INVESTIGATIONS AND RESEARCH IN NEVADA BY THE WATER RESOURCES DIVISION, U.S. GEOLOGICAL SURVEY, 1982-83

Compiled by
Terry Katzer, Otto Moosburner, and William D. Nichols

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ILLUSTRATION

CONVERSION FACTORS AND ABBREVIATIONS

"Inch-pound" units of measure used in this report may be converted to International System (metric) units by using the following factors:

Multiply	*By*	*To obtain*
Acres	0.4047	Square hectometers (hm^2)
Acre-feet (acre-ft)	0.001233	Cubic hectometers (hm^3)
Feet (ft)	0.3048	Meters (m)
Inches (in.)	25.40	Millimeters (mm)
Miles (mi)	1.609	Kilometers (km)
Square miles (mi^2)	2.590	Square kilometers (km^2)

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ABSTRACT

The Water Resources Division, U.S. Geological Survey, is charged with (1) maintaining a hydrologic network in Nevada that provides information on the status of the State's water resources and (2) engaging in technical water-resources investigations that have a high degree of transferability. To meet these broad objectives, 26 projects were active in Nevada during fiscal year 1982, in cooperation with 36 Federal, State, and local agencies. Total funds were $3,319,455, of which State and local cooperative funding amounted to $741,500 and Federal funding (comprised of Geological Survey Federal and cooperative programs plus funds from six other Federal agencies) amounted to $2,577,955 for the fiscal year.

Projects other than continuing programs for collection of hydrologic data included the following topics of study: geothermal resources, areal ground-water resources and ground-water modeling, waste disposal, prehistoric hydrology, acid mine drainage, the unsaturated zone, stream and reservoir sedimentation, river-quality modeling, flood hazards, and remote sensing in hydrology. For each project, the objectives, approach, progress in fiscal year 1982, and plans for fiscal year 1983 are described herein. A total of 26 reports and symposium abstracts were published or in press during fiscal year 1982 as an outgrowth of project work in the State.

INTRODUCTION

Mission

The mission of the Water Resources Division, in concert with the overall mission of the U.S. Department of the Interior and the Geological Survey, is to provide the hydrologic information and understanding needed for the best use and management of the Nation's water resources for the benefit of the people of the United States.

To accomplish its mission, the Water Resources Division, in cooperation with State and local governments and other Federal agencies:

- Collects, on a systematic basis, data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.

- Conducts analytical and interpretive water-resources investigations to describe the occurrence, availability, and physical, chemical, and biological characteristics of surface water and ground water.

- Conducts supportive basic and problem-oriented research in hydraulics, hydrology, and related fields of science and engineering to improve the basis for field investigations and measurement techniques and to understand hydrologic processes and systems sufficiently well to predict quantitatively their response to stress, either natural or manmade.

- Disseminates water data and the results of investigations and research through reports, maps, computerized information services, and other forms of public release.

- Coordinates the activities of Federal agencies in the acquisition of water data for streams, lakes, reservoirs, estuaries, and ground water.

- Provides scientific and technical assistance in hydrologic fields to other Federal, State, and local agencies, to licensees of the Federal Energy Regulatory Commission, and to international agencies on behalf of the U.S. Department of State.

Source of Funds

Programs of the Water Resources Division in Nevada are funded as follows: (1) the Federal program, which is specifically identified in annual Geological Survey appropriations made by Congress; (2) the Federal-State cooperative program, where the Water Resources Division represents national interests, the cooperating agencies represent State and local interests, and the funding is shared equally (the Federal share comes from direct Congressional appropriations); and (3) the Other-Federal-Agencies (OFA) program, which is funded by the agencies that request the work. (See figure 1.)

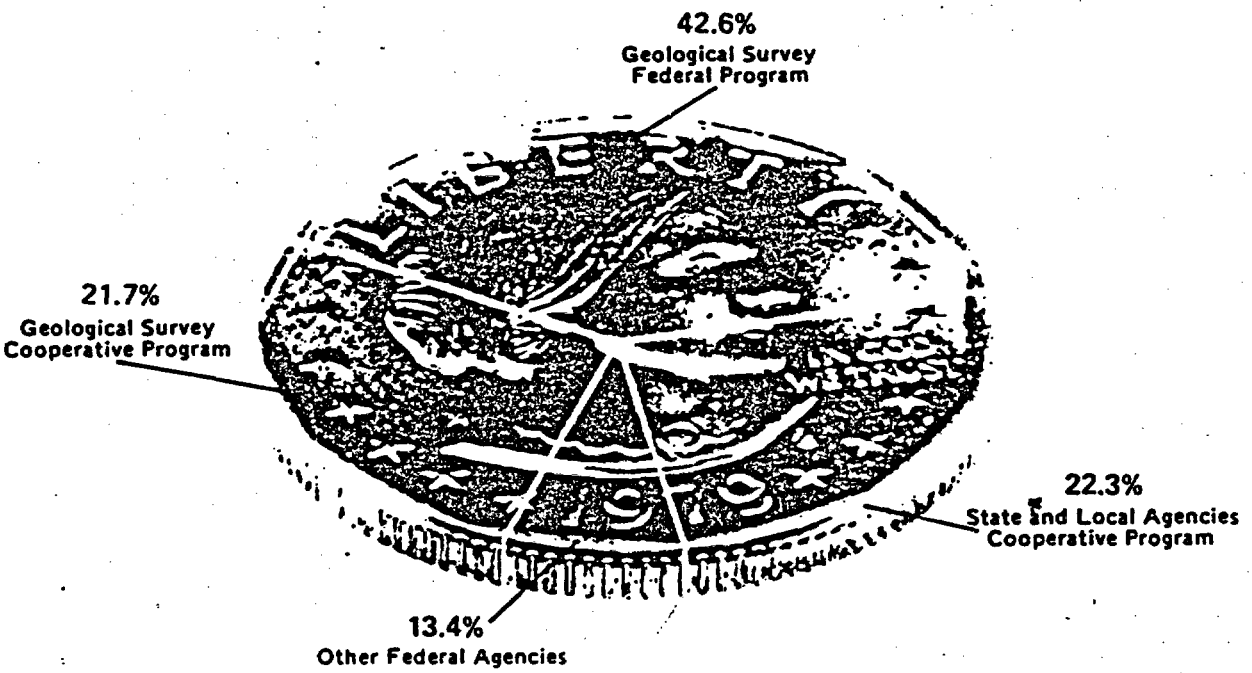
State and local agencies cooperating with the Nevada Office of the Water Resources Division during fiscal year 1982 (Oct. 1, 1981-Sept. 30, 1982) are listed on the following page.

Nevada Bureau of Mines and Geology
Nevada Department of Conservation and Natural Resources
- Division of Water Resources
- Cooperators through Division of Water Resources
  - Carson-Truckee Water Conservancy District
  - Carson Water Subconservancy District
  - City of Las Vegas
  - City of Reno
  - City of Sparks
  - Clark County Department of Public Work
  - U.S. District Court Water Master
  - Lander County Fair and Recreation Board
  - Nevada Power Company
  - Sierra Pacific Power Company
  - Southern California Edison
  - Truckee-Carson Irrigation District
  - U.S. Board of Water Commissioners
  - Walker River Irrigation District
  - Washoe County Public Works Department
- Division of Environmental Protection
- Division of Forestry

Nevada Department of Transportation
California Department of Water Resources
Clark County Department of Comprehensive Planning
Douglas County
Washoe County Regional Administrative Planning Agency
Carson City Public Works Department
Las Vegas Valley Water District
Lahontan Water Quality Control Board
University of California-Davis

Federal agencies that funded work in Nevada during fiscal year 1982 were as follows:

U.S. Army Corps of Engineers
U.S. Bureau of Indian Affairs
U.S. Bureau of Land Management
U.S. Bureau of Reclamation
U.S. Department of Energy
U.S. National Park Service



Geological Survey			
Federal program	42.6%		$1,412,800
Cooperative program	21.7		721,500
State and local agencies			
Cooperative program	22.3		741,500
Other Federal agencies	13.4		443,655
Total	100.0%	=	$3,319,455

FIGURE 1.--Nevada Office funding, fiscal year 1982.

