or management, such as the occurrence and availability of groundwater supplies, movement of contaminants in ground water, aquifer characteristics, and saltwater encroachment. A majority of the projects were being performed under the Survey's Federal/State Cooperative Water Resources Program which combines federal, state, and local governments' resources to carry out water resource studies. Geological Survey personnel generally perform the work.

A March 1983 Department of the Interior directory describes the federal regulatory, technical assistance, research, and land management activities whose primary purpose is the monitoring, protection, or conservation of groundwater quantity and quality. The directory identifies 44 programs and activities, administered by 25 offices in 9 separate federal agencies and departments, but does not contain information on the amount of federal funds being spent by these agencies on groundwater activities.

STATE AUTHORITY

The 15 states told us that they currently had sufficient authority to protect ground water and that additional authority could be obtained in the future, if needed. For example, Rhode Island, in May 1983, passed legislation which assigned primary responsibility for ground water to a single agency. Massachusetts recently passed legislation appropriating $10 million to be used to acquire land or land rights and easements to land over aquifer recharge zones. Ohio is planning to conduct a complete assessment of its groundwater regulatory authority.

STATE PROGRAMS AND RESOURCES

All of the 15 states were conducting groundwater protection activities to some extent, although states' progress varied greatly. There were substantial variations in state efforts in such areas as developing groundwater protection strategies, mapping aquifers and land use in the vicinity of aquifers, developing hydrology data, and using federal and state funds.

Of the 15 states, 9 had some form of overall groundwater protection strategy or policy. The remaining 6 states had not yet developed a strategy. The nature of the strategies varied considerably from the inclusion of relatively comprehensive, specific goals, to strategies consisting of regulatory programs which set water quality standards and required dischargers to demonstrate that those standards will not be violated. An example of a relatively comprehensive state strategy, which was approved by the Massachusetts Legislature in January 1983, is described below.

> The nature of the strategy involves: (1) groundwater resource definition (mapping) and assessment, (2) prioritization of sites with potential for contamination, (3) groundwater monitoring, (4) hydrogeological studies, and (5) coordination of activities. The strategy provides that the state coordinate and administer existing programs and regulations concerning subsurface disposal, landfills, hazardous waste, drinking water, and wetlands. A primary focus of the strategy has been to map aquifers and land overlays of sites in the vicinity of aquifers. These maps are made available to local communities. The strategy encourages local communities to use their zoning and land use powers in conjunction with these maps to control certain activities close to aquifers and recharge areas.

Seven of the states had completed mapping aquifers and two had completed mapping land use in the vicinity of aquifers. The eight states that had not completed mapping had initiated some aquifer mapping activity, and generally plan to complete mapping throughout the states.

Maps need to be updated periodically based on new hydrological information and identification of new potential contamination sites. State officials in Massachusetts, which had completed mapping, informed us that hydrological studies are needed and the maps need refinement to include new contamination sites. However, no data has been developed since about September 1981 as a result of a reduction of funds. Maine, which had not completed mapping, estimated that it will take at least 2 additional years (beyond 1985) to complete mapping and data collection because of reduced funding.

The 15 states had used both state and federal funds for groundwater protection efforts. The amount of funds used was not generally identified as being specifically used for this purpose. Most states gave us estimates for the funds expended.

The source of federal funds was primarily provided by section 208 and section 205 of the Clean Water Act and the underground injection control (UIC) program of the Safe Drinking Water Act. Section 208 funds were available from fiscal years 1978 through 1981 and section 205 funds were available in fiscal years 1982 and 1983. Both section 208 and UIC program funding required a 25 percent state match of funds. In addition to the general funding of groundwater protection efforts, some states received grants for specific projects relating to ground water. For example, Michigan received a $900,000 grant under section 208 to define the state's groundwater sources and develop information, legislation, or organization and resource needs to manage the state's groundwater resources.

The following chart represents the states' best estimates of the amounts of federal and state funds spent in recent years for groundwater protection. Because they do not develop cost information on the specific groundwater protection activities they have carried out, the states consider the estimates as being rough and not completely reliable. The periods of time over which the funds were spent range from 1977 to 1983, and vary between states due to the availability of information upon which the estimates were based.

State Estimates of Funds Expended for Ground Water Protection Efforts 1977-83

State	Federal funds	State funds	Total
Arizona	$ 1,542,000	$ 550,000	$ 2,092,000
Arkansas	374,700	529,300	904,000
California	4,000,000	1,160,000	5,160,000
Florida	250,000	1,050,000	1,300,000
Georgia	735,000	592,000	1,327,000
Illinois	453,254	176,484	629,738
Kentucky	195,600	(a)	195,600
Maine	355,667	126,000	481,667
Massachusetts	368,000	52,221	420,221
Michigan	1,458,000	300,000	1,758,000
Nevada	421,000	(a)	421,000
New Mexico	(a)	(a)	1,154,700
Ohio	26,250	8,750	35,000
Rhode Island	418,488	83,404	501,892
Texas	10,365,000	12,604,700	22,969,700
Total(b)	$20,962,959	$17,232,859	$39,350,518

[a]Specific amount is not available.

[b]The total for federal funds and state funds do not add to the total funds, because the New Mexico total was not separated between federal and state funds.

CHAPTER 4

FEDERAL ROLE IN GROUNDWATER PROTECTION

Groundwater contamination is viewed as a nationwide problem, but as discussed earlier, the sources of contamination vary from region to region. As a result, a uniform nationwide solution to these problems may not be possible. In addition, the groundwater issue addressing the nation has involved a level of concern and debate, principally because the groundwater issue directly involves the question of states rights versus federal control.

All 15 states in our review favored a federal role in formulating, administering, and supporting a national groundwater protection program. However, their views differed on the nature of the role and the level of regulatory control and oversight needed. Nine states believed that some form of national criteria was needed for basic data collection, such as recording contamination incidents and mapping aquifers. Ten states saw EPA's overall role as providing general guidance to states, coordinating groundwater activities, and disseminating information to the states. The highest priority needs of the states were research and technical assistance on groundwater quality and funding to support their programs. Specifics on each of the 15 states' views are included in appendices II through XVI.

EPA has drafted several versions of a groundwater protection policy over the past 3 years. In January 1984, EPA released a draft groundwater protection strategy which proposes to (1) strengthen state groundwater programs, (2) review the need to control unaddressed groundwater problems, (3) create a policy framework for guiding EPA programs, and (4) strengthen EPA's groundwater management organization. Congressional concern over groundwater contamination has prompted the proposal to establish a National Ground Water Commission. Under a bill passed by the House in late November 1983, the commission would develop extensive data and assess the role of federal, state, and local governments in protecting ground water. No similar bill was introduced in the Senate.

NATIONAL CRITERIA FOR BASIC GROUNDWATER DATA COLLECTION

Basic groundwater data includes information on an aquifer's location, size, direction of flow, and geology; the withdrawal and replenishment of water in the aquifer; and the location and nature of contamination or potential contamination sites in the vicinity. The development of basic data provides the knowledge needed for states and municipalities to make protection decisions, such as land use, zoning, and aquifer classification.

In responding to our question on the need for national criteria for basic data collection, nine states favored some

form of national criteria for basic groundwater data collection and four states did not favor national criteria. Two states did not specifically comment on this matter. Three of the nine states that favored some form of national criteria preferred a broad criteria that was not restrictive and which could be used to meet their specific groundwater needs. The following example illustrates this preference.

Kentucky is in the process of the basic mapping of its aquifers. Groundwater officials were cautious about supporting national criteria. They told us that the state had some problems with restrictive criteria in other environmental programs and suggested that federal groundwater criteria should be broad and flexible.

Three states that had completed their basic mapping of aquifers also qualified their preferences for a national criteria. Texas considered such criteria beneficial only for areas or regions with similar data needs. Arizona supported a national criteria if it provided for control over site-specific assessments of groundwater quality and exemptions. New Mexico preferred a national computerized information data system.

Three of the four states that did not favor a national criteria did not provide specific reasons for their preference. Nevada did not favor a national criteria because it believed that the state did not need any additional groundwater mapping or monitoring.

REGULATORY CONTROL AND OVERSIGHT

State views on the need for regulatory control and oversight also varied. Ten states favored a national program with little federal regulatory control. For example, Florida, Illinois, Massachusetts, Michigan, and New Mexico preferred general national groundwater goals. Two of the 10 states--Arizona and Texas--believed that existing federal environmental laws provided adequate groundwater authority. The remaining three states--California, Georgia, and Nevada--preferred a national program with generally no increase in federal regulatory control.

Five states favored a national program with relatively comprehensive federal activity. Arkansas and Ohio preferred the enactment of a new groundwater law. Kentucky, Maine, and Rhode Island preferred a specific national groundwater policy.

The following examples show the range of state preferences concerning the degree of regulatory control needed in a national groundwater program.

--Arkansas groundwater officials favored national groundwater legislation because it might help to give the

state clout to deal with groundwater contamination activities.

--Florida groundwater officials preferred general national groundwater goals along with federal coordination and consolidation of existing environmental laws and activities.

--Arizona groundwater officials were generally opposed to increased federal regulation of ground water and favored a national approach where federal and state agencies would cooperate more closely in implementing existing federal environmental laws.

Although some states were opposed to increased federal regulatory control, most states generally believed that the overall EPA role should be to provide research and technical assistance and to coordinate and disseminate information on groundwater activities. Nine states, for example, believed that EPA should be coordinating and disseminating groundwater information. All 15 states considered research or technical assistance as one of their primary needs. Furthermore, 11 states believed that federal funding to support programs was also a high priority.

STATE NEEDS FOR RESEARCH AND TECHNICAL ASSISTANCE

All 15 states believed that research or technical assistance to support their groundwater programs was one of their highest priority needs. The states' needs for research and technical assistance generally focused on groundwater quality matters. Eight states needed information on safe levels of contaminants; six states wanted information on how various chemicals affect groundwater quality. Five states needed technical assistance on various related matters such as groundwater monitoring and sampling, surface/groundwater interaction, and laboratory analysis techniques.

The following example of Maine's research and technical assistance needs shows this aspect of the federal role in perspective.

Maine favored an overall federal role which provides a national focus for ground water as is now being done for surface water. The state views EPA's role as providing funds to states for groundwater data collection, funding research to meet states' needs, and coordinating what the states are doing. A state official said that to be useful, research should be of nationwide, or at least regionwide, applicability rather than addressing some isolated matters of concern to only one or two states. Maine's groundwater research needs included: (1) determining the effects of various chemicals on groundwater quality, (2) selecting groundwater sampling, drilling, and well

techniques, and (3) determining less costly ways of doing these things.

EPA has information and research ongoing to assist the states in their groundwater protection efforts. For example, in 1981 EPA published a manual describing groundwater sampling techniques. EPA has also published a manual which describes methods for analyzing water and wastes. In addition, EPA will, on an as-needed basis, develop health advisories to assist states and local governments in responding to spills or other types of contamination incidences.

OTA is currently performing a study for the Senate Committee on Environment and Public Works on technologies to measure, monitor, and mitigate groundwater contamination. The study included requesting data from the 50 states. A Spring 1984 report is planned and will be available for state use.

STATE FUNDING NEEDS

Of the 15 states in our review, 11 considered federal funding as one of their primary needs in developing and implementing their groundwater protection programs. All the states told us how they would use any additional federal funds. The following schedule summarizes the information by type of activity.

Activity	Number of states
Mapping of aquifers and improved data collection	9
Increasing staff for groundwater programs	9
Monitoring of groundwater quality	5
Enforcing groundwater regulations	3
Acquiring drilling and laboratory equipment	3
Cleaning up contaminated aquifers	2
Other activities include resolving underground gasoline storage contamination problems, expanding program staff training, and educating the public and private sector	5

Specifics on the priority assigned by the states to these various activities is discussed in the individual state summaries.

Four states did not identify federal funding as a high priority need. Nevertheless, state officials said that if additional funds were provided for groundwater activities, the funds would be used as follows.

--Arizona would use the funds for (1) expanding current groundwater programs, (2) increasing groundwater monitoring, (3) providing additional staff, and (4) establishing a sophisticated data gathering system.

--Georgia would use the funds for (1) monitoring groundwater quality, (2) completing aquifer mapping, and (3) developing a groundwater management system.

--Nevada would use the funds for increasing staff for its discharge permit program.

--New Mexico would use the funds for (1) staffing its groundwater program, (2) improving its management of groundwater data, (3) improving cleanup procedures, and (4) acquiring related support equipment.

EPA EFFORTS AND CONGRESSIONAL ACTIONS AS TO FEDERAL ROLE

EPA has attempted to develop a groundwater protection strategy for the past 3 years. In January 1984, EPA released a draft groundwater protection policy which proposes to (1) strengthen state groundwater programs, (2) review the need to control unaddressed groundwater problems, (3) create a policy framework for guiding EPA programs, and (4) strengthen EPA's groundwater management organizations. Congressional concern over groundwater contamination has prompted a proposal to establish a National Ground Water Commission to assess the federal role in protecting ground water.

Strategy development

Since 1980, EPA has drafted several versions of a groundwater protection policy but has yet to issue a final policy. EPA started developing a national groundwater protection policy in 1979. In November 1980, EPA issued its "Proposed Ground Water Protection Strategy," which emphasized a preventive approach to groundwater protection and established a goal of assessing, protecting, and enhancing the quality of ground water. The strategy proposed the classification of ground water according to its use and encouraged all states to develop their own groundwater protection strategy. The strategy limited EPA's role to establishing minimum national requirements for selected high priority problems, for example, highly toxic chemicals and coordinating the various federal groundwater protection activities..

With the change in administrations in January 1981, work on the November 1980 strategy ceased. In June 1982, the EPA Administrator directed that EPA develop a groundwater protection policy. Shortly before publicly announcing the draft policy, the Administrator decided to refer the policy to the Cabinet Council on Natural Resources and the Environment for its review

and approval. The Secretary of the Interior, who chaired the council, opposed the draft policy because he felt that it would establish federal control over ground water. The council did not approve the policy and all EPA work on the policy stopped.

In June 1983, the EPA Administrator established a task force to study EPA's groundwater protection efforts and to determine how these efforts can support states in carrying out groundwater protection activities. Specifically, the Administrator directed the task force to (1) assess the differences in EPA's major policies, regulations, and operational practices of its major groundwater-related programs, (2) determine how EPA should coordinate its groundwater policy development and implementation among the EPA offices and regions, and (3) review EPA's policies and actions in light of their effect on state groundwater protection programs.

