WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN NEW MEXICO -- FISCAL YEAR 1988

Compiled by R. L. Knutilla

U.S. GEOLOGICAL SURVEY

Open-File Report 88-473

Albuquerque, New Mexico

1988

DEPARTMENT OF THE INTERIOR

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MESSAGE FROM THE DISTRICT CHIEF

The U.S. Geological Survey has collected and disseminated information on the water resources of New Mexico for nearly a century. The Survey began to collect records on streamflow in New Mexico in December 1888 when the first discharge measurements were made on the Rio Grande near the present gaging station at Embudo. This site is indeed the "birthplace of systematic stream gaging" because it is the site chosen to be the training center for the first hydrographers of the Irrigation Survey, a bureau within the Geological Survey. Since that time, through cooperative programs with local, State, and Federal agencies, we have monitored streams at hundreds of sites throughout the State and have a current network of more than 200 gaging stations. Also through the cooperative program, we have established sites where ground-water levels are monitored and sites where surface water and ground water are sampled to determine the water chemistry. The cooperative program also enables the undertaking of investigative studies to define the availability of water resources. Information from the data program and results of investigative studies are made available to water resources managers, regulators, and the public to be used for the effective management of the State's water resources.

This report provides a brief summary of the New Mexico District of the U.S. Geological Survey, including its organization, mission, types of funding, and cooperators. Also provided are descriptions of current projects, each of which list the statement of the problem and the study objective, approach, progress, significant results, and future plans. Additional information about these projects can be obtained by contacting the principal investigator or me.

Water is one of many significant factors that influence the economy of New Mexico. Recently the demands for freshwater have risen because of population growth and industrial development. These demands compete with continuing agricultural water needs. Coupled with these needs is the value of water for recreation and esthetics. Often the demands on the resource are in conflict with each other. These needs and water-resource issues related to water transfer, water contamination, water shortages or excesses, water rights, water supply, in-stream flow, and the like will require continued evaluation. Public concern about hazardous wastes, toxic substances in water, and the environment are issues that must be increasingly addressed in the coming years. Continued and increased cooperation between agencies will be essential in dealing with these challenges. I look forward to an active role for the Geological Survey in meeting these challenges and maintaining a strong cooperative program.

Robert L. Knutilla
District Chief
U.S. Geological Survey
Water Resources Division
Albuquerque, New Mexico

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY

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ORIGIN OF THE U.S. GEOLOGICAL SURVEY

The U.S. Geological Survey was established by an act of Congress on March 3, 1879, as a permanent Federal agency in the Department of the Interior. Its mission is to conduct the systematic and scientific classification of the public lands and to examine the geological structure, mineral resources, and products of the national domain. An integral part of that original mission includes publishing and disseminating the earth-science information needed to understand, to plan the use of, and to manage the Nation's energy, land, mineral, and water resources.

Since 1879, the Geological Survey has become the Federal Government's largest earth-science research agency, the Nation's largest civilian mapmaking agency, the primary source of data on the Nation's surface- and ground-water resources, and the employer of the largest number of professional earth scientists. Today, programs of the Geological Survey serve a diversity of needs and users and include:

1. Conducting detailed assessments of the energy and mineral potential of the Nation's land and offshore areas.
2. Investigating and issuing warnings of earthquakes, volcanic eruptions, landslides, and other geologic and hydrologic hazards.
3. Conducting research on the geologic structure of the Nation.
4. Studying the geologic features, structure, processes, and history of the other planets of our solar system.
5. Conducting topographic surveys of the Nation and preparing topographic and thematic maps and related cartographic products.
6. Developing and producing digital-cartographic data bases and products.
7. Collecting data on a routine basis to determine the quantity, quality, and use of surface and ground water.
8. Conducting water-resource appraisals in order to describe the consequences of alternative plans for developing land and water resources.
9. Conducting research in hydraulics and hydrology and coordinating all Federal water-data acquisition.
10. Using remotely sensed data to develop new cartographic, geologic, and hydrologic research techniques for natural-resources planning and management.
11. Providing earth-science information through an extensive publications program and a network of public access points.

Along with its continuing commitment to meet the growing and changing earth-science needs of the Nation, the Geological Survey remains dedicated to its original mission to collect, analyze, interpret, publish, and disseminate information about the natural resources of the Nation--providing earth science in the public service.

BASIC MISSION AND PROGRAM OF THE WATER RESOURCES DIVISION

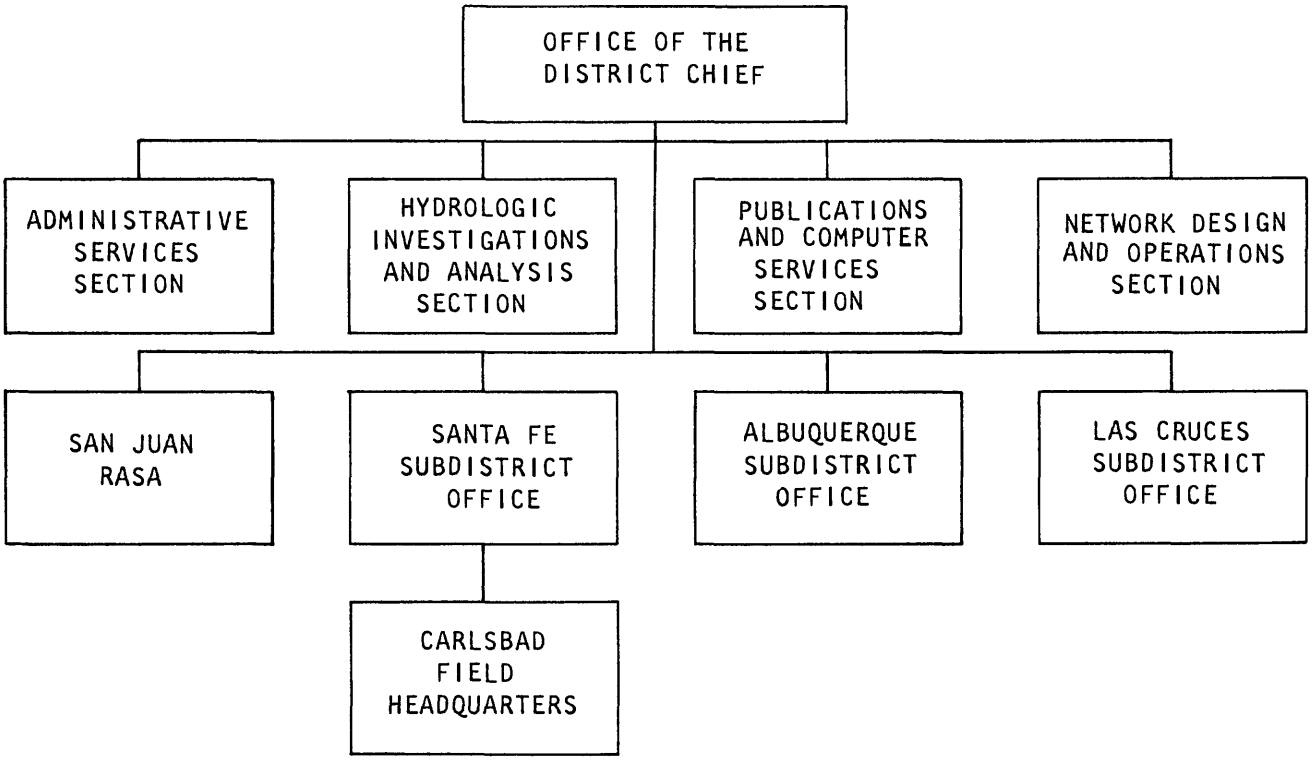
The U.S. Geological Survey, through its Water Resources Division, investigates the occurrence, quantity, distribution, and movement of the surface and underground waters that comprise the Nation's water resources. The Survey also coordinates Federal water-data acquisition activities.

The mission of the Division is accomplished through programs supported by the U.S. Geological Survey independent of or in cooperation with other Federal and non-Federal agencies. These programs involve:

1. Collecting, on a systematic basis, data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.
2. Conducting analytical and interpretive water-resource appraisals that describe the occurrence, availability, and physical, chemical, and biological characteristics of surface and ground water.
3. Conducting basic problem-oriented research in hydrology to improve the scientific basis for investigations and measurement techniques and to predict quantitatively the response of hydrologic systems to stress.
4. Disseminating water data and the results of investigations and research through reports, maps, computerized information services, and other forms of public releases.
5. Coordinating the activities of Federal agencies in the acquisition of water data for streams, lakes, reservoirs, estuaries, and ground waters.
6. Providing scientific and technical assistance in hydrologic fields to other Federal, State, and local agencies, to licensees of the Federal Power Commission, and to international agencies on behalf of the U.S. State Department.
7. Administering the provisions of the Water Resources Research Act of 1984, which includes the State Water Resources Research Institute Program (Section 104) and the National Water Resources Research Grant Program (Section 105).
8. Acquiring information useful in predicting and delineating water-related natural hazards from flooding, volcanoes, mudflows, and land subsidence.

NEW MEXICO DISTRICT OFFICE ORGANIZATION AND ADDRESSES

The New Mexico District is organized into three operating sections, two support sections, and three Subdistrict offices under the District Chief. The operating sections are the Hydrologic Investigations and Analysis Section, the Network Design and Operations Section, and San Juan Regional Aquifer-Systems Analysis (RASA) (see organization chart below). The Administrative Services Section and the Publications and Computer Services Section are the support sections. The New Mexico District consists of the District office in Albuquerque, a Subdistrict office and Water-Quality and Sediment Laboratory in Albuquerque, Subdistrict offices in Santa Fe and Las Cruces, and a Field Headquarters in Carlsbad (fig. 1). The Carlsbad office reports to the Santa Fe Subdistrict.



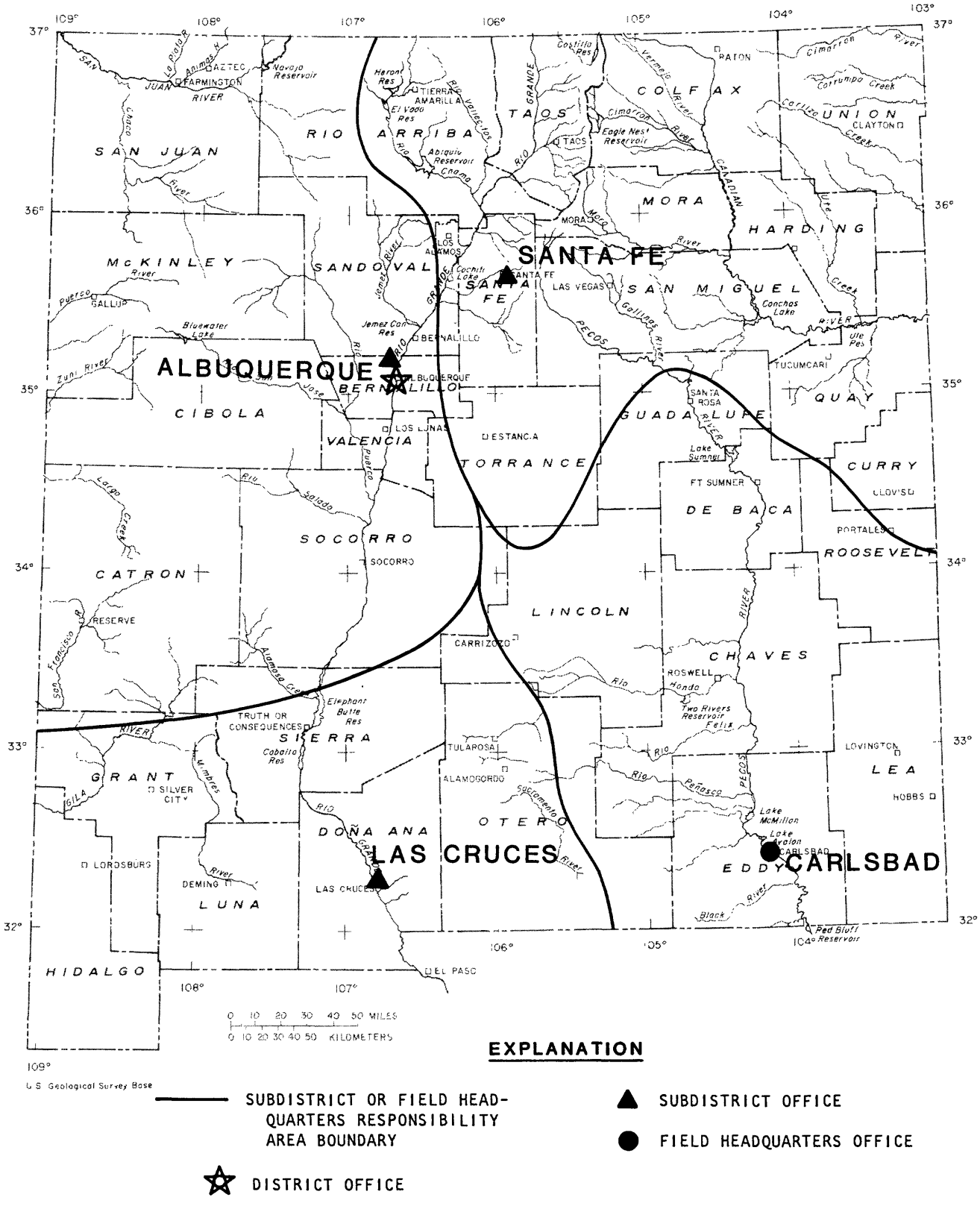


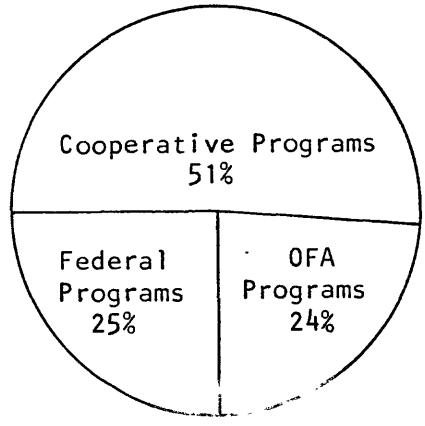
Figure 1.--Location of U.S. Geological Survey offices in New Mexico and general areas of responsibility.

Inquiries regarding projects described in this report may be directed to the District Office, Subdistrict Offices, or Field Headquarters in which the work originated or is being carried out.

DISTRICT OFFICE (505) 262-6630 Chief: Robert L. Knutilla	U.S. Geological Survey Water Resources Division Pinetree Office Park 4501 Indian School Road NE Suite 200 Albuquerque, New Mexico 87110
ALBUQUERQUE SUBDISTRICT OFFICE (505) 761-4615 Hydrologist-in-Charge: Robert L. Gold, Acting	5821-D Midway Park Boulevard NE Albuquerque, New Mexico 87109
SANTA FE SUBDISTRICT OFFICE (505) 988-6307 Hydrologist-in-Charge: Herbert Garn	Room 115, Federal Building Cathedral Place Santa Fe, New Mexico 87501
LAS CRUCES SUBDISTRICT OFFICE (505) 646-4885 Hydrologist-in-Charge: Robert G. Myers, Acting	P.O. Box 30001 Dept. 3167 New Mexico State University Las Cruces, New Mexico 88003
CARLSBAD FIELD HEADQUARTERS (505) 885-5939 Technician-in-Charge: Ronny L. McCracken	Room 101, Federal Building Carlsbad, New Mexico 88220

TYPES OF FUNDING

Water-resources activities are supported by services and funds in three program areas based on source of funds. Cooperative-Program funds are provided from State, tribal, and local governmental agencies and generally are matched by Federal funds on a 50-50 basis. Funds transferred from other Federal agencies are part of the OFA Program, and funds appropriated directly to the Geological Survey by Congress are part of the Federal Program. Total financial support from these programs for the New Mexico District is about $6,000,000 in fiscal year 1988. The distribution of funds among the three sources is as follows:



In fiscal year 1988, the New Mexico District is programmed to pursue two broad categories of studies: (1) collection of hydrologic data, and (2) areal appraisals and interpretive studies. Approximately 40 percent of the program is for collection of hydrologic data and 60 percent for appraisals and interpretive studies. These studies provide managers and planners with information about the availability and quality of New Mexico's water resources.

LIST OF COOPERATORS

The following is a list of local, tribal, State, and Federal agencies that support water-resources investigations in cooperation with the U.S. Geological Survey during fiscal year 1988.

Local, tribal, and State Agencies

Alamogordo, City of
Albuquerque, City of
Albuquerque Metropolitan Arroyo Flood Control Authority
Canadian River Municipal Water Supply
Costilla Creek Compact Commission
El Paso, City of
Gallup, City of
Las Cruces, City of
Las Vegas, City of
Los Alamos, County of
Navajo Nation
New Mexico Bureau of Mines and Mineral Resources
New Mexico Highlands University
New Mexico State Engineer Office/Interstate Stream Commission
New Mexico State Environmental Improvement Division
New Mexico State Highway Department
Pecos River Commission
Pueblo of Acoma
Pueblo of Laguna
Pueblo of Zuni
Raton, City of
Rio Grande Compact Commission
Ruidoso, City of
Santa Fe Metropolitan Water Board
Santa Rosa, City of

Federal Agencies

Federal Emergency Management Agency
International Boundary and Water Commission, U.S. Section
U.S. Department of Agriculture
  Forest Service
U.S. Department of the Air Force
  Kirtland Air Force Base
U.S. Department of the Army
  Corps of Engineers
  White Sands Missile Range
U.S. Department of Energy
U.S. Department of the Interior
  Bureau of Indian Affairs
  Bureau of Land Management
  Bureau of Reclamation
  Office of the Secretary

WATER SITUATION IN NEW MEXICO

Surface water and ground water in New Mexico, a semiarid state, vary widely in availability, quantity, and quality. Three principal drainage systems in the United States have part of their headwaters in New Mexico: the Colorado River, Mississippi River, and Western Gulf of Mexico tributaries. The majority of New Mexico surface water exists in six major rivers. The largest in terms of total discharge is the San Juan River (tributary to the Colorado River) in the northwestern part of the State. The second largest is the Rio Grande, which transects the center of the State from Colorado on the north to Texas on the south. Other major rivers include the Rio Chama in the north, the Canadian River in the northeast, the Pecos River in the east and southeast, and the Gila River in the southwest. Surface water in the State is fully appropriated; all of New Mexico's major streams are subject to one or more of eight interstate water compacts to which the State is a party. The New Mexico State Engineer estimates that when the State has fully developed its surface-water resources within the allowances of the eight interstate compacts, river inflow into New Mexico will approximate river outflow from the State.

For administrative purposes, the State Engineer has declared 31 underground water basins, encompassing approximately 84,700 square miles (70 percent of the State's total area). The State Engineer has jurisdiction over appropriation and use of water resources of declared basins and intrastate administration of surface-water rights. In many areas where development has occurred and ground-water use is significant, draft on the ground-water supply exceeds recharge, thus ground-water levels are declining. In eastern New Mexico, large withdrawals for irrigation have contributed to the lowering of water levels in the Ogallala aquifer by as much as 100 feet. Increases in municipal, domestic, industrial, and agricultural water use in the west-central part of the State, in the vicinity of Gallup, Grants, and the Pueblos of Acoma and Laguna, have caused concern about sufficiency of ground-water supplies to meet future requirements. Other areas of decline in ground-water levels include the Mimbres Basin in the southwest, the San Juan Basin in the northwest, the Estancia Basin in the central part, and the Albuquerque-Belen and Santa Fe Basins in the central and north-central parts of New Mexico.

Proper allocation and optimum utilization of New Mexico's water resources may be accomplished by comprehensive planning and management, which require reliable hydrologic information. The current activities of the New Mexico District address many of the State's current and anticipated problems and water-information needs. These activities, as described in this report, are designed to provide hydrologic data and related information needed for the best utilization and management of the water resources of New Mexico and the Nation.

REPORTS RELEASED OR APPROVED DURING 1986 AND 1987

Anderholm, S.K., 1988, Ground-water geochemistry of the Albuquerque-Belen Basin, central New Mexico: U.S. Geological Survey Water-Resources Investigations Report 86-4094, 110 p.

_____1987, Reconnaissance of hydrology, land use, ground-water chemistry, and effects of land use on ground-water chemistry in the Albuquerque-Belen Basin, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 86-4174, 37 p.

_____1987, Hydrogeology of the Socorro-La Jencia Basins, Socorro County, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 84-4342, 62 p.

Anderholm, S.K., and Bullard, T.F., 1987, Description of piezometer nests and water levels in the Rio Grande valley near Albuquerque, Bernalillo County, New Mexico: U.S. Geological Survey Open-File Report 87-122, 51 p.

Baldwin, J.A., in press, Ground-water resources of Cibola County, New Mexico: New Mexico Bureau of Mines and Mineral Resources Hydrologic Report.

Beal, L.V., and Gold, R.L., 1987, Water resources data--New Mexico, water year 1986: U.S. Geological Survey Water-Data Report NM-86-1, 454 p.

Burns, A.W., and Hart, D.L., Jr., 1988, Simulated water-level declines caused by ground-water withdrawals near Holloman Air Force Base, Otero County, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 86-4324, 44 p.

Cruz, R.R., 1986, Annual water-resources review, White Sands Missile Range, New Mexico, 1985: U.S. Geological Survey Open-File Report 86-401, 21 p.

Dam, W.L., 1987, Methods and preliminary results of geochemical sampling, San Juan Basin, New Mexico [abs.]: 23rd Annual American Water Resources Association Conference and Symposium, Salt Lake City, Utah, November 1-6, 1987, Proceedings.

Davies, P.B., 1986, Pleistocene-to-present flow-system evolution in the northern Delaware Basin (southeastern New Mexico)--Analysis using transient cross-sectional flow simulations [abs.]: Geological Society of America, Abstracts with Programs, v. 18, no. 6, p. 580.

_____1987, Modeling areal, variable-density, ground-water flow using equivalent freshwater head--Analysis of potentially significant errors: National Water Well Association Conference, Denver, Colo., February 10-12, 1987, Proceedings, v. II, p. 888-903.

Denis, L.P., Beal, L.V., and Allen, H.R., 1986, Water resources data--New Mexico, water year 1985: U.S. Geological Survey Water-Data Report NM-85-1, 482 p.

Goetz, C.L., 1987, Portable field-chamber measurement of evapotranspiration and comparison to Bowen-ratio, energy-balance measurement of evapotranspiration rate [abs.]: American Geophysical Union Meeting, San Francisco, Calif., December 6-11, 1987, Proceedings.

Goetz, C.L., and Abeyta, C.G., 1987, Adequacy of NASQAN data to describe areal and temporal variability of water quality of the San Juan River drainage basin upstream from Shiprock, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 85-4043, 89 p.

Goetz, C.L., Abeyta, C.G., and Thomas, E.V., 1987, Application of techniques to identify coal-mine and power-generation effects on surface-water quality, San Juan River basin, New Mexico and Colorado: U.S. Geological Survey Water-Resources Investigations Report 86-4076, 77 p.

Gold, R.L., and Winkless, Dan, 1988, Procedures for determining drainage areas using a digitizer, digital computer, and topographic maps: U.S. Geological Survey Water-Resources Investigations Report 86-4083, 33 p.

Hudson, J.D., 1986, Ground-water depletion allowed by the Internal Revenue Service in Lea, Roosevelt, and Curry Counties, 1985: New Mexico State Engineer Maps LC-28, CU-26, RO-29, LN-28, 4 sheets.

Hudson, J.D., 1987, Ground-water depletion allowed by the Internal Revenue Service in Lea, Roosevelt, and Curry Counties, 1986: New Mexico State Engineer Maps LC-29, LN-29, CU-27, and RO-30, 4 sheets.

Kernodle, J.M., Miller, R.S., and Scott, W.B., 1987, Three-dimensional model simulation of transient ground-water flow in the Albuquerque-Belen Basin, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 86-4194, 86 p.

Kernodle, J.M., and Scott, W.B., 1986, Three-dimensional model simulation of steady-state ground-water flow in the Albuquerque-Belen Basin, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 84-4353, 58 p.

Knutilla, R.L., compiler, 1986, Water-resources activities of the U.S. Geological Survey in New Mexico--Fiscal year 1986: U.S. Geological Survey Open-File Report 86-141, 83 p.

Kues, G.E., 1986, Ground-water levels and direction of ground-water flow in the central part of Bernalillo County, New Mexico, summer 1983: U.S. Geological Survey Water-Resources Investigations Report 85-4325, 24 p.

_____1987, Ground-water-level data for the Albuquerque-Belen Basin, New Mexico, through water year 1985: U.S. Geological Survey Open-File Report 87-116, 51 p.

McAda, D.P., and Shelton, S.G., 1987, Hydrologic data for the San Juan and Animas River valleys in the Farmington, Aztec, Bloomfield, and Cedar Hill areas, San Juan County, New Mexico: U.S. Geological Survey Open-File Report 87-385, 18 p.

McAda, D.P., and Wasiolek, Maryann, 1988, Simulation of the regional geohydrology of the Tesuque aquifer system near Santa Fe, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 87-4056, 71 p.

Myers, R.G., 1987, Hydrology of the Carrizo Wash basin in Catron and Cibola Counties, New Mexico: Geological Society of American Abstracts with Programs, Rocky Mountain Section, March 1987, v. 19, no. 5.

_____1987, Test wells TW1, TW2, and TW3, White Sands Missile Range, Doña Ana County, New Mexico: U.S. Geological Survey Open-File Report 87-47, 19 p.