WATER-RESOURCES ISSUES

Water is a valuable natural resource in Nevada. The availability and management of this resource is of primary concern to many State and local officials, to Federal agencies charged with stewardship of the resource, and to the citizens of the State. The resolution of water-resource problems inevitably involves a variety of conflicting and competing demands. Frequently, such problems can be more easily resolved if there are solid factual data and a sound scientific basis for guiding the decisionmaking process. Scientific observations and interpretations of the hydrologic cycle are the principal interest of the U.S. Geological Survey.

Many of the basic hydrologic processes in Nevada are not well known and remain to be quantified. The singularly important process of ground-water recharge to the numerous basins in Nevada is poorly understood and has been determined only empirically. The monitoring of movement and sampling of contaminants in the unsaturated zone is difficult at best. Once these contaminants reach the saturated zone, predicting their fate is neither simple nor straightforward. Even basic questions concerning the availability of water, particularly ground water, cannot be answered with certainty—especially questions concerning the quantities available and the long-term impacts of development. Technical advances over the past 10 years allow the use of techniques that provide better estimates with which to resolve some of these problems, but much work remains to be done.

Many important water or water-related problems and issues will face the State of Nevada in the coming years. The extent to which they can be resolved will depend in part on the technical progress in understanding the basic hydrologic processes involved. The following are a few examples of some of the more important issues.

Great Basin Carbonate-Rock Hydrology

Demand and competition for water in central, eastern, and southern Nevada are expected to increase. Las Vegas continues to look for additional supplies. Three coal-fired power plants, each of which can require as much as 30,000 acre-feet of water annually, have been constructed, and others are planned. Agricultural demand continues, and with an upturn in the economy, increased demand by the mining industry can be expected.

Many of these entities are considering the use of ground water in the carbonate rocks of central, eastern, and southern Nevada to meet the demands. This may represent a viable source of water, but little is known of the carbonate-rock aquifer system and the effects of increased development. A long-term study to evaluate the hydrology of the carbonate terrane is proposed. The Geological Survey, in cooperation with the White Pine Power Project in White Pine County and the Nevada Department of Conservation and Natural Resources, is beginning a 3-year reconnaissance investigation and comprehensive planning study to develop specific program goals and objectives for a succeeding 6- to 8-year investigation. Data and interpretations resulting from the Geological Survey's Great Basin Regional Aquifer System Analysis (see following discussion) will be used extensively in developing the continuing program.

Great Basin Aquifer Systems

Population centers in Utah along the west flank of the Wasatch Mountains and in Nevada along the east flank of the Sierra Nevada are experiencing rapid growth and increased demand for water. In many of these areas, demand has increased so much that no readily exploitable source of water remains. Careful management of all water resources is needed to meet anticipated future needs. Conversely, the central part of the Great Basin is characterized by remoteness and open space; in recent years, these attributes have become a resource. Large coal-fired power plants are being constructed at several locations, and other areas are being evaluated as potential sites for nuclear waste disposal. Colorado River water is currently imported by the Southern Nevada Project, and similar imports are planned by the Central Utah Water Project. Ground-water resources in much of the region will be impacted during the next several decades. Impacts will be on both regional and local scales.

Adequate understanding of the complex ground-water systems involved is prerequisite to wise ground-water management. Fiscal year 1982 is the second of a 4-year effort by the Geological Survey to characterize the various aquifer systems. The study, known as the Great Basin Regional Aquifer System Analysis, will develop much of the regional perspective and broad understanding of the resource required to cope with full impacts of anticipated future development.

Diamond Valley

Located on the western edge of the carbonate-rock terrane, this is one of the first valleys in central Nevada to experience significant lowering of ground-water levels and reduction in spring discharge as a result of pumping for irrigation. Work on a mathematical model to represent this system is scheduled to start in fiscal year 1984.

Humboldt River

Ground-water pumping in some valleys tributary to the Humboldt River has caused water levels to decline for several years and may ultimately decrease ground-water flow to the river. Paradise Valley, a tributary basin, is the only one that is currently being evaluated hydrologically. This work is being done as part of the Great Basin Regional Aquifer Systems Analysis.

Nevada Test Site

The Nevada Test Site, north of Las Vegas, is a leading candidate for the siting of a repository for high-level nuclear waste. An evaluation of the geohydrology has pointed to the east flank of Yucca Mountain as a possible location. Work is underway to evaluate in detail the unsaturated zone, the ground-water system, and the flood hazards at this site. No decisions have as yet been made, however, for locating the facility at the Test Site.

Beatty Repository for Low-Level Solid Radioactive Waste

A study has been underway for several years to define the hydrology and geology at this site. The net downward movement of water through the unsaturated zone is unknown; consequently, the potential rate of downward movement of radioactive solutes cannot be determined for present climatic conditions. Applied research regarding the unsaturated zone is being done at the site in an attempt to better understand processes related to the possible migration of buried waste.

MX Water Supply

The recent change in basing mode of the MX Missile has caused the U.S. Air Force to suspend their hydrologic investigations in Nevada and western Utah. Their entire ground-water data network, some 300 wells, has been turned over to the U.S. Geological Survey. The Air Force is also considering the designation of the Nevada Department of Conservation and Natural Resources, the Geological Survey, or other appropriate agencies as the repositories for all of their geohydrologic data.

Las Vegas Valley

Several years of cooperative work between the Geological Survey, the Clark County Department of Comprehensive Planning, the Nevada Department of Conservation and Natural Resources, and the Las Vegas Valley Water District have led to the development of a mathematical ground-water model and a delineation of ground-water quality that will allow planners and developers to better manage the water resources in the valley. Two main items of concern are subsidence, which is still occurring in the valley, and the potential for ground-water contamination. As part of the cooperative program, the Clark County Department of Comprehensive Planning will operate the Geological Survey model. The Survey is providing user training for a member of the Planning Department.

Flood Hydrology

A major problem facing planners and developers as well as the public is the simple question, "What areas are safe from flooding?" Twenty years of cooperative effort with the Nevada Department of Transportation, and more recently with the Nevada Bureau of Mines and Geology, has provided the basic data to answer the above question with some degree of confidence. However, 20 years of data collection is but a short period of time from a geohydrologic standpoint. Thus, it seems entirely appropriate to extend the existing data base back in time—to "resurrect" past floods and define the corresponding magnitudes. If these paleohydrologic efforts are successful, the results, in conjunction with the data on current floods, will provide a very useful tool for planners and developers.

Lake Tahoe

Lake Tahoe is one of the clearest and most beautiful lakes in North America. Research has shown that its aesthetic beauty is being threatened by a reduction in water clarity and a concomitant increase in aquatic-plant production. The Lake's water-quality problems are believed to be caused primarily by excess sediment and nutrient loads from tributary streams that drain developed areas. Nutrient inputs from other sources such as the atmosphere and ground-water recharge need to be quantified.

Truckee-Carson River System

Overdemand, conflicting use, and deteriorating water quality affecting re-establishment of endangered fish species are continuing major problems facing water users of the Truckee-Carson River system. River flows are well defined, as are some aspects of water quality. However, the water-quality impact of man on the system is not well defined. Some phases of this work have been completed, but much remains to be done before the managers and planners will have workable hydrologic tools.

Contamination of Ground Water by Industrial Waste near Henderson

Leakage of stored chemicals and the practice of onsite disposal of chemical wastes generated at the Henderson Industrial Complex near Las Vegas from 1940 to 1970 have resulted in contamination of the near-surface ground water. At least three distinct chemical plumes have been identified in proximity to the 4,200-acre complex. One plume contains elevated concentrations of pesticides and organic compounds such as benzene. The other two plumes contain elevated concentrations of inorganic constituents such as nitrate, and chloride, as well as a variety of trace metals.

The areal extent, the rate of contaminant movement, and the biogeochemical processes affecting such movement have yet to be fully evaluated. The State of Nevada, however, is developing a program to eliminate or minimize the long-term effects of the ground-water contamination at the Henderson Complex.