During congressional hearings in June 1983, the EPA Administrator indicated that he would await the task force's report before taking any action on ground water. The task force presented its findings to the EPA Deputy Administrator in September 1983 and in late January 1984, EPA distributed its draft groundwater protection strategy to select state, business and industry, and environmental organizations for comment. The strategy proposes to (1) strengthen state groundwater programs, (2) review the need to control unaddressed groundwater problems, (3) create a policy framework for guiding EPA programs, and (4) strengthen EPA's groundwater management organization.

Under EPA's draft strategy, the states, with the local governments, have the principal role in groundwater protection. To strengthen state groundwater programs, EPA plans to provide financial assistance to support state program development, offer technical assistance to the states, and target its research efforts toward state requirements. The strategy states that the financial assistance will come from existing grant programs but does not identify the amount of such assistance.

To control unaddressed groundwater contamination problems, EPA plans to assess the extent of groundwater contamination by leaking underground storage tanks, issue an advisory warning gasoline owners and operators of the problem and develop a regulatory program for this contamination source. The draft strategy also states that EPA plans to assess groundwater contamination problems associated with surface impoundments and landfills and whether there is a need to further regulate these facilities.

To create a policy framework for guiding EPA programs, EPA plans to adopt guidelines to insure consistent decision making among EPA programs. The strategy states that the guidelines will make use of existing statutes to define an appropriate protection strategy for three classes of aquifers: special aquifers (aquifers vulnerable to contamination because of their

hydrological characteristics and which are irreplaceable sources of drinking water or ecologically vital); aquifers that are current and potential sources of drinking water; and aquifers that are not considered potential sources of drinking water. According to the strategy, the guidelines are to improve the consistency and effectiveness of EPA's current groundwater programs. The strategy also states that states will generally have to establish programs that are at least as stringent as the guidelines in order to obtain authorization to administer these programs.

To strengthen EPA's internal groundwater organization, EPA plans to establish an Office of Ground-Water Protection in the Office of Water and comparable offices in each region. The responsibilities of the groundwater office will include coordinating all EPA groundwater activities, identifying and directing the development of groundwater policies and guidelines, and coordinating the activities of EPA program offices to carry out EPA's groundwater protection strategy.

EPA expects to receive public comments on its proposed groundwater protection strategy by the end of March 1984. EPA anticipates that the comments will provide it with valuable perspectives on the proposed strategy and will consider the comments in issuing a final groundwater protection strategy in the spring of 1984.

Congressional actions

Congressional concern over groundwater contamination has prompted the proposal of a National Ground Water Commission. Under a bill passed by the House in November 1983, the commission would undertake an extensive data accumulation and assessment effort involving 21 facets of the groundwater issue. In addition to identifying the general sources, extent, and types of groundwater contamination in this country, the commission would also assess the (1) need to protect ground water from degradation caused by contamination, (2) role of land use as it relates to protecting groundwater quality, (3) adequacy of existing standards for groundwater quality under existing federal and state law, (4) monitoring methodologies of the states and federal government, (5) adequacy of existing groundwater research and the need for future research, and (6) roles of federal, state, and local governments in managing groundwater quality and quantity.

The commission proposed by the House bill would consist of 19 members--10 members of Congress; the Director, Office of Technology Assessment; and 8 individuals appointed by the President from the public and private sectors. The commission would be required to report its findings and any recommendations for legislative or adminsitrative actions to the President and the Congress by October 30, 1985. The House bill would authorize up to $7 million for the commission's work. No similar bill was introduced in the Senate.

LIST OF STUDIES AND PUBLICATIONS REVIEWED

DEALING WITH GROUNDWATER CONTAMINATION

Studies

"Compendium of Cases of Ground Water Contamination." EPA, Aug. 1982.

"Contamination of Ground Water by Toxic Organic Chemicals, Council on Environmental Quality." Jan. 1981.

"Draft Report on Assessment of Hazardous Waste Mismanagement: Damage Case Histories." Fred C. Hart Associates, Dec. 1982.

"Draft Report on Surface Impoundment Assessment--National Report." EPA, Dec. 1982.

"Draft Report on Groundwater Contamination by Toxic Substances: A Digest of Reports." Congressional Research Service, June 1983.

"Final Community Water Supply Survey." EPA, Jan. 1981.

"Ground Water Contamination in the United States." Environmental Assessment Council, Academy of Natural Sciences, Sept. 1983.

"Institutional Responses to Contamination of Ground Water Used for Public Water Supplies: Implications for EPA R&D Programs." ICF Incorporated, March 1983.

"Issue Brief--Groundwater Contamination and Protection." Congressional Research Service, July 1983.

"National Statistical Assessment of Rural Water Conditions." EPA, June 1982.

"Occurrence of Tetrachloroethylene in Drinking Water, Food, and Air." JRB Associates, Aug. 1982.

"Report to the Congress: Waste Disposal Practices and their Effects on Ground Water." EPA, Jan. 1977.

"Review of the Potential Hazards to Ground and Drinking Water Sources in the United States and Ohio." Congressional Research Service, May 1983.

"Surface Impoundments and their Effects on Ground Water Quality in the United States-A Preliminary Survey." EPA, June 1978.

"The Ground Water Supply Survey - Summary of Volatile Organic Contaminant Occurrence Data." EPA, June 1982.

Publications

"Groundwater Quality Management." American Water Works Association Journal, Oct. 1982.

"Groundwater Contamination: An Emerging Threat." Technology Review Magazine, July 1982.

"How Much Ground Water Have We Really Polluted." Ground Water Monitoring Review, Winter 1982.

ARKANSAS GROUNDWATER ACTIVITIES

Arkansans consume about 4 billion gallons of ground water each day out of the state's 200 trillion gallon groundwater reserve. Ground water supplies 42 percent of the population with drinking water through public supply systems; however, 75 percent of the public supply systems and nearly all domestic users depend on ground water. About 86 percent of the ground water is used for crop irrigation.

The largest agricultural consumers are in the Mississippi Delta area. The rice growers consume 80 percent of all ground water used in irrigation. Many counties in the southern and eastern part of the state depend totally on ground water for domestic and industrial uses. Some aquifers in these areas are being drained faster than they can be recharged. Residents in central and northern Arkansas primarily use surface water.

The information contained in this summary was obtained from the Chief, Water Division, Arkansas Department of Pollution Control and Ecology.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

Although Arkansas is a water-rich state, depletion in the coastal plain area, oil and gas contamination in the south central area, and efforts by less water-rich states to divert Arkansas' water cause Arkansans increased concern about their water. Generally, state officials believe that the overall quality of their ground water is good, but they are concerned about the potential for contamination from abandoned, solid, and hazardous waste sites; oil and gas operations; irrigation and other farming activities; aquifer depletion; municipal wastewater treatment facilities; and saltwater encroachment.

Arkansas has six abandoned waste sites approved for cleanup under the Superfund program. The state also knows of 140 uncontrolled solid and hazardous waste sites that may have groundwater or other environmental problems, but it has not had enough resources to assess the potential harm. By September 1984, state officials hope to have determined the status of these sites and their potential for contamination. The state's Surface Impoundment Assessment identified 7,000 surface impoundments, e.g. pits, ponds, and lagoons, that contain brine residues from the oil industry and are potential sources of contamination.

Irrigation in the gulf coastal plain region has resulted in groundwater depletion and saltwater encroachment. Freshwater aquifers are in direct contact with saline water, and improper drilling and overpumping of wells may allow salt water to migrate into freshwater zones. As overpumping lowers the water table and the relative thickness of the freshwater zone, the movement of salt water up into the well becomes more pronounced.

A rural contamination problem results from insufficient spacing between water wells and animal operations, or between wells and septic tank filter fields. Fifteen of the western and north central counties have shallow soil underlain by cavernous or fractured limestone, which allows almost unrestricted downward flow of improperly stored or applied animal or human wastes into aquifers. Although there have been no reports of wells closed because of these problems, the state is certain that some wells have been closed or redrilled. The Department of Agriculture's Soil Conservation Service is working with farmers to improve manure-spreading practices and irrigation practices.

STATE EFFORTS TO PROTECT GROUND WATER

Arkansas has seven agencies involved in protecting ground water. The two primary groundwater protection agencies are the Arkansas Department of Pollution Control and Ecology and the Arkansas Soil and Water Conservation Commission. The Department is responsible for the various environmental programs (water, hazardous waste, Superfund, and mining) that protect ground water; the Commission is charged with planning for effective use of all Arkansas waters, including ground water.

The state believes it has sufficient authority through existing laws and regulations to implement a statewide groundwater policy. The Department believes that it has sufficient authority to address groundwater quality issues and those quantity issues that affect quality. However, some state legislation may be needed to regulate water use, especially during periods of drought. The Department currently has authority through its Water and Air Pollution Control Act to protect the "waters of the State," including its ground water.

The Commission sought additional groundwater authority during the last legislative session, introducing two bills relating to water protection. One bill provided for developing a water code and establishing water management districts. The second bill provided for registration of any groundwater diversions and was aimed primarily at controlling water quantity rather than quality. Both bills failed to pass the state legislature.

The state is developing a groundwater strategy, which should be completed in 1984. As part of the strategy, the Department is (1) compiling information on ground water, (2) proposing a groundwater classification and monitoring system, (3) developing management strategies to control groundwater pollution, and (4) recommending new legislation. Reports on the siting of hazardous waste landfills, surface impoundments, and land application systems have already been completed.

Arkansas has also identified its major aquifers. Aquifers in the gulf coastal plain area have been described in detail, including contours, thickness, and water quality. The west central region has not been as extensively mapped because the complicated

geology makes hydrology mapping extremely difficult and costly. Most ground water has not been as highly developed in this area because of low well yields, low population density, and because the ground surface is more suited to construction of surface run-off impoundments. Maps for the more clearly defined aquifers of the state's southeastern part have been completed.

Arkansas does not have a systematic statewide groundwater quality monitoring network. The Arkansas Department of Health takes routine samples every 3 years as required under the Safe Drinking Water Act, and the United States Geological Survey samples 26 selected wells for quality on a 5-per-year basis. Also, the University of Arkansas analyzes water samples submitted from irrigation and private wells on request. Except for USGS and computerized systems that contain surface water monitoring data, no centralized system for collecting and maintaining groundwater data exists, nor is there any comprehensive statewide groundwater monitoring system.

The state estimated that in the fiscal year ended June 30, 1982, principal state agencies spent approximately $192,000 in federal funds from the Clean Water Act and the Safe Drinking Water Act, and $247,900 in state funds for groundwater data collection, mapping, monitoring, and data analysis activities. The state estimates that in fiscal year 1983, $182,700 in federal funds and $281,400 in state funds will be spent on these activities.

STATE VIEWS OF THE FEDERAL ROLE

The state believes that groundwater technology, data exchange, and research would be beneficial to the states and said that the following elements are necessary to enable Arkansas to have a cohesive state groundwater protection policy:

--Staff to adequately address current programs. The Department has only 14 persons to conduct compliance inspections in 75 Arkansas counties for the air, water, and solid waste programs, and only 3 for the hazardous waste program.

--Greater commitment from the state government. As Arkansas elects its governor for only 2-year terms, the Department is in a state of flux until the new governor outlines his environmental stance. Without a commitment from the state, there is little likelihood that environmental programs can deal efficiently with pollution problems. The EPA region said that because the state pays relatively low salaries, it has problems recruiting and keeping hydrogeologists.

--Map overlays of activities that are potentially threatening to ground water. The Department believes that maps designating critical aquifer recharge areas and areas especially sensitive to surface pollution, such as the limestone areas of northwest and northcentral Arkansas, would be beneficial. Such mapping is needed both on a broad basis and

on a local basis. The Arkansas Geological Commission believed that a consolidation of available information into maps, by aquifer, showing information such as depth to aquifer top, aquifer thickness, depth to aquifer bottom and anticipated water quality, would be beneficial, as would a test drilling program to obtain this type of information where it is not available. USGS, on the other hand, suggested mapping the extent of the pollution once groundwater problem areas were defined.

--A groundwater data gathering system that includes data currently available from the various state and federal agencies. Also, a groundwater monitoring network should be established for both quantity and quality.

The Department stated that it would use additional federal funds for (1) more staff for inventory, assessment, and planning, (2) staff training, (3) public education, (4) corporate education, and (5) monitoring equipment.

The state generally believes that federal groundwater legislation might help give the state clout to deal with activities that could potentially contaminate the ground water. Although existing state and/or federal laws regulate these activities, the state has problems administering and enforcing the laws because of resource constraints.

The Department stated that the federal government needs to develop consistent guidelines for protecting interstate aquifers and their recharge areas and for maintaining sustained yields. The Department recommended establishing a central clearinghouse for information from groundwater research, states' experiments with different administrative and legislative approaches, and more data on the feasibility of various corrective techniques. The Department also suggested that a clear statement of responsibility for groundwater contamination should be made similar to that contained in Section 309 of the Clean Water Act, which establishes federal enforcement activities when permit violations occur.

The Arkansas Geological Commission believed that increased funding would be benefical and suggested that more 100 percent federal money be injected into the state's Geological Survey programs.

The Department suggested that a federal council be established to coordinate all groundwater efforts, since much of the mapping, data collection, and monitoring efforts are done by agencies other than EPA. The state should then establish a similar organization to coordinate the state efforts.

APPENDIX III

ARIZONA GROUNDWATER ACTIVITIES

Arizona is a semi-arid state with 68 groundwater basins. The state relies on its ground water for about 60 percent of its drinking water supply. Recharge of its aquifers is small, and the state presently consumes 2.5 million acre-feet more ground water than is replenished each year. Many areas use ground water as their only drinking water source. Ground water use is distributed fairly uniformly about the state, but only 40 percent underlies deeded land that can be developed by private landowners. Of the state's 68 water basins, development is concentrated in only 24. These 24 basins contain about 89 percent of the state's total population (2,718,000) and are responsible for approximately 94 percent of total state water depletion, 60 percent of the mineral industry, and 96 percent of the crops harvested.

The information in this summary was obtained from the Deputy Director for Engineering/Administration of the Arizona Department of Water Resources (ADWR).

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

While the state does not have a comprehensive summary that shows the significance of groundwater contamination for all sources, there have been many studies regarding specific contaminants in Arizona's aquifers and the effect of various kinds of surface activities on groundwater quality. Overall quality of the state's ground water varies from acceptable to unusable, primarily due to the mineralogical makeup of the formations from which water is being pumped. Some aquifers have high levels of total dissolved solids, while others exceed established levels of arsenic or have excessive amounts of sulfates, chlorides, or fluorides.