Myers, R.G., Everheart, J.T., and Wilson, C.A., in press, Geohydrology of the San Agustin Basin, the Alamosa Creek basin northwest of Monticello Box, and the upper Gila Basin in parts of Catron, Socorro, and Sierra Counties, New Mexico: New Mexico State Engineer Technical Report.

Myers, R.G., and Villanueva, E.D., 1986, Geohydrology of the aquifers that may be affected by the surface mining of coal in the Fruitland Formation in the San Juan Basin, northwestern New Mexico: U.S. Geological Survey Water-Resources Investigations Report 85-4251, 41 p.

Nickerson, E.L., 1986, Selected geohydrologic data for the Mesilla Basin, Doña Ana County, New Mexico, and El Paso County, Texas: U.S. Geological Survey Open-File Report 86-75, 59 p.

Orr, B.R., 1987, Water resources of the Zuni tribal land, McKinley and Cibola Counties, New Mexico: U.S. Geological Survey Water-Supply Paper 2227, 76 p.

Orr, B.R., and Myers, R.G., 1986, Water resources in basin-fill deposits in the Tularosa Basin, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 85-4219, 94 p.

Orr, B.R., and White, R.R., 1986, Selected hydrologic data from the northern part of the Hueco Bolson, New Mexico and Texas: U.S. Geological Survey Open-File Report 85-696, 88 p.

Peter, K.D., 1987, Ground-water flow and shallow-aquifer properties in the Rio Grande inner valley south of Albuquerque, Bernalillo County, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 87-4015, 29 p.

Peter, K.D., Williams, R.A., and King, K.W., 1988, Hydrogeologic characteristics of the Lee Acres landfill area, San Juan County, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 87-4246, 69 p.

Richey, S.F., 1986, Hydrologic-test data from wells at hydrologic-test pads H-7, H-8, H-9, and H-10 near the proposed Waste Isolation Pilot Plant site, southeastern New Mexico: U.S. Geological Survey Open-File Report 86-413, 126 p.

_____1987, Preliminary hydrologic data for wells tested in Nash Draw near the proposed Waste Isolation Pilot Plant site, southeastern New Mexico: U.S. Geological Survey Open-File Report 87-37, 131 p.

_____1987, Water-level data from wells in the vicinity of the Waste Isolation Pilot Plant, southeastern New Mexico: U.S. Geological Survey Open-File Report 87-120, 107 p.

Risser, D.W., 1987, Possible changes in ground-water flow to the Pecos River caused by Santa Rosa Lake, Guadalupe County, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 85-4291, 79 p.

_____1988, Simulated water-level and water-quality changes in the bolson-fill aquifer, Post Headquarters area, White Sands Missile Range, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 87-4152, 71 p.

Umari, A.M.J., and Gorelick, S.M., 1986, The problem of complex eigensystems in the semianalytical solution for advancement of time in solute-transport simulation--A new method using real arithmetic: Water Resources Research, July 1986, v. 22, no. 7, p. 1149-1154.

_____1986, Evaluation of the matrix exponential for use in ground-water flow and solute-transport simulations--Theoretical framework: U.S. Geological Survey Water-Resources Investigations Report 86-4096, 33 p.

U.S. Geological Survey, 1986, New Mexico water issues, in National water summary 1985--Hydrologic events and surface-water resources: U.S. Geological Survey Water-Supply Paper 2300, p. 341-346.

_____1986, Report of the Rio Grande Compact Commission, 1985: Albuquerque, N. Mex., 55 p.

_____1986, Annual report to the Pecos River Commission on investigations being made in New Mexico and Texas, calendar year 1985: Albuquerque, N. Mex., 18 p.

_____1987, Annual report to the Pecos River Commission on investigations being made in New Mexico and Texas, calendar year 1986: Albuquerque, N. Mex., 20 p.

_____1987, Report of the Rio Grande Compact Commission, 1986: Albuquerque, N. Mex., 55 p.

_____1988, New Mexico water issues, in National Water Summary 1986--Hydrologic events and Ground-water quality: U.S. Geological Survey Water-Supply Paper 2325, p. 377-384.

_____in press, New Mexico water issues, in National Water Summary 1987--Water supply and demand: U.S. Geological Survey Water-Supply Paper.

Waltemeyer, S.D., 1986, Techniques for estimating flood-flow frequency for unregulated streams in New Mexico: U.S. Geological Survey Water-Resources Investigations Report 86-4104, 56 p.

_____1987, Trends in streamflow and reservoir contents in the Rio Grande basin, New Mexico, in 31st Annual New Mexico Water Conference, Santa Fe, N. Mex., 1986, Proceedings: Las Cruces, New Mexico Water Resources Institute Research Report 219, p. 133-144.

Welder, G.E., 1986, Plan of study for the Regional Aquifer-System Analysis of the San Juan structural basin, New Mexico, Colorado, Arizona, and Utah: U.S. Geological Survey Water-Resources Investigations Report 85-4294, 23 p.

_____1988, Hydrologic effects of phreatophyte control, Acme-Artesia reach of the Pecos River, New Mexico, 1967-82: U.S. Geological Survey Water-Resources Investigations Report 87-4148, 46 p.

Wilkins, D.W., 1986, Geohydrology of the Southwest Alluvial Basins Regional Aquifer-Systems Analysis, parts of Colorado, New Mexico, and Texas: U.S. Geological Survey Water-Resources Investigations Report 84-4224, 61 p.

_____1987, Characteristics and properties of the basin-fill aquifer determined from three test wells west of Albuquerque, Bernalillo County, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 86-4187, 78 p.

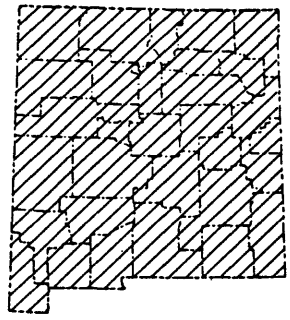
PROJECTS IN PROGRESS IN FISCAL YEAR 1988

Hydrologic-data stations are maintained by the Geological Survey at many locations in New Mexico. These stations constitute a network for obtaining stream stage and discharge, reservoir and lake elevation and storage, ground-water levels, well and spring discharge, sediment yields, and the quality of surface and ground water. The Water Resources Division has a current and a historical file of hydrologic data. Data collected are stored in the Geological Survey's National Water-Data Storage and Retrieval System (WATSTORE) and are available on request. This information can be retrieved in machine-readable form, as computer-printed tables or graphs, or as digital plots. Computer programs are available for statistical analyses of the data, and the results of these analyses also are available. Local assistance in acquisition of services or products from WATSTORE can be obtained from the District Chief, Water Resources Division, Albuquerque.

A summary of each data-collection program is included in this report. This summary consists of maps that show the area covered by the project, period of the project, principal investigator, a list of cooperating agencies, a brief description of the need for the program, its objective, the approach taken, progress and significant results, plans for FY 88, and reports released or in progress.

In addition to the hydrologic-data program, a number of interpretive projects, areal appraisals, and continuing cooperative projects are undertaken in New Mexico. The interpretive projects and areal appraisals are initiated for investigation of a particular hydrologic problem or specified area. These projects may be active for several years and usually are conducted in cooperation with one or more Federal, State, tribal, or local agencies. Some projects are continued for many years because of the need for long-term data collection and analysis.

NM-001 SURFACE-WATER STATIONS, NEW MEXICO



Period of Project: Continuous since 1930

Principal Investigator: J.P. Borland

Cooperating Agencies: Most of the agencies shown in the list of cooperators

Problem: Surface-water information is needed for surveillance, planning, design, hazard warning, operation, and management. This information is used in water-related fields such as water supply, hydroelectric power, flood control, irrigation, bridge and culvert design, wildlife management, pollution abatement, flood-plain management, and water-resources development. A historically complete data base is necessary to provide this information.

Objective: To obtain and document surface-water discharge (streamflow) and stage (water level) for general hydrologic purposes such as assessment of water resources, areal analysis, determination of long-term trends, research and special studies, or for management and operational purposes on streams and reservoirs.

Approach: Standard methods of data collection are used as described in the series, "Techniques of water-resources investigations of the U.S. Geological Survey." Daily and partial (annual peak discharge) records are collected, computed, and prepared for publication each year in the annual report, "Water resources data--New Mexico." The following table summarizes the types of stations in operation during FY 88.

Station classification	Number of stations
Streamflow stations:	
Continuous stage and discharge record:	
Water year	141[1/]
Seasonal	28
Low-flow	2
Cumulative discharge record:	
Irrigation season total only	17
Lake and reservoir stations:	
Continuous stage and contents	18[2/]
Intermittent stage and contents	7[3/]
Total stations	213

1/ Includes 6 stations where record is provided by a cooperating agency.
2/ Includes 15 stations where record is provided by a cooperating agency.
3/ Includes 6 stations where record is provided by a cooperating agency.

All streamflow stations (except cumulative irrigation season stations) are summarized in table 1, and reservoir and lake stations are summarized in table 2. Locations of the stations are shown in figure 2 except for selected stations operated only during the irrigation season. As part of interpretive hydrologic investigations, streamflow measurements sometimes are made at temporary gaging stations and at locations other than gaging stations.

Progress and Significant Results: Streamflow and stage data were collected at 213 network sites and prepared for publication.

Plans for FY 88: Continuation of network operated in fiscal year 1987 with minor revisions made in response to program changes. The following stations were discontinued in the cooperative program from water year 1987 to water year 1988:

07199600 Chicorica Creek near Yankee, N. Mex.
07199650 East Fork Chicorica Creek near Yankee, N. Mex.
07200500 Chicorica Creek near Raton, N. Mex.
07202000 Chicorica Creek near Hebron, N. Mex.
08260500 Costilla Creek below Diversion Dam at Costilla, N. Mex.
08281100 Rio Grande above San Juan Pueblo, N. Mex.
08394500 Rio Felix at Old Highway Bridge near Hagerman, N. Mex.
08401000 Pecos River below McMillan Dam, N. Mex.
08401100 Pecos River above Seven Rivers near Lakewood, N. Mex.

The following station was added to the program during the 1988 water year:

08361100 Cuchillo Negro Creek near Cuchillo, N. Mex.

Reports in Progress: None

Reports Released:

Beal, L.V., and Gold, R.L., 1987, Water resources data--New Mexico, water year 1986: U.S. Geological Survey Water-Data Report NM-86-1, 454 p. Reports on water-resources data for New Mexico are published annually.

Beal, L.V., and Gold, R.L., in press, Water Resources data--New Mexico, water year 1987: U.S. Geological Survey Water-Data Report NM-87-1, 450 p.

Table 1.—Streamflow-gaging stations in operation during the 1988 water year

[*, some records have been collected previously; S-seasonal; P-provided record; L-low flow only]

Station number	Station name	County	Drainage area (square mile)	Hydrologic unit code	Period of record
07202400	Vermejo River at Vermejo Park, N. Mex. (S)	007	--	11080001	1985-
07202500	Eagle Trail Ditch near Maxwell, N. Mex.	007	--	11080001	*1975-
07203000	Vermejo River near Dawson, N. Mex.	007	301	11080001	*1927-
07203505	Vermejo Ditch near Colfax, N. Mex.	007	--	11080001	1980-
07203525	Vermejo River near Maxwell, N. Mex.	007	--	11080001	1983-
07204000	Moreno Creek at Eagle Nest, N. Mex. (S)	007	73.8	11080002	*1964-
07204500	Cieneguilla Creek near Eagle Nest, N. Mex. (S)	007	56.0	11080002	*1964-
07205000	Sixmile Creek near Eagle Nest, N. Mex. (S)	007	10.5	11080002	*1958-
07206000	Cimarron River below Eagle Nest Dam, N. Mex.	007	167	11080002	1950-
07207000	Cimarron River near Cimarron, N. Mex.	007	294	11080002	1950-
07207500	Ponil Creek near Cimarron, N. Mex.	007	171	11080002	1950-
07208500	Rayado Creek at Sauble Ranch near Cimarron, N. Mex.	007	65.0	11080002	*1927-
07211000	Cimarron River at Springer, N. Mex.	007	1,030	11080002	*1926-
07211500	Canadian River near Taylor Springs, N. Mex.	007	2,850	11080003	*1964-
07215020	La Cueva Wasteway at La Cueva, N. Mex.	033	--	11080004	1956-
07215100	La Cueva Canal below La Cueva, N. Mex.	033	--	11080004	*1956-
07215500	Mora River at La Cueva, N. Mex.	033	173	11080004	*1931-
07218000	Coyote Creek near Golondrinas, N. Mex.	033	215	11080004	*1930-
07221000	Mora River near Shoemaker, N. Mex.	033	1,100	11080004	*1927-
07221500	Canadian River near Sanchez, N. Mex.	047	6,010	11080003	*1935-
07222500	Conchas River at Variadero, N. Mex.	047	523	11080005	1936-
07223300	Conchas Canal below Conchas Dam, N. Mex.	047	--	11080006	*1984-
07226500	Ute Creek near Logan, N. Mex.	021	2,060	11080007	*1942-
07227000	Canadian River at Logan, N. Mex.	037	11,100	11080006	1959-
07227100	Revuelto Creek near Logan, N. Mex.	037	786	11080008	1959-
08252500	Costilla Creek above Costilla Dam, N. Mex. (S)	055	25.1	13020101	1937-
08253000	Casias Creek near Costilla, N. Mex. (S)	055	16.6	13020101	1937-
08253500	Santistevan Creek near Costilla, N. Mex. (S)	055	2.15	13020101	1937-
08254000	Costilla Creek below Costilla Dam, N. Mex.	055	54.6	13020101	1937-
08255500	Costilla Creek near Costilla, N. Mex.	055	195	13020101	1936-
08256000	Acequia Madre at Costilla, N. Mex. (S)	055	--	13020101	1944-
08258000	Cerro Canal at Costilla, N. Mex. (S)	055	--	13020101	1944-
08258600	Cerro Canal below Association Ditch at Costilla, N. Mex. (S)	055	--	13020101	1972-
08259600	Cerro Canal at State line near Jaroso, Colo. (S)	055	--	13020101	1973-
08261000	Costilla Creek near Garcia, Colo. (S)	055	200	13020101	1944-
08263500	Rio Grande near Cerro, N. Mex.	055	8,440	13020101	1948-
08265000	Red River near Questa, N. Mex.	055	113	13020101	*1926-
08265500	Llano Ditch near Questa, N. Mex.	055	--	13020101	1961-
08266000	Cabresto Creek near Questa, N. Mex.	055	36.7	13020101	1943-
08266820	Red River below Fish Hatchery near Questa, N. Mex.	055	186	13020101	*1978-

Table 1.—Streamflow-gaging stations in operation during the 1988 water year—Continued

Station number	Station name	County	Drainage area (square mile)	Hydrologic unit code	Period of record
08267500	Rio Hondo near Valdez, N. Mex.	055	36.2	13020101	1934-
08268700	Rio Grande near Arroyo Hondo, N. Mex.	055	8,760	13020101	1963-
08269000	Rio Pueblo de Taos near Taos, N. Mex.	055	66.6	13020101	*1962-
08271000	Rio Lucero near Arroyo Seco, N. Mex.	055	16.6	13020101	*1962-
08275500	Rio Grande del Rancho near Talpa, N. Mex.	055	83	13020101	*1985-
08276300	Rio Pueblo de Taos below Los Cordovas, N. Mex.	055	380	13020101	1957-
08276500	Rio Grande below Taos Junction Bridge near Taos, N. Mex.	055	9,730	13020101	1925-
08279000	Embudo Creek at Dixon, N. Mex.	039	305	13020101	*1962-
08279500	Rio Grande at Embudo, N. Mex.	039	10,400	13020101	1889-
08284100	Rio Chama near La Puente, N. Mex.	039	480	13020102	1955-
08284160	Azotea Tunnel at Outlet near Chama, N. Mex. (P)	039	--	13020102	1970-
08284200	Willow Creek above Heron Reservoir near Los Ojos, N. Mex. (P)	039	112	13020102	1962-
08284300	Horse Lake Creek above Heron Reservoir near Los Ojos, N. Mex. (S) (P)	039	45.0	13020102	1962-
08284520	Willow Creek below Heron Dam, N. Mex. (P)	039	193	13020102	1971-
08285500	Rio Chama below El Vado Dam, N. Mex.	039	877	13020102	*1935-
08286500	Rio Chama above Abiquiu Reservoir, N. Mex.	039	1,600	13020102	1961-
08287000	Rio Chama below Abiquiu Dam, N. Mex.	039	2,140	13020102	1961-
08289000	Rio Ojo Caliente at La Madera, N. Mex.	039	419	13020102	1932-
08290000	Rio Chama near Chamita, N. Mex.	039	3,140	13020102	1912-
08291000	Santa Cruz River near Cundiyo, N. Mex.	049	86.0	13020101	1930-
08291950	Santa Clara Creek below Turkey near Española, N. Mex. (S)	039	--	13020101	1984-
08292000	Santa Clara Creek near Española, N. Mex.	039	34.5	13020101	*1985-
08294210	Rio Nambe below Nambe Falls Dam near Nambe, N. Mex. (P)	049	34.1	13020101	1979-
08313000	Rio Grande at Otowi Bridge, N. Mex.	049	14,300	13020101	1895-
08313500	Cochiti east side main canal at Cochiti, N. Mex.	043	--	13020201	*1970-
08314000	Sili Main Canal (at head) at Cochiti, N. Mex.	043	--	13020201	*1970-
08316000	Santa Fe River near Santa Fe, N. Mex.	049	18.2	13020201	1913-
08317200	Santa Fe River above Cochiti Lake, N. Mex.	049	231	13020201	1970-
08317400	Rio Grande below Cochiti Dam, N. Mex.	043	14,900	13020201	1970-
08317950	Galisteo Creek below Galisteo Dam, N. Mex.	049	597	13020201	1970-
08319000	Rio Grande at San Felipe, N. Mex.	043	16,100	13020201	1925-
08321500	Jemez River below East Fork near Jemez Springs, N. Mex.	043	173	13020202	*1981-
08323000	Rio Guadalupe at Box Canyon near Jemez, N. Mex.	043	235	13020202	*1981-
08324000	Jemez River near Jemez, N. Mex.	043	470	13020202	*1953-
08329000	Jemez River below Jemez Canyon Dam, N. Mex.	043	1,030	13020202	*1943-
08329700	Campus Wash at Albuquerque, N. Mex. (S)	001	--	13020203	1982-
08329835	North Floodway Channel at Albuquerque, N. Mex. (S)	001	--	13020203	1982-
08329840	Hahn Arroyo at Albuquerque, N. Mex. (S)	001	4.35	13020203	1978-
08329860	Villa del Oso Drain at Albuquerque, N. Mex. (S)	001	0.05	13020203	1976-
08329880	Academy Acres Drain at Albuquerque, N. Mex. (S)	001	0.12	13020203	1976-
08329890	La Cueva Arroyo trib. near Albuquerque, N. Mex. (S)	001	0.09	13020203	1977-
08329900	North Floodway Channel near Alameda, N. Mex. (S)	001	--	13020203	1968-
08329914	North Camino Arroyo trib. near Albuquerque, N. Mex. (S)	001	0.21	13020203	1979-
08329935	Arroyo 19A at Albuquerque, N. Mex. (S)	001	1.42	13020203	1977-
08329936	Taylor Ranch Drain at Albuquerque, N. Mex. (S)	001	0.14	13020203	1978-

Table 1.—Streamflow-gaging stations in operation during the 1988 water year—Continued

Station number	Station name	County	Drainage area (square mile)	Hydrologic unit code	Period of record
08329938	Ladera Arroyo at Albuquerque, N. Mex. (S)	001	0.87	13020203	1981-
08330000	Rio Grande at Albuquerque, N. Mex.	001	17,400	13020203	1941-
08330600	Tijeras Arroyo near Albuquerque, N. Mex. (S)	001	133	13020203	*1974-
08330800	Tijeras Arroyo below s div inlet near Albuquerque, N. Mex. (S)	001	--	13020203	1974-
08331140	N Pajarito Arroyo at Grant Bdry near Albuquerque, N. Mex. (S)	001	0.79	13020203	1979-
08331990	Rio Grande Conveyance Channel near Bernardo, N. Mex.	053	--	13020203	*1952-
08332010	Rio Grande Floodway near Bernardo, N. Mex.	053	19,200	13020203	*1941-
08332050	Bernardo Interior Drain near Bernardo, N. Mex.	053	--	13020203	*1943-
08334000	Rio Puerco above Arroyo Chico near Guadalupe, N. Mex.	043	420	13020204	1951-
08343000	Rio San Jose at Grants, N. Mex.	006	1,020	13020207	*1968-
08343100	Grant Canyon at Grants, N. Mex.	006	13.0	13020207	1961-
08343500	Rio San Jose near Grants, N. Mex.	006	2,300	13020207	1936-
08349800	Rio Paguate below Jackpile Mine near Laguna, N. Mex.	006	107	13020207	1976-
08351500	Rio San Jose at Correo, N. Mex.	006	3,660	13020207	1943-
08353000	Rio Puerco near Bernardo, N. Mex.	053	7,350	13020204	1939-
08354500	Socorro Main Canal North at San Acacia, N. Mex.	053	--	13020203	1936-
08354800	Rio Grande Conveyance Channel at San Acacia, N. Mex.	053	--	13020203	1960-
08354900	Rio Grande Floodway at San Acacia, N. Mex.	053	26,700	13020203	1936-
08358300	Rio Grande Conveyance Channel at San Marcial, N. Mex.	053	--	13020203	1969-
08358400	Rio Grande Floodway at San Marcial, N. Mex.	053	27,700	13020203	1964-
08361000	Rio Grande below Elephant Butte Dam, N. Mex.	051	29,400	13030101	1915-
08361100	Cuchillo Negro Creek near Cuchillo, N. Mex.	051	--	13030101	*1988-
08362500	Rio Grande below Caballo Dam, N. Mex. (P)	051	30,700	13030102	1938-
08377900	Rio Mora near Terrero, N. Mex.	047	53.2	13060001	1963-
08378500	Pecos River near Pecos, N. Mex.	047	189	13060001	1919-
08379500	Pecos River near Anton Chico, N. Mex.	019	1,050	13060001	*1927-
08380500	Gallinas Creek near Montezuma, N. Mex.	047	84.0	13060001	1916-
08382500	Gallinas River near Colonias, N. Mex.	019	610	13060001	1951-
08382600	Pecos River above Cañon del Uta near Colonias, N. Mex.	019	2,330	11080005	1976-
08382650	Pecos River above Santa Rosa Lake, N. Mex.	019	2,340	13060001	1976-
08382730	Los Esteros Creek above Santa Rosa Lake, N. Mex.	019	65.6	13060001	1973-
08382760	Los Esteros Creek trib. above Santa Rosa Lake, N. Mex.	019	13.7	13060001	1973-
08382830	Pecos River below Santa Rosa Lake, N. Mex.	019	2,430	13060001	1980-
08383000	Pecos River at Santa Rosa, N. Mex.	019	2,650	13060001	*1928-
08383500	Pecos River near Puerto de Luna, N. Mex.	019	3,970	13060001	1938-
08384500	Pecos River below Sumner Dam, N. Mex.	011	4,390	13060003	*1938-
08385000	Fort Sumner Main Canal near Fort Sumner, N. Mex.	011	--	13060003	*1954-
08386000	Pecos River near Acme, N. Mex.	005	11,300	13060007	*1937-
08387000	Rio Ruidoso at Hollywood, N. Mex.	027	120	13060008	1953-
08390500	Rio Hondo at Diamond A Ranch near Roswell, N. Mex.	005	947	13060008	*1939-
08390800	Rio Hondo below Diamond A Dam near Roswell, N. Mex.	005	963	13060008	1963-
08393500	Rio Hondo at Roswell, N. Mex.	005	--	13060008	1981-
08394100	Pecos River near Hagerman, N. Mex. (L)	005	13,600	13060007	1968-
08395500	Pecos River near Lake Arthur, N. Mex.	005	14,700	13060007	1938-
08396500	Pecos River near Artesia, N. Mex.	015	15,300	13060007	*1909-

Table 1.--Streamflow-gaging stations in operation during the 1988 water year--Concluded