WATER RESOURCES DIVISION PHILOSOPHY

Accurate hydrologic data are invaluable to the efficient design and management of water-related projects. If the available hydrologic data are not used or if the hydrologic system is not understood, then inefficiency, high cost, and adverse impacts are sure to follow. For example, sewage-treatment plants can be overdesigned in terms of the removal of potential pollutants--a process that is expensive and may in fact compound the water-quality problem, depending on the downstream ecosystem. Conversely, under-designed plants cost much less initially, but the resultant downstream water-quality problems may require an inordinate later expense to rectify. On a national level, good streamflow data on interstate and international waters are necessary for harmonious interactions between often competing parties. The point is that the hydrologic system must be understood to allow its optimum use.

It is within this framework that the Water Resources Division operates, and must therefore be responsive to the needs of the local, State, and regional cooperators, as well as satisfying a national need. This can be accomplished by:

1. Maintaining a hydrologic network that provides government entities with information on the status of our water resources, and

2. Engaging in broad-scale investigations that have a high degree of transferability, and therefore include both basic and applied research.

An examination of the following projects shows that most are interdisciplinary, thus drawing on the expertise of Water Resources Division scientists having diverse professional backgrounds. The selection of these projects is a unique process, and great weight is given to the scientific knowledge that the resulting work will provide. Often, a study that has high local interest and considerable value as applied research will be given a lower priority in favor of a project that has basic as well as applied research aspects. The competition for Water Resources Division dollars and expertise is great and, in these times of shrinking resources, will probably become even greater. It is appropriate, therefore, to select projects that are not only interdisciplinary but also bring the expertise of the Water Resources Division to bear on significant unresolved hydrologic problems. Thus, a basic process, such as ground-water recharge, can be investigated through the combined efforts of several projects. It is within these guidelines that the following projects were selected for fiscal year 1982.

PROJECTS FUNDED IN
FISCAL YEAR 1982

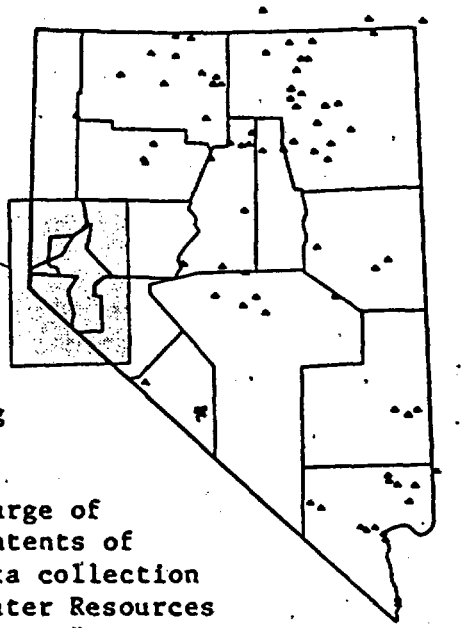
Summary of Projects

Project title and number	Status as of Oct. 1, 1982
Surface-water data network (NV 001)	Continuing
Ground-water data network (NV 002)	do.
Water-quality data network (NV 003)	do.
Water-use inventory (NV 007)	do.
Flood investigations (NV 036)	do.
History of water supplies for mining camps (NV 045)	Completed in FY 1982
Pumping effects on Devils Hole (NV 049)	Continuing
Environmental studies (NV 056)	do.
Beatty disposal-site investigation (NV 072)	do.
Las Vegas Valley ground-water models (NV 081)	do.
Geothermal studies (NV 083)	do.
Great Basin aquifer systems (NV 091)	do.
Statewide ground-water level network (NV 095)	do.
Carson Valley ground-water model (NV 096)	do.
Washoe County ground water (NV 097)	do.
Edgewood Creek sediment and nutrient transport (NV 098)	do.
Geochemistry of Leviathan Mine drainage (NV 099)	do.
Lahontan Reservoir sedimentation history (NV 100)	do.
Hydrologic studies at Nevada Test Site (NV 101)	do.
Unsaturated zone studies at Nevada Test Site (NV 102)	do.
Paleohydrology (NV 103)	do.
Las Vegas ground-water quality network (NV 104)	do.
Flood hazards Fortymile Wash (NV 105)	do.
Great Basin flood hazards (NV 108)	do.
Remote sensing in hydrology (NV 109)	do.
Truckee River water-quality model (NV 111)	do.

Status of Individual Projects

Surface-Water Data Network (NV 001)

Location: Statewide.
Period of project: Continuing.
Project leader: Howard R. Frisbie.



Objective: Collect surface-water data sufficient to permit (1) assessment of water resources, (2) operation of reservoirs, (3) forecasting, (4) evaluation of waste disposal and pollution control, (5) fulfillment of legal requirements, and (6) assessment of statistical properties and trends in occurrence of water in streams, lakes, reservoirs, canals, and drains for use in planning and design.

Approach: Measure and record the stage and discharge of streams, canals, and drains, and the stage and contents of lakes and reservoirs. The standard methods of data collection used are described in the series "Techniques of Water Resources Investigations of the United States Geological Survey."

Progress in FY 1982: Continued collection and compilation of stage and discharge data for 120 recording gages, stage, and contents data for 21 lakes and reservoirs, and partial-record data for 6 low-flow stations. All data were incorporated as part of the WATSTORE (National Water Data Storage and Retrieval) System of the U.S. Geological Survey.

Plans for FY 1983: Continue scheduled program of statewide data collection.

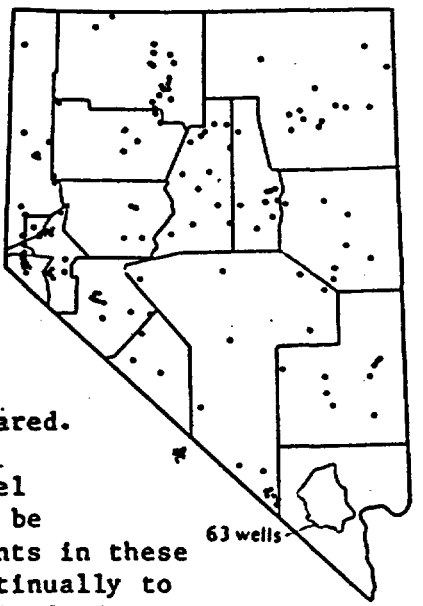
Data supplied by: Washoe County, Truckee-Carson Irrigation District, Pershing County Water Conservation District, Salmon River Canal Company, Walker River Irrigation District, Nevada Power Company, Colorado River Commission of Nevada, and U.S. Bureau of Reclamation.

Funding sources: Corps of Engineers, U.S. Army; Bureau of Indian Affairs, Bureau of Land Management, Bureau of Reclamation, and Geological Survey, U.S. Department of the Interior; U.S. District Court Water Master, U.S. Board of Water Commissioners; Nevada Department of Conservation and Natural Resources, Nevada Department of Transportation, California Department of Water Resources; Lander County Fair and Recreation Board, Washoe County Public Works Department, Carson City Public Works Department, City of Las Vegas, City of Reno, City of Sparks, Carson Water Subconservancy District, Carson-Truckee Water Conservancy District, Truckee-Carson Irrigation District, Walker River Irrigation District, Nevada Power Company, Sierra Pacific Power Company, and Southern California Edison.

Report product: U.S. Geological Survey, 1982, Water resources data for Nevada, water year 1980: U.S. Geological Survey Water-Data Report NV-80-1, 426 p.

Ground-Water Data Network (NV 002)

Location: Statewide.
Period of project: Continuing since 1945.
Project leader: David B. Wood.



Objective: (1) Establish and maintain an observation-well network sufficient to provide a minimum long-term data base so that the general response of the hydrologic system to climatic variations and induced stresses is known, and potential problems can be identified early enough to allow proper planning and management of the water resources; and (2) provide a data base with which the short-term records acquired in areal studies can be compared.

Approach: (1) Select wells in which the water-level fluctuations are representative of the aquifers to be monitored; (2) make periodic water-level measurements in these wells; and (3) evaluate and revise the network continually to provide the best possible coverage for the available funding.

Progress in FY 1982: An intensive effort in the Humboldt River basin resulted in 442 water-level measurements and a total of 500 wells inventoried. More than 200 other measurements were obtained for the statewide network and about 260 measurements were obtained for the Las Vegas network.