According to a March 1983 "Water Quality Assessment Report" prepared by the Arizona Department of Health Services (ADHS), the most publicized and potentially the most dangerous threats in the Santa Cruz area are from contamination by trichloroethylene (TCE), an industrial solvent, and in the Phoenix and Yuma areas from dibromochloropropane (DBCP), a pesticide used in nemotode control. TCE was first discovered in May 1981 near the Tuscon International Airport, and since that time, five city of Tuscon public drinking water wells have been abandoned. Seven wells in the Phoenix-Scottsdale area were also closed because of TCE contamination. An EPA-funded well sampling program in Yuma and Maricopa counties from June to September 1979 showed that 22 of 47 wells in Yuma County were contaminated and 25 others were recommended for abandonment. In Maricopa County, of 93 wells sampled, 26 were contaminated and 5 were recommended for closing. The state has some concern presently that no DBCP studies have been conducted since 1980.

The state believes that other possible activities which may result in groundwater contamination are past and existing mining activities, septic tanks and other kinds of onsite disposal

systems, sewage treatment plant discharges, and agricultural irrigation. One of the state's most serious groundwater problems results from large-scale withdrawals and the limited recharge.

STATE EFFORTS TO PROTECT GROUND WATER

Two Arizona agencies share ground water protection responsibilities--ADWR and ADHS. ADWR's primary responsibility is for ground water quantity and other water-related matters. ADHS is responsible for groundwater quality.

Arizona's water quality statutes, as adopted in 1967, provide for the prevention, control, and abatement of pollution in the state's waters. The statutes were passed in response to the Federal Water Pollution Control Act, and resulted in a pollution control program that focused on the state's surface waters. Early in the program, the Arizona Attorney General issued an opinion that the state's waters included ground water and said that the state's water pollution control agency should develop a program for groundwater pollution control. Pending final review and certification by the State Attorney General, ADHS is now in the early stages implementing a program.

The program specifies standards for ground water and establishes a permit system for potential discharges. The standards build from the broad goals of management and maintenance of Arizona's groundwater quality to a set of general standards that deal with protection of existing and future uses of ground water, prevention of public health hazards, control of discharges of hazardous or toxic wastes, and protection of the quality of surface waters fed by groundwater discharge. The permits are part of a system that establishes ". . . procedures, requirements and criteria with which activities which may affect groundwater quality must comply." The permit system applies to existing and new activities and includes both point and nonpoint activities.

Implementation of the program began in 1983. Work has included: compiling and prioritizing a list of individual facilities and general activities that will require permits; developing data management systems to track permit status and compliance by facility; organizing and training technical staff; and establishing programs, procedures, and policies to process permits and monitor compliance.

Arizona passed a Ground Water Code in 1980 to restrict and control groundwater withdrawals and uses and reduce rates of groundwater overdraft so that Arizona would attain safe yield conditions in three major management areas by the year 2025. According to a recent article written by the Deputy Director, Engineering, ADWR, the Code

> ". . . provides for ground water management by: (1) creating a system of rights for existing users, allowing the conveyance and transfer of rights to new

users to meet the changing nature of the state's economy and permitting new rights to be issued only if the withdrawals will not exacerbate the overdraft problem; (2) mandating all users to implement evermore stringent conservation measures that will be specified in a series of management plans; (3) providing for purchase and retirement of irrigated agricultural lands and rights; and (4) providing for augmentation and recharge projects. Implementation of the Code is proceeding; although statutorily mandated programs have been completed on time, as the Code's restrictions become more binding on the users, resistance among them is increasing."

Based on the statute, program, and code, the state generally believes that it has sufficient authority to implement a comprehensive groundwater protection policy.

The bulk of the groundwater resource data has been collected by the USGS (in cooperation with Arizona), which has conducted a program of groundwater studies in Arizona since 1939. These studies define the amount, location, and quality of the groundwater resources of Arizona and monitor the effects of large-scale development of the groundwater supplies. The program includes the collection, compilation, and analysis of the geologic and hydrologic data necessary to evaluate the state's groundwater resources.

Since 1974, a major thrust of the program has been to inventory the groundwater conditions in the 68 groundwater areas of the state. Several selected groundwater areas are studied each year, water levels are measured annually in a statewide observation-well network, and groundwater pumpage is computed for most of the areas. As of July 1982, reports had been published for 54 of the 68 groundwater areas. Data collected in the groundwater areas include information on selected wells, water-level measurements, and water samples for chemical analysis. The data for each of the selected groundwater areas are analyzed, and the results are published in map form. Typically, the maps show water depth, change in water levels, altitude of the water level, and water quality data, such as specific conductance, dissolved solids, and fluoride.

ADWR has also prepared other specialized maps. For example, one series designates the suitability of ground water in the state for development of (1) domestic water supplies, (2) municipal and industrial supplies, and (3) irrigation water supplies. In addition, it identifies amount of groundwater supplies in each designated basin within the state.

EPA region IX officials estimated that Arizona used about $1,542,000 in federal funds for groundwater protection in fiscal year 1983. These funds included the following:

Clean Water Act		Safe Drinking Water Act	
Section 106	$ 20,000	Public water supply	$ 65,000
Section 205	$ 127,000	UIC and sole source aquifer protection	$129,000
Section 208	$1,201,000		

The state was not able to totally estimate state expenditures for groundwater protection. However, ADHS officials said that $40,000 to $60,000 in state funds had been spent in fiscal year 1981 for identifying TCE contamination, and an ADWR official identified $500,000 ADWR spent to study groundwater basins.

STATE VIEWS OF THE FEDERAL ROLE

Commenting on national groundwater legislation, Arizona's Governor stated in an April 1983 letter to the Secretary of the Interior that he would ". . . oppose any efforts by Congress to pass laws directly regulating ground-water quality." The letter said that the fishable, swimmable standards of the Clean Water Act are inapt for ground water and for that reason EPA's proposed groundwater policy dated November 30, 1982, is a well-reasoned starting point for discussion of a groundwater policy. The Governor agreed with the draft's general goal that preventing all contamination is not appropriate for universal application; instead, contamination that might endanger human health or the environment should be prevented.

ADHS officials agreed with a uniform national program if it allowed for site-specific assessments of groundwater quality and exemptions. Generally, these officials believed that the federal role should consist of providing technical assistance and research rather than regulation. They said that research was needed to determine what are the safe levels of chemicals in the ground water. ADHS also suggested that EPA develop uniform field investigation criteria as well as continuing to provide laboratory analysis.

ADHS believed that additional groundwater mapping would not solve the state's existing problems and since Arizona covers 113,000 square miles, mapping would be extremely expensive. ADHS agreed that there was a need for more data such as hydrological data on recharge. The Deputy Director of ADWR's Engineering Administration said that more intensive data analysis and interpretation of the groundwater systems was needed for a better understanding of many of the basins.

The state would use additional federal funds for such activities as expanding its current groundwater protection programs, increasing monitoring of the state's aquifers, increasing the state's staffing, and for more sophisticated data gathering and analysis for such areas as better understanding how water systems respond to stress and land subsidence.

CALIFORNIA GROUNDWATER ACTIVITIES

Groundwater basins are present under about 40 percent of California's surface. The 394 groundwater basins provide about half the state's drinking water, or 2-1/2 million acre-feet per year. Total pumping from the basins is about 15 million acre-feet per year from all sources. Several of the state's basins are treated like underground reservoirs with artificial replenishment and management plans (more than 2 million acre-feet per year are replaced).

The information contained in this summary was obtained from the Chief, Division of Technical Services, State Water Resources Control Board.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

In recent years groundwater contamination has occurred in many of the basins throughout the state. An April 1983 report prepared by the state's Assembly Office of Research stated that groundwater contamination resulted from a number of sources but that underground chemical storage and hazardous waste disposal was particularly threatening. The state's Chief of Sanitary Engineering laid the cause of the majority of the state's contamination cases to agricultural use of pesticides rather than to industrial operations. A June 1983 report of the State Water Resources Control Board identified 512 known instances of groundwater contamination by more than 50 pesticides. Regardless of cause, there are many examples of groundwater contamination in California, including the following:

--In late December 1979, the industrial solvents TCE and tetrachloroethylene were discovered in several domestic water supply wells in the San Gabriel Valley of Los Angeles County. This discovery caused more than 50 wells to close.

--The San Francisco Regional Water Quality Control Board has compiled a list of motor vehicle fuel leaks reported in the Bay area in 1980-1982. The list, while not all encompassing, contains 43 separate instances of gasoline or other fuel leaks into the ground. For over half the leaks, no estimate of the amount could be made; the others ranged from 1 to over 100,000 gallons, generally in the 1,000 to 5,000 gallon range.

--DBCP is a soil fumigant used to kill worms that attack a wide variety of agricultural tree and row crops. Although banned in 1977, DBCP, with concentrations greater than or equal to 1 part per billion, was found in 359 community water supply systems and in 30 school wells. In the testing program in the Central Valley, 1,000 of 7,000 wells were found to have DBCP present in concentrations of greater than or equal to 1 part per billion.

--Additional agricultural contaminants have been found in 67 wells, mostly domestic, in eight counties.

--A potential carcinogen has been found in ground water in the San Joaquin Valley.

STATE EFFORTS TO PROTECT GROUND WATER

Groundwater protection is a shared responsibility in California. The state has four agencies involved in groundwater protection--the State Water Resources Control Board, the Department of Water Resources, the Department of Health, and the Department of Food and Agriculture. The State Water Resources Control Board is the "umbrella agency" for the state's ground and surface water protection efforts.

The Board consists of a five-member appointed board and has nine semi-autonomous Regional Water Quality Boards under it. The regional boards are the action parties for water quality.

Together with the regional boards, the state board has been active in groundwater protection. The state policy on groundwater pollution, laid out in a state board resolution, does not distinguish between ground and surface water, but it does set up a nondegradation policy to maintain existing water quality.

Presently, state policy exists and local problems are being dealt with by the state and regional boards. Examples of actions taken by these boards include enforcement measures for mitigation and cleanup of TCE in water supplies and field sampling and literature analysis. The boards have recommended re-evaluation of registration for certain pesticides by the California Department of Food and Agriculture. The State Resource Control Board told us that no systematic statewide approach to groundwater problems is available, nor is there a statewide monitoring system. The State Board, however, has been planning groundwater monitoring for about 5 years and is also trying to design monitoring networks, with the aid of USGS, to tie together the monitoring efforts of Regional Water Quality Boards and local agencies. The state has spent about $100,000 to $200,000 each year for this network design. Originally, the monitoring was to be groundwater basin or geographically based; however, because of the lack of funds to expand the monitoring beyond only a few basins, the board is considering focusing groundwater monitoring on problem areas. This effort has also suffered because of inconsistent funding.

The state's UIC program is administered by the Water Resources Control Board with participation by the California Division of Oil and Gas, which administers the portion of the program involving oil and gas production wells (class II wells). The Board has not been delegated program responsibility for the four remaining classes of UIC wells. Although the Water Resource Control Board has prepared a draft application requesting

delegation of such responsibility, EPA still has concerns regarding differences between federal and state laws according to a board official. This official stated that EPA intends to announce that it will run the UIC program in California in the interim, but he said that state agency involvement in this case would be unclear.

The regional boards' power to regulate any discharge that could affect ground water is provided by legislative authority. This authority, combined with the state's policy of nondegradation, seems to be quite extensive. Yet, the available resources are not sufficient to deal with future groundwater problems, according to state personnel.

Monitoring has suffered from lack of funding and, according to a state board official, present resources are not sufficient to deal with future groundwater problems. For example, in May 1983, the state legislature was considering efforts to inventory and control chemical storage tanks, but such efforts would require additional staff. One state official estimated that an adequate resource level for groundwater protection would require the addition of about 75 staff years for the next couple of years to the state board staff.

A definite estimate of federal groundwater funds used in California was not available. The EPA region identified that California used: $2.7 million (through fiscal year 1981) of section 208 funds; $300,000 of UIC and sole-source aquifer protection funds; and $1 million of Public Water Supply Systems funds in fiscal year 1983. EPA also identified eight federal section 205 grants in fiscal year 1983, which have groundwater related actions.

The state board is to receive $672,000 in Resource Conservation and Recovery Act (RCRA) funds from EPA for first 9 months of federal fiscal year 1984 to inspect, review, and evaluate interim status groundwater monitoring programs, alternative systems, and facilities requesting waivers. The funds will be used to review the water quality provisions of site closure plans and assist the State Department of Health Services and EPA in related enforcement actions.

The Department of Water Resources is the state's long-term water supply planning agency and is responsible for mapping the state's groundwater resources. The mapping, which has been conducted for more than 30 years, gives quantity (boundaries of groundwater basins, quantity of water, and replenishment) and often quality information. The state estimated state funds spent for groundwater studies by the Department at $750,000 annually.

The Department of Health Services regulates domestic water supplies and has issued permits to about 1,400 community systems. It has also delegated permitting authority to the counties, which in turn have permitted about 10,000 small community systems. In

1981, the state reported that the existing monitoring program (required tests of public systems) cost about $410,000. The Department has been involved in groundwater investigations and monitoring for DBCP since 1979, and more recently, in investigating and monitoring for TCE in four groundwater basins.

The Department of Food and Agriculture is also peripherally concerned with protecting groundwater quality, primarily through regulating the use of pesticides, (California uses about 50 percent of the pesticides used in the nation). The Department has also been involved in testing for DBCP in ground water since 1979.

STATE VIEWS ON FEDERAL ROLE

The state believes that a useful federal role in groundwater protection would be to provide technical assistance to the state on the toxicity of various chemicals and to provide federal research to help the state set safe levels for various chemicals. The state was not responsive to increased federal involvement--except in terms of research or providing resources so that the state could go ahead with its programs. For example, the state thought federal funding of a state program to inventory groundwater conditions and monitoring activities and then design groundwater monitoring networks for up to 100 of California's most important groundwater basins would be beneficial. The estimated cost would be about $10 million. The state also suggested federal-state matching program (75-25) for operating these monitoring networks at an estimated annual federal cost of $1.5 million.

Generally, the state did not believe any additional groundwater mapping was needed because basic mapping has already been completed. However, the state does need additional resources to accomplish more groundwater investigations to localize and develop solutions for groundwater problems.

The state said that if additional federal money was provided to the state for ground water, it would be used for:

--definition, resolution, and abatement of problems associated with underground storage tanks;

--increased groundwater monitoring, particularly in the vicinity of hazardous waste disposal sites or other sources of hazardous wastes; and

--increased "hot spot" monitoring to define severe problems due to such contaminants as pesticides and industrial chemicals.

FLORIDA GROUNDWATER ACTIVITIES

Florida is a water-rich state; over one-fourth is classified as wetlands. Its aquifers underlie most of the state and are the source of over 90 percent of the population's drinking water. Unique hydrological and climatic features, such as heavy rainfall and shallow aquifers, make Florida's ground water particularly vulnerable to pollution. This is most evident in the case of the heavily populated Miami-Dade County area, which is served by the shallow Biscayne Aquifer.