Station number	Station name	County	Drainage area (square mile)	Hydrologic unit code	Period of record
08398500	Rio Peñasco at Dayton, N. Mex.	015	1,060	13060010	1951-
08399500	Pecos River (Kaiser Channel) near Lakewood, N. Mex.	015	--	13060011	1950-
08400000	Fourmile Draw near Lakewood, N. Mex.	015	265	13060011	1951-
08401200	South Seven Rivers near Lakewood, N. Mex.	015	220	13060011	1963-
08401500	Pecos River below Major Johnson Sp near Carlsbad, N. Mex. (L)	015	17,600	13060011	*1971-
08401900	Rocky Arroyo at Hwy Br near Carlsbad, N. Mex.	015	285	13060011	1963-
08402000	Pecos River at Damsite 3 near Carlsbad, N. Mex.	015	17,900	13060011	*1944-
08403500	Carlsbad Main Canal at head near Carlsbad, N. Mex.	015	--	13060011	1939-
08404000	Pecos River below Avalon Dam, N. Mex.	015	18,000	13060011	*1951-
08405150	Dark Canyon Draw at Carlsbad, N. Mex.	015	451	13060011	1973-
08405200	Pecos River below Dark Canyon Draw at Carlsbad, N. Mex.	015	18,500	13060011	1970-
08405500	Black River above Malaga, N. Mex.	015	343	13060011	*1946-
08406500	Pecos River near Malaga, N. Mex.	015	19,100	13060011	1920-
08407000	Pecos River at Pierce Canyon Crossing, N. Mex.	015	19,200	13060011	*1951-
08407500	Pecos River at Red Bluff, N. Mex.	015	19,500	13060011	1937-
08408500	Delaware River near Red Bluff, N. Mex.	015	689	13070002	*1937-
08477110	Mimbres River at Mimbres, N. Mex.	017	184	13030202	--
08481500	Tularosa Creek near Bent, N. Mex.	035	120	13050003	1947-
08484500	La Luz Creek at La Luz, N. Mex.	035	62.7	13050003	1983-
08492900	Sacramento River near Sunspot, N. Mex.	035	12.7	13050004	1984-
09355500	San Juan River near Archuleta, N. Mex.	045	3,260	14080101	1954-
09363500	Animas River near Cedar Hill, N. Mex.	067	1,090	14080104	1933-
09364500	Animas River at Farmington, N. Mex.	045	1,360	14080104	*1912-
09365000	San Juan River at Farmington, N. Mex.	045	7,240	14080105	*1912-
09367500	La Plata River near Farmington, N. Mex.	045	583	14080105	1938-
09367561	Shumway Arroyo near Waterflow, N. Mex.	045	73.8	14080105	1974-
09367680	Chaco Wash at Chaco Culture National Historical Park, N. Mex.	045	578	14080106	1976-
09367950	Chaco River near Waterflow, N. Mex.	045	4,350	14080106	*1975-
09368000	San Juan River at Shiprock, N. Mex.	045	12,900	14080105	*1927-
09371010	San Juan River at Four Corners, Colo.	083	14,600	14080201	1977-
09386900	Rio Nutria near Ramah, N. Mex.	031	71.4	15020004	1969-
09386950	Zuni River above Black Rock Reservoir, N. Mex.	031	810	15020004	1969-
09387300	Zuni River near Ariz.-N. Mex. State line	031	--	15020004	1986-
09395381	Foster Canyon near Continental Divide, N. Mex.	031	--	15020006	1987-
09395390	Sixmile Canyon near Fort Wingate, N. Mex.	031	--	15020006	1987-
09430500	Gila River near Gila, N. Mex.	017	1,860	15040001	*1927-
09430600	Mogollon Creek near Cliff, N. Mex.	017	69.0	15040001	1967-
09431500	Gila River near Redrock, N. Mex.	017	2,820	15040002	*1962-
09442680	San Francisco River near Reserve, N. Mex.	003	350	15040004	1959-
09442692	Tularosa River above Aragon, N. Mex.	003	94.0	15040004	1966-
09444000	San Francisco River near Glenwood, N. Mex.	003	1,650	1504004	1927-

Table 2.—Reservoir and lake-gaging stations in operation during the 1988 water year

[*, some records have been collected previously; I-intermittent; P-provided record]

Station number	Station name	County	Drainage area (square mile)	Hydrologic unit code	Period of record
07199450	Lake Maloya near Raton N. Mex. (I) (P)	007	20.8	11080001	1975-
07199550	Lake Alice near Raton, N. Mex. (I) (P)	007	29.4	11080001	1975-
07205500	Eagle Nest Lake near Eagle Nest, N. Mex. (I) (P)	007	167	11080002	*1950-
07223500	Conchas Lake at Conchas Dam, N. Mex. (P)	047	7,400	11080006	1938-
07226800	Ute Reservoir near Logan, N. Mex.	037	11,100	11080006	1963-
08284510	Heron Reservoir near Los Ojos, N. Mex. (P)	039	193	13020102	1970-
08285000	El Vado Reservoir near Tierra Amarilla, N. Mex. (P)	039	873	13020102	1935-
08286900	Abiquiu Reservoir near Abiquiu, N. Mex. (P)	039	2,140	13020102	1963-
08294200	Nambe Falls Reservoir near Nambe, N. Mex. (P)	049	25.0	13020101	1976-
08315500	McClure Reservoir near Santa Fe, N. Mex.	049	17.4	13020201	*1947-
08316500	Nichols Reservoir near Santa Fe, N. Mex.	049	22.8	13020201	1943-
08317300	Cochiti Lake near Cochiti Pueblo, N. Mex. (P)	043	14,900	13020201	1973-
08317900	Galisteo Reservoir near Cerrillos, N. Mex. (P)	049	596	13020201	1970-
08328500	Jemez Canyon Reservoir near Bernalillo, N. Mex. (P)	043	1,030	13020202	1953-
08341400	Bluewater Lake near Bluewater, N. Mex. (I)	006	201	13020207	*1958-
08360500	Elephant Butte Reservoir at Elephant Butte, N. Mex. (P)	051	29,400	13020211	1915-
08362000	Caballo Reservoir near Arrey, N. Mex. (P)	051	30,700	13030102	1938-
08382810	Santa Rosa Lake near Santa Rosa, N. Mex. (P)	019	--	13060001	1980-
08384000	Lake Sumner near Fort Sumner, N. Mex. (P)	011	4,390	13060001	1938-
08390600	Two Rivers Reservoir near Roswell, N. Mex. (I) (P)	005	1,020	13060008	1963-
08390610	Rio Hondo Reservoir near Roswell, N. Mex. (I) (P)	005	963	13060008	1963-
08390620	Rocky Arroyo Reservoir near Roswell, N. Mex. (I) (P)	005	64.0	13060008	1963-
08400500	Lake McMillan near Lakewood, N. Mex. (P)	015	16,900	13060011	1939-
08403800	Lake Avalon near Carlsbad, N. Mex. (P)	015	18,000	13060011	1939-
09355100	Navajo Reservoir near Archuleta, N. Mex. (P)	045	3,230	14080101	1962-

Code	County name	Code	County name	Code	County name	Code	County name
001	Bernalillo	019	Guadalupe	037	Quay	057	Torrance
003	Catron	021	Harding	039	Rio Arriba	061	Union
005	Chaves	023	Hidalgo	041	Roosevelt	067	La Plata (Colorado)
006	Cibola	025	Lea	043	Sandoval		
007	Colfax	027	Lincoln	045	San Juan	083	Montezuma (Colorado)
009	Curry	028	Los Alamos	047	San Miguel		
011	De Baca	029	Luna	049	Santa Fe		
013	Doña Ana	031	McKinley	051	Sierra		
015	Eddy	033	Mora	053	Socorro		
017	Grant	035	Otero	055	Taos		

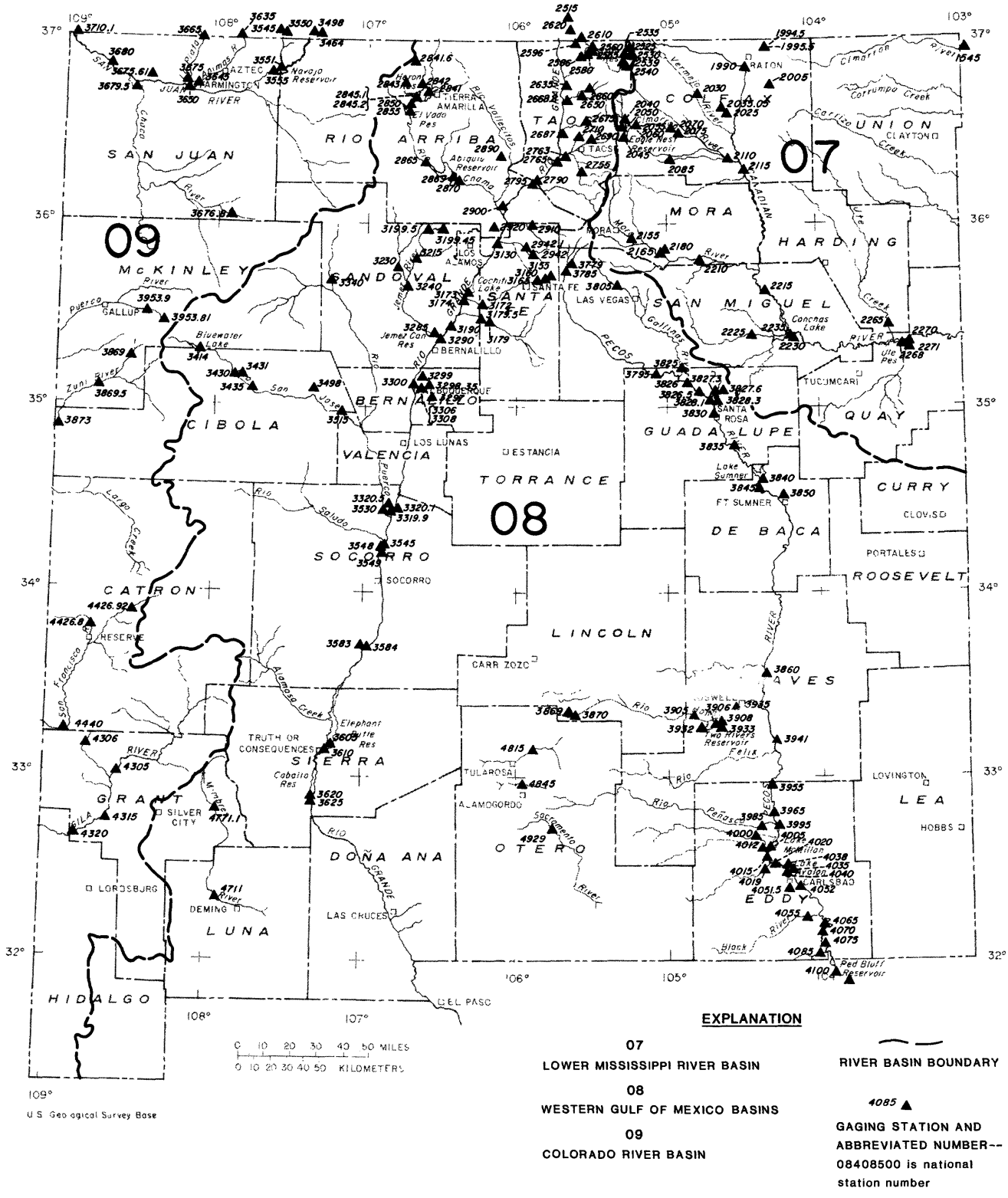
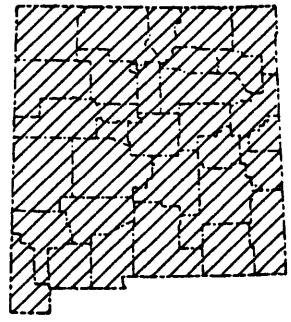


Figure 2.--Location of surface-water gaging stations.

NM-002 GROUND-WATER STATIONS, NEW MEXICO



Period of Project: Continuous since 1925

Principal Investigator: Jim D. Hudson

Cooperating Agencies: New Mexico State Engineer Office and Federal program

Problem: Information on the response of ground-water systems to development and other changes is needed before a predictive capability is possible. Pumpage removes water from storage and thus decreases water levels. Changes in water levels may lead to changes in water quality. Water-level data from wells, spring and well discharge data, and water-quality data are critical for monitoring ground-water trends; however, these data must be integrated with other observations and studies of ground-water systems to have the fullest meaning and usefulness.

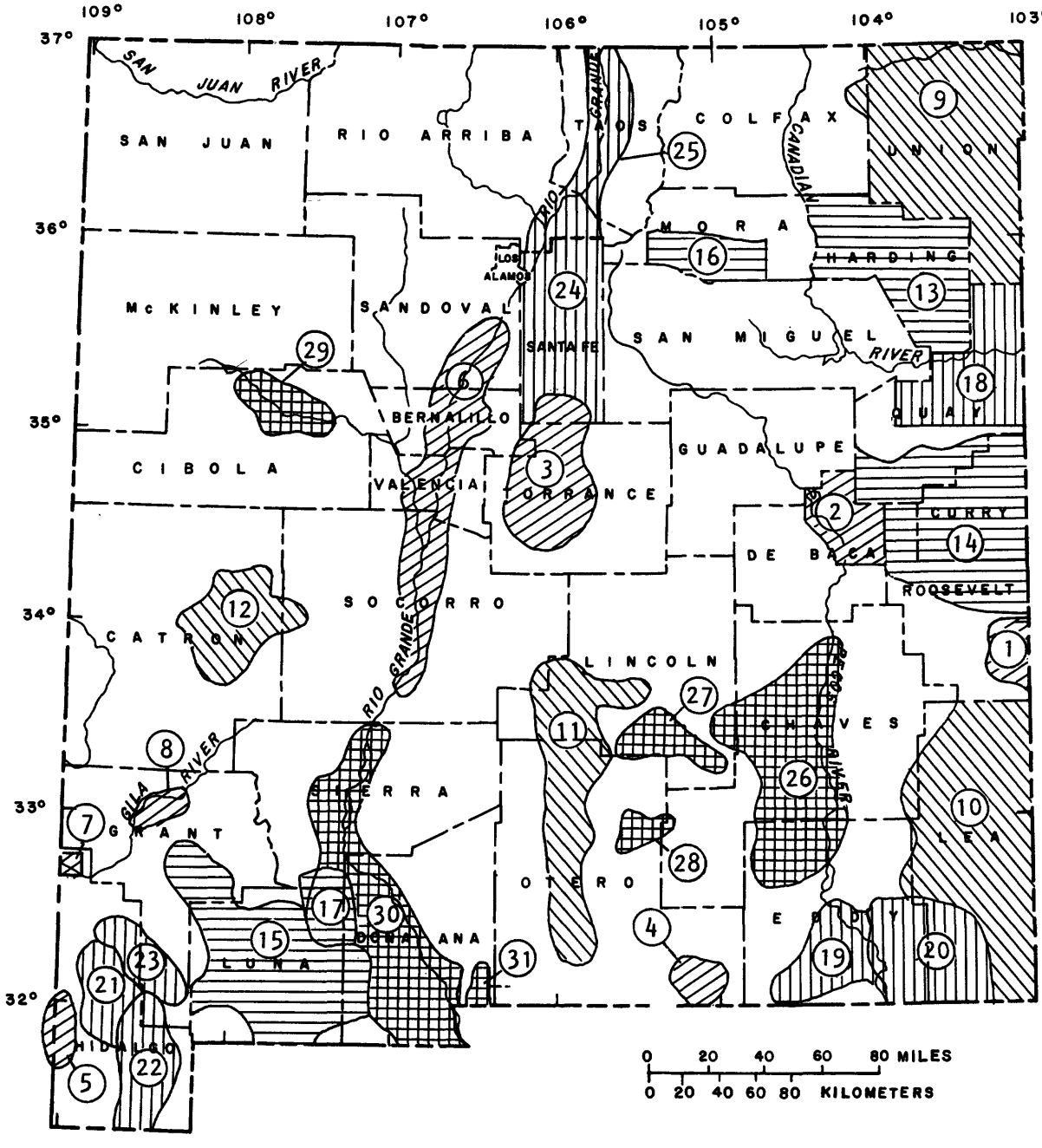
Objective: A network of ground-water observation wells is maintained to provide a long-term data base encompassing areas of ground-water development or potential development. This data base is designed to allow evaluation of the general response of the hydrologic system to natural and induced stresses.

Approach: Most areas of ground-water development in the State are scheduled for intensive water-level measurements at 5-year intervals (fig. 3). Work in an area selected for 5th-year water-level measurements includes inventory of wells and collection of data, such as depths to water, well drilling and completion records; well yields; and water-quality analyses that are readily available. Observation wells are selected using the inventory data. Water levels for these selected wells are evaluated to assure that the levels are representative of the primary ground-water aquifer. A number of wells in each major ground-water basin are selected as "key wells" (fig. 4) that are scheduled for annual water-level measurements. A special effort is made to determine well construction and aquifer characteristics for each key well.

Progress and Significant Results: Intensive water-level measurement efforts were made in five areas of the State, resulting in about 2,000 water levels for inclusion in the ground-water data base. All areas were 5th-year measurement areas and included: Harding and Curry Counties; the Mora, House, Portales, Nutt-Hockett areas; and the Mimbres Basin (fig. 3).

The ground-water data base was updated and checked for error. The additional water-level information in the seven mass-measurement areas included data from about 200 key wells and approximately 120 Federal observation wells and daily values from the continuous water-level recorders.

Approximately 250 wells in the eastern High Plains are measured annually for inclusion in the Internal Revenue Service accounting system. Four maps drawn from water-level data from those wells that show ground-water depletion in the Ogalalla Formation were published. These maps are used by the Internal Revenue Service to determine allowable ground-water depletion for tax purposes.



1. CAUSEY-LINGO
2. FT. SUMNER
3. ESTANCIA
4. SALT BASIN
5. SAN SIMON
6. MIDDLE RIO GRANDE
7. VIRDEN
8. GILA RIVER
9. N. HIGH PLAINS
10. TATUM-LOVINGTON-HOBBS
11. TULAROSA BASIN
12. SAN AGUSTIN PLAINS
13. HARDING COUNTY
14. CURRY COUNTY-HOUSE-PORTALES
15. MIMBRES BASIN
16. MORA AREA
17. NUTT-HOCKETT
18. LOWER CANADIAN
19. CARLSBAD
20. CAPITAN REEF
21. ANIMAS
22. PLAYAS
23. LORDSBURG
24. SANTA FE COUNTY
25. UPPER RIO GRANDE
26. ROSWELL BASIN
27. RIO HONDO
28. RIO PEÑASCO
29. GRANTS-BLUEWATER
30. LOWER RIO GRANDE
31. HUECO

Figure 3.--Areas of 5-year ground-water-level monitoring and years measured or scheduled for measurement.

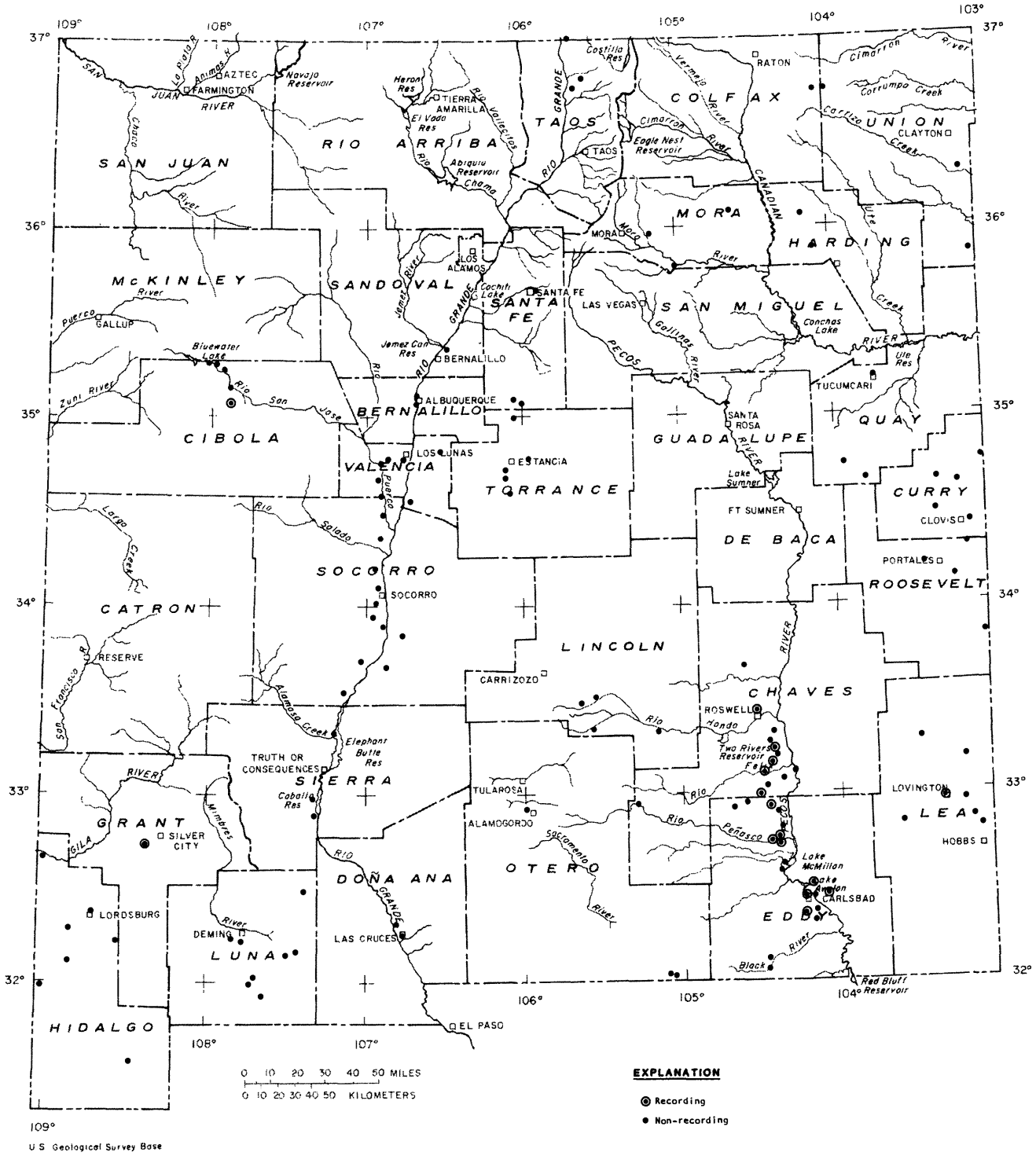


Figure 4.--Location of key observation wells.

About 120 (Federal) net wells are funded for inclusion in the annual water year report "Water resources data--New Mexico." Water levels in these wells are measured in the summer and winter and the data are included in the ground-water data base.

Continuous water-level recorders are maintained on 15 wells, mostly in the Roswell-Carlsbad area (fig. 4). Daily highest and lowest recorded water-level measurements for those wells due are included in the data base.

Plans for FY 88: The schedule of 5th-year mass measurements beginning in January and scheduled to be completed by the end of March includes eight areas to be measured. These areas are: the Lower Canadian in the east-central part of the State; Carlsbad area and Capitan Reef in the southeast; Upper Rio Grande and Santa Fe County in the north-central part; and the Animas, Lordsburg, and Playas basins in the southwest (fig. 3). These measurements will be made, verified, and entered into the data base, along with measurements from about 200 key wells, 250 Eastern High Plains wells, and daily values from recorder wells.

The ground-water-depletion maps for the Internal Revenue Service accounting system will be completed. Base maps showing areas of mass water-level measurements, well locations, depths to water, and changes in water level since the previous measurement will be constructed for the 5-year periods 1982-87 and 1983-88.

Reports in Progress:
In a December 1986 conference with the New Mexico State Engineer Office, the decision was made to discontinue publishing data reports on ground-water levels as had been done previously. Data from the program will continue to be published in the annual data report, "Water resources data--New Mexico." A new map series is proposed that would include data collected in cooperation with the New Mexico State Engineer Office. Maps for the 1982-87 period are being prepared.

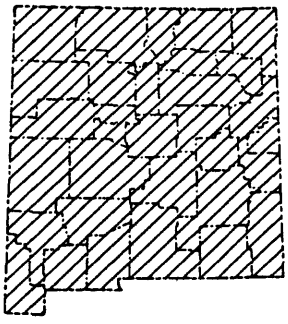
Reports Released in 1987:

Hudson, J.D., 1987, Ground-water depletion, in feet, allowed in Portales Valley, Roosevelt County, New Mexico, 1987: New Mexico State Engineer Office Map RO-30, 1 sheet.

_____1987, Ground-water depletion, in feet, allowed in part of Curry County, New Mexico, 1987: New Mexico State Engineer Office Map CU-27, 1 sheet.

_____1987, Ground-water depletion, in feet, allowed in central and northern Lea County, New Mexico, 1987: New Mexico State Engineer Office maps LC-27 and LN-27, 2 sheets.

NM-003 CHEMICAL AND BIOLOGICAL WATER-QUALITY NETWORK IN NEW MEXICO



Period of Project: Continuous since 1937

Principal Investigator: Richard Lepp

Cooperating Agencies: New Mexico State Engineer Office, U.S. Bureau of Land Management, Pecos River Commission, U.S. Bureau of Reclamation, U.S. Bureau of Indian Affairs, City of Gallup, and Federal Program

Problem: Water-resource planning and water-quality assessment require standardized information. For informed planning and assessment of water resources, the chemical, biological, and physical quality of ground water and surface water must be monitored and defined.

Objectives: To provide water-quality data for Federal, State, and local planning and to provide data for management of interstate and international waters.

Approach: Operate a network of water-quality stations to provide data that describe chemical concentrations, constituent loads, and time trends. Chemical and biological water-quality data are obtained at 59 continuous-record stations for surface water (table 3 and fig. 5). Information also is collected at numerous partial-record stations and miscellaneous sites, and some of these stations also are part of the Geological Survey's nationwide network known as the National Stream-Quality Accounting Network (NASQAN). Miscellaneous water-temperature data, recorded at the time streamflow measurements are made, are available from Subdistrict offices. The type of data collected and the number of continuous-record stations where those data are collected are given in the following table:

Type of data	Number of sites
Physical data:	
specific conductance, pH, dissolved oxygen, etc.	59
suspended sediment	42
Chemical data:	
major dissolved inorganic constituents	59
chemical analyses of fluvial sediments	16
nutrients	35
trace elements	37
radiochemicals	12
organic compounds	8
Biological data:	
bacteria	27

Table 3.--Surface-water-quality stations in operation during the 1988 water year

EXPLANATION

Type of data:

- B biological (bacteria, phytoplankton, etc.)
- C major dissolved inorganic constituents (sodium, chloride, sulfate, etc.)
- D daily sediment
- M chemical analyses of fluvial sediments (streambed materials or lake-bottom materials)
- N nutrient (nitrogen and phosphorus compounds)
- O organic compounds (insecticides, herbicides, organic carbon, etc.)
- P physical measurements (pH, specific conductance, dissolved oxygen, etc.)
- R radiochemicals (uranium, radium, etc.)
- S suspended sediment (concentration and particle size)
- T trace elements (arsenic, lead, iron, etc.)