Plans for FY 1983: Well-data records will continue to be updated, coded, and processed for storage and retrieval in the automated data base. The number of wells measured in the State observation well network and the special-purpose network will be revised. An intensive water-level measurement effort will be made in east-central Nevada.

Funding sources: Nevada Department of Conservation and Natural Resources and U.S. Geological Survey.

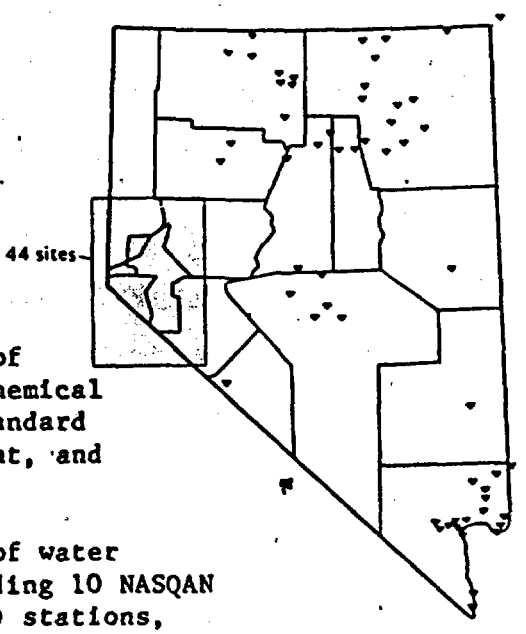
Report products:

U.S. Geological Survey, 1982, Water resources data for Nevada, water year 1980: U.S. Geological Survey Water-Data Report NV-80-1, 426 p.

Wood, D. B., [in press], Water-level changes associated with ground-water development in Las Vegas Valley, Nevada, March 1978 to March 1979: Nevada Division of Water Resources Information Report 30.

Water-quality Data Network (NV 003)

Location: Statewide.
Period of project: Continuing since 1951.
Project leader: Richard J. LaCamera.



Objective: (1) Provide a bank of water-quality data for broad Federal and State planning and action programs and (2) provide data for Federal management of interstate waters.

Approach: Establish and operate a network of water-quality stations to provide data on chemical concentrations, loads, and time trends. Standard methods of water-sample collection, treatment, and analysis are used.

Progress in FY 1982: Statewide monitoring of water quality continued at 74 stream sites, including 10 NASQAN (National Stream Quality Accounting Network) stations, 2 Hydrologic Bench-Mark stations, 13 lake and spring sites, and 2 wells. Data collected at least once per day were: water temperature and specific conductance at 11 stations, and water temperature alone at 6 stations.

Plans for FY 1983: The present network will be continued at a reduced level. Eight NASQAN stations will be sampled every 2 months. Two NASQAN and two Bench-Mark stations will be sampled only quarterly. Data collected at least once per day will be as follows: water temperature and specific conductance at nine stations, and water temperature alone at one station.

Funding sources: U.S. Bureau of Reclamation, Nevada Department of Conservation and Natural Resources, and U.S. Geological Survey.

Report product:

U.S. Geological Survey, 1982, Water resources data for Nevada, water year 1980: U.S. Geological Survey Water-Data Report NV-80-1, 426 p.

Water-Use Inventory (NV 007)

Location: Statewide.
Period of project: Continuing since 1965.
Project leader: Walter L. Rennick.

Objective: Develop and implement a data-collection and management system that will provide water-use information for planning, budgeting, and managing the water and associated land resources of Nevada. Ground-water pumpage and surface-water use for agriculture, industry, residences, and livestock are included in the inventory.

Approach: The general approach will be to compile information on the basis of the smallest unit feasible, and then sum the results. Two major benefits will be realized from this approach: (1) many people are knowledgeable about the water requirements of small areas; thus, the small-unit technique provides more sources of reliable information; (2) compilations detailed enough to provide specific information about small areas are very useful within the State, quickly becoming valuable sources of information for many State and local agencies.

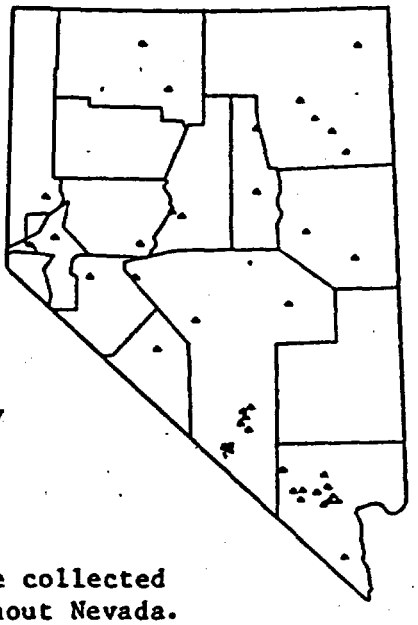
Progress in FY 1982: Work began on developing a Nevada State Water-Use Data-Base Management System through the use of remote sensing. Hardware acquisition and software development proceeded through the year. Cooperating agencies in the State were contacted, and arrangements were made for participation in the collection of water-use data.

Plans for FY 1983: Continue development of the State data-base system, complete hardware and software development, and map a test area such as Paradise Valley.

Funding sources: Nevada Department of Conservation and Natural Resources and U.S. Geological Survey.

Flood Investigations (NV 036)

Location: Statewide.
Period of project: Continuing since 1962.
Project leader: Robert R. Squires.



Objective: Appraise the frequency and magnitude of floods on Nevada streams as they relate to the design of highways and related hydraulic structures.

Approach: Install and operate crest-stage gages to measure peak stage; make indirect measurements to determine peak discharge. Visit sites periodically to determine whether flood flows have occurred and to make necessary measurements. Accumulate data to provide the basis for preparation of flood magnitude and frequency curves.

Progress in FY 1982: Peak streamflow data were collected and interpreted at 40 crest-stage sites throughout Nevada. Flooding at several ungaged sites throughout the State was investigated, and peak-flow determinations were made when possible.

Plans for FY 1983: The emphasis will be placed on verification of streambed roughness coefficients, continued collection of data, and investigations of mud and debris flows.

Funding sources: Nevada Department of Transportation, Clark County Department of Public Works, and U.S. Geological Survey.

Report product:

U.S. Geological Survey, 1982, Water resources data for Nevada, water year 1980: U.S. Geological Survey Water-Data Report NV-80-1, 426 p.

History of Water Supplies for Mining Camps (NV 045)

Location: Statewide.
Period of project: 1973 through 1982.
Project leader: Hugh A. Shamberger.

Objective: Gather information and prepare reports on the history of the water supplies at selected major mining camps in Nevada.

Approach: (1) Interview the few remaining "old timers" for first-hand information on the camps, (2) search records at libraries, State offices, and newspaper files, (3) make field investigations at each site, and (4) prepare a report on each mining district studied.

Progress in FY 1982: Completed the last report in a series of ten.

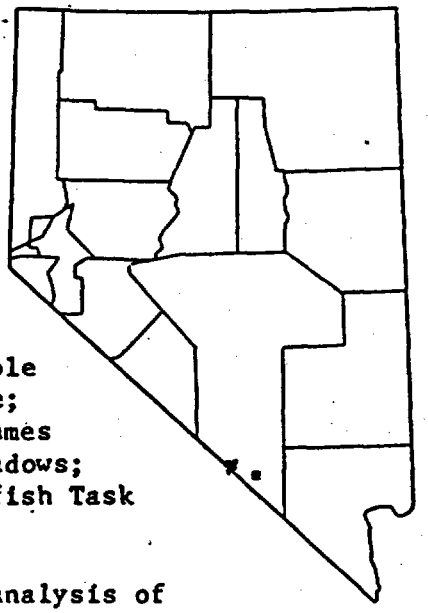
Plans for FY 1983: None.

Funding source: U.S. Geological Survey.

Report product:

Shamberger, H. A., 1982, Historic mining camps of Nevada--Goldfield: Carson City, Nev., Nevada Historical Press, 240 p.

Pumping Effects on Devils Hole (NV 049)



Location: Ash Meadows, Nye County.
Period of project: Continuing since 1971.
Project leader: Rodney L. Carson.