The information contained in this summary was obtained from the Administrator, Groundwater Section, Florida Department of Environmental Regulation.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

A State Legislative Task Force report on groundwater pollution identified 42 cases of groundwater contamination as of August 1982. Five of these 42 cases were in the Miami-Dade County area. The task force also identified widespread problems of contamination from surface impoundments, industrial storage tanks, agricultural chemicals, and drainage wells discharging water and wastewater directly into potable water aquifers. For example, an industrial drum-recycling facility in Miami disposed of washings from the drums into an unlined pit on its property for 14 years. The disposal pit is located 750 feet from a newly developed water supply for the city of Miami, and groundwater samples there showed high concentrations of industrial organic solvents. The state's list of 25 Superfund sites include many cases of groundwater contamination, most of which affect the Biscayne Aquifer.

STATE EFFORTS TO PROTECT GROUND WATER

The state is undertaking an extensive effort to identify and control groundwater pollution, including naming a single state office responsible for ground water; planning and developing a computer-based, ambient groundwater monitoring system; promulgating rules and policies for classifying and protecting the state's ground water; and related activities, such as mapping the state's aquifers.

Florida has given statutory authority to direct, manage, and protect groundwater resources to the Florida Department of Environmental Regulation. The Department has created a Groundwater Section with a staff of about 20 people. Most of the groundwater activities flow through this single point of responsibility.

The state has developed two computer systems, one for inventorying the pollution sources and the other for groundwater testing and reporting. When operational, these systems will contain data on aquifer characteristics, boundaries, and monitored contaminants. A part of this effort will be to determine the best locations for groundwater monitoring wells for a monitoring network.

Earlier studies located 1,800 wells that could be used in the network, but additional wells may have to be drilled where no suitable wells exist.

The USGS completed a set of maps for all aquifers in 1980. These maps illustrate all major sources of groundwater supplies and show locations of cities and communities in relation to the groundwater sources. The maps graphically define the structure of Florida's aquifers and the dimensions of the top, base, and thickness of each aquifer. Maps also state the aquifer quality, drawn from a consolidation of historical water-quality reports. These maps illustrate some of the contaminants and their relation to usable groundwater sources.

According to the Department's Environmental Administrator, Groundwater Section, the state has an extensive body of law and regulations pertaining to ground water which provides for protection, as well as quantity management. The state is attempting to pass additional groundwater legislation to strengthen and extend existing statutes and rules, such as laws to regulate gasoline storage and to designate a specific authority for regulating pesticide use.

The state's groundwater strategy has as its goal protecting ground water for its "current and future most beneficial use." The state has established a classification system that provides the highest protection for "single source aquifers" and potable aquifers. This system allows discharge into low quality aquifers that are not expected to serve as a source of potable water. The state enforces its protection policies through a permit program. The state has no power over zoning; however, local governmental bodies do.

The state does not believe it has sufficient resources to go into the more expensive phases of the state's groundwater strategy at this time: to install monitoring wells and begin data compilation for a statewide system. In fiscal year 1982, the state spent an estimated $525,000 in state funds and $175,000 in federal (UIC and section 106 grant) funds for groundwater protection, including groundwater mapping, monitoring, data collection, and analysis. For fiscal year 1985, the state estimates that about $525,000 in state funds and $75,000 federal (UIC and 106 grant) funds would be used for groundwater activities. The 1983 figures represent 9 months of state funds and 6 months of federal funds.

STATE VIEWS OF THE FEDERAL ROLE

The state believes that the federal role in protecting ground water should be more research and technical assistance than regulatory. Technical assistance in establishing the safe levels of various chemicals is extremely difficult for Florida because it lacks scientists and technicians and cannot afford these highly trained, specialized personnel. The state suggested research at the national level on chemical toxicity rather than duplicative

state efforts. However, the state believes that if the federal government does not provide this research, it should provide the state with additional funds to hire scientists who can help evaluate the potential effects of the state's growing toxic pesticides problem.

No new federal laws are needed to protect the ground water. The state believes that establishing general national goals and coordinating and consolidating existing federal environmental laws and activities would be the most effective strategy. The state expressed concern that detailed rules and federal control over the state's use of water would result from a national approach to groundwater protection.

If additional federal financial and technical assistance were made available, Florida would use the assistance in the following ways:

--Financial assistance for evaluation and correction of known groundwater pollution sites. Florida lacks the resources to gather necessary information on the severity of pollution at the many existing groundwater pollution sites.

--Financial assistance in setting up a statewide ambient water-quality monitoring network. The network would document existing water quality and be used for planning and early warning purposes. Initially, emphasis should be placed on investigation, evaluation, and mapping of aquifer segments most susceptible to pollution, such as recharge areas and high population density areas.

--Technical assistance for research into the safe levels of various chemicals and their persistence in the water and soil. The state believes that present EPA research into the effects of chemicals on the environment is inadequate.

APPENDIX VI

GEORGIA GROUNDWATER ACTIVITIES

About 50 percent of Georgia's water needs, excluding power generation, is provided by ground water, and 28 percent of the drinking water is supplied by ground water. Georgia began its Accelerated Ground-Water Program in fiscal year 1978 because of concern that much agricultural use of ground water was not controlled by permitting. Program officials have disclosed that the overall groundwater supply picture in Georgia is very good and that the aquifers in the state are underutilized in all but a few areas.

The information contained in this summary was obtained from the Director, Environmental Protection Division, Georgia Department of Natural Resources.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

The "State Surface Impoundment Report" indicated that Georgia does not have any significant man-made groundwater contamination problems. The only recent case of contamination resulting in a well closing involved high levels of natural radioactivity. The state told us that, to its knowledge, only one well has been closed in the last 2 years because of gasoline contamination from a local gasoline station.

The division director responsible for groundwater protection attributes the lack of man-made groundwater problems to the state's geology. Georgia's aquifers tend to be fairly deep in areas most susceptible to contamination, and Georgia does not have many industries that would pollute the ground water.

The state's primary source of groundwater contamination is connate saltwater intrusion from extensive groundwater withdrawals.

The Accelerated Ground-Water Program's status report for 1982 showed that Georgia's entire coastal plain is underlain by salt water at varying depths. In some places, salt water apparently is moving upward along possible geologic faults or through improperly constructed wells. Extensive groundwater withdrawals in this area for industrial, municipal, or irrigation use could accelerate this upward flow of salt water, thereby contaminating shallower freshwater aquifers. Also, the heavy use of ground water for irrigation to the north of Savannah in Georgia and South Carolina probably will intercept ground water, which historically has flowed to Savannah. If such interception occurs, it is believed that the cone of depression at Savannah will deepen and enlarge, thereby accelerating the flow of salt water beneath Hilton Head Island in South Carolina towards Savannah.

STATE EFFORTS TO PROTECT GROUND WATER

The state has assigned primary responsibility for groundwater protection to the Georgia Environmental Protection Division within the Department of Natural Resources. The Division oversees the principal activities within the state that affect ground water. Groundwater responsibilities lie within various programs in the Division's Water Protection Branch, Land Protection Branch, Geologic Survey Branch, and Water Resource Management Branch. Therefore, Georgia has its mining, solid and hazardous waste, dam management, drinking water, and surface water protection programs and its resources for mapping and monitoring within one division.

Georgia's groundwater protection policy is part of its Water Quality Control Act, which requires that waters of the state ". . .be utilized prudently to the maximum benefit of the people in order to restore and maintain a reasonable degree of purity . . . ."

The state believes that it has sufficient authority to protect the state's ground water. In addition to the Water Quality Control Act and the other laws and regulations that indirectly protect ground water, Georgia has promulgated a Ground Water Use Act. Although this act is aimed primarily at protecting water quantity, it also addresses saltwater encroachment and deterioration of groundwater quality. Under these acts, the Division can require the user to take whatever action is necessary to protect against degradation. Georgia does not have a specific aquifer designation program; however, as part of its groundwater policy, Georgia will protect all freshwater aquifers for future use through its permit approvals.

The state estimates that about $677,000--$162,000 in state and $515,000 in federal funds--were spent on their aquifer designation program for fiscal years 1981 through 1983. Primarily through a UIC grant, Georgia identified and mapped its seven major aquifer formations, as well as other formations, producing 47 maps. For each aquifer, 10 categories of maps and diagrams have been prepared, including structure contour maps indicating the elevations of the top and the base of each aquifer, water quality maps showing concentrations of total dissolved solids or sodium chloride, geologic cross sections, and miscellaneous maps showing current flow conditions and other data relevant to assessing the state's aquifers. For each formation, an aquifer summary plate has been compiled that presents map type, aquifer boundaries, primary data sources, and other types of information.

During fiscal years 1981 through 1983, the state spent about $650,000--$430,000 in state and $220,000 in federal funds--for monitoring and collecting groundwater quality data on public water systems. Under the Safe Drinking Water Act, the state is monitoring over 2,500 public water systems using ground water. The monitoring data becomes a secondary data source whenever it is not known which aquifer provides the source of a well's water. The

state currently plans to develop a quality program to monitor additional substances not now monitored under the act. The program will be designed to evaluate the area's vulnerability to various types of contamination due to the industries and activities in the area. The state will then monitor for potential contamination related to that activity.

To date, the state has completed drilling 73 monitoring wells in the central and southwestern regions of the state. Drilling of monitoring wells in the coastal region is currently underway. After fiscal year 1985, Georgia plans to have about 150 monitoring wells in service, in addition to the over 2,500 public water systems from which they currently collect data.

The Division Director stated that, even though Georgia is still in the process of completing its groundwater program, he believes that his department has sufficient authority and resources to continue to protect ground water. He said that the state actively seeks the tools necessary to ensure groundwater protection, such as seeking primary responsibility for administering and enforcing the underground injection control program.

STATE VIEWS OF THE FEDERAL ROLE

Division officials, including the Director and the Water Protection and Geologic Survey Branch Chiefs, do not favor a uniform national program or national criteria. Although they stated there would be no problem with exchanging groundwater information with neighboring states, they do not believe nationwide exchange of such information would be beneficial. In his January 1981 testimony before EPA on its proposed groundwater protection strategy, the Division Director stated:

> ". . . we do not wish to see the creation of a new nationally uniform program for groundwater protection for which approval or disapproval of a State's program would rest with the Federal government. . .Georgia needs all available personnel to conduct the ongoing State program without having to divert efforts to comply with some unproductive Federal demands, such as a 'classification system'. . . The proposed 'three-tier system' outlined is totally unacceptable to Georgia and reflects a lack of understanding of the complexity of aquifer systems such as those in Georgia . . .."

The state believes that the federal government could provide technical assistance and research that would help the respective states develop and implement meaningful groundwater management programs. The state suggested that the federal government provide technical assistance, such as guidance for groundwater quality and quantity monitoring; assistance in data handling; recommendations for groundwater legislation based on states' experiences with

their laws and the respective effects; and guidance as to the best elements of a workable groundwater management program, saving states the time and expense of a "trial and error" type program. However, the Division Director added that because the respective state groundwater management programs range from small basic approaches to very large and sophisticated approaches, the technical assistance must cover a wide spectrum.

The Division Director believes that the bulk of the federal assistance should be directed toward research efforts, particularly on the link between surface activities and the potential or actual contamination of groundwater aquifers. He also stated that research on the short- and long-term health effects for various concentrations of contaminants, such as radium, barium, fluoride, and other organic compounds, on ground water is needed, as well as methods to assess the risk of public exposure to these groundwater contaminants. Other research areas suggested included practical ways of controlling contaminants on the surface to prevent them from contaminating the aquifers and a better understanding of cause/effect relationships particularly geared to the ground water's ultimate use, i.e., irrigation versus drinking water. The state generally believes that most of the research should be funded through USGS and universities. EPA should coordinate the research efforts and determine research priorities.

The Division Director stated that if additional funds were provided, the state would increase its efforts on groundwater quantity and quality monitoring, complete its aquifer mapping program and publish a complete groundwater atlas, and develop and implement a data handling system as a means of managing current and future groundwater data, including both quantity and quality data.

ILLINOIS GROUNDWATER ACTIVITIES

Ground water is an important resource in Illinois. Throughout the state, it is obtained mainly from glacial drift aquifers (sand and gravel aquifers), shallow bedrock aquifers, and deep sandstone aquifers. The largest and highest quality groundwater supplies are in the northern third of the state where dependable bedrock and extensive sand and gravel aquifers have been relied on for decades. About 38 percent of the state's population depends on ground water for drinking water. Dependence is much higher in rural areas, ranging from 85 to 100 percent.

Groundwater protection activities in Illinois are under the overall direction of the Illinois Environmental Protection Agency. While jurisdiction over various phases of the state groundwater programs is spread over several state agencies and divisions, the agency coordinates these activities through a groundwater project team comprised of members from the agencies and divisions. The state Divisions of Water Supply and Land Pollution Control are the two principal organizations that have the bulk of groundwater activity. In 1982, the state established an underground water task force, which adopted a policy to protect, preserve, and manage groundwater resources as a natural public resource. The following information in this summary was obtained from the Public Water Supply Division Manager.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

Illinois is an industrial and agricultural state, and ground water is used in every county. Although supplies are extensive, they are not limitless, and the state is concerned about protecting this valuable resource. The state has a wide variety of actual and potential groundwater contamination problems. The significance of these problems varies by regions and locations throughout the state.

--In the state's southern part, oil field brines and disposal of liquid and solid waste in ponds, lagoons, and sanitary landfills have caused problems. These problems have the potential of being statewide. Sewage and other waste, including toxic chemicals and hazardous waste, are disposed of through landfills or are stored in holding ponds or lagoons and can infiltrate into the ground water. The oil field brines are commonly stored in holding ponds and lagoons, and if these are unlined or not properly lined, the pollution problems can be especially severe.

--In the state's northern part, there has been some groundwater contamination problems from organic hydrocarbons, such as carbon tetrachloride and benzedene, which are industrial solvents. So far the state has found only small amounts in a few locations.

--In agricultural sections throughout the state, some groundwater contamination problems from animal feedlots exist. The feedlots produce a large amount of animal waste and the intense concentration of these wastes results in nitrate pollution of the ground water. The state requires public wells to locate a certain distance from the feedlots; however, private wells are not controlled and could be contaminated by these feedlots.

--Underground pipelines and above and below ground storage tanks also are a potential source of groundwater contamination.

--Septic system failures are also a potential source of groundwater contamination. One water supply in the state was declared a health hazard by the state as a direct result of a septic system failure. The state does not have a lot of data on system failures. About 400,000 people are served by 110,000 septic systems.