Cooperators:

- BIA - U.S. Bureau of Indian Affairs
- BLM - U.S. Bureau of Land Management
- BR - U.S. Bureau of Reclamation
- CE - U.S. Army Corps of Engineers
- COG - City of Gallup
- GS - U.S. Geological Survey
- PRC - Pecos River Commission
- SEO - New Mexico State Engineer Office/Interstate Stream Commission

Table 3.—Surface-water-quality stations in operation during the 1988 water year—Continued

Station number	Station name	Type of data	Cooperator	Drainage area (square mile)	Period of record (water year)
		CANADIAN RIVER BASIN			
07207000	Cimarron River near Cimarron, N. Mex.	CNOPST	SEO	294	1979, 1981 to current year
07207500	Ponil Creek near Cimarron, N. Mex.	CPS	SEO	171	1981 to current year
07208500	Rayado Creek at Sauble Ranch near Cimarron, N. Mex.	CPS	SEO	65	1981 to current year
07215500	Mora River at La Cueva, N. Mex.	CPS	SEO	173	1981 to current year
07221500	Canadian River near Sanchez, N. Mex.	BCMNOPST	SEO	6,015	1975 to current year
07226560	Ute Res. at B, 0.6 mi above Ute Dam, N. Mex.	BCMNOPST	SEO	11,140	1963 to current year
07226800	Ute Res. near Logan, N. Mex.	BCMNOPST	SEO	11,140	1963 to current year
07227100	Revuelto Creek near Logan, N. Mex.	CP	SEO	786	1959 to current year
		RIO GRANDE BASIN			
08251500	Rio Grande near Lobatos, Colo.	BCNPRT	GS	7,700	1969 to current year
08263500	Rio Grande near Cerro, N. Mex.	PT	BLM	8,440	1977, 1979 to current year
08265000	Red River near Questa, N. Mex.	PT	BLM	113	1979 to current year
08266500	Red River below Questa, N. Mex.	PT	BLM	160	1979 to current year
08266790	Red River above State Fish Hatchery near Questa, N. Mex.	PT	BLM	175	1979 to current year
08266820	Red River below Fish Hatchery, near Questa, N. Mex.	PT	BLM	185	1978 to current year
08267400	Rio Grande above Rio Hondo at Dunn Bridge, N. Mex.	PT	BLM	--	1979 to current year
08267500	Rio Hondo near Valdez, N. Mex.	CNOPS	SEO	36.2	1985 to current year
08269000	Rio Pueblo de Taos near Taos, N. Mex.	CPS	BIA	66.6	1987 to current year
08271000	Rio Lucero near Arroyo Seco, N. Mex.	CPS	BIA	16.6	1987 to current year
08276300	Rio Pueblo de Taos below Los Cordovas, N. Mex.	CNOPS	SEO	380	1985 to current year

Table 3.—Surface-water-quality stations in operation during the 1988 water year—Continued

Station number	Station name	Type of data	Cooperator	Drainage area (square mile)	Period of record (water year)
08276500	Rio Grande below Taos Junction Bridge near Taos, N. Mex.	BCMNOPST	BLM,SEO	9,730	1975 to current year
08279000	Embudo Creek at Dixon, N. Mex.	CP	SEO	305	1970 to current year
08281100	Rio Grande above San Juan Pueblo, N. Mex.	BCOPST	BIA	10,550	1987 to current year
08284100	Rio Chama near La Puente, N. Mex.	CNOPS	SEO	480	1985
08290000	Rio Chama near Chamita, N. Mex.	BCOPST	BIA	3,144	1948-85, 1987 to current year
08291600	Rio Grande at Santa Clara, N. Mex.	BCOPST	BIA	--	1987 to current year
08313000	Rio Grande at Otowi Bridge, N. Mex.	BCDMNOPRST	GS,SEO	14,300	1947 to current year
08317200	Santa Fe River above Cochiti Dam, N. Mex.	CNOPS	SEO	231	1974-75, 1979, 1981 to current year
08317300	Cochiti Lake (Site A) near Cochiti Pueblo, N. Mex.	BCMNOPST	SEO	14,900	1981 to current year
08317400	Rio Grande below Cochiti Dam, N. Mex.	D	BIA	14,900	1972 to current year
08319000	Rio Grande at San Felipe, N. Mex.	BCMNOPST	SEO	16,100	1975 to current year
08324000	Jemez River near Jemez, N. Mex.	CNOPRST	SEO	470	1981 to current year
08329000	Jemez River below Jemez Canyon Dam, N. Mex.	CP	BIA	1,038	1966 to current year
08330000	Rio Grande at Albuquerque, N. Mex.	CDNOPRT	BIA	17,440	1969 to current year
08331000	Rio Grande at Isleta, N. Mex.	BCMNOPRST	SEO	18,100	1972 to current year
08332010	Rio Grande FW near Bernardo, N. Mex.	CDNOPT	SEO	19,230	1957 to current year
08334000	Rio Puerco above Arroyo Chico near Guadalupe, N. Mex.	D	BLM	420	1948-56, 1981 to current year
08341400	Bluewater Lake near Bluewater, N. Mex.	CPT	BIA	201	1987 to current year
08343500	Rio San Jose near Grants, N. Mex.	BCMNOPRST	SEO	2,300	1985
08349800	Rio Paguate below Jackpile Mine near Laguna, N. Mex.	CPRT	BIA	107	1987 to current year
08353000	Rio Puerco near Bernardo, N. Mex.	CDPR	SEO,CE	7,350	1947 to current year
08354800	Rio Grande CV CH at San Acacia, N. Mex.	BDCMNOPST	SEO	--	1959 to current year

Table 3.--Surface-water-quality stations in operation during the 1988 water year--Continued

Station number	Station name	Type of data	Cooperator	Drainage area (square mile)	Period of record (water year)
		PECOS RIVER BASIN			
08354900	Rio Grande FW at San Acacia, N. Mex.	BDCMNOPST	SEO	26,770	1937-56, 1959 to current year
08358300	Rio Grande CV CH at San Marcial, N. Mex.	BCDMNPRST	GS,SEO	--	1954 to current year
08358400	Rio Grande FW at Marcial, N. Mex.	BCDMNPRST	GS,SEO	27,700	1905-7, 1946 to current year
08364000	Rio Grande at El Paso, Tex.	BCNPST	GS	32,207	1930 to current year
08370500	Rio Grande at Fort Quitman, Tex.	BCNPST	GS	31,944	1930 to current year
08377900	Rio Mora near Terrero, N. Mex.	BCNPRST	GS	53.2	1963 to current year
08382650	Pecos River above Santa Rosa Reservoir, N. Mex.	BCNOPST	SEO	2,340	1976, 1981 to current year
08383000	Pecos River at Santa Rosa, N. Mex.	CP	SEO	2,650	1905-7, 1959 to current year
08383500	Pecos River near Puerto de Luna, N. Mex.	BCMNOPST	SEO	3,970	1937-66, 1972 to current year
08384500	Pecos River below Sumner Dam, N. Mex.	D	GS	4,390	1937-66, 1972 to current year
08386000	Pecos River near Acme, N. Mex.	CMNOPST	SEO	11,380	1937 to current year
08387000	Rio Ruidoso at Hollywood, N. Mex.	CMNOPST	SEO	120	1987 to current year
08396500	Pecos River near Artesia, N. Mex.	BCDMNOPST	SEO	15,300	1937 to current year
08401500	Pecos River below Major Johnson Springs near Carlsbad, N. Mex.	CP	SEO	17,650	1960, 1962, 1978-79, 1981 to current year
08405200	Pecos River below Dark Canyon Draw at Carlsbad, N. Mex.	CP	PRC	18,550	1972 to current year
08406500	Pecos River near Malaga, N. Mex.	CP	PRC	19,190	1937 to current year
08407000	Pecos River at Pierce Canyon Crossing, N. Mex.	CP	PRC	19,260	1938-41, 1952 to current year
08407500	Pecos River at Red Bluff, N. Mex.	BCNPST	GS	19,540	1937 to current year

Table 3.--Surface-water-quality stations in operation during the 1988 water year--Concluded

Station number	Station name	Type of data	Cooperator	Drainage area (square mile)	Period of record (water year)
		TULAROSA RIVER BASIN			
08481500	Tularosa Creek near Bent, N. Mex.	BCNOPST	GS,SEO	120	1963 to current year
		SAN JUAN RIVER BASIN			
09355500	San Juan River near Archuleta, N. Mex.	CP	BR	3,260	1955 to current year
09363500	Animas River near Cedar Hill, N. Mex.	CMNOPS	SEO	1,090	1969-73, 1987 to current year
09364500	Animas River at Farmington, N. Mex.	BCDNPS	GS	1,360	1940 to current year
09367540	San Juan River near Fruitland, N. Mex.	CP	BR	8,010	1978 to current year
09367950	Chaco River near Waterflow, N. Mex.	MST	GS	4,350	1976 to current year
09368000	San Juan River at Shiprock, N. Mex.	BCMNOP*RST	GS,SEO	12,900	1941-45, 1951 to current year
09371010	San Juan River at Four Corners, Colo.	CP	BR	14,600	1978-81, 1985
09386900	Rio Nutria near Ramah, N. Mex.	CPST	BIA	71.4	1987 to current year
09386950	Zuni River above Black Rock Reservoir, N. Mex.	CPST	BIA	810	1978 to current year
09395381	Foster Canyon near Continental Divide, N. Mex.	CNOPS	COG	--	1988
09395390	Sixmile Canyon near Fort Wingate, N. Mex.	CNOPS	COG	--	1988
		GILA RIVER BASIN			
09430600	Mogollon Creek near Cliff, N. Mex.	BCNPRST	GS	69	1967 to current year
09431500	Gila River near Redrock, N. Mex.	BCNPRST	GS	2,829	1967 to current year

* Continuous recorder

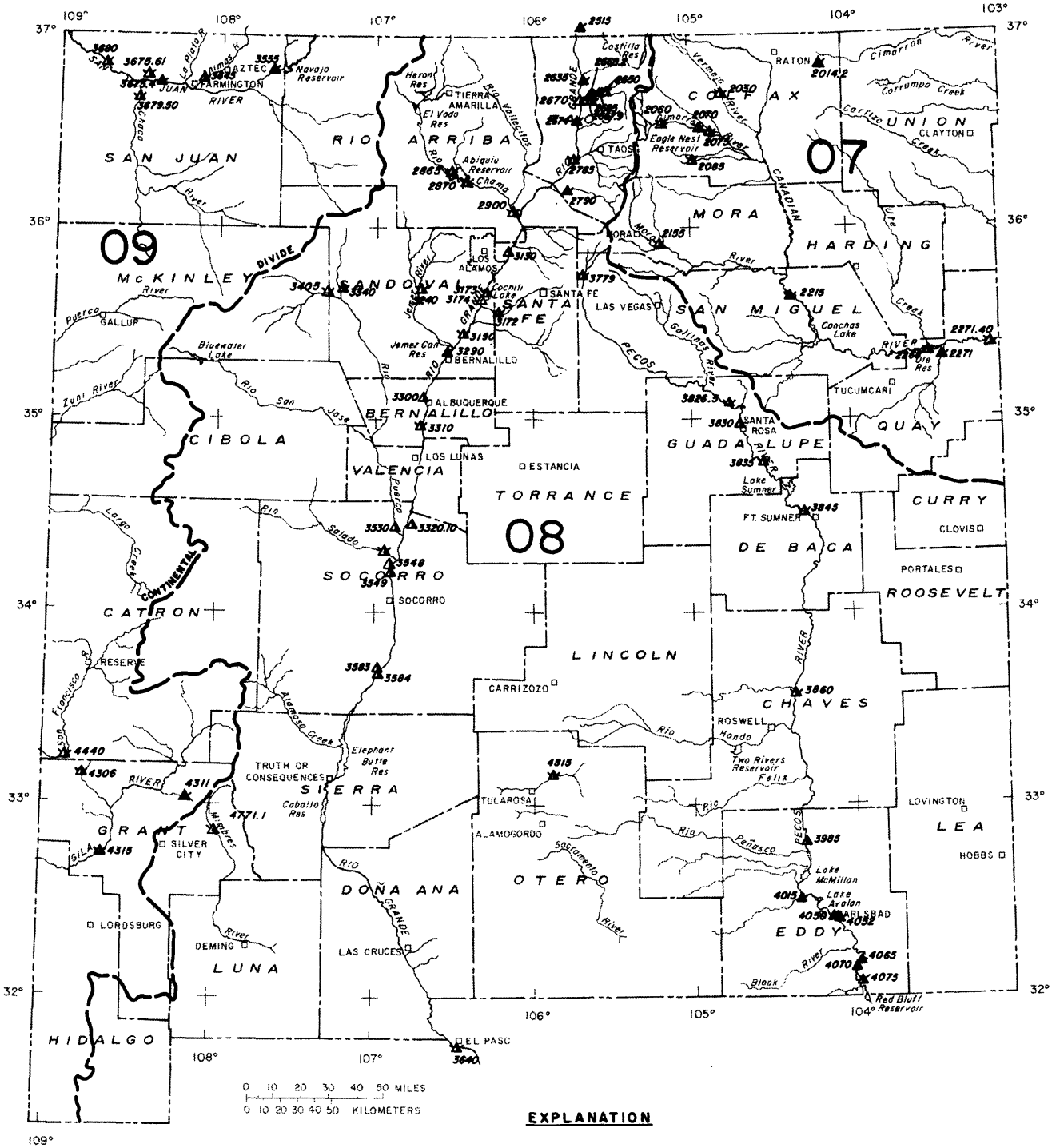


Figure 5.--Location of surface-water-quality gaging stations.

Chemical water-quality data for ground water also were obtained in conjunction with project activities. In 1986, approximately 140 sites were sampled.

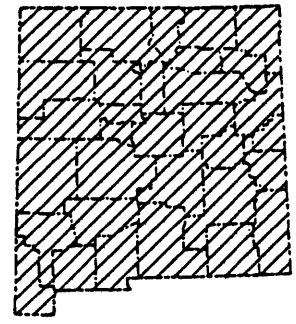
Progress and Significant Results: The water-quality data tables for the 1986 water year report, "Water resources data--New Mexico, water year 1986" were completed.

Plans for FY 88: Hydrologic-data network (fig. 5 and table 3) will be continued with only minor revisions from 1987.

Reports in Progress:
Water resources data--New Mexico, water year 1988.

Reports Released:
Beal, L.V., and Gold, R.L., 1987, Water resources data--New Mexico, water year 1986: U.S. Geological Survey Water-Data Report NM-86-1, 454 p. Reports on water-resources data for New Mexico are published annually.
Beal, L.V., and Gold, R.L., in press, Water resources data--New Mexico, water year 1987: U.S. Geological Survey Water-Data Report NM-87-1, 450 p.

NM-004 SEDIMENT STATIONS, NEW MEXICO



Period of Project: Continuous since 1937

Principal Investigator: David E. Funderburg

Cooperating Agencies: New Mexico State Engineer Office, U.S. Bureau of Land Management, U.S. Army Corps of Engineers, U.S. Bureau of Indian Affairs, City of Gallup, and Federal Program

Problem: Water-resource planning and water-quality assessment require a data base of relatively standardized information. Sediment concentrations, sediment loads, and particle size of sediment carried in New Mexico rivers and streams must be monitored and defined to determine the impacts of sediment loads and the changes over time.

Objective: To provide sediment data for use in Federal, State, and local planning needs. Information is collected for evaluation of sources of sediment, effects of changing land use, effects of water management on channel stability, and regional baseline conditions.

Approach: Establish and operate a network of sediment stations to provide spatial and temporal averages and trends of sediment concentration, sediment load, and particle size of sediment being transported by rivers and streams.

Progress and Significant Results: Sediment data at 57 streamflow-gaging stations in New Mexico, including continuous- and partial-record stations, were collected and will be published in the annual report, "Water resources data--New Mexico, water year 1988." The location of sediment sampling stations is shown in figure 5, and the listing of sediment stations is shown in table 3.

Plans for FY 88: Continue collection and analyses of sediment data in New Mexico for approximately 51 continuous- or partial-record sites.

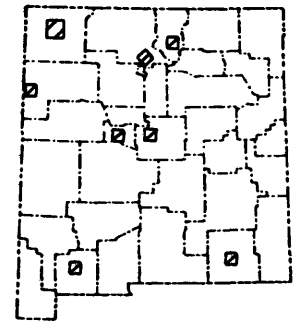
Reports in Progress:
Water resources data--New Mexico, water year 1988.

Reports Released:

Beal, L.V., and Gold, R.L., 1987, Water resources data--New Mexico, water year 1986: U.S. Geological Survey Water-Data Report NM-86-1, 454 p. Reports on water-resources data for New Mexico are published annually.

Beal, L.V., and Gold, R.L., in press, Water resources data--New Mexico, water year 1987: U.S. Geological Survey Water-Data Report NM-87-1, 450 p.

NM-006 FLOOD-INSURANCE STUDIES



Period of Project: Continuous since 1983.

Principal Investigators: H.R. Hejl and S.D. Waltemeyer

Cooperating Agency: Federal Emergency Management Agency

Problem: The National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 provide for the operation of a flood-insurance program. The Federal Emergency Management Agency (FEMA) needs flood studies in selected areas to determine the extent of flooding for given recurrence intervals in order to define applicable flood-insurance-premium rates.

Objectives: Conduct hydraulic analyses of selected stream reaches to determine the 100-year flood profile for those reaches. The analyses will be performed as Limited Detail Studies. Assist FEMA in identification of potential flood-plain encroachment violations in their Community Assistance Program.

Approach: The studies are conducted in three phases. In the first phase, unincorporated urban areas and areas within counties where the need for flood studies exists are identified. In the second phase, community meetings are held to identify areas of significant growth that may be subject to flooding. In the last phase, selected stream reaches are studied to determine their 100-year flood profiles. The analyses include field determination of roughness coefficients, surveying of cross sections, and computation of flood-profile altitudes.

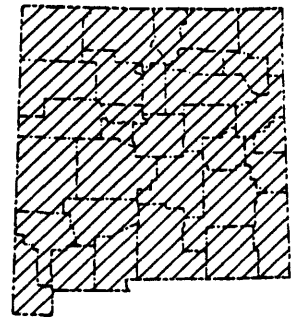
Progress and Significant Results: Seven areas have been selected for study since 1983. They are: (1) San Juan County--City of Aztec, (2) Rio Arriba County, (3) Taos County, (4) Eddy County, (5) Luna County, (6) Valencia County, and (7) town of Estancia. Community meetings were conducted for each study area. The status of the studies are: reports for areas (1) through (3) have been approved for release to FEMA, and final community meetings have been held; area (4) is complete except for review and regional approval; and reports for areas (4) through (7) have been submitted to Region for approval for release to FEMA. Reconnaissance was made at Gallup, New Mexico, to identify potential flood-plain encroachment violations in the Community Assistance Program, and a report was submitted to FEMA.

Plan for FY 88: Reports for study areas (4) through (7) will be released to FEMA, and final community meetings will be held. Reconnaissance will be made at El Paso, Texas, and Santa Fe, New Mexico, to assist FEMA in identifying potential violations in its Community Assistance Program.

Reports in Progress:
Reports for study areas (4) through (7) have been submitted for Regional approval.

Reports Released:
Reports for the City of Aztec and San Juan County, Rio Arriba County, and Taos County have been released to FEMA, and final community meetings have been held.

NM-007 NEW MEXICO WATER-USE DATA ACQUISITION AND DISSEMINATION PROGRAM



Period of Project: Continuous since 1978

Principal Investigator: Lynn A. Garrabrant

Cooperating Agency: New Mexico State Engineer Office

Problem: Information on water use is required for management of the Nation's water resources. In the past, there was no single source for accurate, consistent, timely, and accessible water-use information. In 1977, the U.S. Congress recognized the need for information on water use and directed the Survey to establish a National Water-Use Data Program. The New Mexico State Engineer Office had collected information on water use at 5-year intervals since 1965. State and Federal efforts were combined as part of a State-Federal Cooperative Program in 1978 in order to standardize a water-use information system.

Objectives: The goals are to: (1) Collect and compile water-use data; (2) develop and refine computerized data storage and retrieval systems at the State and national levels; (3) devise methods and techniques to improve and standardize collection and analysis of water-use information; and (4) disseminate this information to water users and water-resource managers.

Approach: Three types of water-use data (withdrawal, consumptive use, and type of use) will be collected and compiled by State, county, and hydrologic unit for 12 major categories of use. The U.S. Geological Survey's computer data bases SWUDS (State Water-Use Data System) and EUOWITUS (Estimated Use of Water in the United States) will be used to store site-specific and aggregated information.

Progress and Significant Results: Completed work on water-use data collection and preparation for the report "Estimated use of water in the United States in 1985." A survey of irrigated acreage of the State by county, drainage basin, crop type, and irrigation type was completed in cooperation with N. Mex. State University. About 1,000 wells were measured during January and February under the 5-year intensive program for measuring ground-water levels. Work was completed on a map report summarizing withdrawals by county in New Mexico for various categories of use.

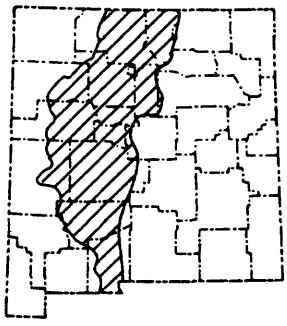
Plans for FY 88: Apply the SWUDS and ARC/INFO software to data from the San Juan Basin. Begin a study of conveyance losses in ditches in northern New Mexico. Continue water-level measurements under the intensive program. Continue program development in cooperation with the State Engineer Office.

Reports in Progress: None

Reports Released:

Garrabrant, L.A., 1988, Water use in New Mexico, 1985: U.S. Geological Survey Open-File Report 88-343, 1 sheet.

NM-100 DUTIES FOR THE RIO GRANDE COMPACT COMMISSION, NEW MEXICO



Period of Project: Continuous since 1948

Principal Investigator: Herbert S. Garn

Cooperating Agency: Rio Grande Compact Commission

Problem: The Rio Grande Compact Commission is composed of representatives from Colorado, New Mexico, and Texas. Administration of the compact requires that certain water data be collected, compiled, correlated, and presented to the commission. The U.S. Geological Survey acts as secretary to the commission under rules and regulations for administration of the Rio Grande Compact.

Objectives: The principal duties as secretary to the commission are to compile monthly streamflow and storage data, to prepare a report on activities and a summary of data needed for determination of debits and credits of water, to prepare and publish annual reports of the commission, and to aid in other matters pertaining to the administration of the compact.

Approach: Basic report input consists of data on streamflow and storage at index stations and storage facilities. Monthly reports on streamflow at index stations and release of water from project storage are sent to the commissioners. Data are summarized annually, presented to the commissioners' engineer advisers, and prepared for publication in an annual report.

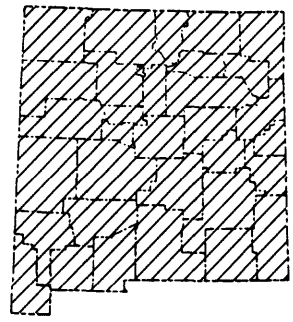
Progress and Significant Results: Attended the 1987 annual meeting in April. Prepared the minutes from the 1987 annual compact meeting and the January 13, 1987, special meeting. Reports of current data for administration of the compact were provided monthly. The reports of the Rio Grande Compact Commission are prepared, published, and distributed annually.

Plans for FY 88: Continue secretarial duties as in previous years, including monthly data reporting, preparation of minutes from meetings, and publication of the annual report.

Reports in Progress:
Report of Rio Grande Compact Commission for 1988.

Reports Released:
Rio Grande Compact Commission, 1987, Report of the Rio Grande Compact Commission for 1986. Reports of the Rio Grande Compact Commission are published annually.

NM-101 INFORMATION DISTRIBUTION AND PROGRAM DEVELOPMENT, NEW MEXICO



Period of Project: Continuous since 1960

Principal Investigator: Paul J. Blanchard

Cooperating Agency: New Mexico State Engineer Office

Problem: There is a continuing need for information on water in New Mexico by private citizens, government agencies, industry, and business. The project provides support required for answering requests for water-resources data from the public, for special data computation required by the State Engineer Office, and for computer hardware and data-base management.

Objectives: The objectives of this project are to: (1) Respond to requests for data on the water resources of New Mexico, and (2) support limited, special studies requested by the State Engineer Office.

Approach: Project coordinators in the offices of the New Mexico State Engineer and the U.S. Geological Survey handle requests made by individuals and other agencies. They provide data requested or direct questions to other qualified staff members for response.

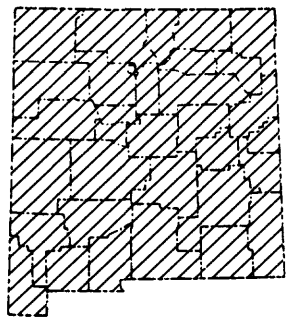
Progress and Significant Results: In FY 87, 519 requests for information were answered by Geological Survey personnel. In addition, numerous informal requests were answered.