Objective: Monitor water levels in Devils Hole and nearby wells, and measure nearby spring discharge to determine the effects of pumping on the pupfish—an endangered species—in Devils Hole. Publish collected data.

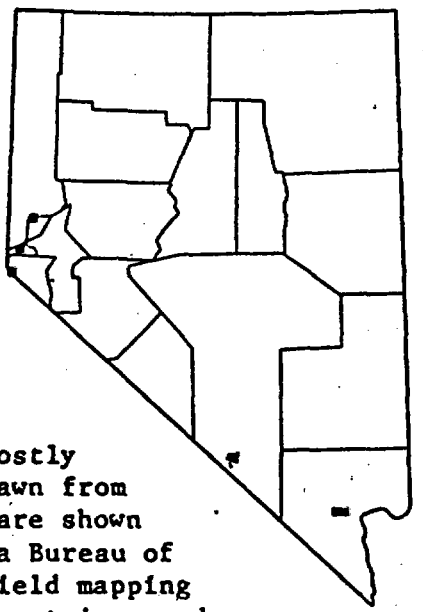
Approach: (1) Measure water levels in Devils Hole and nearby wells, using recorders where possible; (2) measure spring discharge using weirs and flumes with recorders; (3) inventory pumpage in Ash Meadows; and (4) prepare monthly data reports to the Pupfish Task Force.

Progress in FY 1982: Continued collection and analysis of springflow and ground-water data.

Plans for FY 1983: Continue data collection and analysis.

Funding source: U.S. National Park Service.

Environmental Studies (NV 056)



Location: Statewide.
Period of project: Continuing since 1974.
Project leader: Terry Katzer.

Objective: On 7½-minute quadrangles, delineate (1) flood-hazard areas (those subject to 100-year flooding) and determine flood frequency, (2) sediment transport and hazards, (3) areas of shallow ground water and water logging, to assist in land-use planning; and (4) well-yield information to assist tract developers and general public in water development.

Approach: The studies encompass urban areas, mostly in western and southern Nevada. Material is drawn from existing reports plus field work. The results are shown on 7½-minute quadrangles published by the Nevada Bureau of Mines and Geology as folios. Work involves: field mapping of flood-prone areas, sediment sources in the mountains, and valley areas subject to mud-flow inundation; and collection of data on ground-water levels and well yields.

Progress in FY 1982: Completed vegetation map for the South Lake Tahoe quadrangle, and maps showing flood and debris hazards for the Carson City and Las Vegas SE quadrangles.

Plans for FY 1983: Complete maps showing flood and debris hazards and general hydrology for the Las Vegas SW quadrangle. Complete field work for a general hydrology map of the Vista quadrangle.

Funding sources: Nevada Bureau of Mines and Geology and U.S. Geological Survey.

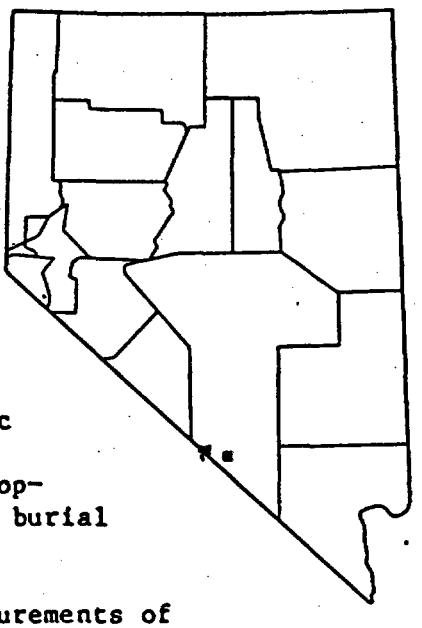
Report products:

Berggren, Gregg, and Harrill, J. R., [in press], Vegetation, South Lake Tahoe quadrangle: Nevada Bureau of Mines and Geology Urban Maps Series, South Lake Tahoe Folio.

Katzer, Terry, 1982, Flood and related debris flow hazards, Las Vegas SE quadrangle: Nevada Bureau of Mines and Geology Urban Maps Series, Las Vegas SE Folio, Map 3A1.

Katzer, Terry, and Schroer, C. V., 1982, Flood and related debris flow hazards, Carson City quadrangle: Nevada Bureau of Mines and Geology Urban Map Series, Carson City Folio, Map 1A1.

Beatty Disposal-Site Investigation (NV 072)



Location: Amargosa Desert, Nye County.
Period of project: Continuing since 1976.
Project leader: Harold H. Zehner.

Objective: (1) Estimate average potential rate of soil-moisture flux and downward transport of radioactive solutes or leachates in the unsaturated zone beneath the burial site, and of the lateral movement of radioactive solutes or leachates in the regional aquifer. (2) Attempt to determine if radionuclides from buried waste have migrated into the unsaturated zone beneath the burial trenches. (3) Assess the geohydrologic suitability of the site for burial of low-level radioactive solid waste. Contribute to the development of guidelines and criteria for selecting new burial sites.

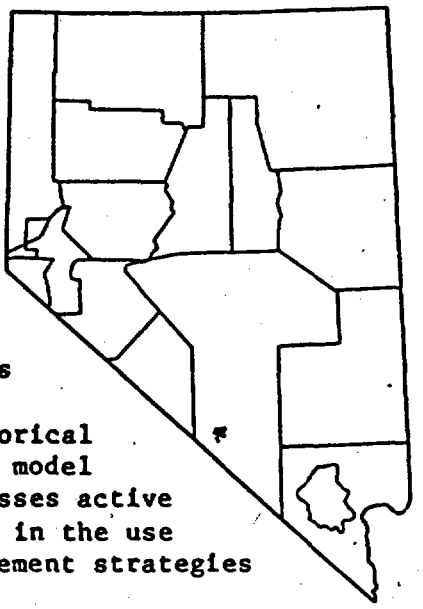
Approach: Calculate soil-moisture flux from measurements of matric potential, soil moisture, and unsaturated conductivity. Determine infiltration indirectly by measuring evaporation and surface runoff. Obtain new data on regional ground-water system by drilling several deep wells. Drill beneath waste-burial trenches and sample for radioactive contamination. Conduct detailed geologic and hydrologic evaluation of burial-site area.

Progress in FY 1982: A shaft 45 feet deep and 5 feet in diameter was designed for use in drilling horizontal holes at various depths and to measure unsaturated flow. Arrangements were made to do organic-compound and tritium analyses of gases collected when the shaft is completed. Preliminary design work was completed for an access shaft that will be used for the study of water movement through the unsaturated alluvium.

Plans for FY 1983: Let drilling contract and complete the 45-foot hole for installation of casing. Develop methodology for drilling horizontal holes outward from the vertical shaft. Install instruments to measure unsaturated ground-water flow. Purchase instruments for measuring precipitation, soil-moisture content, soil-moisture potential, and evaporation.

Funding source: U.S. Geological Survey.

Las Vegas Valley Ground-Water Models
(NV 081)



Location: Clark County.
Period of project: 1978 through 1983.
Project leader: David S. Morgan.

Objective: (1) Develop a hydraulic model of the ground-water basin that will simulate water levels and reasonably reproduce observed historical head changes. (2) Utilize the model and the knowledge and insight gained in its formulation to better describe and quantify the hydrology of Las Vegas Valley. (3) Use the model to predict the effects on the ground-water basin of alternative ground-water management strategies. (4) Compile a historical water-quality data base and develop a conceptual model of the natural and man-related geochemical processes active in the valley. (5) Train Clark County personnel in the use of the model for evaluation of alternative management strategies for the ground-water basin.