--There is also a potential for contamination of ground water from abandoned wells, which often connect two or more aquifers. These wells act as conduits through which pollutants can enter and contaminate aquifers. Illinois has only one actual contamination case so far.

The state does not have a comprehensive summary that shows the number of instances of contamination by source; however, some data exists that indicates how widespread certain contamination problems are or may be. In a March/April 1983 newsletter, the Agency reported that it had identified 27 hazardous waste sites throughout the state that required remedial action. Eleven of these were Superfund sites. A September 1981 state study on underground sources of drinking water and nondrinking water stated that there were nearly 12,000 operating injection wells in the state that were mainly associated with the apparent disposal of oil field brines. While the data does not indicate actual instances of groundwater contamination, it does provide some information on the magnitude of this form of waste disposal and the potential for contamination.

STATE EFFORTS TO PROTECT GROUND WATER

The assumption that ground water was safe and uncontaminated was dispelled when improved methods of analysis were developed in the late 1970's and an increased number of groundwater contamination instances were being noted. The state of Illinois has concluded that groundwater contamination is not a separate problem from surface water because surface waters recharge aquifers and aquifers recharge surface waters and what goes into either source ultimately affects the other.

The state has established an interdivisional groundwater project team to develop its groundwater strategy. The planned

strategy addresses seven issues including: (1) establishing a resource inventory on the quality, quantity, and location of existing aquifers, their recharge areas, and the regional flow systems, (2) determining what federal, state, and local statutory and regulatory authorities exist, (3) inventorying contamination sources, (4) identifying users and uses of ground water, (5) classifying aquifers on the basis of the level of protection, enhancement, and preservation desired, (6) reviewing and evaluating current aquifer protection practices along with other approaches which might provide enhanced protection of ground water, and (7) developing programs to protect ground water on the basis of information obtained in items (1) through (6). While work on several of these issues is well underway (i.e., the resource inventory and statutory and regulatory authority), other issues may be more difficult to complete.

To completely develop its groundwater protection program under the planned strategy, the state may make statutory and regulatory changes. Current state water pollution control laws provide the Agency (and a State Pollution Control Board) with an extremely broad mandate to protect both ground water and surface water. The state has regulatory control over deep well injection of industrial waste, contamination from landfills, mining operations, and other related surface activities. A permit is required from the state for all discharges of waste into ground water. The state has regulations on hazardous waste and is in the process of determining what regulations are needed on groundwater quality standards. The Division Manager said that Illinois' regulatory authority is adequate for the state's groundwater quality programs.

A primary focus of the state's groundwater strategy is the resource inventory, which includes the basic mapping of aquifers, their recharge zones, and groundwater flows. The State Geological Survey had developed some aquifer maps, but these were not detailed enough to be useful to the Agency. Two statewide mapping projects are currently underway: (1) potential for contamination of shallow aquifers from surface and waste disposal and (2) potential for contamination of shallow aquifers from land disposal of waste. A third project is planned on the potential for contamination of deep aquifers. When completed, these studies will include detailed aquifer maps for various sections of the state.

Illinois has used federal funding from Section 208 of the Clean Water Act and UIC for aquifer mapping activities and groundwater data development. The estimated federal and state funds Illinois used for aquifer mapping and groundwater data gathering activities follow.

Source of funds	Federal	State	Total
Section 208[a]	$215,838	$ 97,346	$313,184
UIC[b]	237,416	79,138	316,554
Total	$453,254	$176,484	$629,738

[a]Section 208 funding was for state fiscal years (ended June 30, 1981 through 1983).

[b]Cost data on UIC and state funds was provided by the Illinois Division of Land Pollution Control for fiscal years 1980 through 1983. Most of this funding was used for identification of aquifers.

STATE VIEWS OF THE FEDERAL ROLE

The Division Manager stated that EPA's role in groundwater protection should be to (1) provide funding to the states for planning and field investigation activities, (2) fund and report on research in areas where states need the technical assistance, and (3) provide the states with general guidance on groundwater data collection. Illinois' highest priority need is for federal funding to (1) plan for management of the groundwater strategy and (2) make field investigations of contamination sites. The Agency also needs research and technical assistance on the hazards of various types of contaminants and how these affect ground water, the rates of groundwater flow, and the effects of underground formations on ground water. While some national guidance or criteria is needed on basic groundwater data collection, this should not be too restrictive because each state is addressing its own specific and unique problems.

The Division Manager said that the federal funding for planning management of the groundwater strategy would address matters such as: (1) an ambient groundwater monitoring network, (2) a comprehensive data management program, (3) groundwater quality standards, (4) groundwater quantity allocation, (5) legal authority and regulation development, and (6) the handling of nonregulated contamination sources. The funding for field investigations would address site-specific and nonsite-specific groundwater contamination, provide geophysical and laboratory support equipment, and identify and classify additional water supplies.

KENTUCKY GROUNDWATER ACTIVITIES

Since groundwater supplies only 6.7 percent of Kentucky's drinking water, the state has been more concerned about the quantity and quality of its surface water.

The information contained in this summary was obtained from the Assistant to the Commissioner, Department for Environmental Protection, Natural Resources and Environmental Protection Cabinet.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

With the discovery of groundwater problems resulting from some sources, groundwater is of growing concern. While state environmental agencies have maintained site-specific groundwater data related to those areas that the state is regulating, detailed knowledge of groundwater occurrence, distribution, reserves, use, and recharge is limited. A few of the difficulties in delineating Kentucky's aquifer systems are:

--steep elevations in eastern Kentucky that restrict the spatial distribution of regional aquifers,

--the presence of limestone in more than 50 percent of the state that creates irregular groundwater movement in karst (sinkhole) terrains, and

--exploratory oil and gas drilling and production since the turn of the century that has interconnected aquifer systems in the state's oil and gas fields.

These conditions result in unique problems: (1) in eastern Kentucky the coal seams often become the aquifer, in many cases supplying good quality water and (2) in coal mining areas, wells drilled into the same geological formations several hundred feet apart may have a very different groundwater quality.

Kentucky does not have summary data on groundwater contamination problems. While groundwater complaints may be reported to the environmental program divisions, field investigations are generally not conducted because of limited funds, unless the condition is extremely serious.

The state believes that it has some groundwater problems but the extent of the problems is unknown. The activities having the greatest potential for contaminating ground water follows.

--Surface and deep mining activities, including acid mine drainage, blasting, and surface impoundments may adversely affect groundwater quality and quantity.

--Oil and gas operations, including brine pits, processes used after initial drilling to extract oil and gas, and improper well casings, may contribute to pollution.

--Permitted and abandoned hazardous waste and solid waste sites as well as open dumps may elevate contaminated levels and restrict drinking water sources. Roadside dumping is of particular concern since only 42 percent of Kentucky's 120 counties have trash collection and many counties do not have any solid waste disposal facilities.

--Septic tank and drain field malfunctions and installation problems have produced groundwater contamination, especially in the state's limestone areas.

STATE EFFORTS TO PROTECT GROUND WATER

The primary responsibility for environmental protection resides in the Natural Resources and Environmental Protection Cabinet, which consists of three departments, including the Department for Environmental Protection, which is responsible for developing and implementing a groundwater management and control program. Programs in the other two cabinet departments--the Departments for Surface Mining Reclamation and Enforcement and for Natural Resources--address groundwater issues. In addition, the Department of Mines and Minerals, part of the Public Protection and Regulation Cabinet, is responsible for groundwater protection related to the oil and gas industry; however, this Department's primary concern is to foster conservation of mineral resources.

A statewide groundwater strategy is being developed. The initial strategy development step, a management report on existing state groundwater control programs and problems, is underway. The strategy should be completed by early spring of 1984 but it is not expected to be regulatory in nature. The Commissioner, Department of Environmental Protection, said he believes that Kentucky has sufficient authority to protect the state's ground water and to implement a comprehensive and cohesive policy. Its current Water Resource Law makes ground water subject to state control and regulation if the water is to be used for a beneficial purpose. Another Kentucky statute authorizes the Natural Resources and Environmental Protection Cabinet to prevent, abate, and control all water pollution, including pollution of ground water.

In fiscal years 1979-81, the Kentucky Geological Survey conducted research, funded through a UIC grant of $195,600 and matching state funds, to identify the depth to nonpotable ground water. The designations of the nonpotable ground water were done primarily by reviewing records from test wells, supplemented by limited historical water quality data. Kentucky's Geological Survey and USGS have also conducted some studies on specific problems and/or basins with USGS and state funds.

Although USGS, in cooperation with the Kentucky Geological Survey, the Natural Resource and Environmental Protection Cabinet, and other agencies maintains about 175 monitoring wells, the wells are not equally dispersed across the state (about one-third of the wells are located in the Louisville area). Many are older,

abandoned wells incorporated into the monitoring system because of their availability rather than because of specific siting or other requirements. In addition, numerous site-specific wells are monitored at hazardous solid waste, Superfund, and mining sites.

The Division of Water within the Natural Resources and Environmental Protection Cabinet also collects pump test information on all groundwater withdrawals in excess of 10,000 gallons per day. However, the data is supplied voluntarily from permit holders and is not mandated from all groundwater withdrawal permittees. While this data contributes to known groundwater information, the state considers that it has limited value in understanding the most serious of the state's problems--groundwater distribution, quantity, and quality in mining areas.

Groundwater monitoring wells are required at a mining site unless an applicant can obtain a waiver. According to the Department for Surface Mining Reclamation and Enforcement staff, about 60 percent of the mines have monitoring wells, but a permitted mine may have only one well whether the mine covers 2 or 2,000 acres. A manual file on groundwater quality data is compiled from the 6 months of pre-mine groundwater quality data submitted by the applicant, and monitoring results from active mining operations are maintained on file at the facility.

EPA plans to implement the UIC program for Kentucky in early 1984. Proposed UIC regulations were to be published in August 1983. The state's Department for Mines and Minerals plans to seek primary enforcement responsibility for wells used to dispose of oil and gas drilling brines and to pump fluids underground to recover oil and gas.

The Commissioner, Department for Environmental Protection, stated that although the Department does not currently have sufficient resources to implement its groundwater strategy, he is confident that it will have in the future. However, the Kentucky General Assembly has not yet approved a budgetary request to expand the state's groundwater protection programs.

STATE VIEWS OF THE FEDERAL ROLE

The state was cautious about endorsing uniform national criteria for collecting basic groundwater data, primarily because the state has experienced difficulties in dealing with various federal program criteria. The state prefers the criteria to be broad and allow flexibility in dealing with individual problems.

The state believes that a national policy similar to the policy proposed by EPA, which would coordinate the implementation of existing laws would be helpful to Kentucky in its effort to emphasize groundwater protection. However, the state was not interested in a federal groundwater law that would require a delegation or authorization process to implement the program.

The state believes that the federal role should be to support research, oversee data collection and information transfer, and set criteria for maximum safe levels of various substances in ground water. Then, a federal law setting certain groundwater contamination standards would be useful guidance in developing state-specific levels. The Department of Surface Mining Reclamation and Enforcement staff is required to review groundwater data submitted by applicants for surface mining permits, but no statewide groundwater quality standard exists against which the data could be reviewed.

Kentucky officials would like additional money to fund studies on specific groundwater problems. In 1982, for example, the Kentucky Geological Survey was studying coal mining areas of eastern Kentucky to determine the effects of mining on the ground water. Because of USGS funding constraints, the studies were eliminated about halfway through completion. Kentucky believes that adequate funding of USGS grants and cooperative programs with state agencies is needed to assure proper delineation and characterization of aquifers. Kentucky also needs groundwater research in the karst topography to help set groundwater standards.

Kentucky believes that it needs information on the relationship between environmental and safety concerns to effectively protect the ground water. For example, although the Department of Surface Mining Reclamation and Enforcement requires that abandoned deep mines be capped, on some occasions the buildup of pressure after capping has caused mines to blow out, creating safety and additional environmental problems.

Kentucky said that if additional money was provided to the state, it would be used to hire personnel for a groundwater unit that could implement a groundwater protection program and coordinate and support state-specific groundwater research. An information system for compiling current and future groundwater information in a usable format would be a high priority. Additional mapping, particularly in the limestone areas, could be very useful; however, the cost-benefits of such mapping should be acknowledged by the federal government before requiring and funding any statewide mapping.

MAINE GROUNDWATER ACTIVITIES

Maine has many low yielding bedrock aquifers and widely scattered high yielding glacial sand and gravel aquifers. About 45 percent of the state's population depends on these aquifers for their drinking water. The shallow sand and gravel aquifers supply the large volumes of water needed by municipalities and industries and are the principal source of recharge to the deeper bedrock aquifers. Being relatively close to the ground surface, the aquifers are particularly susceptible to contamination from various land use sources.

Groundwater protection is primarily the responsibility of the Maine Department of Environmental Protection. Although various agencies, commissions, and boards within the state administer groundwater programs, the Department is responsible for coordinating them. The information in this summary was obtained from the Director, Division of Management Planning.

THE NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

The groundwater contamination that has occurred, although severe, has been localized and has affected relatively few people. Nevertheless, the state is very concerned about groundwater contamination because once ground water is contaminated, it is very difficult and expensive to clean up and it may be lost for centuries. In terms of health concerns, the Division Director ranked Maine's groundwater contamination problems as (1) leachate from municipal and industrial landfills, (2) hazardous waste sites, (3) leaking underground gasoline storage tanks, and (4) road salt storage. Pesticides and herbicides used in the state's agriculture counties for the potato and blueberry crops are a potential source of groundwater contamination, but insufficient data exists to specifically determine the extent of contamination.

The state does not have a comprehensive summary that shows the significance of groundwater contamination for all sources. Once the state completes its aquifer mapping and data collection, a comprehensive summary of contamination sources will be developed. The Division does have some data that indicates that groundwater contamination may be somewhat widespread. The Division has identified 25 to 30 hazardous waste problem sites, but not all of these have been investigated in detail. The state and municipal salt storage piles may be causing groundwater contamination. Seven or eight private wells have closed due to salt problems in a town in southern Maine. Also, the Division has identified 25 incidents of groundwater contamination due to leaking underground gasoline storage tanks.

STATE EFFORTS TO PROTECT GROUND WATER

The state's early groundwater activities, such as the groundwater monitoring network established with the U.S. Geological Survey, were concerned primarily with the quantity or supply

of water. The groundwater protection issue emerged in the late 1970's when the state legislature became interested in incidents of severe contamination. Subsequently the state environmental statutes were amended to: (1) establish a Ground Water Protection Commission, (2) direct the Maine Geological Survey to map aquifers and develop related groundwater data, and (3) strengthen water pollution and siting laws.