Plans for FY 88: Continue to respond to public information requests.

Reports in Progress: None

Reports Released: None

NM-105 NEW MEXICO DISTRICT DATA BANK



Period of Project: Continuous since 1970

Principal Investigator: Roy R. Cruz

Cooperating Agency: New Mexico State Engineer Office

Problem: The need to provide timely handling and distribution of large quantities of hydrologic data has required the design of efficient data-management systems. The New Mexico District minicomputer provides increased potential for effectiveness and productivity in many projects and hydrologic applications. Good data-base management is essential for the District to more fully realize this potential in data processing, utilization of critical personnel, and data dissemination.

Objective: To provide computer applications and improved documentation of existing computer programs. Project support is provided through management, control, maintenance, and refinements to widely used data bases such as the Ground-Water Site-Inventory (GWSI) file and the water-quality file (WATSTORE).

Approach: Programs or other computer applications are examined and documented as necessary or as requested. Ground-water hydrologic data are transferred from the local data base (OMNIANA) to the nationally used (GWSI) system.

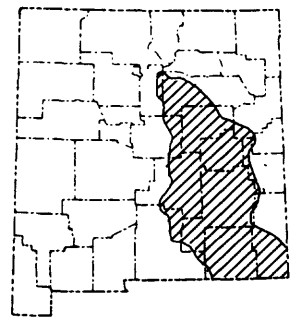
Progress and Significant Results: Ground-water and water-quality data from approximately 25,100 sites (wells and springs) are in the New Mexico District GWSI data file. Site-duplication checks for transfer of ground-water hydrologic data from the previously used OMNIANA data base to GWSI are 50% complete. The GWSI data base currently is being managed under the closed-system concept as part of a quality assurance program. Minimum data requirements have been established for any new sites that are to be added to the GWSI data base.

Plans for FY 88: Complete site-duplication checks for OMNIANA to GWSI data-base transfer. Cease using OMNIANA as a data base. Continue data file cleanup and project support.

Reports in Progress: None

Reports Released: None

NM-106 MISCELLANEOUS RIVER-REACH STUDIES, PECOS RIVER, NEW MEXICO



Period of Project: Continuous since 1970

Principal Investigator: Herbert S. Garn

Cooperating Agency: Pecos River Commission

Problem: The Pecos River Commission, which administers the Pecos River Compact between New Mexico and Texas, requires that certain water data be collected, compiled, and presented to the commission. The commission also often requests special studies about the relation of surface water, ground water, and water quality in specific reaches of the river. These data and the results of hydrologic studies aid the commission in its inflow-outflow computations that are used to apportion water of the Pecos River equitably between the States. The U.S. Geological Survey acts as secretary to the commission.

Objectives: Relate gains or losses in streamflow and changes in water quality to ground-water flow conditions, transpiration, evaporation, or flow diversions. Provide administrative services to the Pecos River Commission. Prepare an annual report to the commission that summarizes special studies of surface water, ground water, and water quality in specific reaches of the Pecos River.

Approach: A continuous record of streamflow is collected at stations in New Mexico and Texas for computation of annual runoff. Ground-water levels are measured and seepage runs are made as needed to evaluate the effects of pumpage and phreatophyte control on streamflow. Three water-quality stations are operated to monitor changes in quality between Carlsbad, N. Mex., and Red Bluff Reservoir, Tex. Administrative services are provided as secretary to the Pecos River Commission, including summaries of data and results of special studies, preparation of annual reports and minutes of meetings, record keeping, and other tasks.

Progress and Significant Results: Streamflow and water-quality data-collection activities supported by the commission were completed for the year. An analysis and draft report of water-level data for the water-table depression near Hagerman was completed for the commission. Served as secretary to the commission by preparing annual reports and minutes of meetings and completing other administrative tasks. A report on the effects of phreatophyte control was completed, approved by the Director of the U.S. Geological Survey, and published.

Plans for FY 88: Continue routine data-collection activities supported by the Pecos River Commission. Continue secretarial duties, including preparation of minutes, administrative tasks, and the annual report. Compute base-flow gain in the Acme-to-Artesia reach of the Pecos River. Compute flood inflows in the reach of the Pecos River from Carlsbad to Red Bluff.

Reports in Progress: None

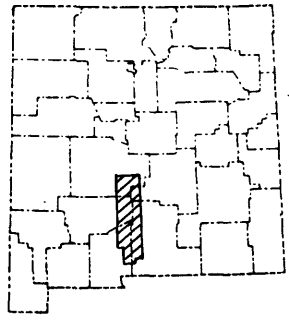
Reports Released:

Garn, H.S., 1988, Seasonal changes in ground-water levels in the shallow aquifer near Hagerman and the Pecos River, Chaves County, New Mexico: U.S. Geological Survey Open-File Report 88-197, 17 p.

U.S. Geological Survey, 1987, Annual report to the Pecos River Commission for 1986. Annual reports have been published since 1982.

Welder, G.E., 1988, Hydrologic effects of phreatophyte control, Acme-Artesia reach of the Pecos River, New Mexico, 1967-82: U.S. Geological Survey Water-Resources Investigations Report 87-4148, 46 p.

NM-109 CONTINUING RECONNAISSANCE AND EVALUATION OF WATER RESOURCES ON THE WHITE SANDS MISSILE RANGE, NEW MEXICO



Period of Project: Continuous since 1960

Principal Investigator: Robert G. Myers

Cooperating Agency: White Sands Missile Range

Problem: (1) Because the volume of fresh ground water on the White Sands Missile Range is limited, the effects of pumpage in various well fields must be known with reference to depletion of fresh ground water and possible saline-water encroachment. Several wells provide water throughout the missile range; continued operation of these wells is vital to the range. (2) Various military projects and activities could have an environmental impact on surface water and ground water.

Objectives: Obtain water-level and pumpage data so periodic evaluation of ground-water depletion can be made and make short-term site studies where additional water supplies are needed. Evaluate alternatives for economical recovery of the maximum volume of freshwater. Provide geohydrologic information to various military projects so the missile range can prepare environmental impact statements.

Approach: Monitor water levels semiannually in supply wells, test wells, and boreholes throughout the White Sands Missile Range. Monitor the chemical quality of water in selected wells throughout the missile range. Evaluate the water resources of selected areas. Observe, advise, and assist the missile range with geohydrological problems and projects throughout the range area.

Progress and Significant Results: During the past 6 years, the U.S. Geological Survey continued to monitor water levels in about 100 supply wells, test wells, and boreholes throughout the White Sands Missile Range. Monitored the chemical quality of water from selected test wells and supply wells, especially in the Post Headquarters area. Conducted field reconnaissance of selected range areas. Observed, advised, and taught geohydrology for the U.S. Army and U.S. Navy well-drilling training program from 1982 to 1985. Constructed a flow model to quantitatively evaluate future water-level declines and water-quality changes in the Post Headquarters well field. Observed, advised, and assisted the U.S. Army Corps of Engineers with construction of the Fluor-1 well near Orogrande Range Camp. Provided geohydrologic information on request.

Plans for FY 88: Continue monitoring water levels and water quality in wells throughout the White Sands Missile Range. Observe, advise, and assist the U.S. Army Corps of Engineers with development of the Soledad well field. Develop and clean selected wells drilled during training exercises at WSMR and sample water for chemical analysis. Replace selected boreholes in the Post Headquarters area. Provide geohydrologic information on request.

Reports in Progress:

Myers, R.G., Biannual water-resources review, White Sands Missile Range, New Mexico, 1986-87 [in colleague review].

Risser, D.W., Simulated water-level and water-quality changes in the Post Headquarters area, White Sands Missile Range, New Mexico [in preparation for publication].

Reports Released Since 1980:

Water-resources review reports were published annually from 1969 to 1985.

Cruz, R.R., 1986, Annual water-resources review, White Sands Missile Range, New Mexico, 1985: U.S. Geological Survey Open-File Report 86-410, 21 p.

Myers, R.G., 1983, Test wells T21, T22, and T25, White Sands Missile Range, Doña Ana County, New Mexico: U.S. Geological Survey Open-File Report 83-771, 30 p.

Myers, R.G., and Pinckley, K.P., 1985, Test wells T23, T29, and T30, White Sands Missile Range and Fort Bliss Military Reservation, Doña Ana County, New Mexico: U.S. Geological Survey Open-File Report 84-805, 28 p.

Myers, R.G., and Pinckley, K.P., 1985, Test wells T27 and T28, White Sands Missile Range, Doña Ana County, New Mexico: U.S. Geological Survey Open-File Report 84-809, 19 p.

Myers, R.G., and Pinckley, K.P., 1987, Test wells TW1, TW2, and TW3, White Sands Missile Range, Otero County, New Mexico: U.S. Geological Survey Open-File Report 87-47, 19 p.

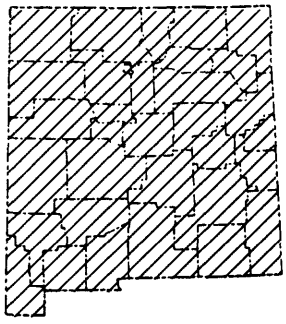
Wilson, C.A., and Myers, R.G., 1981, Ground-water resources of the Soledad Canyon re-entrant and adjacent areas, White Sands Missile Range and Fort Bliss Military Reservation, Doña Ana County, New Mexico: U.S. Geological Survey Water-Resources Investigations 81-645, 22 p.

NM-203 INVESTIGATION AND ANALYSIS OF FLOOD DISCHARGES FOR UNREGULATED STREAMS IN NEW MEXICO

Period of Project: August 1966 to September 1989

Principal Investigator: Scott D. Waltemeyer

Cooperating Agency: New Mexico State Highway Department



Problem: The State Highway Department needs data on the magnitude and frequency of floods for design of highway structures.

Objective: To collect, compute, and compile hydrologic data to relate the magnitude, volume, and frequency of floods at ungaged sites to basin properties that can be measured easily. Special emphasis is placed on an adequate network of sites with drainage areas of less than 50 square miles.

Approach: Operate a network of 110 crest-stage gages for determination of annual peak discharges. Evaluate flood-flow frequency distributions and various techniques for improving regional flood-frequency relations based on basin and climatic characteristics.

Progress and Significant Results: The program is in the data-collection phase. It has been determined that indirect discharge measurements are needed to define peak-flow discharges. Gage maintenance has been performed as required and the peak-flow file has been updated. Basin and climatic characteristics have been determined and have been found to be significant in regional regression equations.

Plans for FY 88: Measurement of annual peak discharge, which includes discharge determination by indirect means, will continue. An investigation of flood-flow frequency for improved regional relations will commence. A study of regional flood-flow frequency of the arid Southwest has begun in conjunction with several other districts of the U.S. Geological Survey.

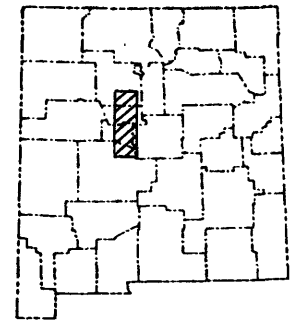
Reports in Progress: None

Reports Released:

Thomas, R.P., and Gold, R.L., 1982, Techniques for estimating flood discharges for unregulated streams in New Mexico: U.S. Geological Survey Water-Resources Investigations 82-24, 42 p.

Waltemeyer, S.D., 1986, Techniques for estimating flood-flow frequency for unregulated streams in New Mexico: U.S. Geological Survey Water-Resources Investigations Report 86-4104, 56 p.

NM-240 GROUND-WATER-LEVEL MONITORING IN THE ALBUQUERQUE-BELEN BASIN, NEW MEXICO



Period of Project: Continuous since 1982

Principal Investigator: Dale R. Rankin

Cooperating Agency: City of Albuquerque

Problem: Ground water is used for all domestic and industrial purposes in the basin. A population increase of approximately 100 percent from 1960 to 1980 has increased the demand for water, increasing stress on the ground-water system.

Objectives: Develop a data base in order to document the basin's hydrologic system. Monitor changes in ground-water levels as the system responds to increased stress.

Approach: Establish a water-level monitoring network using available wells. Equip several wells with continuous-recording equipment and measure other wells at regular intervals, usually monthly.

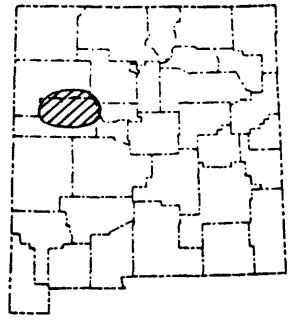
Progress and Significant Results: Continued water-level data collection and network evaluation. Data were entered into GWSI computer files. A data report summarizing water-level data through water year 1985 was published. An informal data report summarizing water-level data for water year 1986 was given to the cooperator.

Plans for FY 88: Continue data collection and network evaluation. Prepare a letter to the cooperator containing data collected in water year 1987.

Reports in Progress:
Letter report for cooperator containing water-level data collected in water year 1987.

Reports Released:
Kues, G.E., 1987, Ground-water-level data for the Albuquerque-Belen Basin, New Mexico, through water year 1985: U.S. Geological Survey Open-File Report 87-116, 51 p.

NM-246 HYDROLOGY OF THE SAN ANDRES-GLORIETA AQUIFER SYSTEM, PUEBLOS OF ACOMA AND LAGUNA, NEW MEXICO



Period of Project: October 1983 to September 1988

Principal Investigator: Peter F. Frenzel

Cooperating Agencies: New Mexico State Engineer Office, Pueblo of Acoma, and Pueblo of Laguna

Problem: The Pueblos of Acoma and Laguna need additional ground water. The San Andres-Glorieta aquifer is a possible source of water, but there is uncertainty regarding the quantity and distribution of available freshwater, and there is concern about the effects that additional ground-water development might have on existing water users.

Objective: Under an assumed scenario of development, estimate the effect of previous and new development upon water users.

Approach: Study the geohydrologic framework. Collect existing and new data pertaining to aquifer characteristics. Define the ground-water/surface-water interconnection, natural recharge and discharge, water quality, water use, and water-level changes. Interpret the data and simulate the hydrologic system.

Progress and Significant Results: Discharges in Bluewater Creek and Ojo del Gallo have been estimated. The ground-water flow model has been prepared, and preliminary projections have been completed. Preparation of a geohydrologic report, including a section discussing water-quality, continued.

Plans for FY 88: Finish the geohydrologic report and a report describing simulation of the hydrologic system.

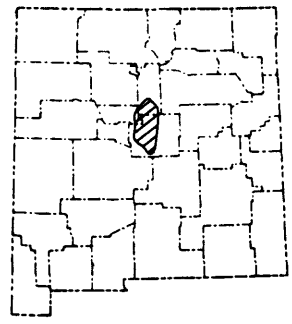
Reports in Progress:

Baldwin, J.A., and Anderholm, S.K., Geohydrology of the San Andres-Glorieta aquifer in the Acoma embayment and eastern Zuni uplift, west-central New Mexico [draft completed].

Frenzel, P.F., Digital ground-water flow model of Permian and Pennsylvanian rocks in the Acoma embayment and eastern Zuni uplift, west-central New Mexico [draft completed].

Reports Released: None

NM-249 GEOHYDROLOGY OF THE ESTANCIA VALLEY, NEW MEXICO



Period of Project: October 1985 to September 1988

Principal Investigator: Robert R. White

Cooperating Agency: New Mexico State Engineer Office

Problem: The Estancia Valley is a closed basin. The water table is declining in the irrigated area, which increases pumping costs and enhances the possibility of saline-water encroachment. Population growth at the western margin of the basin has resulted in an increased demand on water resources. Although many reports cover various aspects of the hydrology of the Estancia Valley, the last comprehensive study of this area was in the early 1950's.

Objectives: Conduct a comprehensive study of the occurrence, movement, and quality of ground water in the basin and the relation between ground water and inflowing surface water. The emphasis of the study will be on the alluvial aquifer.

Approach: Water-level measurements will be made, water-quality samples will be collected, and results will be compared with historical data. Changes that may have occurred in the past four or five decades will be assessed.

Progress and Significant Results: Data have been obtained on more than 200 wells and are being compared to information on water level and specific conductance collected since 1941. Continuous water-level data are available from three wells in the valley. Periodic streamflow measurements have been made as part of a study of recharge. The Ground-Water Site-Inventory data base is being reviewed, corrected, and updated. A preliminary review of the information compiled indicates that water levels are declining as much as 2 feet per year in parts of the valley. Degradation of water quality is occurring in an area north of Moriarty.

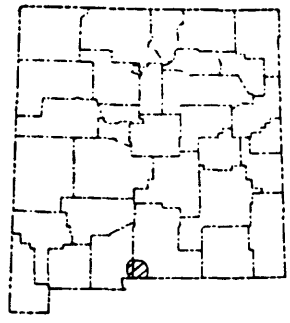
Plans for FY 88: This project is in the report-writing phase. Maps, graphs, and hydrographs are being prepared that compare current and historical data so that changes can be quantified. Approximately 10 wells in the Federal observation-well network will be measured at the first of the year and in early autumn. A draft of the final report will be completed and submitted for review.

Reports in Progress:

White, R.R., Geohydrology of the Estancia Valley, New Mexico [initial preparation].

Reports Released: None

NM-250 FRESHWATER AVAILABILITY AND THE EFFECTS OF FUTURE GROUND-WATER DEVELOPMENT IN THE HUECO BOLSON, SOUTH-CENTRAL NEW MEXICO



Period of Project: January 1984 to September 1988

Principal Investigator: Brennon R. Orr

Cooperating Agencies: New Mexico State Engineer Office and the City of El Paso

Problem: Evaluation of the impact of potential increased demands upon the ground-water supply of the Hueco Bolson in New Mexico requires an understanding of the hydrologic system and its response to pumpage. At present, lack of hydrologic data precludes a quantitative understanding of the effects of this potential development on existing resources.

Objectives: (1) To determine the extent and thickness of water-bearing sediments and the distribution of water quality in those sediments; and (2) to determine changes in water levels, water in storage, and water quality that would result from additional pumpage in New Mexico.

Approach: Compile water-use, water-level, water-quality, and other geohydrologic information. Construct a preliminary three-dimensional ground-water flow model and a cross-sectional solute-transport model. Collect additional data, including surface electrical-geophysical soundings, to define the extent and thickness of water-bearing sediments and water-quality zones. Refine models using additional information.

Progress and Significant Results: Surface-electrical sounding data were collected at 55 sites throughout the northern part of the Hueco Bolson. These geophysical data are presented in U.S. Geological Survey Open-File Report 85-607. Four test holes were drilled and completed as observation wells. Hydrologic information from these wells and from other sources is presented in U.S. Geological Survey Open-File Report 85-696. The ground-water flow system in the northern part of the Hueco Bolson was simulated using the U.S. Geological Survey modular three-dimensional model. Simulations were used to evaluate possible effects of additional pumpage stresses on the flow system. Cross-sectional solute-transport simulations and analyses of ground-water flow vectors were used to evaluate present and future vertical and horizontal encroachment of saline water. The geohydrology of the northern part of the Hueco Bolson and simulation results have been incorporated into the project's final report.

Plans for FY 88: Technical and editorial reviews will be completed on the final report prior to submission for Regional and Director's approval. The report will be published as a Water-Resources Investigations Report.

Reports in Progress:

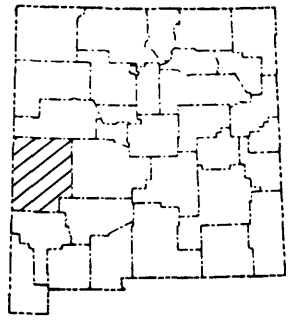
Orr, B.R., and Risser, D.W., Freshwater resources of the northern part of the Hueco Bolson and the projected effects on these resources from future well development in Doña Ana and Otero Counties, New Mexico, and El Paso County, Texas [colleague review completed].

Reports Released:

Bisdorf, R.J., 1985, Schlomberger sounding results in the Hueco Bolson, New Mexico: U.S. Geological Survey Open-File Report 85-607, 120 p.

Orr, B.R., and White, R.R., 1985, Selected hydrologic data from the northern part of the Hueco Bolson, New Mexico and Texas: U.S. Geological Survey Open-File Report 85-696, 88 p.

NM-254 GROUND-WATER RESOURCES OF CATRON COUNTY, NEW MEXICO



Period of Project: October 1984 to September 1989

Principal Investigator: Robert G. Myers

Cooperating Agencies: New Mexico State Engineer Office and New Mexico Bureau of Mines and Mineral Resources

Problem: Demand for water for public, domestic, agricultural, and coal-mining uses has increased. Surface waters are fully appropriated, and ground-water supplies need to be determined.

Objective: To describe the occurrence and quality of ground-water resources in the county.

Approach: Using data assembled in previous Catron County projects, determine where additional data need to be collected. Update geohydrologic maps where necessary. Describe the aquifers and their potential for water-supply development.

Progress and Significant Results: To date, hydrologic data for the San Agustin, Gila, San Francisco, Alamosa Creek, and Carrizo Wash basins have been collected. Hydrologic data for the San Agustin, Carrizo Wash, and Alamosa Creek basins have been analyzed and interpreted.

Plans for FY 88: To compile and analyze data from the Gila and San Francisco basins and begin writing the report. To input data from the Gila and Carrizo Wash basins into the Ground-Water Site-Inventory data base.

Reports in Progress:

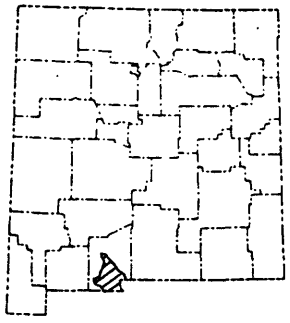
Myers, R.G., Ground-water resources of Catron County, New Mexico [initial preparation].

Reports Released:

Myers, R.G., 1987, Hydrology of the Carrizo Wash basin in Catron and Cibola Counties, New Mexico [abst.]: Geological Society of America Abstracts with Programs, Rocky Mountain Section, March 1987, v. 19, no. 5, p. 322.

Myers, R.G., 1988, Hydrogeology of the San Agustin Basin, the Alamosa Creek basin upstream from Monticello Box, and the upper Gila Basin, west-central New Mexico [abst.]: New Mexico Geological Society, 1988 Annual Spring Meeting, Socorro, N. Mex.

NM-258 DETERMINATION OF VERTICAL HYDRAULIC CONDUCTIVITY AND GROUND-WATER VELOCITY FROM TEMPERATURE PROFILES IN WELLS IN NEW MEXICO



Period of Project: February 1986 to September 1989

Principal Investigator: Kathy D. Peter

Cooperating Agency: New Mexico State Engineer Office

Problem: Ground-water pumpage from alluvial aquifers in arid basins of the southwestern United States eventually captures surface water. In New Mexico, the amount of captured Rio Grande water may affect the capability to deliver the specified amount of Rio Grande water to downstream users dictated by compact and treaty. The amount of water that leaks from the river to underlying sediments is controlled by the vertical hydraulic conductivity. The leakage rate and hydraulic conductivity are not known.

Objectives: Develop and apply convective transport of heat methods to determine vertical flow rates and vertical hydraulic conductivity. Compare vertical flow rates and vertical hydraulic-conductivity values with those obtained by using conventional aquifer-test methods. Evaluate the transferability of the heat-transfer method results to other basins along the Rio Grande.

Approach: Locate suitable wells. Temperature log the wells to determine temperature differences that may be associated with different lithologies in the heterogeneous sedimentary material. Assign thermal properties to the aquifer matrix using gamma-gamma, neutron, and electric logs. Establish flow and temperature boundary conditions through construction and testing of wells. Use the SUTRA simulation program to determine aquifer properties that could account for the temperature profile. Apply these aquifer coefficients to a radial-flow model and simulate an existing aquifer test in the study area. Evaluate transferability of aquifer properties using the temperature-profile technique against more conventional aquifer-test methods in other basins along the Rio Grande.

Progress and Significant Results: Test drilling, seismic surveying, initial aquifer testing, and geologic framework mapping have been completed. Temperature profiles were run throughout FY 86 and part of FY 87. Profile results illustrate the use of temperature data in documenting flow assumptions and the difficulty in designing and executing aquifer tests in thick alluvial aquifers. The needed software to be run with the SUTRA code has been written and tested. The SUTRA code can handle the cross-sectional modeling. However, applying the code to radial-flow simulation with heat transport results in scaling problems from the borehole to a distant boundary. The result is a large model that requires a large amount of computer execution time. Results have been summarized, and the report has been prepared.

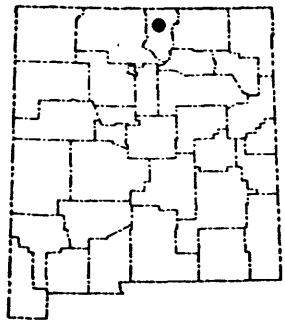
Plans for FY 88: Report will be reviewed, revised as required, and processed for release to the open file.

Reports in Progress:

Stevens, K.E., Determination of vertical aquifer coefficients using temperature data in the Mesilla Basin, New Mexico and Texas.

Reports Released: None

NM-259 INVESTIGATION OF SEASONAL AND EPISODIC WATER-QUALITY CHANGES IN PRECIPITATION AND LAKE WATER IN NORTHERN NEW MEXICO



Period of Project: June 1986 to September 1988

Principal Investigator: Scott K. Anderholm

Cooperating Agency: New Mexico Highlands University

Problem: High-mountain watersheds in northern New Mexico may be susceptible to the effects of atmospheric pollution from point-source emissions of sulfur dioxide (SO_2) and nitrogen compounds (NO(x)), which are acid precursors. The Latir Lakes, at altitudes of more than 11,000 feet, have supported cutthroat trout populations in the past. Recently, fewer large fish have been caught, and fewer young classes have entered the fish population. The causes for these declines are unknown but may by related to changes in lake-water chemistry.