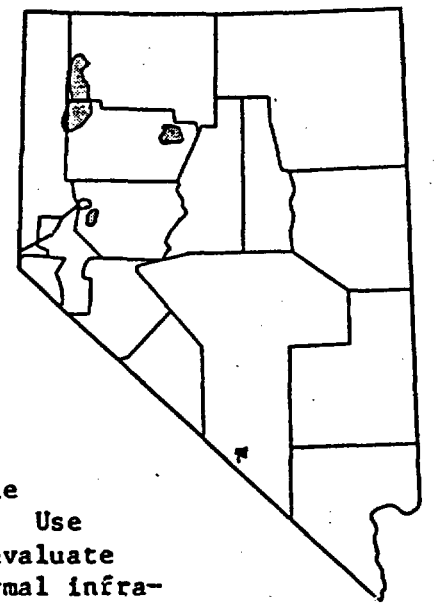
Approach: The first phase involves the collection and interpretation of sufficient geologic and hydrologic data to describe the system in enough detail to permit successful modeling. The second phase involves the development, verification, and use of the simulation model. The third task involves collection, verification, and interpretation of historical water-quality data. Finally, the fourth phase involves the preparation of documentation for and training of Clark County personnel in the use of the model.

Progress in FY 1982: Construction and calibration of a digital model of the multi-layered aquifer system began. During the period 1955-71, approximately 1,100,000 acre-feet of ground water was withdrawn by pumping. Preliminary model tests evaluated (1) the proportion of this total withdrawal that constituted storage depletion and (2) the component of that depletion attributable to compaction of fine-grained sediments.

Plans for FY 1983: Complete model calibration and report.

Funding sources: Clark County Department of Comprehensive Planning and U.S. Geological Survey.

Geothermal Studies (NV 083)



Location: Northern Nevada.
Period of project: Continuing since 1979.
Project leader: Alan H. Welch.

Objective: Develop and test geologic, geophysical, geochemical, and hydrologic techniques that will locate geothermal systems; determine the nature and magnitude of the systems and their contained fluids; and determine the flux of heat and fluid through the systems. The ultimate goal is to formulate conceptual and mathematical models that will describe the system dynamics, both before and after development.

Approach: Make a literature search of available geologic, hydrologic, and water-chemistry data. Use geophysical surveys and aerial photographs to evaluate geologic structures. Use information from thermal infrared imagery and thermal-gradient test holes to delineate areas of high-heat flow. Collect ground-water samples for chemical analysis and hydrologic data to define the regional geochemical and hydrologic relations. Examine details of recharge to the geothermal system and relationships between geochemistry of the springs and chemistry of recharge water. Develop a mathematical model simulating the movement of water and heat through the system.

Progress in FY 1982: A paper describing the Leach Hot Springs area was presented at the National Water Well Association convention in September 1982; reports discussing the Soda Lakes-Upsal Hogback and Bradys Hot Springs geothermal areas progressed to the colleague-review stage; and work continued on reports describing (1) the hydrology and geochemistry of geothermal areas in western Black Rock Desert and (2) the use of shallow temperature data in evaluating the extent of geothermal areas.

Plans for FY 1983: Complete the above two reports and, time permitting, rewrite the Leach Hot Springs and the Black Rock Desert reports for publication in the Professional Paper series.

Funding sources: U.S. Bureau of Land Management and U.S. Geological Survey.

Report products:

Morgan, D. S., 1982, Hydrogeology of the Stillwater geothermal area, Churchill County, Nevada: U.S. Geological Survey Open-File Report 82-345, 95 p.

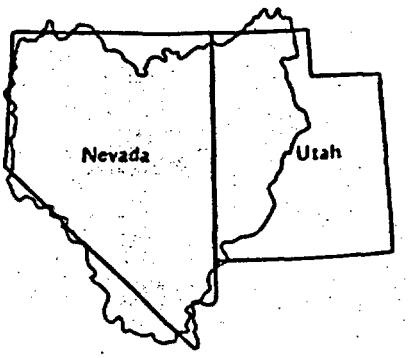
Schaefer, D. H., [in press], Gravity survey of Dixie Valley, west-central Nevada: U.S. Geological Survey Open-File Report 82-111.

Schaefer, D. H., Welch, A. H., and Maurer, D. K., [in press], Geothermal resources of the western arm of the Black Rock Desert, northwestern Nevada--Part I, geology and geophysics: U.S. Geological Survey Open-File Report 81-918.

Welch, A. H., Sorey, M. L., and Olmsted, F. H., [in press], Hydrology of the hydrothermal system in southern Grass Valley, Pershing County, Nevada [abs.]: Ground Water, v. 21.

Great Basin Aquifer Systems (NV 091)

Location: Nevada, western Utah, southeastern California.
Period of project: 1980 through 1984.
Project leader: James R. Harrill.



Objective: (1) Describe, both hydraulically and geochemically, the present ground-water system and the original system as it existed prior to development; (2) analyze the changes that have led to the present condition of the system; (3) bring together, in a regional analysis, the results of prior studies dealing with individual segments of the system; and (4) provide predictive capabilities through which the effects of further ground-water development can be estimated.

Approach: Identify widespread hydrologic problems and information deficiencies. Identify areas that contain hydrologic conditions typical of the Great Basin. Conduct detailed study of selected typical areas, and then incorporate the results into an overall regional analysis of the Great Basin. During the first 3 years of study, effort is to be concentrated in two general categories: (1) a description and regional analysis of aquifers throughout the region; and (2) a series of detailed studies of individual valleys to produce information that has high transfer value to similar areas elsewhere in the Great Basin. During the final year of study, effort will be concentrated on drawing results together into a comprehensive regional analysis.

Progress in FY 1982: Some 240 hydrographic areas tentatively have been grouped into 11 single-basin flow systems and 39 multibasin systems. Recognition of flow systems in eastern Nevada and western Utah is complicated by carbonate-rock aquifers that are adjacent to and underlie basin-fill reservoirs and sometimes readily transmit flow between individual basins. Maps showing water-level contours in basin-fill deposits and consolidated rocks of the carbonate-rock province have been prepared. A set of about 50 detailed chemical and isotopic analyses has been obtained for well and spring waters in the carbonate-rock province. Preliminary analysis suggests that some currently recognized flow-system boundaries may have to be modified. Boundaries of the carbonate-rock province have been delineated using both stratigraphic and structural evidence. Aquifers are not continuous throughout the province, and some stratigraphic units may act as aquitards over large areas. Analysis of evapotranspiration data collected during the 1982 field season began. The continuous data obtained from the eddy-correlation equipment provide considerable insight into the manner in which phreatophytes actually function. Other important parts of the investigation are ground-water models in several individual basins, as well as two regional models.

Additionally, gravity surveys have been used to define the underlying structural basins. Downhole gravity measurements refine the interpretation of surface measurements and may allow an estimate of the hydrologic properties of the sediments.

Plans for FY 1983: Continued work on models will include transient-state simulations and comparison of responses between valleys. Emphasis will be on analysis of data and preparation of reports.

Funding source: U.S. Geological Survey.

Report product:

Harrill, J. R., Welch, A. H., Prudic, D. E., Thomas, J. M., Carman, R. L., Plume, R. W., Gates, J. S., and Mason, J. L., [in press], Aquifer systems in the Great Basin region of Nevada, Utah, and adjacent states—a study plan: U.S. Geological Survey Open-File Report 82-445.

Statewide Ground-Water Level Network (NV 095)

Location: Statewide.
Period of project: Continuing since 1980.
Project leaders: Patrick A. Glancy and Jon O. Nowlin.

Objective: Develop a data base for well sites and ground-water levels that is adequate to meet the needs of resource managers and is sufficiently comprehensive to support future quantitative analyses of ground-water systems.

Approach: Separate the 256 ground-water areas of Nevada into two categories of evaluation (intensive and background) for monitoring purposes, depending on their state of resource development. Inventory and monitor a given number of basins of each type each year until statewide coverage is completed.