The Division Director believes that the state has adequate authority under two state laws to implement the groundwater protection programs. The protection and improvement of water law prohibits the discharge of a pollutant without first obtaining a license from the State Board of Enviromental Protection. This gives the state the authority to prevent discharges to the ground water. The site location and development law prohibits activities that may pollute the ground water from locating on aquifer recharge areas.

The Division is developing more information on the state's aquifers through its aquifer mapping program. Mapping will be used to develop a comprehensive summary of groundwater contamination sources and ultimately to classify aquifers. From 1978 to 1981, the state and the U.S. Geological Survey mapped most of the state's sand and gravel aquifers. These maps were developed through field observation and testing, combined with available data on wells.

In 1981, the Division started more detailed mapping to (1) more clearly define aquifer boundaries, depths, flow direction and recharge areas and (2) develop data on the extent of aquifer contamination, including identifying the plume, its contaminants and its flow direction. The Division originally planned to complete this phase in about 5 years and after completing 2 years work (through 1982), they requested $100,000 per year from the state for the remaining 3 years. The state legislature appropriated about $50,000 per year. At that funding level, it will take at least 2 additional years to complete the mapping and data collection.

The following is the Division estimate of the federal and state funds used for mapping and basic data collection of ground water information from fiscal year 1978 through fiscal year 1983.

Source of funds	Federal	State	Total
Section 208	$305,622	$76,500	$382,122
UIC	50,045	49,500	99,545
Total	$355,667	$126,000	$481,667

The section 208 funds were used for basic aquifer mapping; the UIC funds were used for more detailed mapping.

The Division has drafted a groundwater strategy that highlights its role under the state siting and discharge laws. The draft also includes policies on groundwater classification and on various land use activities, such as municipal solid waste disposal, sludge disposal, municipal sewage disposal, non-hazardous waste, hazardous waste, salt storage, and certain agricultural activities.

STATE VIEWS OF THE FEDERAL ROLE

The Division Director stated that EPA's role should be to provide a national focus for ground water as is now being done for surface water. EPA should provide funds to states for groundwater data collection, fund research geared to states'needs, and coordinate what the states are doing.

The Division's first priority is to have EPA provide funds specifically earmarked for groundwater data collection. The state believes that because groundwater protection is a land use problem and can best be handled by the states, the specific use of federal funds should be left up to the states, and the funds could be used to map aquifers, determine groundwater flow, and monitor the water quality.

The state is concerned that with the termination of section 208 funding, and recent reductions in state funds appropriated for mapping and data collection activities, the data collection effort will now take an additional 2 years to complete.

The state would use federal funds for the following activities, ranked by priority.

1. Second phase detailed mapping of aquifers, which would define aquifer boundaries, depths, flow directions, recharge areas, and groundwater contamination.

2. Drilling rigs and also laboratory equipment that would be used to test groundwater quality. However, the state suggested that USGS purchase costly drilling rigs and make them available to the states to meet their ground water drilling needs.

Maine officials believe that EPA should fund research on ground water concerns of the states. To be useful, the research should have nationwide, or at least regionwide, applicability rather than addressing some isolated matters of concern to only one or two states. Some of the research areas of concern to the Division are (1) the effects of various chemicals on groundwater quality, (2) groundwater sampling, drilling, and well techniques and (3) determining less costly ways to do these things. The

state also believes that EPA should coordinate what is going on in the various states and provide a means of disseminating or exchanging ideas and approaches.

MASSACHUSETTS GROUNDWATER ACTIVITIES

Groundwater protection in Massachusetts is directed by the Water Supply Planning and Development Section of the Division of Water Supply, a component of the Department of Environmental Quality Engineering in the Executive Office of Environmental Affairs. About 34 percent of the population in 275 of the state's 351 cities and towns relies on ground water as their primary source of drinking water. The information in this summary was obtained from the Director, Water Supply Planning and Development Section.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

Groundwater contamination is a serious problem in Massachusetts. The state has many aquifers, most of which are close to the surface and threatened by many contamination sources. Ranked in terms of severity of contamination from a health standpoint, the problems are: (1) hazardous waste, (2) landfills, dumps, and abandoned junkyards, (3) leaks in underground gasoline tanks, and (4) road salt. While septic systems are a problem due to their numbers, they do not pose a serious health problem.

While the state does not have a comprehensive summary of groundwater contamination from all sources, considerable data bears out that contamination is a problem. A 1981 state report summarizing the status of hazardous waste sites in Massachusetts showed that 20 of 140 sites under investigation contained hazardous waste. Nine of the 20 are candidates for Superfund assistance. A May 1982 state report on groundwater quality and protection disclosed excessive sodium concentrations from road salting in ground water in 47 communities and elevated sodium levels in the public water supplies of another 43 communities. Municipal wells in two communities had been closed because of extremely high sodium concentrations.

STATE EFFORTS TO PROTECT GROUND WATER

Massachusetts issued a groundwater protection strategy in January 1983 that involves: (1) mapping and assessing aquifers; (2) ranking sites with potential for contamination, (3) monitoring ground water, (4) making hydrogeological studies; and (5) coordinating activities. The strategy provides for the state to coordinate and administer existing programs and regulations concerning subsurface disposal, landfills, hazardous waste, drinking water, and wetlands.

The state has completed basic mapping of aquifers for the entire state with overlays for (1) public water supplies such as reservoirs, wells, and springs, (2) waste sources such as hazardous waste sites, landfills, dumps, and injection wells, (3) aquifer information, and (4) drainage divides. The maps are available to local officials to use in making land use and zoning decisions. Although hydrological studies are needed and new

contamination sites should be added to maps, no data has been developed for about 18 months as a result of a reduction in federal funds.

The state believes that it has adequate authority to begin implementing the groundwater strategy. After more experience, legislative changes may be necessary to expand the programs if a local government fails to adequately protect ground water. The state Legislature recently appropriated $10 million to acquire land, land rights, and easements over aquifers and recharge zones. Communities with the best groundwater management and protection plans are given preference in awarding these funds. In addition, the state is investigating the need for controls over groundwater withdrawal.

The estimated federal and state funds expended during fiscal years 1981 through 1983 on basic groundwater data collection follow.

Source of funding	Federal	State	Total
Section 208[a]	$ 50,000	$18,888	$ 68,888
Section 205[b]	218,000	-	218,000
UIC[c]	100,000	33,333	133,333
Total	$368,000	$52,221	$420,221

[a]Groundwater and surface water data collection efforts are commingled. The state share is 25 percent.

[b]To continue groundwater non-point source planning which was started with 208 funds.

[c]For basic data collection.

STATE VIEWS OF THE FEDERAL ROLE

The Section Director believed that there is a dual role for the federal government in groundwater protection. First, EPA should develop a groundwater policy and provide leadership, resources, and encouragement to states for groundwater planning and data collection. Second, EPA should do basic groundwater protection research and provide technical support and training to the states on groundwater matters.

Federal funds are needed for the following activities, ranked by priority.

--Update basic maps and overlays as new contamination sites are identified and as new wells are opened.

--Computerize the data included on the maps and overlays to provide comprehensive data to municipalities faster and more efficiently.

--Provide technical assistance and training to state and local officials in groundwater protection activities.

Essential groundwater planning activities will have to be curtailed due to the termination of section 208 funding and the further stretchout and reduction of section 205 funding.

EPA also needs to undertake groundwater research and provide the results to the states. Two specific Massachusetts research needs are: (1) modeling to project the rate and direction of movement of chemical contaminants in ground water and (2) modeling of the interaction between surface and ground water.

EPA could also assist the states by training state groundwater protection staffs.

MICHIGAN GROUNDWATER ACTIVITIES

Although Michigan has plentiful surface water supplies, including four of the Great Lakes and thousands of inland waterways, half of the state's population depends on ground water from municipal and private wells for its drinking water supply. Forty-one of 83 counties in Michigan are almost totally dependent on ground water for their needs. Michigan's ground water comes primarily from numerous high-yield aquifers in glacial deposits, but these aquifers are the most likely to become contaminated and overdrawn due to increased consumption and industrialization.

Groundwater protection in Michigan is the responsibility of a recently formed (December 1982) Ground Water Quality Division in the Michigan Department of Natural Resources. The Division's goal is to develop and implement a consolidated protection program that will prevent ground water from becoming contaminated and that will correct or properly manage known or suspected cases of contamination. The information in this summary was obtained from the Chief, Remedial Action Section, Ground Water Quality Division.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

Contamination of ground water is a serious problem in Michigan and is the state's most urgent environmental problem. In 1979, the Department developed an inventory of known, suspected, and potential groundwater contamination sites within the state. This inventory was later updated by the Department and included in a July 1982 report, entitled: Assessment of Ground Water Contamination: Inventory of Sites. The inventory includes data on (1) the type of facility known or suspected of contaminating the ground water, (2) the nature of the contamination, and (3) the vulnerability of the groundwater resource. The data is included on page 9 of this report.

As part of its contamination assessment, the Department also listed locations where there was potential groundwater contamination, that is, activities which by their very nature could cause ground water to become contaminated. The Department estimated that there were thousands such sites, including about 14,000 manufacturing plants, 6,000 gasoline stations, 1,600 landfills and dumps, and thousands of oil and gas drilling sites. For the majority of these potential sites, the Department did not have sufficient information to assess whether the sites had actually caused groundwater problems.

An October 9, 1982 status report on the state's groundwater program showed that there were 210 sites where one or more drinking water supply wells had been contaminated and that new problem sites were being discovered at a rate of about four per month.

STATE EFFORTS TO PROTECT GROUND WATER

In the late 1970's, groundwater contaminated by chemicals and hazardous waste became a serious problem in Michigan. As a growing number of groundwater contamination sites were discovered, the Department formed a groundwater management committee to evaluate the state groundwater management program. In December 1979, the Department developed a comprehensive inventory that documented known, suspected, and potential sites of contamination (previously discussed).

Michigan has passed groundwater protection laws that discourage degradation of ground water through permits and licensing programs. The state has regulatory control over those activities that obviously degrade groundwater quality, such as hazardous waste sites and landfills. The Hazardous Waste Management Act, for example, created a site approval board to review and grant or deny approval for each construction permit application. One criteria the board considers is the potential for groundwater contamination by leaching and runoff. Michigan's permit and licensing programs require each applicant to complete a hydrogeological study that includes identifying land use and mapping of aquifers, if not already available. The state currently has inadequate statutory control of underground gasoline storage tanks but is proposing new legislation to provide the control.

Michigan is developing a groundwater strategy that focuses on preventing ground water from becoming contaminated and will correct or properly manage known or suspected cases of contamination. To implement this strategy Michigan was awarded a $900,000 EPA grant to develop a national prototype project for the prevention of and response to groundwater contamination. Michigan plans to complete the strategy in the spring of 1984.

An important part of the strategy is to determine the extent of the quality, quantity, and location of the state's groundwater resources. Toward this end, Michigan's Geological Survey has done some mapping, such as (1) aquifer vulnerability maps, which show groundwater susceptability to contamination, for less than half of the state's counties, (2) aquifer maps, showing aquifers with no drinking water potential, for the entire state, and (3) computerized mapping data in several counties. This mapping is often not in sufficient detail for the Department to use. Selective mapping of site-specific locations is needed to take into account numerous changes in Michigan's geology.

In May 1983, EPA approved Michigan's proposal to use about $558,000 of its $975,000 section 205 grant for groundwater projects for (1) prioritizing chemical contamination sites in the state, (2) investigating suspected drinking water contamination on a statewide basis, (3) developing groundwater strategies to be implemented at the local, regional, and state level to fill administrative gaps, (4) establishing a model computer program for

county groundwater activities, and (5) studying the need for environmental impairment insurance.

STATE VIEWS OF THE FEDERAL ROLE

The Section Chief stated that national coordination of planning for groundwater protection is needed to get states to do some things they may not now be doing. EPA's role should include (1) providing needed federal funding for data collection and (2) providing groundwater research that meets a state's needs.

The design of groundwater programs should be left up to the states, and they should not have to substantially redesign their programs in order to qualify for the federal funds. Federal funding is the Department's highest priority need. Federal funding would be used for the following groundwater activities, ranked by priority.

--To prevent contamination activities associated with the state's discharge permits and landfill programs and to control pollutants above or below ground. For example, Michigan is currently studying controls for underground gasoline tank storage.

--To fund compliance activities such as pursuing responsible parties that have contaminated ground water.

--To staff hydrogeologic and geophysical investigations of ground water. For example, the state is considering the use of penetrating radar to examine the quality of aquifers.

--To evaluate and cleanup hazardous waste.

EPA should also provide more research assistance (1) to develop data on how various contaminants act in aquifers and (2) to identify more economical ways to monitor and investigate groundwater contamination.

NEVADA GROUNDWATER ACTIVITIES

Nevada is characterized by isolated, long, narrow, roughly parallel mountain ranges and broad, intervening valleys and basins. The state estimated that 250 million acre-feet of ground water is stored in the upper 100 feet of saturated valley fill. Sand or clay deposits in the valleys commonly are deep, and in some valleys are estimated to exceed 8,000 feet. Annual groundwater recharge averages 2.2 million acre-feet. About 13 percent of Nevada's drinking water is supplied by ground water.

The information contained in this summary was obtained from th Administrator, Division of Environmental Protection (NDEP), Department of Conservation and Natural Resources.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

The Administrator, NDEP, Department of Conservation and Natural Resources, told us that no drinking water wells have been closed or abandoned as a result of contamination and only a few cases of contamination have been documented. The state's "Surface Impoundment Assessment Report" attributed this limited groundwater contamination to (1) Nevada's arid climate, which encourages rapid evaporation, thus reducing subsurface discharges, (2) the great depths to the first aquifer and the minimal surface recharge, (3) the existing poor quality of many aquifers, and (4) the lack of state industrial activity to generate the materials to cause the contamination.

Although the state does not maintain summary data on groundwater contamination cases, a recent section 208 study by the state and the surface impoundment assessment completed in 1979 provide some examples of groundwater contamination and potential activities that may cause groundwater contamination. The assessment reported seven documented contamination cases resulting from surface impoundments. One of these cases involved an industrial complex in Henderson which was begun in 1940 by the federal government to produce magnesium metal. It is currently privately owned and produces chemicals and processes titanium. Since 1970, EPA and the state have been examining the groundwater pollution potential from discharges of liquid wastes into 250 unlined ponds between 1940 and 1975. Their studies disclosed that these surface impoundments are located over a large groundwater mound, which overlays an impervious formation over a shallow acquifer which has been contaminated.

The surface impoundment assessment lists the following as areas of possible groundwater contamination.

--The concentration of septic fields along the east slope of the Sierra front. This area has vast granite formations varying from gentle to steeply sloping, and excessively drained soils.