Approach: Atmospheric deposition (wet-fall) samples will be collected at a site near the Latir Lakes. These samples, snow samples, early-snowmelt samples, and lake samples will be analyzed to determine concentrations of dissolved ions. Stream gages will be installed at the outflow from Latir Lakes 2 and 9 to measure the discharge from the lakes. A three-parameter (pH, specific conductance, and temperature) minimonitor will be installed at the outflow of Lake 2 to continuously monitor changes in those parameters.

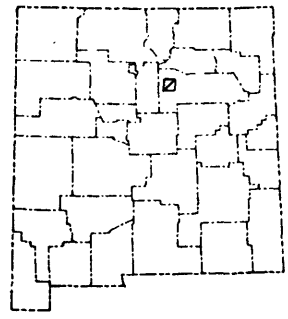
Progress and Significant Results: Snowpack profiles for specific conductance and pH were made from snow samples collected on April 1 and May 7, 1987. A three-parameter minimonitor has been installed at the Latir Lake 2 outflow station. The streamflow gage on Lake 9 outflow has been activated. pH, specific conductance, and temperature have been measured in outflow from Lakes 1 through 9. Samples of outflow from Lakes 2, 5, and 9 have been collected. The field activities have been coordinated with Dr. Jacobi's (Highlands University) aquatic biology surveys. Dr. Jacobi has furnished a preliminary summary report of the survey. Depth profiles of temperature and dissolved oxygen were done on Lakes 3, 5, and 9. Wet-fall samples from the atmospheric deposition station have been processed weekly. A snowmelt collector has been installed at the atmospheric deposition station at the Rio Costilla ski area. The atmospheric deposition samples, snow samples, lake samples, and quality control samples from 1987 were sent to an EPA contract laboratory for analysis.

Plans for FY 88: Atmospheric deposition samples will be collected weekly. Snow surveys will be done at the Rio Costilla ski area throughout the winter. Snowmelt samples will be obtained from a snowmelt collector during the spring. The minimonitor will be activated on the Lake 2 outflow station in the spring as soon as the site can be accessed. Stream gages on Lake 2 and Lake 9 outflow also will be activated as soon as access is possible. Samples of outflow from Lakes 2 and 9 will be collected monthly after May. Depth profiles on Lakes 3, 5, and 9 also will be done monthly.

Reports in Progress: None

Reports Released: None

NM-260 EFFECTS OF FOREST MANAGEMENT PRACTICES ON WATER QUALITY OF A HIGH MOUNTAIN STREAM IN THE SOUTHERN ROCKY MOUNTAINS OF NEW MEXICO



Period of Project: April 1987 to September 1992

Principal Investigator: Herbert S. Garn

Cooperating Agencies: New Mexico Environmental Improvement Division, City of Las Vegas, New Mexico, and New Mexico Highlands University

Problem: Very little information is available on the effects of forest harvesting activities in New Mexico and the Southwest on water quality. Such information is needed to evaluate the effectiveness of water-quality management plans and to develop the best silviculture management practices to control nonpoint-source pollution. Hydrologic studies are needed to determine the water-quality effects of forest harvesting operations used in this region.

Objectives: (1) Establish baseline water-quality data and evaluate the effects of forest harvesting practices and road construction activities on the chemical and biotic characteristics of a mountain stream; (2) compare the changes, if any, in stream quality to water-quality standards and the designated uses of the streams; and (3) relate the changes in stream quality to land-use practices.

Approach: Paired upstream and downstream water-quality stations in a municipal water-supply watershed (Gallinas Creek) and a watershed to be logged (Tecolote Creek) will be used to establish baseline water-quality data and to monitor the effects of timber harvesting and road construction activities. These streams are west of Las Vegas in northeastern New Mexico. Emphasis will be placed on monitoring stream-water quality during runoff events. Stations will be operated seasonally to coincide with runoff from snowmelt and summer thunderstorms, which produce the bulk of the annual precipitation. Water characteristics and constituents to be analyzed include physical, chemical (major ions and nutrients), and biological (aquatic invertebrates) attributes.

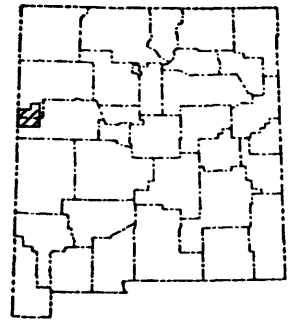
Progress and Significant Results: A reconnaissance of the study area has been completed. Five water-quality sampling sites with staff gages have been installed on Gallinas Creek. Three gaging stations and five water-quality sampling sites also have been installed on Tecolote Creek. Water-quality samples were collected and sites were operated during the summer of 1987 to define baseline characteristics. Aquatic invertebrates have been collected at all sites.

Plans for FY 88: Continue data collection during the frost-free season to establish baseline water-quality characteristics.

Reports in Progress: None

Reports Released: None

NM-261 TEST DRILLING AND HYDROLOGIC INVESTIGATIONS ON THE PUEBLO OF ZUNI, NEW MEXICO



Period of Project: October 1987 to September 1989

Principal Investigator: Thomas M. Crouch

Cooperating Agency: Pueblo of Zuni

Problem: Economic growth and development on the Pueblo of Zuni are dependent partly on the availability of adequate supplies of good-quality water for agriculture and industry. Recent water-rights litigation has created a need to evaluate the quality and availability of surface and ground water on the Pueblo. Hydrologic information is needed in selected areas in order to plan for the Pueblo's future water supplies and to protect its water resources.

Objective: Obtain quantitative information on aquifer properties, streamflow, water-level fluctuations, and water quality in selected areas of the Pueblo of Zuni where such information has been identified in previous studies as lacking.

Approach: Drill test and observation wells. Conduct single- or two-well aquifer tests using new and existing wells. Analyze aquifer tests to determine aquifer properties. Collect water samples and test water quality. Install a streamflow-gaging station on the Zuni River near Arizona, monitor river stage for about 2 years, and collect water samples. Evaluate Zuni River discharge from records obtained at this new station (outflow) and the existing gaging station near Black Rock (inflow). Install recorders and monitor water levels in as many as seven wells. Evaluate natural and human-induced water-level fluctuations.

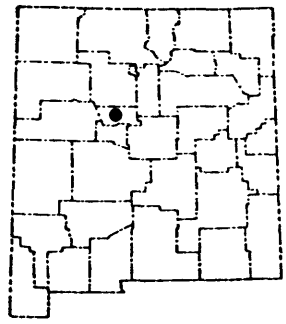
Progress and Significant Results: A streamflow gage was installed and operated on the Zuni River. A recorder was installed on one Chinle well in Zuni Village. Recorders were operated on four San Andres-Glorieta wells. A report was completed for previous drilling and aquifer testing in the Bidahochi and San Andres-Glorieta aquifers.

Plans for FY 88: Drill one test well in the San Andres-Glorieta aquifer northeast of Black Rock and run a single-well aquifer test. Optionally, drill a nearby observation well and run a two-well aquifer test. Collect and analyze water samples. Continue Zuni River monitoring and sampling. Drill one or two observation wells near existing wells in the Chinle Formation sandstone aquifers at Zuni Village. Install and operate water-level recorders on newly drilled test and observation wells and continue to operate water-level recorders on existing wells. Conduct a two-well aquifer test on the Bidahochi Formation using existing test wells.

Reports in Progress: None

Reports Released: None

NM-262 SIMULATION OF THE EFFECTS OF URBANIZATION IN A DESERT PLATEAU ENVIRONMENT THROUGH THE USE OF KINEMATIC MODELING IN ALBUQUERQUE, NEW MEXICO



Period of Project: October 1986 to September 1990

Principal Investigator: Richard P. Thomas

Cooperating Agencies: Albuquerque Metropolitan Arroyo Flood Control Authority and the City of Albuquerque

Problem: The relation between urbanization and runoff characteristics in the desert plateau environment of Albuquerque needs to be defined. The Albuquerque Metropolitan Arroyo Flood Control Authority and the City of Albuquerque require information that will allow them to design engineering works that will accommodate expected increases in runoff peaks and volumes from urbanized areas. The changes in runoff characteristics need to be defined relative to changes in urbanization.

Objective: To develop a single calibrated watershed model for the Albuquerque area where differences between individual watersheds will be modeled by deterministic changes to specific, physically based parameters.

Approach: (1) Segment each of the basins using ARC/INFO GIS software; (2) calibrate Distributed Routing Rainfall Runoff Model (DR3M) for each of nine watersheds within the Albuquerque Urban Hydrology Program; (3) combine individual calibrations into a single calibrated model with deterministic variables defining the differences between watersheds; (4) use long-term measurements of rainfall in Albuquerque to compute a series of runoff characteristics that would be expected to occur as watersheds are developed.

Progress and Significant Results: The pilot calibration for Academy Acres Drain has been recalibrated for 1984-85 data using a finer segmentation of the drainage basin. ARC/INFO has been used to segment the basins for six of the nine watersheds. Data that will be used for calibration and verification of the nine basins have been collated into a computerized data base and are being used to build watershed data management files that can be used in the ANNIE watershed model management system.

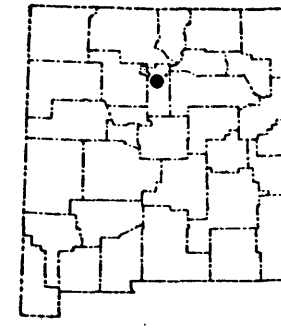
Plan for FY 88: All the basins will be segmented using ARC/INFO. Calibrations will begin on the remaining basins.

Reports in Progress: None

Reports Released:

Fischer, E.E., Rote, J.J., and Borland, J.P., 1984, Rainfall-runoff data in the Albuquerque, New Mexico, metropolitan area, 1976-83: U.S. Geological Survey Open-File Report 84-48, 306 p.

NM-263 PUMPING EFFECTS FROM THE BUCKMAN WELL FIELD ON THE RIO GRANDE, SANTA FE COUNTY, NEW MEXICO



Period of Project: January 1987 to February 1989

Principal Investigator: Douglas P. McAda

Cooperating Agency: Santa Fe Metropolitan Water Board

Problem: The New Mexico State Engineer Office, which regulates the appropriation and use of water in New Mexico, recognizes that ground-water withdrawal from the Buckman well field has an effect on streamflow in the Rio Grande, Pojoaque River, and Rio Tesuque. However, the effects of pumping on the discharge in the rivers are not fully understood.

Approach: A recently developed Geological Survey regional ground-water flow model of the Santa Fe area will be used to simulate the effects of Buckman well-field withdrawals on the Rio Grande and its tributaries. Estimates of the streamflow capture from the Rio Grande, Pojoaque River, and Rio Tesuque as a result of ground-water withdrawals will be made from the simulations. Approximately three nests of observation wells will be installed in the Buckman area near the Rio Grande. The wells will vary in depth from the water table to about 300 feet below land surface. Water levels in these wells, the Rio Grande, and existing observation wells will be monitored to document water-level changes at different zones in the aquifer in response to Buckman well-field withdrawals.

Progress and Significant Results: Estimates of the effects of Buckman well-field withdrawals on streamflow in the Rio Grande, Pojoaque River, and Rio Tesuque were made using the Geological Survey regional ground-water flow model of the Santa Fe area. Construction of three nests of observation wells in the Buckman area was completed. A draft of the final report has been completed and submitted for review.

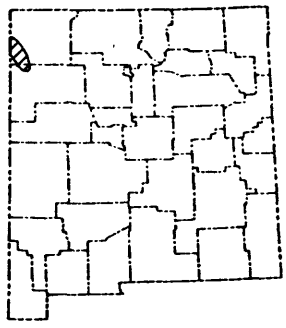
Plans for FY 88: Continue monitoring the observation wells in the Buckman area. Continue processing the final report for review and approval.

Reports in Progress:

McAda, D.P., Simulated effects of withdrawals at Buckman well field on streamflow in the Rio Grande, Pojoaque River, and Rio Tesuque, Santa Fe County, New Mexico [received colleague review].

Reports Released: None

NM-264 ASSESSING THE SENSITIVITY OF CHUSKA MOUNTAIN, NEW MEXICO, LAKES TO ATMOSPHERIC DEPOSITION



Period of Project: March 1987 to September 1988

Principal Investigator: Scott K. Anderholm

Cooperating Agency: Navajo Nation

Problem: High mountain watersheds in New Mexico may be susceptible to the effects of atmospheric deposition from point-source emissions of sulfur dioxide (SO_2) and nitrogen compounds (NO(x)), acid precursors. Baseline data necessary to assess the sensitivity of lakes in the Chuska Mountains to atmospheric deposition are not available. The majority of baseline limnological data in New Mexico indicate that lakes at altitudes below 10,000 feet appear to be relatively insensitive to changes in atmospheric chemistry. However, it has been hypothesized that in some lakes in New Mexico, large concentrations of cadmium, chromium, mercury, and zinc have resulted from atmospheric pollution or leaching by precipitation.

Objectives: To assess the precipitation chemistry, including trace elements, in the Chuska Mountains and to characterize and evaluate the chemistry of selected lakes in the mountains.

Approach: An atmospheric deposition station will be established in the Chuska Mountains for biweekly sampling. Several lakes will be selected for water-quality sampling. The lakes to be sampled will be surveyed to determine depths and the occurrence, if any, of vertical stratification.

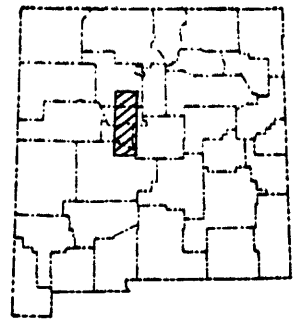
Progress and Significant Results: A reconnaissance of an atmospheric deposition station site and lakes has been completed. An atmospheric deposition collector has been installed. Six lakes (Asaayi Lake, Long Lake, Whiskey Lake, Berland Lake, Toadlena Lake, and Tsaile Lake) have been sampled. Depth profiles of temperature and dissolved oxygen were done on Asaayi Lake, Long Lake, Whiskey Lake, and Tsaile Lake.

Plans for FY 88: Assist in the maintenance of the atmospheric deposition station and collection of the atmospheric deposition samples. Review results of the water-quality analyses and prepare an open-file data report on the results. Collect a second set of water samples from selected lakes immediately after snowmelt.

Reports in Progress: None

Reports Released: None

NM-265 WATER-RESOURCES INVESTIGATIONS IN THE ALBUQUERQUE BASIN, NEW MEXICO



Period of Project: July 1987 to September 1990

Principal Investigator: David W. Wilkins

Cooperating Agency: City of Albuquerque

Problem: Albuquerque is the largest single user of ground water in the Albuquerque Basin. As the prime consumer of water from the Santa Fe aquifer system, the City recognizes its responsibility to take the lead in understanding this resource and in using the water wisely. As a result, the City of Albuquerque and the U.S. Geological Survey are participating in a program to identify and quantify hydrologic aspects of the interconnected ground- and surface-water systems.

The immediate need is to conduct water studies to help determine the siting of new city wells. The long-term components of the program are to compile, collect, and interpret geohydrologic information about the city's long-term water supply.

Objectives: The project is to develop basinwide information about the water resources that will assist in developing an adequate supply of good-quality water for many years to come. The following will be considered in this program:

Evaluation of ground-water and surface-water resources of the study area.
Estimates of the effect of present and projected water demand on the surface- and ground-water relation.
Evaluation of potential for augmenting the City's ground-water supply.

Approach: The following elements of investigation may be addressed:

Data collection
Ground-water resource evaluation
Ground-water quantity and quality modeling
Potential for artificial ground-water recharge
San Juan-Chama Project water losses and possible current uses
Alternate sources for the present water supply

Progress and Significant Results: Two efforts were started during FY 87: (1) Lithologic cross sections and areal changes in lithology resulting from the Southwest Alluvial Basins project during geology studies of the Albuquerque Basin are being prepared for publication. The possibility of developing a geophysical-log data base for the basin is being investigated as part of this effort. (2) A water-quality digital data base for the Albuquerque Basin, which will contain all available water-quality data, was initiated and data sources determined.

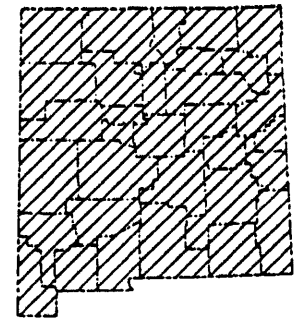
Plans for FY 88: Publish the cross sections and the basin lithologic report. Determine the feasibility of a geophysical-log digital data base. If the decision is to develop the data base, begin digitizing existing logs and enter digital borehole-log data as they are collected. Transfer water-quality data from the WATSTORE and STORET data bases into the Albuquerque Basin data base and input data from paper files into the data base. Pursue the possibilities of beginning work efforts to determine the volume of recharge to the alluvial aquifer through beds of ephemeral streams entering the basin from the surrounding mountains. Quantify the water budget for a reach of the Rio Grande flood plain.

Reports in Progress:

Kaehler, C.A., and Kues, G.E., Lithologic characterization of the alluvial aquifers in the Albuquerque Basin, Bernalillo County, New Mexico.

Reports Released: None

NM-266 DEVELOPMENT OF AN ALGORITHM FOR CHANNEL TRANSMISSION LOSS AND PEAK FLOW ATTENUATION IN EPHEMERAL STREAMS IN NEW MEXICO



Period of Project: October 1987 to September 1991

Principal Investigator: Richard P. Thomas

Cooperating Agencies: Albuquerque Metropolitan Arroyo Flood Control Authority and the City of Albuquerque

Problem: Substantial volumes of water can be lost into a channel bed as a flood wave moves down an ephemeral stream. Peak discharges also can be significantly attenuated. These hydrographic changes need to be quantified to allow a more precise estimation of peak discharges and to enable the modeling of losses and attenuation in watershed models.

Objective: To develop an algorithm for incremental transmission loss and peak flow attenuation that can be applied in the Geological Survey Distributed Rainfall Runoff Routing Model (DR3M).

Approach: (1) Review literature and previous studies and evaluate developed equations for transferability; (2) develop equations that will compute increments of loss and attenuation; (3) verify equations using data collected from New Mexico study sites; (4) develop algorithm using final equation; (5) apply algorithm to DR3M and install in the ANNIE watershed model management system.

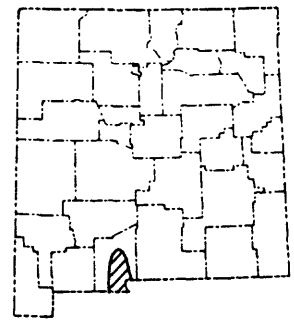
Progress and Significant Results: Literature and the results of previous studies have been collected and are being evaluated. Stream-gaging stations have been installed at three reaches in the Albuquerque area, and data are being collected.

Plans for FY 88: Continue review of literature and previous studies and begin evaluation of published equations. Continue data collection at existing reaches and begin collation of data. Evaluate new reaches for inclusion in the data-collection network.

Reports in Progress: None

Reports Released: None

NM-267 MONITORING NETWORK OF THE GROUND-WATER FLOW SYSTEM IN THE MESILLA BASIN, SOUTH-CENTRAL NEW MEXICO



Period of Project: October 1987 to September 1989

Principal Investigator: Edward L. Nickerson

Cooperating Agency: City of El Paso

Problem: Urban growth within the Mesilla Basin and adjacent areas has resulted in a significant increase in ground-water withdrawals. Historically, ground-water data within the basin have been obtained on a nonrecurring and unsystematic basis. Economic and efficient management of the surface- and ground-water resources of the Mesilla Basin requires monitoring the magnitudes and rates of water-level changes in wells throughout the basin and their relation to the surface-water system.

Objectives: To document changing conditions within the Mesilla ground-water basin and establish a continuous, long-term ground-water data base that will permit quantitative evaluation of the surface- and ground-water flow systems.

Approach: Water-level measurements will be made in 143 wells in the Mesilla Basin observation-well network. This network consists of wells completed in the Rio Grande flood-plain alluvium and wells completed in the Santa Fe Group and includes 99 wells on the West Mesa.

Continuous water-level data will be collected at three instrumented hydrologic sections at Las Cruces, near Mesquite, and near Cañutillo. Each hydrologic section consists of a river-stage recorder and multiple nests of instrumented wells, each nest including several wells completed at depth intervals from 35 to 801 feet.

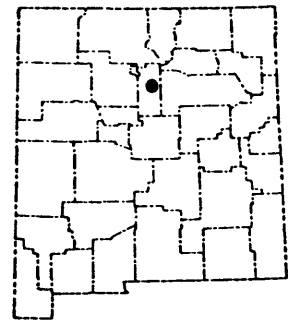
Progress and Significant Results: Annual water-level measurements were made in January in 143 wells in the Mesilla Basin observation-well network. Continuous water-level data were collected from 34 wells and three river-stage sites in three hydrologic sections.

Plans for FY 88: Measure water levels in network observation wells. Continue operation and maintenance of hydrologic sections at Las Cruces, near Mesquite, and near Canutillo.

Reports in Progress: None

Reports Released: None

NM-268 RECHARGE STUDY IN THE SANTA FE AREA, NEW MEXICO



Period of Project: July 1987 to September 1990

Principal Investigator: Scott K. Anderholm

Cooperating Agencies: Santa Fe Metropolitan Water Board and New Mexico State Engineer Office

Problem: Because of increases in population and the subsequent increase in water use in the Santa Fe area, planners and managers have expressed interest in a more detailed understanding of the ground-water flow system. Identification of sources and volumes of recharge to an aquifer is important in the understanding of the ground-water system.

Objectives: To determine sources of recharge to the basin-fill aquifer in the vicinity of Santa Fe and to make estimates of the percentages of recharge lost to evapotranspiration and evaporation.

Approach: Most recharge studies in New Mexico have been based on rainfall/runoff relations. The study of the chemical properties of various sources of recharge and the chemical properties of ground water in areas where recharge occurs is another approach that can be used to investigate recharge. This approach is based on the premise that various sources of recharge water have unique chemical properties that can be used to examine the amount of recharge that occurs and the movement of ground water from recharge areas to discharge areas. Mass balances of specific chemical constituents can be used to estimate volumes of recharge to the aquifer. Samples from various sources of recharge, such as precipitation and snowmelt and summer thunderstorm runoff from adjacent mountainous areas, will be collected, and the stable isotopic composition will be measured. The areal distribution of the stable isotopic composition of ground water will be compared to the isotopic composition of the various sources of recharge to evaluate the relative significance of the various sources of recharge. To make estimates of the percentages of recharge lost to evapotranspiration and evaporation, a mass balance method using chloride concentrations of precipitation and water in the unsaturated zone will be used.

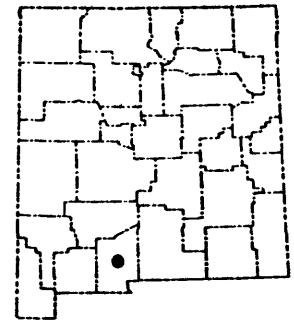
Progress and Significant Results: Reconnaissance of the study area was completed. Eighteen water samples were collected from selected streams to characterize the chloride concentration and isotopic composition of snowmelt runoff. Nine water samples were collected in late August from selected streams to characterize the chloride concentration and isotopic composition of runoff resulting from summer thunderstorms. Water samples were collected from selected private wells to characterize the chloride concentration and isotopic composition of ground water. An atmospheric deposition sampler and a rain gage were installed at the Santa Fe Water Treatment Plant on Canyon Road. Biweekly collection of atmospheric deposition (bulk precipitation) samples was begun.

Plans for FY 88: Continue to collect atmospheric deposition samples. Implement a contract for analysis of oxygen-18 and deuterium. Auger holes in selected areas to get samples of water from the unsaturated zone. Examine existing ground-water chemistry data so additional ground-water sampling sites can be located and ground-water sampling completed. Process the unsaturated zone samples. Interpret data from the project and report on progress to the cooperators.

Reports in Progress: None

Reports Released: None

NM-269 DETERMINATION OF INCISED, BURIED ARROYO CHANNELS IN THE HORST SEPARATING THE SOUTHERN JORNADA DEL MUERTO GROUND-WATER BASIN AND MESILLA GROUND-WATER BASIN, DOÑA ANA COUNTY, NEW MEXICO



Period of Project: October 1987 to September 1991

Principal Investigator: Robert G. Myers

Cooperating Agencies: New Mexico State Engineer Office and City of Las Cruces

Problem: Geohydrologic data indicate that most ground water in the Jornada del Muerto ground-water basin moves north. Some ground water moves west over a horst separating the Jornada del Muerto ground-water basin from the Mesilla ground-water basin, and in some areas the sediments overlying the horst are dry. Incised, buried arroyo channels through the horst may transmit ground water from the Jornada del Muerto ground-water basin to the Mesilla ground-water basin. The location of ground water moving into the Mesilla Basin is not known.

Objective: To locate incised, buried arroyo channels in the horst separating the southern Jornada del Muerto ground-water basin from the Mesilla ground-water basin.

Approach: Two seismic reflection lines perpendicular to the horst will be used to help locate the axis of the horst. One seismic reflection line about 8 miles long will be run down the axis of the horst to determine the possible locations of any incised, buried arroyo channels. One small well will be drilled in a suspected channel to collect geohydrologic information.