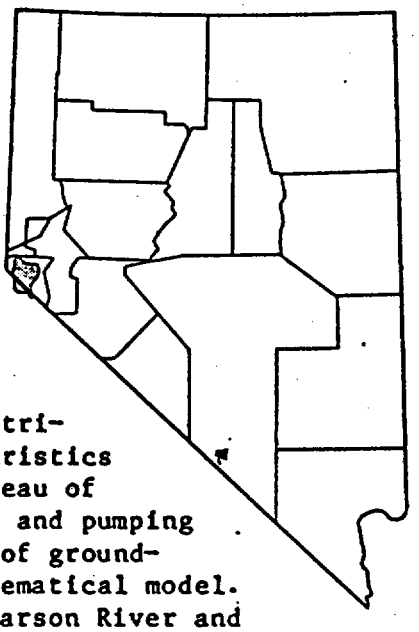
Progress in FY 1982: In developing a coordinated program to monitor ground-water levels in Nevada, the goal was to devise a rational approach for systematic long-term collection and management of water-level data in a state composed of 256 hydrologic areas totaling more than 110,000 mi^2. An approach was developed that divides the state into six regions. Each region is to be addressed on an annual, rotating basis; thus, the entire state would be covered in a 6-year period and each region would be reexamined every 6 years. For each region, the program consists of five major work elements: (1) compilation and review of existing data, (2) synoptic regional water-level survey, (3) network design, (4) data-base review and update, and (5) reporting of results. A trial of the design was made in 1982 in the Humboldt River basin (approximately 17,500 mi^2). Data products include maps for 1982 water levels and 1966-82 water-level differences, water-level hydrographs, and tabulations of historical data. Previously undocumented water-level declines of more than 40 feet in the period 1966-82 were found in Antelope, Middle Reese River, and Upper Reese River Valleys, which have experienced intensive agricultural development.

Plans for FY 1983: The water-level monitoring effort in FY 1983 will concentrate on east-central Nevada. The results of the 1982 measurement program will be published in a series of State reports.

Funding sources: Nevada Department of Conservation and Natural Resources and U.S. Geological Survey.

Carson Valley Ground-Water Model (NV 096)

Location: Douglas County.
Period of project: 1981 through 1984.
Project leader: Douglas K. Maurer.



Objective: Investigate the geology and hydrology of the basin and incorporate the acquired data in a model that will simulate response of the ground-water reservoir to changes in recharge and discharge. The model will then be used to predict the effects of various development plans.

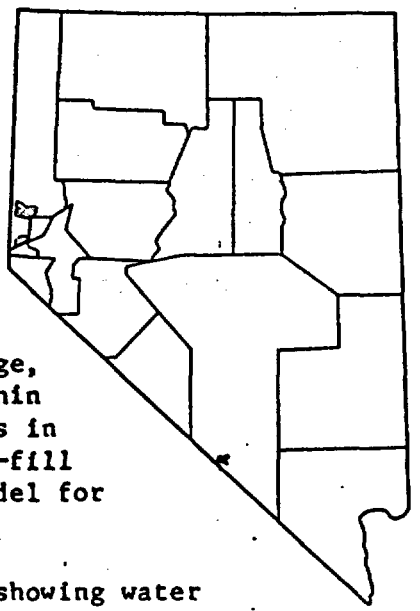
Approach: Make gravity and seismic geophysical surveys to provide data on the thickness and distribution of aquifers. Obtain data on the characteristics of the aquifers from recent work by the U.S. Bureau of Reclamation and from streamflow recession curves and pumping tests on existing wells. Quantify each element of ground-water recharge and discharge for use in the mathematical model. The model will include a representation of the Carson River and will simulate interaction between the surface-water and ground-water systems.

Progress in FY 1982: Monthly data collection continued on a 70-well water-level network and at 11 streamflow measurement stations. Eleven new observation wells were drilled, including five in conjunction with stilling wells installed in major irrigation ditches to observe streamflow/ground-water relationships. Seismic work intended to delineate the depth of semiconsolidated Tertiary sediments beneath unconsolidated valley-fill deposits was discontinued after seismic velocities of the two units were found to be too similar to permit a distinction. Transmissivity was estimated using aquifer-test data obtained from drillers' logs for 20 wells. Existing geohydrologic data were compiled into data sets, and preliminary steady-state model runs were made using two schemes—one with a 1-mile node size and one layer, and the other with four layers and a half-mile node size.

Plans for FY 1983: Continuation of data networks, instrumentation of stilling-well and observation-well sites to obtain infiltration rates from irrigation ditches, low-flow pumping tests, collection and analysis of chloride data to obtain recharge estimates, and continued steady-state and transient modeling.

Funding sources: Douglas County and U.S. Geological Survey.

Washoe County Ground Water (NV 097)



Location: Truckee Meadows area, Washoe County.
Period of project: Continuing since 1981.
Project leader: Freddy E. Arteaga.

Objective: Appraise the ground-water resources of the Truckee Meadows and adjacent areas, and present results of the appraisal in an atlas format for direct use by resource managers.

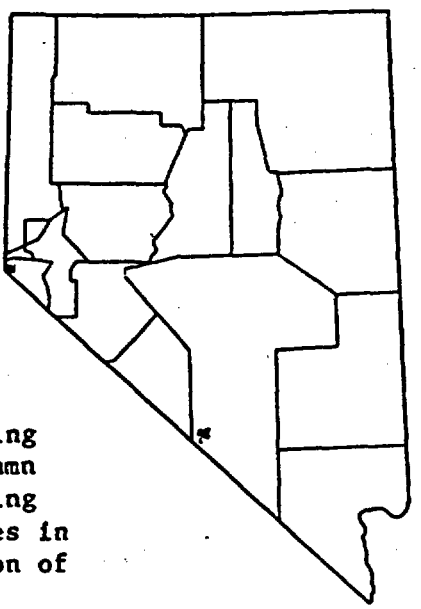
Approach: Make estimates of water yield, recharge, and discharge for individual drainage basins within the study area. Make gravity and seismic surveys in some areas to define the thickness of the valley-fill deposits. Develop a preliminary ground-water model for each basin in the study area.

Progress in FY 1982: Four atlas-format sheets, showing water yield, geohydrology, recharge/discharge, and data needs for modeling, were prepared for Washoe Valley in southern Washoe County.

Plans for FY 1983: Complete report and initiate similar studies in Spanish Springs and Lemmon Valleys.

Funding sources: Washoe County Regional Administrative Planning Agency and U.S. Geological Survey.

Edgewood Creek Sediment and Nutrient Transport (NV 098)



Location: Lake Tahoe Basin, Douglas County.
Period of project: 1981 through 1983.
Project leader: Kerry T. Garcia.

Objective: Monitor the movement of fluvial sediment and nutrients for selected runoff events before and after the contruction of erosion-control facilities. This will allow estimates of sediment and nutrient loads which will be used to evaluate the efficiency of the control facilities.

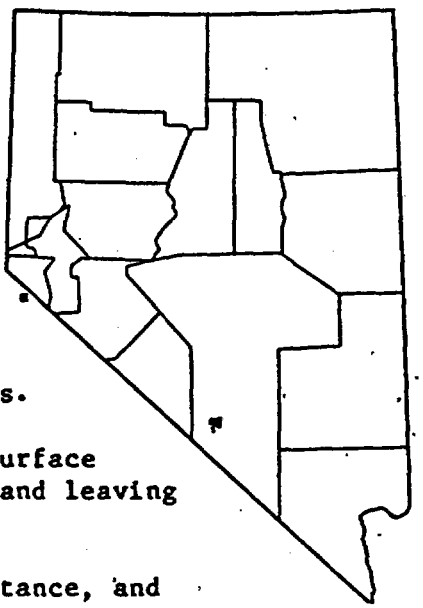
Approach: Collect and analyze water samples to characterize sediment and nutrient movements during the following types of runoff events: first autumn storm, winter snowmelt, spring snowmelt, and spring rainfall runoff. Use the data to estimate changes in sediment and nutrient movement due to installation of erosion-control structures.

Progress in FY 1982: Water samples were collected to determine the effectiveness of erosion control. Three sampling sites are being monitored: site 1 is on a stream that drains a partly developed 510-acre area; site 2 is on an adjacent stream that drains a largely developed 90-acre residential area; and site 3 is downstream from sites 1 and 2, and drains an additional 190 acres that is partly developed. Sediment- and nutrient-data collection subsequent to completion of the erosion-control work began in May 1982.

Plans for FY 1983: Continue sample collection to evaluate the effects of the erosion-control structures, and write report.

Funding sources: Douglas County and U.S. Geological Survey.

Geochemistry of Leviathan Mine Drainage (NV 099)



Location: Carson River basin, Alpine County, Calif.
Period of project: 1981 through 1983.
Project leader: Dale P. Hammermeister.