--Past and present mining operations throughout the state. Spills of cyanide solutions and abandoned leaking, impoundments, and waste piles may contribute to the contamination of ground water.

--Underground nuclear testing at the Nevada Test Site, which poses the potential for radioactive contamination of ground water. Some of the underground tests may have come in contact with ground water at depths of 700 to 1,500 feet. A system of monitoring wells has been established in the direction of groundwater flow and any movement of radioactive contamination towards the agricultural valley assumed to be the outflow of this ground water should be detected.

--The use of fertilizers along the recharge area of a shallow aquifer which is the water supply for the Fallon area of the states. This may contribute to nitrogen and phosphorous in the aquifer. Because of documented reductions in water quality, the Nevada Division of Health recommended that the city sewer be expanded to handle outlying areas.

STATE EFFORTS TO PROTECT GROUND WATER

The state's Department of Conservation and Natural Resources is responsible for implementing the groundwater protection program through two of its divisions--NDEP and the Nevada Division of Water Resources (NDWR). The Nevada Water Pollution Control Regulations make it illegal to discharge a pollutant into state waters without obtaining a permit. A pollutant is defined as any discharge material that alters the condition of the water. As defined by the regulations, water includes underground as well as surface waters. The state has adopted a nondegradation policy for water the state considers to be of high quality.

NDWR's state engineer may designate underground water basins that are being depleted and declare preferred uses in such designated areas. The state engineer's office monitors static water levels, pumping levels, and well discharges throughout the year. These measures are primarily to control water quantity; however, in the interest of public welfare, the state engineer is also authorized by statute to designate groundwater basins as "critical." Such a designation may well limit further groundwater development. NDWR is also responsible for the state water plan, which emphasizes three objectives: environmental quality, economic efficiency, and area development. In establishing a basis for the plan, an inventory of water supplies, an appraisal of present water and land use, and a determination of land suitability were developed.

As part of the UIC delegation application, NDEP gathered existing aquifer data from various state and federal agencies. The following information on ground water was available.

--Aquifer hydrologic characteristics, including direction and pattern of groundwater movement, depth of water table, and groundwater quality. According to the state engineer, approximately 70 percent of the state's aquifers are mapped. The remaining 30 percent are being mapped cooperatively by USGS and NDWR. The state has 242 groundwater basins.

--Basins designated as potential drinking water sources and basins designated for underground injection of waste.

--Site-specific studies conducted on Nevada basins anticipated to be affected by the proposed siting of missile.

EPA region IX estimates that about $421,000 in federal funds was spent in fiscal year 1983 for groundwater protection. These funds included sections 106 and 208 of the Clean Water Act, and the underground injection control program of the Safe Drinking Water Act. The state could not estimate how much state money has been spent for groundwater mapping, monitoring, and data collection activities, although it said that state funds were used to match the federal underground injection control monies.

Nevada does not have a routine groundwater monitoring program, although it requires monitoring around mining operations for specific periods. NDWR primarily conducts quantity monitoring. The state strongly believes that neither additional groundwater mapping nor monitoring is needed in Nevada.

STATE VIEWS OF THE FEDERAL ROLE

The Administrator, NDEP, stated that the national role should be one of technical assistance and research. For example, the federal government should establish safe levels for all known groundwater contaminants. He did not believe that the federal government should impose regulations to control either groundwater quality or quantity. The state believes this to be exclusively a state right.

If the state received additional funds for groundwater protection, the funds would be used to augment personnel to assure compliance with permit requirements, particularly for mining and geothermal operations.

NEW MEXICO GROUNDWATER ACTIVITIES

New Mexico has about 20 billion acre-feet of groundwater storage. While not all ground water is physically or economically extractable, about 4.5 billion acre-feet of the extractable reserve is fresh or only slightly brackish. Hydrologists and geologists generally believe that most of the state's economically usable ground water has been located. The state has 31 underground water basins, covering over 84,433 square miles.

Ground water is the only source of drinking water in many areas of New Mexico and accounts for 95 percent of the water supplied by public systems. Because of New Mexico's expanding population, groundwater use for drinking water and non-irrigation uses increased about 56 percent between 1970 and 1980.

The information contained in this summary was obtained from the Program Manager-Ground Water Section, Environmental Improvement Division, New Mexico Health Environment Department.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

Because ground water is such an important resource to New Mexico, the state has conducted numerous studies to identify the sources of groundwater contamination. New Mexico has identified five major contributors to groundwater contamination: saline intrusions; mining and milling of uranium and other minerals; brine disposal; onsite liquid waste disposal systems; and organic chemical discharges, including hydrocarbon fuels. Most cases of groundwater contamination have involved relatively small areas in shallow aquifers, which in turn can result in nearby shallow domestic and municipal wells being contaminated. Since 1980, three community wells have actually been closed due to contamination.

As of June 1982, the state had identified 105 sites with known groundwater problems, not including individual septic tank effluent or undocumented reports of limited contamination by brine and gasoline. Forty percent of the 105 sites are known or suspected to result from surface impoundment seepage or discharge. Another 25 to 30 percent are associated with such sources as leaky fuel storage tanks and disposal wells.

A more recent state study identified 78 sites of documented surface and groundwater petroleum-product contamination, including some of the 105 cases mentioned above, as follows: 28 from underground leakage, 8 from surface spillage, 33 from surface disposal, and 9 from unknown sources. One example of petroleum-product contamination occurred in May 1982 when a Lockheed jet-fuel truck disposed of sludge and residual fuel on airport property. Following a report of the incident, it was discovered that these trucks disposed of their sludge at the site about four times a year. Airport officials stopped this practice, but the impact on

the ground water from past disposal practices has not been determined. Depth of the ground water at the site is 125 meters, and a major municipal well is located only 15 meters from the most recent dumping.

STATE EFFORTS TO PROTECT GROUND WATER

The Water Quality Control Commission is primarily responsible for preventing and abating water pollution. The Commission is made up of a public representative, appointed by the Governor, plus a representative from each of its eight constituent state agencies. The Commission has authority under the New Mexico Water Quality Act to adopt any standards and regulations that state officials believe are necessary to protect the ground water.

Within the Commission, the Environmental Improvement Division of the Health and Environment Department administers Commission regulations that apply to all types of discharges of effluent, sludge, and leachate. Regulations applicable to certain aspects of the oil and gas industry, such as refining, are administered by the Oil Conservation Division of the Energy and Minerals Department.

The state's concern over groundwater quality led to the development of a groundwater regulatory program in 1977. The program (1) sets groundwater quality standards and (2) requires that a discharger demonstrate that those standards will not be violated.

As of September 1982, numerical standards for 35 toxic substances had been adopted. In addition to the numerical standards, New Mexico has a generic "toxic pollutant" provision that does not specify numerical toxic levels. Instead, if a listed pollutant is present in concentrations shown by current scientific literature to unreasonably threaten human health or the health of commonly cultivated or protected plants or animals, it is considered toxic.

These standards do not apply to the effluent, as it is discharged at the surface, but to the ground water itself. When an existing concentration of any groundwater contaminant exceeds the specified standard, no degradation of the ground water beyond the existing concentration will be allowed.

New Mexico has identified its major aquifer basins and their associated geological characteristics. New Mexico has inventoried and mapped all major existing sources of groundwater contamination, including industrial and commercial operations, municipal waste and other onsite disposal systems, animal confinement facilities, mining, agriculture, and saline intrusion. New Mexico has also completed a review that disclosed that 9 of the 11 water-quality basins in New Mexico contain at least some areas where aquifers are rated highly vulnerable to contamination (shallow water table or highly fractured vadose zone).

In 1979, the state instituted a groundwater quality monitoring program, which focuses on areas having high aquifer vulnerability and/or significant potential contaminant sources. Monitoring efforts are designed to provide information useful in developing recommendations on a regional as well as site-specific basis.

Until recently, the monitoring program's primary emphasis has been on a regional assessment of water quality impacts attributable to uranium mining and milling. Thirty-three observation wells have been installed in clusters along representative stream segments to provide a three-dimensional examination of contaminant distribution in the alluvial aquifers. Another 5 to 10 stations are being established to evaluate the quality of runoff from the natural surface and from uranium waste piles. Surface water and groundwater samples in these areas are generally collected quarterly and analyzed in the field and at the New Mexico Scientific Laboratory Division for general chemistry, trace elements, and radiochemicals.

The state has installed 15 monitoring wells and 25 test holes to determine the exact nature and scope of toxic contamination in the Middle Rio Grande Valley. USGS is cooperating in efforts to characterize the complex local hydrologic system in this area.

A 1982 state report showed that New Mexico spent almost 50 percent of the Environmental Improvement Division's water pollution control program budget in support of groundwater protection programs. For the fiscal year ended June 30, 1982, the state estimated that $563,700 in federal and state funds were spent for groundwater data collection, analysis, and monitoring activities. For fiscal year 1983, the state estimates that it spent $591,000 on these activities.

New Mexico is satisfied with the state's overall regulatory system of groundwater protection. In a presentation before the National Ground Water Symposium in September 1982, the Groundwater Program Manager stated that the state's standards and regulations have proved extremely effective in preventing groundwater pollution from new and newly modified discharges and have provided steady progress in improving pollution controls at facilities operating before 1977. The manager believes that having standards that apply to the ground water rather than detailed design and operation requirements allows the state to take site-specific conditions into account. However, she said that additional staff and other resources are needed to adequately address such problems as (1) the need for adopting additional numerical standards and regularly updating the regulations in light of new information, (2) the need for developing an improved system for coping with spills and leaks, and (3) the need for faster progress in dealing with historical contamination at abandoned sites, and at currently active sites which caused contamination before the 1977 regulations.

STATE VIEWS OF THE FEDERAL ROLE

New Mexico stated that because ground water is dependent on site-specific conditions, national uniform groundwater standards or regulatory programs for groundwater discharges are inappropriate. The state recommends that the federal government contribute to protecting the groundwater quality by

--continuing the EPA document series entitled "Water Quality Criteria . . ." (toxic pollutants) which has been very helpful to the state in both developing groundwater standards and in assessing the severity of problems;

--providing support and expanding the present USGS and EPA computer-based storage and retrieval systems;

--providing better documentation and training on groundwater computer models;

--expediting the development and release of Superfund procedures so that existing contamination problems can be addressed more timely;

--increasing funds for reclamation of high priority aquifers; and

--providing support to help the state further improve monitoring and laboratory analysis capabilities and to expand basic groundwater protection programs.

New Mexico believes that more groundwater mapping would be beneficial. As New Mexico is large and has extremely diverse geology and hydrology, groundwater mapping of the entire state is probably impracticable. However, mapping of selected high priority areas, and updating of past mapping done in limited areas, would be beneficial. Information obtained should include water levels, basic water quality data, delineation of groundwater quality zones, and basic data on aquifers such as transmissivity, storage, recharge, vertical leakage, and subsidence due to groundwater pumping.

If additional funding were made available to the state, New Mexico would use the funds for (1) additional staff for improving its regulations to cope with newly recognized problems such as leaking underground gasoline tanks and organic contaminants in ground water, obtaining public support for needed changes, and improving interagency liaison, (2) improved organization and management of groundwater quality data and other relevant information, (3) additional staff and planning for crisis reaction, such as coping with spills and leaks and dealing with historical contamination, and (4) equipment, including advanced water quality monitoring equipment, vehicles, and additional laboratory analysis capability for the New Mexico Scientific Laboratory Division.

OHIO GROUNDWATER ACTIVITIES

Ohio has abundant groundwater resources from extensive glacial and bedrock aquifers. Coupled with the state's favorable geographic location in relation to Lake Erie and the Ohio River, total available groundwater and surface water resources far exceed current or projected future demands. Nearly 45 percent of Ohio's population utilizes ground water as a drinking water source through more than 550 municipal supplies and nearly 1 million individual wells. Ground water is also widely used for industrial, agricultural, and various commercial uses.

Groundwater quality protection in Ohio is the responsibility of the Ohio Environmental Protection Agency. While jurisdiction over state groundwater activities is divided among several state agencies or divisions, the Ground Water Section in the Agency's Division of Public Water Supply is responsible the protecting the quality of groundwater resources. The information in this summary was obtained from the Agency's Coordinator for Ground Water Activities.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

Ohio is a densely populated and highly industrialized state that generates large volumes of both solid and liquid wastes. Land disposal and storage facilities, such as landfills, lagoons, sludge sites, and spray irrigation, are widely utilized and comprise potential sources of groundwater contamination. Other land-use activities that may also impact water quality include product storage facilities for coal, salt, and petroleum, on-lot sewage disposal, animal wastes, agricultural chemicals, mining activity, oil and gas production, road salt, product spills, and pipe line or tank leaks. Most of Ohio's ground water is well protected from contamination due to favorable geologic conditions; consequently, the overall groundwater quality in Ohio has not been contaminated to a significant degree. With few exceptions, contamination problems are localized, involving one or two individual wells near the source of pollution.

Ohio does not have a comprehensive summary of all sources of contamination, but the Agency has reported several sources of contaminants. For example, between July 1979 and June 1981, the Agency noted that for 242 well contamination cases, the sources of contamination were as follows:

Contamination source	Number of cases
Oil and gas drilling	62
Natural conditions	56
Sewage/animal waste	35
Refined hydrocarbons (fuel, oil, gasoline, solvents)	32
Pesticides/fertilizers	24
Road salt	14
Coal mining activity	10
Land disposal sites (landfills and lagoons)	9
Total	242

Furthermore, the Agency analyses of tests from wells in the state ambient monitoring network have shown varying degrees of groundwater contamination. Very slight to severe effects have been noted in the immediate vicinity of eight sanitary landfills and 15 industrial lagoons. Most of the monitoring sites around coal storage facilities showed levels of iron, sulfate, and dissolved solids that exceed base line levels. Two monitoring sites in the northeastern area of the state reported high levels of chloride and sodium due to road salting.

The most serious regional groundwater problem is associated with oil and gas production. Contamination from oil field brine has been most frequently noted in a nine county area in east central Ohio and has been attributed to leakage and overflow from brine pits, faulty systems used to inject brine back into the ground and the illegal disposal of oil brine.

STATE EFFORTS TO PROTECT GROUND WATER

Ohio has not developed a written groundwater protection strategy because of staff limitations and budgetary constraints. However, the Agency has established a project coordinating committee to develop a statewide groundwater strategy, and completed a preliminary groundwater strategy in November 1983.