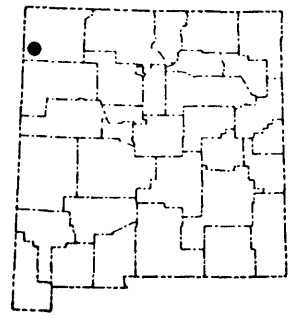
Progress and Significant Results: New project.

Plans for FY 88: Collect available data and literature. Run one seismic reflection line perpendicular to the axis of the horst.

Reports in Progress: None

Reports Released: None

NM-270 WATER BUDGET OF CAPTAIN TOM WASH WATERSHED



Period of Project: May 1988 to September 1989

Principal Investigator: Carole L. Goetz

Cooperating Agency: Navajo Nation

Problem: Hydrologic information on the east side of the Chuska Mountains is sparse. A systematic data-collection network and interpretation of the data to understand the hydrologic system have not been undertaken. Data from Captain Tom Wash may be applicable to other drainages on the east side of the Chuska Mountains.

Objectives: The basic objective is to define the hydrologic system of Captain Tom Wash watershed. Included in this objective are the definition of surface runoff, water use by native vegetation and irrigated crops, precipitation and infiltration rates, and ground-water inflow and outflow.

Approach: Compile and evaluate existing data on the Captain Tom Wash watershed. Install streamflow-gaging stations upstream and downstream of the reservoir on the wash. Install an evaporation pan at the reservoir. Collect evapotranspiration data from juniper-piñon stands and irrigated alfalfa. Collect precipitation data and define land use in the watershed. Compile data on a current basis and develop a water budget for the watershed.

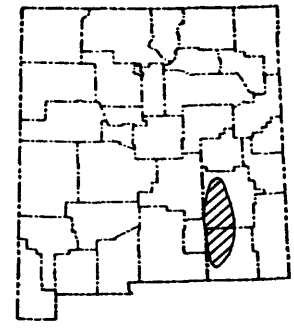
Progress and Significant Results: New project.

Plans for FY 88: Streamflow-gaging stations will be installed on Captain Tom Wash, and an evaporation pan will be installed at the reservoir. Data on streamflow, evapotranspiration, and precipitation will be collected and entered into a data base. Initial evaluations of the data will be made.

Reports in Progress: None

Reports Released: None

NM-271 SIMULATION OF GROUND-WATER FLOW IN THE ROSWELL BASIN, CHAVEZ AND EDDY COUNTIES, NEW MEXICO



Period of Project: October 1987 to September 1992

Principal Investigator: Douglas P. McAda

Cooperating Agency: New Mexico State Engineer Office

Problem: Large-scale use of ground water in the Roswell Basin has resulted in diminution of streamflow in the Pecos River and its tributaries, deterioration of the chemical quality of surface water, loss of head in the major aquifers, and deterioration of the chemical quality of ground water in the vicinity of Roswell and areas north of Roswell. Particular aspects of the general problem have been studied in restricted or compartmentalized fashion. However, it has not been possible to quantitatively correlate the findings of all studies in order to formulate, with a large degree of assurance, a basinwide program that will result in optimum distribution and use of the available water resources.

Objectives: The objectives of this study are to: (1) Gain a better understanding of the interaction between the confined aquifer, water-table aquifer, Pecos River, and other major hydrologic components of the basin; (2) demonstrate the effects of ground-water withdrawals on streamflow in the Pecos River; and (3) develop a water-management tool that can be used to determine the effects on streamflow in the Pecos River by changing ground-water withdrawals from different areas of the basin.

Approach: Existing information reflecting the latest conceptualization of the geology and hydrology of the Roswell Basin will be used to construct a three-dimensional finite-difference ground-water flow model of the basin. The model will include simulation of ground-water flow between the confined aquifer, water-table aquifer, and the Pecos River under steady-state and transient conditions. The transient ground-water flow system will be simulated from the period of initial development of ground water in the basin to recent time.

A geographic information system (GIS) will be used to manipulate the spatial data from the Roswell Basin for input to the model. The GIS will be used to construct a geohydrologic data base that can be used to generate additional models for specific water-management applications.

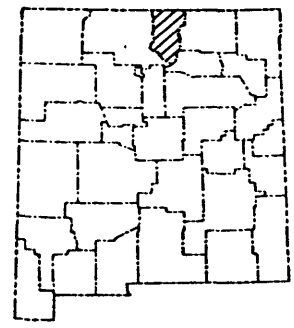
Progress and Significant Results: This project is in its initial stages. A review of geology and hydrology literature of the Roswell Basin and work using the GIS has been initiated.

Plans for FY 88: Continue literature review. Collect geologic and hydrologic information necessary for model development from the various sources and create the GIS coverages.

Reports in Progress: None

Reports Released: None

NM-272 WATER RESOURCES OF TAOS COUNTY, NEW MEXICO



Period of Project: October 1987 to September 1990

Principal Investigators: Robert R. White and Lynn A. Garrabrant

Cooperating Agencies: New Mexico State Engineer Office, New Mexico Bureau of Mines and Mineral Resources, and New Mexico Environmental Improvement Division

Problem: The surface waters of Taos County are fully appropriated and may be insufficient to meet future demands. Ground water is a significant source of water for domestic use, but little is known about ground-water supplies. Assessments are needed to determine the quantity and quality of surface and ground water in the county.

Objectives: The purpose of this investigation is to make a general assessment of the quantity and quality of water in Taos County and to provide data for any future detailed studies that may be needed.

Approach: Literature of the area will be reviewed and a bibliography compiled. Existing data on surface water, ground water, and water quality will be assembled. A network of observation wells will be established, and periodic measurements will be made. Water-level measurements will be made in wells throughout the county in early 1988 as part of the 5-year intensive water-level program, and additional measurements will be made as needed. Samples will be collected from wells for water-quality analysis. The relation between surface water and ground water will be studied using data from 21 streamflow-gaging stations currently operating in the county. Water use will be studied using data from the State Engineer Office and other agencies.

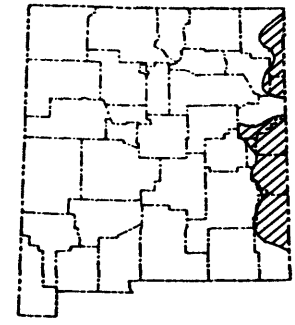
Progress and Significant Results: A preliminary bibliography has been compiled. Ground-water information in the OMNIANA and GWSI data bases has been compiled. Water-use information has been assembled. In March 1988, water-level measurements were made in about 70 wells for the 5-year monitoring program.

Plans for FY 88: Additional water-level measurements will be made during the remainder of the year. Ground-water samples will be collected for chemical analysis. The existing data on surface water and ground water will be analyzed and used to decide where additional information is needed.

Reports in Progress: None

Reports Released: None

NM-273 WATER-LEVEL MONITORING IN THE HIGH PLAINS OF NEW MEXICO



Period of Project: March 1988 to September 1993

Principal Investigator: Roy Cruz

Cooperating Agency: New Mexico State Engineer Office

Problem: The distribution of observation wells in the High Plains area is not adequate to satisfactorily characterize water-level changes in the aquifer. The present monitoring system does not provide adequate data on seasonal water-level fluctuations or make this data readily available to interested parties.

Objectives: Put existing and newly collected water-level data into a data base that may be retrieved and plotted using computer techniques. Add additional monitoring wells to the existing water-level monitoring network and install recorders to monitor daily fluctuations, thus allowing more detailed analysis of water-level changes shown by annual water-level measurements.

Approach: Initially, water-level data in the data base will be located by latitude and longitude. Approximately 10 new wells will be selected for water-level monitoring on a quarterly basis. Four of these wells will be in the House area and the remainder in northeastern New Mexico. Four recorders will be installed on wells in the Clovis-Portales area. Two wells with recorders will be located in major pumpage centers to measure aquifer stress, and two will be located away from the pumping centers to monitor stress that may not be directly related to agricultural activities of the area.

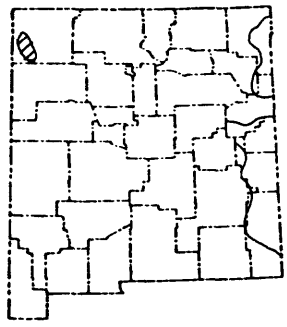
Progress and Significant Results: A work plan has been formulated, and data entry and well locations are being loaded into a data base.

Plans for FY 88: Complete data-base preparation. Select wells to be measured quarterly and wells that will be equipped with recorders. Recorders will be installed late in the year.

Reports in Progress: None

Reports Released: None

NM-274 WATER USE OF SAGEBRUSH AND REPLACEMENT GRASS IN NORTHWEST NEW MEXICO



Period of Project: May 1988 to September 1991

Principal Investigator: Carole L. Goetz

Cooperating Agency: Navajo Nation

Problem: Little information is available on evapotranspiration, precipitation, and infiltration of precipitation in the lower areas of the Chuska Mountains. To manage these areas for grazing, evapotranspiration rates of sagebrush need to be determined as guidelines for selecting replacement grasses that have similar evapotranspiration rates. Evapotranspiration from pasture grass and infiltration characteristics of precipitation into a grass ground cover are not known.

Objectives: The objectives are to: (1) Determine evapotranspiration rates of sagebrush and replacement grass in lower areas of the Chuska Mountains; and (2) determine the depth of precipitation infiltration for sagebrush and replacement grass.

Approach: Two sites that have sagebrush cover will be selected. Bowen-ratio evapotranspiration data-collection equipment, using chilled-mirror technology, will be installed to determine water use by sagebrush. Tensiometers equipped with transducers connected to data loggers will be installed. The tensiometers will be placed at depths of 6, 12, 24, and 60 inches. The character of the soil column will be described and precipitation gages installed. The sagebrush cover will be removed and grass seeded at the selected areas. The same data will be collected for the grass cover as for the sagebrush covers.

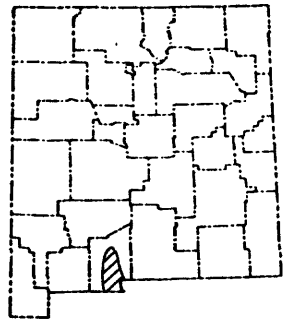
Progress and Significant Results: New project.

Plans for FY 88: Select sites for determining evapotranspiration rates for sagebrush and install monitoring equipment. The sites will be inspected monthly and the data retrieved and processed. Daily evapotranspiration rates will be calculated using the Bowen-ratio method.

Reports in Progress: None

Reports Released: None

NM-275 WATER-USE INVENTORY OF THE MESILLA DRAINAGE BASIN, 1985, DOÑA ANA COUNTY, NEW MEXICO, AND EL PASO COUNTY, TEXAS



Period of Project: July 1988 to September 1991

Principal Investigator: Edward L. Nickerson

Cooperating Agencies: New Mexico State Engineer Office, City of Las Cruces, and City of El Paso

Problem: Recent population growth within the Mesilla Basin and adjacent areas has resulted in a significant increase in ground-water withdrawals to meet municipal water demands. Study areas of recent water-use reports do not coincide with the Mesilla drainage basin. Furthermore, water-use categories listed in those reports are not compatible. Development of a comprehensive water-use inventory of the Mesilla Basin would aid in effective management of water resources. Water-use data also would provide necessary information for future efforts to simulate hydrologic conditions within the basin.

Objectives: The purpose of this study is to develop a comprehensive water-use inventory of the Mesilla Basin for 1985. The objectives are to: (1) Document water use by conducting an inventory of available records; (2) identify water use by source, category, and location; (3) develop methods and establish procedures to estimate water use where records are not available; and (4) evaluate accuracy of reported and estimated values.

Approach: Establish a water-use inventory of the Mesilla drainage basin. The water-use inventory will document water usage and depletion (consumptive use) within the basin in 1985. Principal water uses will be identified by source, category, and locations of major withdrawals. The principal water-use categories are: (1) irrigated agriculture; (2) municipal; (3) domestic; and (4) industrial.

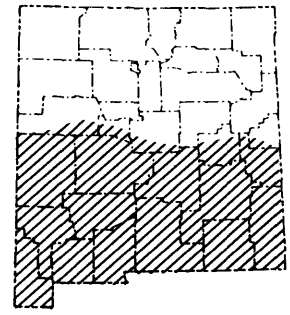
Progress and Significant Results: New project.

Plans for FY 88: Formulate work plan, assess availability of existing water-use information, and initiate collection of water-use data.

Reports in Progress: None

Reports Released: None

NM-276 ESTIMATING POTENTIAL RECHARGE TO ALLUVIAL AQUIFERS IN SOUTHERN NEW MEXICO



Period of Project: October 1987 to September 1991

Principal Investigator: Scott D. Waltemeyer

Cooperating Agency: New Mexico State Engineer Office

Problem: Data on the amount of recharge to alluvial-basin aquifers in the arid Southwest are needed for use in hydrologic models. Mountain-front recharge, the amount occurring at the bedrock-alluvial contact of a relatively impermeable mountainous watershed, is thought to be the primary mechanism for recharge to alluvial-basin aquifers in much of the arid Southwest. The mean annual discharge of streams at mountain fronts is considered to be the potential recharge. Streamflow data at mountain fronts in southwestern New Mexico are lacking.

Objective: Collect, compute, and compile streamflow data at mountain fronts and relate those data to basin and climatic characteristics to estimate annual streamflow at ungaged sites. Alternatives to collecting streamflow data at continuous-record sites will be investigated. Correlation techniques utilizing data at partial-record stations and miscellaneous discharge measurements may provide additional information for the network.

Approach: Establish a network of streamflow-gaging stations in the drainage basins of the San Andres Mountains, Sacramento Mountains, and the Black Range. Data from these stations will be used with data from existing stations in the southern part of the state.

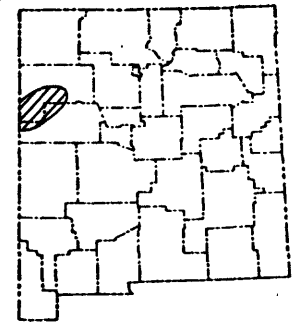
Progress and Significant Results: New project.

Plans for FY 88: Undertake field reconnaissance for site selection and gage installation. Evaluate existing sites and data for inclusion in the data base.

Reports in Progress: None

Reports Released: None

NM-277 OCCURRENCE AND MOVEMENT OF RADIONUCLIDES AND OTHER TRACE ELEMENTS IN THE PUERCO AND LITTLE COLORADO RIVER BASINS, ARIZONA AND NEW MEXICO



Period of Project: July 1988 to June 1993

Principal Investigator: Dale R. Rankin

Cooperating Agency: New Mexico Environmental Improvement Division

Problem: Activities in the Little Colorado River basin have resulted in releases of radionuclides and other trace elements to the surface water and nearby ground water of the Puerco and Little Colorado Rivers. Releases of mine wastes, in addition to the presence of naturally occurring and potentially hazardous trace elements, have made some water resources unsafe for use. Area residents are concerned about potential hazards to humans, livestock, and wildlife that use surface water or ground water from the near-channel alluvial aquifer. Information is needed on the occurrence and movement of potentially hazardous substances in surface and ground water.

Objectives: The purpose of the study is to define the occurrence of radionuclides and other trace elements and their mechanisms of movement in the Puerco River and Little Colorado River basins. The study objectives are to:

1. Determine types, concentrations, spatial and temporal variability, and recent origins of radionuclides and other trace elements in surface water, fluvial sediments, and ground water.

2. Quantify transport rates of radionuclides and other selected trace elements in surface water.

3. Estimate the amount and extent of contaminant movement between surface water and ground water.

4. Evaluate occurrence and movement of contaminants in and between the alluvial aquifer and adjacent geologic units.

5. Provide an assessment of health risks associated with use of the water resources of the region.

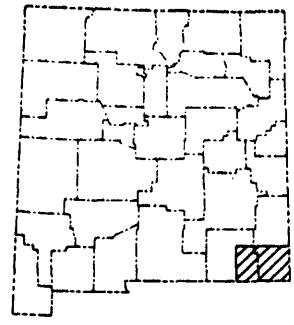
Approach: Establish water-quality-monitoring sites on streams to monitor concentrations of trace elements and activities of radionuclides as water flows downstream. Water samples will be analyzed for sediment concentration, particle-size distribution, and dissolved and suspended water-quality constituents including common ions and selected radionuclides, metals, and metaloids. Establish a network of wells to monitor water levels in the alluvium and adjacent units and to collect water samples. Conduct aquifer tests to estimate aquifer components and rates and directions of ground-water flow. Develop a network of wells by drilling additional wells to maximize areal coverage to determine surface-water and ground-water relations.

Plans for FY 88: Develop a work plan, establish monitoring sites on the Puerco River, and initiate data collection following runoff events.

Reports in Progress: None

Reports Released: None

NM-324 HYDROLOGIC INVESTIGATIONS RELATED TO A RADIOACTIVE-WASTES REPOSITORY IN SALT, SOUTHEASTERN NEW MEXICO



Period of Project: October 1975 to September 1988

Principal Investigator: David W. Wilkins

Cooperating Agency: U.S. Department of Energy

Problem: The Waste Isolation Pilot Plant (WIPP) is a U.S. Department of Energy project with the dual objectives of providing a facility for the permanent disposal of approximately 6 million cubic feet of transuranic waste and providing research on the interaction of high-level waste with a bedded-salt environment. Assessment of the ground-water flow system is a key component in evaluation of the potential for radionuclide transport to the biosphere and in the design and evaluation of a long-term monitoring network.

Objective: To define the direction and rate of ground-water flow in the Rustler Formation in the WIPP site and surrounding region.

Approach: Construct numerical models that simulate the ground-water flow system using existing site and regional hydrologic data. Examine the effects of variations in fluid density on flow patterns using variable-density modeling codes and other analytic techniques.

Progress and Significant Results: The regional hydrogeologic data base has been extended to include information from 1,081 wells in the WIPP region. An areal, variable-density model of ground-water flow in the Culebra Dolomite has been constructed for the immediate site area. A transient cross-sectional model of ground-water flow in the post-Salado rock units also has been constructed. An analytic technique for assessing density-related effects in a gently dipping aquifer has been developed and applied to the WIPP area. A regional-scale, variable-density flow and transport model has been constructed, and a variety of sensitivity analyses have been carried out. The final modeling report has been written and is currently in review.

Plans for FY 88: Provide technical support to DOE on regional hydrologic issues and provide technical support to Sandia Performance Assessment Group on incorporation of regional-model results into Performance Assessment simulations.

Reports in Progress:

Davies, P.B., Variable-density ground-water flow and paleohydrology in the region surrounding the Waste Isolation Pilot Plant (WIPP), southeastern New Mexico [received colleague review].

Reports Released:

Davies, P.B., 1986, Pleistocene-to-present flow-system evolution in the northern Delaware Basin, southeastern New Mexico--Analysis using transient cross-sectional flow simulations [abst.]: Geological Society of America Abstracts with Programs, v. 18, no. 6, p. 580.

Davies, P.B., 1987, Modeling areal, variable-density, ground-water flow using equivalent freshwater head--Analysis of potentially significant errors: National Water Well Association Conference on "Solving Ground Water Problems with Models," v. II, p. 888-903, Proceedings.

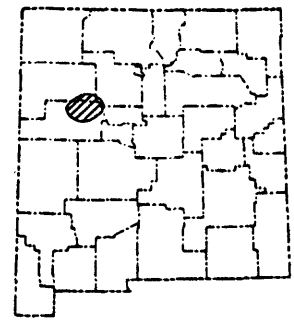
Richey, S.F., 1986, Hydrologic-test data from wells at hydrologic-test pads H-7, H-8, H-9, and H-10 near the proposed Waste Isolation Pilot Plant site, southeastern New Mexico: U.S. Geological Survey Open-File Report 86-413, 126 p.

Richey, S.F., 1987, Preliminary hydrologic data for wells tested in Nash Draw near the proposed Waste Isolation Pilot Plant site, southeastern New Mexico: U.S. Geological Survey Open-File Report 87-37, 131 p.

Richey, S.F., 1987, Water-level data from wells in the vicinity of the Waste Isolation Pilot Plant, southeastern New Mexico: U.S. Geological Survey Open-File Report 87-120, 107 p.

Stevens, Ken, and Beyeler, Walt, 1985, Determination of diffusivities in the Rustler Formation from exploratory shaft construction at the Waste Isolation Pilot Plant in southeast New Mexico: U.S. Geological Survey Water-Resources Investigations Report 85-4020, 32 p.

NM-345 EXPLORATION OF THE SAN ANDRES-GLORIETA AQUIFER SYSTEM, PUEBLOS OF ACOMA AND LAGUNA, NEW MEXICO



Period of Project: October 1983 to September 1988

Principal Investigator: Peter F. Frenzel

Cooperating Agency: U.S. Bureau of Indian Affairs

Problem: The Pueblos of Acoma and Laguna want to develop additional ground-water supplies. The San Andres-Glorieta aquifer system yields sufficient quantities of water for irrigation in other places but is unexplored in the area of the Pueblos.

Objective: Determine the productivity and water quality of the San Andres-Glorieta aquifer system in the area beneath the Pueblos of Acoma and Laguna.

Approach: Drill 10 or more wells for aquifer tests and water-quality determinations. Collect and analyze water samples at selected sites.

Progress and Significant Results: Eighteen wells were sampled for major ions, trace metals, carbon-14, carbon-13, deuterium, and oxygen-18. In some cases where water of recent age may have been found, tritium samples were collected. At Horace Spring, samples for tritium and a soap indicator were collected. The presence of soap would be an indication that some part of the flow is derived from sewage effluent as is much of the perennial part of the surface-water flow system there.

Assisted U.S. Bureau of Indian Affairs and Pueblo of Acoma with site selection and contract oversight for drilling "Acoma 1" test hole. Discovered high-yielding cavernous limestone and water of near-potable quality at Acoma 1. Sampled water at other selected sites.

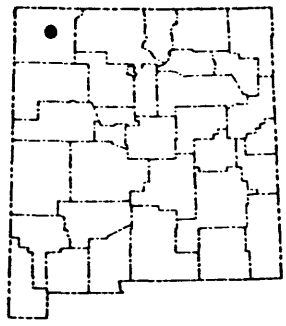
Drilled and tested the San Andres-Glorieta aquifer system at Sand Canyon, Anzac, Casa Blanca, Sky City, North Pasture, and La Mosca Canyon. Water was brackish at Anzac and North Pasture. Water was of quality that might be good enough for stock at other sites. Notably, some of the best water (except for Acoma 1) was at La Mosca Canyon, which is the most distant from the presumed recharge area. Very large transmissivities were encountered at Anzac, La Mosca, and Acoma.

Plans for FY 88: Complete the contract for drilling and testing of about five additional holes, including some "small holes" that would be temporary.

Reports in Progress: None

Reports Released: Drilling reports and data released to BIA as drilling progressed.

NM-351 HYDROLOGIC CHARACTERISTICS OF THE LEE ACRES LANDFILL AREA, SAN JUAN COUNTY, NEW MEXICO



Period of Project: December 1986 to September 1988

Principal Investigator: Kathy D. Peter

Cooperating Agency: U.S. Bureau of Land Management

Problem: The Lee Acres landfill is on land administered by the Bureau of Land Management and contains an undetermined number of buried solid-waste trenches and four unlined liquid-waste lagoons, now dry. The lagoons received a mixture of oil field production and transportation wastes and other unidentified fluids. Samples of the lagoon liquid indicated that this liquid contained volatile and potentially hazardous constituents. Wells in the Lee Acres residential area, downgradient of the landfill, show evidence of contamination by organic constituents. Existing information is inadequate to determine the extent and source of contamination or to design a cleanup.

Objectives: Describe the hydrogeologic conditions of alluvium underlying the landfill and adjacent areas and provide information to be used in the design of a monitoring program.

Approach: Evaluate existing data, install piezometers and collect alluvium samples, map the water table and thickness of alluvium, run seismic and electromagnetic surveys, conduct permeability analyses of alluvium samples, and estimate velocities of ground-water flow.

Progress and Significant Results: Twelve holes have been augered in alluvium. Collected six alluvium samples for permeability analyses. Installed seven piezometers. Mapped the water table. Ran six seismic survey lines using refraction and reflection techniques. Ran 5,000 feet of electromagnetic survey.

The alluvium mostly consists of fine- to coarse-grained sand containing some silt. The lithology and consolidation of the bedrock in contact with the alluvium vary areally. Ground-water flow is controlled by recharge north of the landfill, recharge from a pond, discharge to pumping, discharge to the San Juan River alluvium, and hydraulic conductivity of the alluvium. Volumetric flow through the alluvium is estimated to range from 12 to 1,200 cubic feet per day. Average interstitial velocity is estimated to range from 0.0002 to 37 feet per day. Chloride concentration is larger downgradient from the landfill, but is within drinking water standards. The concentration of sulfate exceeds the drinking water standard upgradient and downgradient of the landfill. Water and sediment samples of the San Juan River did not have any detectable volatile organic compounds. 1,1-dichloroethane and 1,1,1-trichloroethane were detected in water from two piezometers downgradient from the landfill.

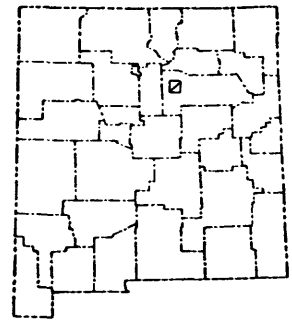
Plans for FY 88: Monitor water levels. Inventory existing wells and construct water-table map of Lee Acres residential area. Install crest-stage gage in arroyo.

Reports in Progress: None

Reports Released:

Peter, K.D., Williams, R.A., and King, K.W., 1987, Hydrogeologic characteristics of the Lee Acres landfill area, San Juan County, New Mexico: U.S. Geological Survey Water-Resources Investigations Report 87-4246, 69 p.

NM-352 EFFECTS OF FOREST MANAGEMENT PRACTICES ON SEDIMENTATION OF A HIGH MOUNTAIN STREAM IN THE SOUTHERN ROCKY MOUNTAINS OF NEW MEXICO



Period of Project: April 1987 to September 1992

Principal Investigator: Herbert S. Garn

Cooperating Agency: U.S. Forest Service

Problem: Very little information is available on the effects of forest harvesting activities in New Mexico and the Southwest on stream sediment. Such information is needed to evaluate the effectiveness of sediment management plans and to develop the best silvicultural management practices to control nonpoint-source pollution.

Objectives: (1) Evaluate the effects of forest harvesting practices and road construction activities on the suspended-sediment characteristics of a mountain stream; and (2) compare changes in stream sediment loads to land-use practices and relate the changes to water-quality standards.

Approach: Paired upstream and downstream water-quality stations will be used to monitor the effects of timber harvesting and road construction activities. Emphasis will be placed on monitoring stream sediment loads during runoff events. Stations will be operated seasonally to coincide with snowmelt runoff and summer thunderstorm runoff, which produce the bulk of the annual precipitation and sedimentation. Water characteristics and constituents to be analyzed include suspended sediment and other physical characteristics.

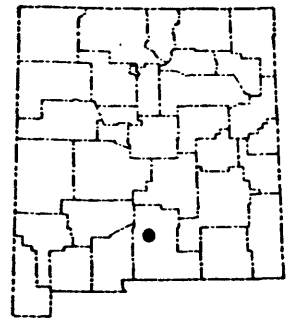
Progress and Significant Results: A reconnaissance of the treatment area has been completed. Three gaging stations and five sediment sampling sites have been installed on Tecolote Creek. Automatic water samplers were installed at all sites. Sediment samples were collected by automatic samplers and by observers during monthly site visits to define baseline characteristics.

Plans for FY 88: Continue data collection during the frost-free season to establish prelogging sediment relations.

Reports in Progress: None

Reports Released: None

NM-353 HYDROLOGIC PROPERTIES OF ALLUVIAL-FAN DEPOSITS SOUTH OF ALAMOGORDO, NEW MEXICO



Period of Project: June 1987 to September 1991

Principal Investigator: Brennon R. Orr

Cooperating Agency: U.S. Bureau of Reclamation

Problem: Limited fresh ground-water supplies on the eastern side of the Tularosa Basin increasingly are being stressed by municipal, military, and industrial development. Artificial recharge of floodwater flows from the Sacramento Mountains is being considered as one alternative to extend the life of these freshwater supplies. In order to determine the feasibility of artificial recharge, information is needed about the availability of water for recharge, the capability of alluvial-fan aquifers to store and transmit water, and the chemical compatibility between recharge water, existing ground water, and aquifer material.

Objectives: (1) To assess the capability of alluvial-fan deposits south of Alamogordo to store and transmit water and to define the horizontal and vertical extent of freshwater in these alluvial-fan deposits, (2) to determine the availability, quality, and variability of discharge from surface runoff and springs; and (3) to assess the effect of potential future development and artificial recharge upon existing ground-water flow systems.

Approach: A well inventory will be conducted and a ground-water monitoring network designed. Several wells will be equipped with water-level monitoring instrumentation. Water samples will be collected from selected wells for chemical analysis.

Several test holes will be drilled to collect lithologic and geophysical data. Petrographic studies will be conducted on drill-cutting samples collected from test holes. Water budgets will be developed, and potentiometric-surface maps will be constructed. Aquifer-test data will be compiled and evaluated. If necessary, multiple-well aquifer tests will be designed and conducted.

Surface runoff and spring discharge in the Sacramento Mountains will be monitored by installing stream-gaging stations and by making miscellaneous discharge measurements. Seepage runs will be conducted on selected streams.

Computer simulations using water-quality modeling techniques will be used to evaluate the compatibility of surface water, ground water, and alluvial-fan deposits. Analytical and numerical techniques will be used to evaluate the effect of additional stresses and artificial recharge on water levels and water quality.

Progress and Significant Results: Seepage-run data from the Sacramento River were analyzed. Long-term hydrographs from observation wells were compared with surface-water discharge data from the Rio La Luz.

Plans for FY 88: Install stream-gaging stations on tributaries to the Tularosa Basin. Conduct seepage runs on Rio La Luz and other streams. Conduct a seismic reconnaissance on alluvial fans south of Alamogordo to determine saturated thickness and to design a test-well drilling program.

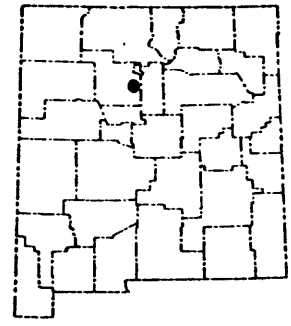
Reports in Progress:

Nagel, C.D., Base-flow investigation and compilation of streamflow data for the Sacramento River [colleague review].

Nagel, C.D., and Orr, B.R., Base-flow investigation and ground-water/surface-water relations on the Rio La Luz [initial preparation].

Reports Released: None

NM-354 INVESTIGATION OF SEEPAGE DOWNSTREAM FROM COCHITI LAKE IN SANDOVAL COUNTY, NEW MEXICO



Period of Project: August 1987 to September 1989

Principal Investigator: Paul J. Blanchard

Cooperating Agency: U.S. Army Corps of Engineers

Problem: Rising ground-water levels in the Rio Grande flood plain downstream from Cochiti Lake are causing some land to become waterlogged and unusable for agriculture. Seepage through and around Cochiti Dam is acknowledged. Flow in the reach of the Santa Fe River downstream from the dam has changed from intermittent to perennial. Unlined canals used to distribute irrigation water to crops grown on the flood plain downstream from Cochiti Lake may contribute to waterlogging of adjacent cropland and pastureland. The ground-water flow system downstream from Cochiti Lake may be complex.

Objectives: The objectives of this investigation of ground-water conditions downstream from Cochiti Lake to Peña Blanca are to: (1) Determine what effect the Cochiti East Side Main Canal and the Sili Main Canal may have on ground-water levels; (2) determine seasonal fluctuations and long-term trends in ground-water levels; and (3) describe the ground-water flow system in the area.

Approach: Review existing data and reports. Conduct streamflow measurements along the Cochiti East Side Main Canal and the westside Sili Main Canal to determine seepage gains or losses. Establish a network of monitoring wells, including existing wells and wells to be drilled as part of this project, to determine direction of ground-water flow and vertical ground-water gradients. Measure water levels monthly in the monitoring wells. Summarize and analyze collected data to describe the ground-water flow system downstream from Cochiti Lake to Peña Blanca.

Progress and Significant Results: Water levels were measured monthly in 19 observation wells. A contract for drilling 13 or more additional observation wells is in preparation. A study of streamflow gain and loss was conducted in the Cochiti East Side Main Canal and in the Sili Main Canal.

Plans for FY 88: Continue measuring water levels in the 19 observation wells. Drill the additional observation wells and conduct monthly water-level measurements in them.

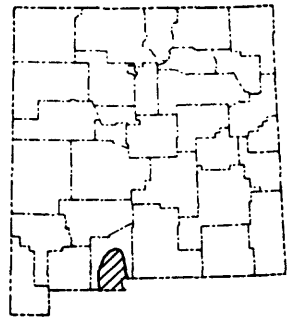
Reports in Progress:

Blanchard, P.J., Comparison of water levels in shallow and deep wells downstream from Cochiti Lake to Peña Blanca, Sandoval County, New Mexico [initial preparation].

Blanchard, P.J., and Roybal, F.E., Ground-water conditions downstream from Cochiti Lake to Peña Blanca, Sandoval County, New Mexico [initial preparation].

Reports Released: None

NM-355 EFFECTS OF GROUND-WATER WITHDRAWALS ON THE RIO GRANDE IN THE MESILLA BASIN, NEW MEXICO AND TEXAS



Period of Project: October 1987 to September 1989

Principal Investigator: Peter F. Frenzel

Cooperating Agency: U.S. Section, International Boundary and Water Commission

Problem: The U.S. Section, International Boundary and Water Commission recognizes that pumping in the Mesilla Basin has affected flow in the Rio Grande. In order to fulfill its responsibility to oversee allocation of water between the United States and Mexico in accordance with the terms of the 1906 treaty, the U.S. Section needs quantitative predictions of the effect of present and future pumping on the Rio Grande.

Objectives: The objectives of this study are to evaluate the effects of existing and future pumping in the Mesilla Basin on flow in the Rio Grande and on water levels within the aquifer. A secondary objective is to develop technical capability within the U.S. Section to operate and update the ground-water model.

Approach: The recently developed U.S. Geological Survey model of the Mesilla Basin will be updated with post-1975 conditions and new information on the aquifer properties and geohydrology. The model will be recalibrated, if necessary, and sensitivity analyses performed. Scenarios of development, provided by the International Boundary and Water Commission, will be individually incorporated into the model, and the effect on water levels and streamflow depletion will be estimated.

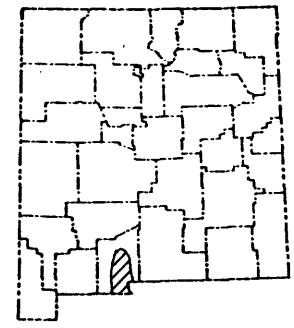
Progress and Significant Results: Collection of pumpage data has begun.

Plans for FY 88: Update the existing model to simulate historical trends through 1985.

Reports in Progress: None

Reports Released: None

NM-356 MONITORING OF THE GROUND-WATER/ SURFACE-WATER RELATIONS IN THE MESILLA BASIN, SOUTH-CENTRAL NEW MEXICO



Period of Project: October 1987 to September 1989

Principal Investigator: Edward L. Nickerson

Cooperating Agencies: U.S. Bureau of Reclamation and the U.S. Section, International Boundary and Water Commission

Problem: Large increases in population in and adjacent to the Mesilla Basin have resulted in increased withdrawals of ground water. A significant hydraulic connection exists between the ground-water flow system and the Rio Grande. Long-term hydrologic data are needed to monitor the effect of ground-water pumpage on flow in the Rio Grande.

Objectives: To expand the observation-well network in areas where the density of data is sparse, to conduct seepage investigations on the Rio Grande, and to monitor ground- and surface-water levels and streamflow within the Mesilla ground-water basin.

Approach: Expand the monitoring network by construction of approximately 20 wells in the flood-plain alluvium. Conduct an inventory on about 20 existing wells completed in the Santa Fe Group for inclusion in the network. Conduct seepage investigations on the Rio Grande and relate findings to ground-water levels. Obtain surface- and ground-water samples for chemical analyses.

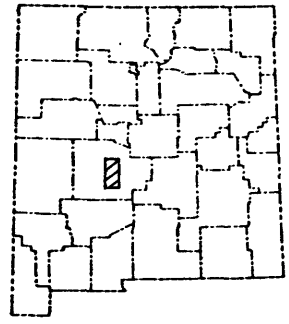
Progress and Significant Results: A seepage investigation was conducted on the Rio Grande from Radium Springs, N. Mex., to El Paso, Tex. This investigation consisted of 35 measurements on the main stream, drains, and tributaries. Water-chemistry data were collected in the field at each site, and water samples were collected at six main-stream sites for chemical analyses. Concurrent with this investigation, water levels were measured in observation wells completed in the flood-plain alluvial aquifer.

Plans for FY 88: Twenty well sites will be located in the flood-plain alluvium as part of the expansion of the present observation-well network. Approximately 20 wells completed in the Santa Fe Group will be inventoried and added to the observation-well network. Data from all surface-water measurements and observation wells will be entered into a computer data base and published in annual data reports.

Reports in Progress: None

Reports Released: None

NM-357 FIELD-SCREENING STUDY OF THE MIDDLE RIO GRANDE PROJECT, BOSQUE DEL APACHE NATIONAL WILDLIFE REFUGE, NEW MEXICO



Period of Project: October 1987 to September 1989

Principal Investigators: Kim Ong, U.S. Geological Survey; Thomas F. O'Brien, U.S. Fish and Wildlife Service; and Bryan Pridgeon, U.S. Bureau of Reclamation

Cooperating Agencies: U.S. Fish and Wildlife Service and the U.S. Bureau of Reclamation

Problem: An ad hoc Department of Interior Interagency Committee on Irrigation Drainage initiated a program in 1986 for assessing water quality of irrigation drainage as it may affect the health of humans, fish, and wildlife. The Bosque del Apache National Wildlife Refuge is one of 19 areas in the western United States selected for a field screening study. Irrigation drainage from the U.S. Bureau of Reclamation's Middle Rio Grande Project flows into the Bosque del Apache National Wildlife Refuge.

Objective: The major objective of this study is to collect data for assessing whether water-quality conditions exist in the irrigation drainage system flowing into and within the Bosque del Apache that may be harmful to the health of humans, fish, or wildlife.

Approach: At specific sites in the irrigation drainage canals and the nearby Rio Grande, water and bottom-sediment samples will be collected for analyses of organic and inorganic chemical constituents. The chemical analyses will include determinations for concentrations of selenium, arsenic, heavy metals, radioactive elements, insecticides, and herbicides. Water and bottom-sediment samples also will be collected from ponds and marshes that are filled with water from irrigation canals. Additionally, samples will be collected from a tile-drained irrigated field and from a well that supplies warm water to the ponds during the winter. The water and sediment samples will be analyzed by laboratories of the U.S. Geological Survey.

Biological samples of selected species of resident birds, fish, aquatic invertebrates, and aquatic vegetation will be collected for organic and inorganic chemical analyses by the U.S. Fish and Wildlife Service laboratory. These samples will be analyzed for many of the same constituents analyzed in the water and bottom-sediment samples.

Water and bottom-sediment samples from the canals and the Rio Grande will be collected at the start, during, and after the end of the irrigation season. The ponds, marshes, and warmwater well will be sampled when the wintering migratory birds are present at the refuge. Biological samples will be collected during the spring and summer.

The data collected from this study will be examined and compared with data from previous studies conducted in the Bosque del Apache National Wildlife Refuge and nearby reaches of the Rio Grande and its tributaries.

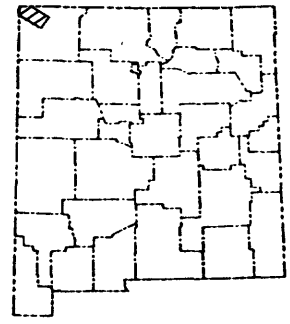
Progress and Significant Results: Sampling sites have been established, and samples of water and bottom sediments have been collected from the irrigation drainage canals. Several analytical reports from the laboratory have been received.

Plans for FY 88: All water samples, bottom-sediment samples, and biological specimens will be collected and analyzed. A search for data from other related studies will be made. These data will be evaluated and compared with data collected from this study.

Reports in Progress: None

Reports Released: None

NM-358 CONTRIBUTIONS OF SALINITY TO THE SAN JUAN RIVER IN THE HOGBACK AREA, NORTHWEST NEW MEXICO



Period of Project: October 1987 to September 1988

Principal Investigator: Carole L. Goetz

Cooperating Agency: U.S. Bureau of Reclamation

Problem: There are increases in salt concentrations from ground-water discharge to the San Juan River along the reach between the Hogback and Four Corners. Sources of saltwater discharged to the San Juan River by ground and surface water need to be located to control the discharge of saltwater. Additional information regarding the quantity and quality of water moving through alluvial and bedrock aquifers that discharge to the river is needed to understand the contribution of salt loads from ground water.

Objectives: This study is to provide additional hydrologic information about the sources of salt loading on the San Juan River from the Hogback to Four Corners. An additional objective is to estimate the size of the load from each source and the potential for control.

Approach: An evaluation of the loading potential of each of the ground-water aquifers discharging to the San Juan River between the Hogback and Four Corners will be made. Water from identified sources will be sampled and analyzed for oxygen, hydrogen, and sulfur isotopic ratios. Well points will be driven into the alluvium at selected sites in order to allow the collection of water-quality samples. The San Juan River channel and tributaries will be sampled in order to assess the increase in salt loading from the Hogback to Four Corners. Geophysical surveys may be used to define the extent of alluvial aquifers.

Progress and Significant Results: Nineteen ground-water and surface-water samples have been collected from the San Juan River, tributaries, springs, seeps, and wells in alluvial aquifers between the Hogback and Four Corners. Specific conductance was closely monitored in the San Juan River main stem in this area.

Plans for FY 88: Evaluate the results of the water-quality analyses. Determine the need for geophysical surveys and conduct the surveys if needed. Analyze the potential for control of any identified salt loads. Prepare an administrative report of the findings.

Reports in Progress: None

Reports Released: None

NM-359 INTERNATIONAL HYDROLOGIC EVALUATIONS AND DEVELOPMENT OF AN INTERNATIONAL WATER-RESOURCES DATA BASE IN SUPPORT OF THE ENGINEER TOPOGRAPHIC LABORATORY, TERRAIN ANALYSIS CENTER

Period of Project: Continuous since 1985

Principal Investigator: Cynthia M. Abeyta

Cooperating Agency: U.S. Army Corps of Engineers, Engineer Topographic Laboratories, Terrain Analysis Center, Fort Belvoir, Virginia

Problem: In the past, most United States military deployments have been in nonarid areas of the world where freshwater supplies were relatively accessible. Recently U.S. military planners have recognized a need for water-support planning in parts of the world where water resources are limited and difficult to access.

Objectives: Determine distribution and availability of surface and ground water in various parts of the world.

Approach: Compile hydrologic and geologic data to be incorporated into a worldwide water-resources data base. Analyze and interpret compiled water-resources information. Results will be used in preparing hydrologic maps of specified study areas.

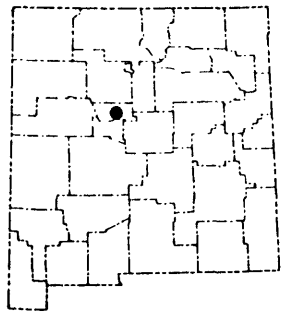
Progress and Significant Results: In FY 87, hydrologic investigations were completed for specified areas in the countries of Kuwait, Somalia, and Egypt. In addition, hydrologic investigations were begun for the countries of Honduras, Bahrain, Qatar, and Iran.

Plans for FY 88: Continue hydrologic investigations of countries in South America and Persian Gulf areas.

Reports in Progress: Administrative reports will be released on the hydrology of specified areas in the countries of Honduras, Bahrain, Qatar, and Iran.

Reports Released: Administrative reports on hydrology of specified areas in the countries of Kuwait, Somalia, and Egypt.

NM-360 INVESTIGATION OF POSSIBLE GROUND-WATER CONTAMINATION AT KIRTLAND AIR FORCE BASE, NEW MEXICO



Period of Project: February 1988 to January 1989

Principal Investigators: Don L. Hart and Paul J. Blanchard

Cooperating Agency: U.S. Air Force

Problem: The Occupational and Environmental Health Laboratory of the U.S. Air Force has identified several sites of potential ground-water contamination at Kirtland Air Force Base. These potential contamination sites are the result of historical and ongoing activities at the base.

Objective: The objective of this investigation is to determine the presence or absence of ground-water contamination at approximately nine sites at Kirtland Air Force Base.

Approach: Existing geologic and hydrologic information and reports will be reviewed. Samples from selected surface-water bodies will be analyzed for heavy metals and volatile organic compounds. Approximately 20 ground-water monitoring wells will be drilled, and water samples will be collected and analyzed for heavy metals, nitrate compounds, and volatile organic compounds. In addition to the laboratory analyses, several surface sites and well borings will be tested using a gas chromatograph. The resulting information will be used to determine if contamination exists, and if so, to what degree.

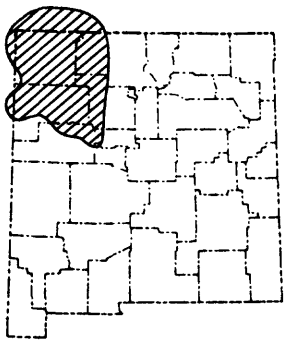
Progress and Significant Results: New project.

Plans for FY 88: Complete surface-water sampling and chemical-quality analyses. Complete project staffing and detailed planning of drilling, ground-water sampling, and chemical-quality analyses.

Reports in Progress: None

Reports Released: None

NM-423 SAN JUAN STRUCTURAL BASIN REGIONAL AQUIFER-SYSTEMS ANALYSIS, NEW MEXICO



Period of Project: October 1984 to September 1990

Principal Investigator: Gary W. Levings

Cooperating Agency: Federal Program

Problem: Competition for limited ground-water supplies in the San Juan Basin among mining, electric-power and other companies, municipalities, and Indian communities is increasing. Surface waters are fully appropriated, and ground-water use is projected to triple in the next 20 years. The quantity, quality, and availability of ground water are not well known, and aquifer systems are not well defined.

Objectives: To define the regional hydrogeologic systems; to define quantitatively the individual aquifer-flow systems; and to assess the effects of past, present, and future ground-water use on aquifers and streams.

Approach: Assemble and evaluate existing hydrologic data. Determine the need for additional data and collect same. Determine the availability of ground water for each pertinent water-bearing unit by analyzing geohydrologic data, constructing hydrologic maps, and describing the geohydrologic framework. Simulate the hydrologic system with a digital model. Assess the possible effects of ground-water development on the system.

Progress and Significant Results: Data collection consisted of inventorying 160 wells, measuring water levels in 37 observation wells, sampling 10 wells for detailed geochemical analysis (including major constituents and isotopes), and drilling 2 test wells completed in the Point Lookout and Gallup Sandstones. A contract was awarded for a study entitled "A chlorine-36 investigation of ground-water flow in the Morrison Formation and Dakota and Gallup Sandstones of the San Juan Basin, New Mexico."

A preliminary three-dimensional ground-water flow model of the Morrison-Dakota-Gallup flow system was assembled. The primary purpose of the model is to determine flow paths and times of travel for water in the Morrison Formation to assist in site selection for age-date analysis. Hydrologic investigations atlases for three aquifers--Morrison Formation, Dakota Sandstone, and Gallup Sandstone--were prepared and are in review. Data used in preparation of the map reports are from the WATSTORE and petroleum industry data bases.

Plans for FY 88: Data collection will continue with the inventory of wells in areas where data are needed, instrumentation will be installed for long-term monitoring of water levels in the two test wells completed during FY 87, and detailed geochemical sampling of selected wells--primarily in the Morrison, Dakota, or Gallup aquifers--will be completed. A major effort will be devoted to preparation of several hydrologic investigations atlases and continued processing of the three atlases currently in review. Compilation of the ground-water flow model will continue as data for each atlas become available. Project personnel will maintain contacts with the Geologic Division, State agencies, university personnel, Indian tribes, and private consultants.

Reports in Progress:

Craigg, S.D., Dam, W.L., Kernodle, J.M., Thorn, C.R., and Levings, G.W., Hydrogeology of the Point Lookout Sandstone in the San Juan structural basin, New Mexico, Colorado, Arizona, and Utah: U.S. Geologial Survey Hydrologic Investigations Atlas [in preparation].

Dam, W.L., Kernodle, J.M., Levings, G.W., and Craigg, S.D., Hydrogeology of the Morrison Formation in the San Juan structural basin, New Mexico, Colorado, Arizona, and Utah: U.S. Geological Survey Hydrologic Investigations Atlas [colleague review completed].

Kernodle, J.M., Levings, G.W., Craigg, S.D., and Dam, W.L., Hydrogeology of the Gallup Sandstone in the San Juan structural basin, New Mexico, Colorado, Arizona, and Utah: U.S. Geological Survey Hydrologic Investigations Atlas [colleague review completed].

Kernodle, J.M., and Philip, R.D., Using a geographic information system to develop a ground-water flow model: American Water Resources Association Monograph Series [in review].

Levings, G.W., Craigg, S.D., Dam, W.L., Kernodle, J.M., and Thorn, C.R., Hydrogeology of the Menefee Formation in the San Juan structural basin, New Mexico, Colorado, Arizona, and Utah: U.S. Geological Survey Hydrologic Investigations Atlas [in preparation].

Thorn, C.R., Levings, G.W., Craigg, S.D., Dam, W.L., and Kernodle, J.M., Hydrogeology of the Cliff House Sandstone in the San Juan structural basin, New Mexico, Colorado, Arizona, and Utah: U.S. Geological Survey Hydrologic Investigations Atlas [in preparation].

Reports Released:

Craigg, S.D., Dam, W.L., Kernodle, J.M., and Levings, G.W., in press, Hydrogeology of the Dakota Sandstone in the San Juan structural basin, New Mexico, Colorado, Arizona, and Utah: U.S. Geological Survey Hydrologic Investigations Atlas.

Dam, W.L., in press, Methods and preliminary results of geochemical sampling, San Juan structural basin, New Mexico: American Water Resources Association Monograph Series.

Welder, G.E., 1986, Plan of study for the Regional Aquifer-System Analysis of the San Juan structural basin, New Mexico, Colorado, Arizona, and Utah: U.S. Geological Survey Water-Resources Investigations Report 85-4294, 23 p.