A complete assessment of groundwater regulatory authority is one of the main tasks in developing a groundwater strategy. Pending this assessment, the state appears to have authority over solid waste, landfills, and surface mining operations and to a lesser extent, authority for oil brine disposal enforcement. However, the Agency is reviewing certain areas in the state's

regulatory authority that gives them concern. Under Ohio regulations, discharge of nonhazardous industrial waste to lagoons does not require EPA water quality permits if the lagoon has no surface discharge. Industries can discharge the waste into the ground without groundwater monitoring. Some sites are currently exempted from hazardous waste controls by EPA, and many of these sites can contaminate ground water with salt brine.

Ohio is preparing river basin maps and groundwater resources maps, and these have been completed for 40 of 88 counties. Ohio has not done much on land use, zoning, and classification of aquifers. The state has an extensive groundwater monitoring network, which includes 60 production wells in principal aquifer areas sampled semi-annually; cluster well sampling around selected landfill disposal and industrial waste sites; ambient surveillance and complaint sampling around industrial sources; and annual monitoring for 20 to 30 substances at municipal groundwater supplies.

For fiscal year 1983, Ohio expended $26,250 in federal section 208 funds for basic groundwater data collection. The state contributed $8,750 to this effort.

STATE VIEWS OF THE FEDERAL ROLE

The Ground Water Coordinator stated that there is a need for a national groundwater policy and legislation to provide funding of state groundwater programs. Five or six federal acts have groundwater sections. States, in turn, have set up staffs in different departments and this has fragmented state groundwater efforts. National groundwater legislation would provide a mandate and consolidate groundwater efforts and provide specific funding for state groundwater protection efforts. The Agency would also like to see EPA continue to provide research and technical assistance for groundwater protection.

Groundwater funding is the Agency's highest priority need. The Agency would use this funding to (1) hire geologists to maintain the state's groundwater ambient monitoring program and (2) establish a data base to accumulate information on groundwater quality. EPA should provide the states with a means of assessing a national groundwater research base.

RHODE ISLAND GROUNDWATER ACTIVITIES

About 30 percent of the population uses ground water for drinking. Groundwater protection in Rhode Island is directed by the Rhode Island Department of Environmental Management. The information in this summary was obtained from the Chief of the Industrial Facilities and Monitoring Section.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

Groundwater contamination generally is not now a major problem in Rhode Island, although some private wells have been contaminated. Most of these problems were caused by (1) improper disposal or storage of hazardous waste, (2) leaking underground gasoline storage tanks, and (3) unprotected road salt storage. For example, in 1981, state tests of 74 private wells in one area showed traces of organic chemicals. Nine of these wells contained contamination levels high enough for the state to recommend that they not be used for drinking water. The suspected contamination sources included a chemical company's hazardous waste site, a tube manufacturer's waste water lagoon, a leaking sanitary sewer, and an extraordinary air emission at an industrial site.

The state does not have a comprehensive summary of contamination instances by source of contamination but does have a list of hazardous waste sites. In 1980, a state surface impoundment assessment identified 47 agricultural, municipal, and industrial sites with 145 impoundments; 107, or 74 percent, of the impoundments were at industrial sites, and 46 of these were located close to aquifers. The Department concluded that surface impoundments had a potential to contaminate shallow aquifers.

STATE EFFORTS TO PROTECT GROUND WATER

Although aware of the need to protect ground water from contamination for many years, the Department only recently was given statutory authority and resources to address this issue. A 1982 State Water Quality Management Plan recommended enacting groundwater protection regulations to prohibit the siting of landfills, hazardous waste disposal facilities, and other activities in groundwater recharge areas. In May 1983, the Rhode Island Legislature amended the state water pollution control laws to give the Department broad authority to prevent, control, and abate new and existing groundwater pollution. The Section Chief believes that this authority is adequate to implement groundwater protection programs, and the Department is developing rules and regulations.

The Department is developing a groundwater protection strategy, which, as now envisioned, will establish two categories of aquifers--one in which discharge or storage of hazardous waste would not be allowed and another in which storage of hazardous waste, properly protected, would be allowed. A third category (an impacted zone) may be established for aquifers contaminated beyond

correction. The Section Chief emphasized that groundwater protection strategies are in their infancy in Rhode Island and many other states.

Before the new legislation, the state, in 1981 and 1982, developed a map showing known wells, waste sites, and aquifers under a surface impoundment assessment. The assessment collected and analyzed data on stratified drift and till deposits, groundwater quality, areas served by public and private wells, and urban and industrial zones.

The state has contracted with USGS to develop more detailed maps of aquifers and recharge areas. During the first year, the Department studied two approaches (1) mapping by field testing which would take about 5 years and (2) mapping by computer modeling, which would take about 3 years. The Department chose the computer modeling approach which, although not as precise as the other one, could be done more quickly. The Department plans to use this mapping data along with groundwater quality data to classify aquifers and enforce land use in recharge areas.

The estimated federal and state funds used for basic data collection on groundwater protection during fiscal years 1977 through 1983 follows.

Source of funds	Federal	State	Total
Section 208[a]	$184,488	$ 5,404	$189,892
UIC[b]	234,000	78,000	312,000
Total	$418,488	$83,404	$501,892

[a]For planning data on groundwater protection during fiscal years 1977 through 1979.

[b]For general groundwater data collection (includes mapping efforts) during fiscal years 1981 through 1983.

STATE VIEWS OF THE FEDERAL ROLE

The Section Chief sees a multifaceted federal role in groundwater protection. First, EPA should establish and maintain a strong federal presence by (1) developing a national groundwater strategy, (2) providing resources for the states to plan, collect data, and develop and implement state strategies, and (3) coordinating the data exchange among states. The Department would like EPA to do and report on research which the states cannot afford. EPA should also assist in training the state's groundwater staff.

Additional federal funds would be used in the following way:

--to hire a hydrologist, several engineers, and eventually an enforcement lawyer to develop rules, regulations, and

programs to carry out the new groundwater protection authority and

--to computerize the groundwater protection system, including aquifer maps and groundwater quality data, and ultimately, the data from zoning and land use decisions.

The Section Chief believes that EPA's approach to research on organic contamination has been too theoretical. EPA should be funding research on how various chemicals affect groundwater quality. The Department needs this information to use as an analytical tool along with aquifer maps before aquifers can be classified and zoning and land use decisions can be made.

TEXAS GROUNDWATER ACTIVITIES

Groundwater supplies about 60 percent, or 10.85 million acre-feet per year, of the water used by Texans for domestic, industrial, and agricultural purposes, and 45 percent of their drinking water. The Department of Water Resources has proposed development schemes for 7 major and 17 minor aquifers. The schemes provide for utilization of the 5.3 million acre-feet of annual effective recharge and would, over time, recover from storage over 431 million acre-feet of ground water.

Texas has two fairly unique aquifers--the Edwards Aquifer in San Antonio, which has been designated by EPA as a "sole source"[1] aquifer, and the High Plains (Ogallala) Aquifer, which is the largest aquifer by volume in the world. The quality of water in the Edwards Aquifer is protected by federal, state, and local governments because it is easily polluted and is the only drinking water supply for San Antonio. The Ogallala Formation is the size of California and stretches from the northern edge of the Pecos River Valley in west Texas into southern South Dakota, but it is slowly being depleted. Over seven million acre-feet are currently being pumped out of the Ogallala annually, while only 439,000 acre-feet per year are being replaced by natural recharge. In 1980, the aquifer contained about 420 million acre-feet. Hydrologists estimate that by the year 2000 the total amount of water in storage will be only 363 million acre-feet, based on current usage and recharge.

The information contained in this summary was obtained from the Director, Data and Engineering Services Division, Texas Department of Water Resources.

NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

Texas believes that the state's ground water is relatively free from contamination, although there are isolated problems with natural mineralization, overpumpage, septic tank and gasoline tank leakage, and industrial and domestic wastes stored in surface impoundments. The state has not developed a comprehensive system for summarizing groundwater problems but considers these activities to have the potential for contaminating ground water:

--Oil and gas operations, which may increase sodium or chlorine concentrations in local groundwater resources. The primary concerns are about (1) the 800,000 operating

[1]Under section 1424(e) of the Safe Drinking Water Act, a sole or principal source aquifer is one which the Administrator, EPA, determines is the sole source of drinking water for an area and, if contaminated, would create a significant hazard to public health. The designation of an aquifer prohibits federal assistance to any project which may contaminate the aquifer.

wells' compliance with current standards to avoid groundwater contamination, (2) the thousands of unplugged abondoned wells drilled between 1930 and 1960 that may have contaminated ground water, (3) injection wells associated with oil and gas operations, industrial activities, and mineral extraction processes, and (4) brine pits used before 1969 as holding pits for disposal of salt water. Although these brine pits were drained and covered with dirt, some sludge remains and through the years has migrated into the ground water, in some places, elevating sodium and chorine concentrations.

--Hazardous, abandoned, and Superfund waste sites pose actual and potential groundwater contamination problems. The hazardous waste sites are regulated by law, and the Superfund sites are being stabilized and, in some instances, cleaned up. The sites posing the greatest threat are the abandoned sites, which cannot be regulated as hazardous waste or do not have a high enough priority to receive Superfund monies for cleanup. There are currently 12 such sites, 2 which have been satisfactorily cleaned up by private parties. Of the remaining 10 sites, only 1 had documented groundwater contamination, but 3 others had potential for contamination because of their locations in flood plains or on an alluvial river terrace.

--Overpumping in coastal areas and some inland areas that depend on ground water has led to saltwater intrusion into some of the aquifers, threatening the usefulness of the aquifers by contaminating fresh water supplies and limiting available recharge capacity.

STATE EFFORTS TO PROTECT GROUND WATER

The Texas Department of Water Resources has primary responsibility for protecting and planning use of the state's ground water. Nine other state agencies (primarily the Texas Department of Health and the Railroad Commission of Texas) and nine Underground Water Conservation Districts also manage, control, and protect the ground water.

The legislative authority to protect water, including ground water, is contained in the Texas Water Code. Generally, the state believes that it has sufficient authority to solve and manage its groundwater quality problems because all waste discharges are state-regulated. Its ability to manage use-related problems is, however, very limited because in Texas ground water is the property of the landowner. However, the nine Underground Water Conservation Districts, created and funded at the local level, have broad powers, including well spacing and pumping regulations, and can restrict land use based on aquifer considerations. But since most of the state's groundwater resources are not within the jurisdiction of these districts, groundwater use is generally not regulated.

Texas has identified the boundaries and various characteristics for all its 7 major and 17 minor aquifers, including water availability, recharge, structural contours, and other geological information; for a limited number of the aquifers, the state has also estimated recoverable storage. In addition, the state has designated the major groundwater uses for each aquifer to facilitate quality and quantity discussions. The categories of use are municipal, manufacturing, steam-electric generating, irrigation, mining, and livestock; however, these designations do not limit the use of the aquifer.

Texas has studied and mapped its ground water for over 40 years. The information on the state's geology is extensive, particularly in oil-and gas-producing areas. Although Texas has not mapped activities above the aquifers, it believes it generally knows the location of current and past activities which may endanger the aquifers.

The Department collects 750 groundwater samples per year from its 5,800 monitoring wells. The sample analyses are compared to the 45,000 sample analyses contained in its computerized data base to identify trends in water quality. The Department helps insure maintenance of the state's groundwater quality by (1) conducting in-depth investigations of alleged groundwater contamination or conditions which threaten to cause deterioration of groundwater quality, (2) making recommendations to the Railroad Commission of Texas for protection of usable quality ground water during exploration, production, and operation of oil, gas, or other mineral and surface mining activities, as well as disposal of applicable wastes, and (3) providing administrative and investigative support to the Texas Water Well Drillers Board, which has responsibility for setting and enforcing standards for the state's water well drillers.

The Department's Data and Engineering Services Division collects basic data on the occurrence, quantity, and quality of the state's water and provides engineering and technical services. The Division spent $1,432,500 of state funds in fiscal year 1982 (ended August 31) and $1,550,400 in fiscal year 1983 for groundwater activities. In fiscal years 1982 and 1983, the division estimated that it spent $415,500 and $462,400, respectively, for data collection, mapping, and monitoring activities.

The other Department divisions estimated that in state fiscal year 1982, they spent about $2 million in federal funds and about $1.1 million state funds for groundwater protection activities. For fiscal year 1983, they estimated that about $6.3 million in federal and $1.2 million in state funds were spent for groundwater protection activities.

The Railroad Commission's Surface Mining and Reclamation Division estimated that it spent about $26,000 and $48,800 in federal and state funds, respectively, in fiscal year 1982 and

approximately $28,000 in federal and $43,000 in state funds in 1983 for groundwater activities. These federal funds are provided by the Office of Surface Mining, U.S. Department of the Interior. The Railroad Commission's Oil and Gas Division estimated it spent $503,000 in federal and $3.4 million in state funds in fiscal year 1982 and $458,000 in federal and $2.8 million in state funds during state fiscal year 1983 for groundwater protection activities. In 1983 the state legislature passed a bill that should generate over $4 million per year from oil and gas permit fees to plug the known abandoned oil and gas wells.

The Texas Division of Water Hygiene spent about $300,000 for groundwater protection in fiscal years 1982 and 1983; about 50 percent of the amounts are federal Safe Drinking Water Act funds.

USGS spent about $900,000 in federal and $880,000 in state and local funds in fiscal years 1982 and 1983 for groundwater activities.

STATE VIEWS OF THE FEDERAL ROLE

The state agreed that funding and technical assistance from the federal government would be beneficial. Additional funding would be used for the following needs.

--Enforcement and field operations personnel for groundwater investigations.

--General counsel personnel for permitting, conducting court proceedings, and interpreting rules for activities affecting ground water.

--Additional studies about land and recharge areas.

--Chemical analyses of groundwater samples for a wider range of pollutants to determine background levels in essentially non-polluted areas.

--A program to aggressively pursue the plugging of leaking wells.

--Identification of deeper zones of usable-quality water through the development of improved record interpretation procedures.

--Investigations into groundwater quality as related to past non-state regulated injection well activities pursuant to future regulatory measures.

The state is not in favor of a national approach to groundwater management, as it believes current federal laws provide adequate protection. One suggestion was that the federal government should sharpen existing environmental priorities and provide indirect funding assistance for specific groundwater problems through current programs.

The Department believes that if additional funds were provided for groundwater protection, Texas would use the money for long-term work such as increased enforcement and permit reviews; staff salaries, for travel, laboratory expenses, and supplies; and to contract with private entities for such short-term work as well plugging and digging deep test holes.

(089207)

*U.S. GOVERNMENT PRINTING OFFICE : 1984 0-421-843/216

21590

AN EQUAL OPPORTUNITY EMPLOYER

UNITED STATES
GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
U. S. GENERAL ACCOUNTING OFFICE

U.S.MAIL

SPECIAL FOURTH CLASS RATE
BOOK

GE