Objective: Provide information to facilitate preparation and evaluation of alternatives for abatement of pollution by drainage water at Leviathan Mine. Specific objectives are the collection of basic data on the quantity and quality of water within and adjacent to the mine site, and the investigation of the geochemistry of those waters.

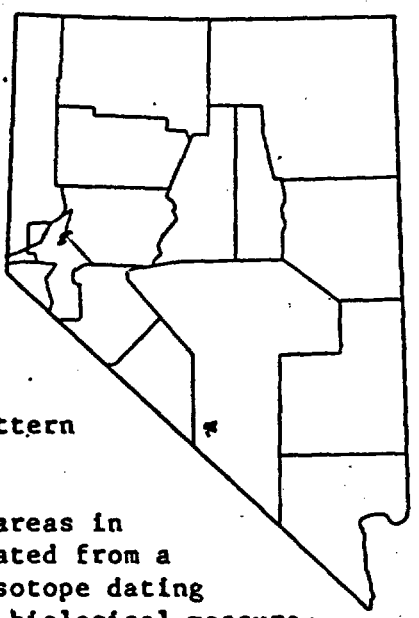
Approach: Measure the quantity and quality of surface water and ground water entering, moving within, and leaving the open-pit mine area.

Progress in FY 1982: Discharge, specific-conductance, and temperature data were collected every 15 minutes at eight gaging stations at strategic locations in the mine and affected parts of the Leviathan Creek-Bryant Creek system. Monthly measurements of discharge, specific conductance, pH, sulfate concentration, and total acidity were also made at other key locations that varied in number from 15 to 30, depending on the time of year. These data were used to calculate pollutant loads, and a mass-balance approach was used in an attempt to identify pollution source areas. Two synoptic surveys were made of the affected watershed; the surveys included pertinent field measurements and the collection of samples for chemical analysis. On the basis of these surveys, bimonthly samples from the eight gaging sites have been collected for analysis of a wide range of dissolved metals. A drilling program for 50 piezometers, 4 neutron-probe holes, and 4 suction-lysimeter holes was designed and implemented. Split-spoon core samples were collected at specified intervals in unconsolidated material, and drill cores were collected in consolidated rocks for laboratory analysis.

Plans for FY 1983: (1) Install unsaturated-zone instrumentation; (2) collect water-quality and hydrologic data from the unsaturated zone; (3) collect similar data from 50 piezometers in the saturated zone; (4) begin to analyze and interpret the accumulating surface-water and ground-water data; (5) measure water content, density, and hydraulic conductivity in representative cores taken from the 50 piezometer holes and the unsaturated zones; (6) prepare basic-data report.

Funding sources: Lahontan Water Quality Control Board and U.S Geological Survey.

Lahontan Reservoir Sedimentation History (NV 100)



Location: Carson River basin, Lyon and Churchill Counties.
Period of project: 1981 through 1983.
Project leader: Ray J. Hoffman.

Objective: Examine bottom sediment from Lahontan Reservoir to compare (1) sedimentation rates and the vertical distribution of carbon, nitrogen, and phosphorus during the 65-year life of the reservoir with (2) an index of algal productivity. A secondary objective is to measure concentrations of iron, manganese, and mercury in bottom-sediment core samples to provide information supporting the pattern of nutrient deposition.

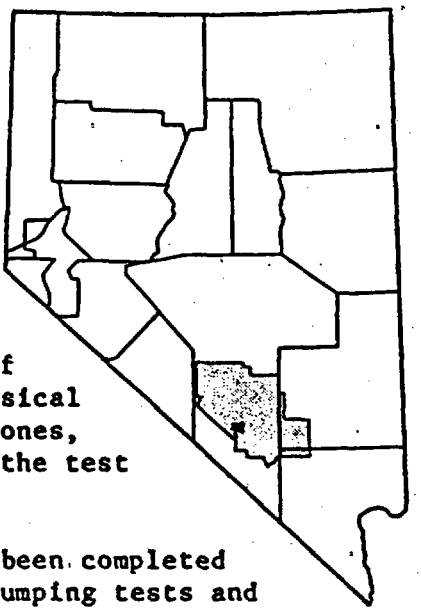
Approach: Collect sediment cores from selected areas in the reservoir, using a core-sampling device operated from a boat. Determine sedimentation rates from radioisotope dating using lead-210. Make nutrient, trace-metal, and biological measurements on thin (about 2 inches) slices of each core.

Progress in FY 1982: Field work and 50 percent of the technical analysis were completed.

Plans for FY 1983: Complete technical analysis, and prepare report.

Funding sources: University of California-Davis and U.S. Geological Survey.

Hydrologic Studies at Nevada Test Site (NV 101)



Location: Nye County.
Period of project: Continuing since 1981.
Project leader: Donald H. Schaefer.

Objective: Evaluate the hydrology of the potential nuclear-waste storage site at Yucca Mountain by hydraulic testing of deep test holes in fractured tuff.

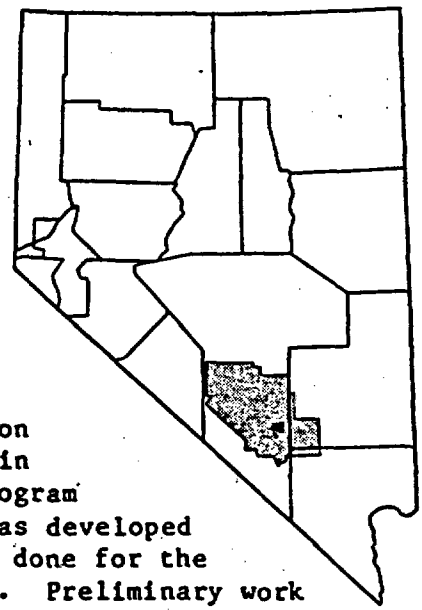
Approach: Select hydrogeologic zones in the fractured tuff sequence penetrated by a deep test hole for hydraulic testing, on the basis of core descriptions, geologists' logs, and geophysical logs. Pack off or straddle pack the selected zones, and make injection or pumping tests. Evaluate the test results using standard analytical methods.

Progress in FY 1982: All four test holes have been completed and tested. Analysis of the results from the pumping tests and preparation of individual reports for each of the four wells began.

Plans for FY 1983: Prepare reports on completed work, and make similar tests at other sites.

Funding source: U.S. Department of Energy.

Unsaturated-Zone Studies at Nevada Test Site (NV 102)



Location: Nye County.
Period of project: Continuing since 1981.
Project leader: Dale P. Hammermeister.

Objective: Test techniques for measuring the vertical permeability to air in the unsaturated zone.

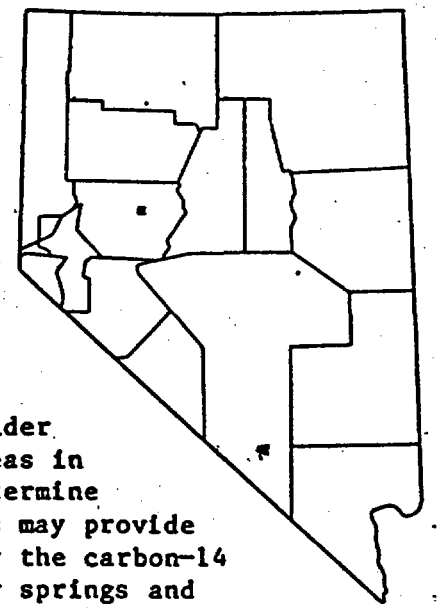
Approach: Use down-hole and core-testing techniques to provide information from which permeability values can be obtained.

Progress in FY 1982: An all-plastic air piezometer system was designed for installation into an existing borehole (UE25 A-4) located in Drillhole Wash at the Nevada Test Site. A program for installing air piezometers in this hole was developed and implemented. Preliminary design work was done for the drilling and coring of boreholes Z-4 and UZ-5. Preliminary work was also done on selecting procedures for the hydrologic testing of core material from the two boreholes.

Plans for FY 1983: Drill and core UZ-3 and UZ-4. Complete hydrologic tests on cores from these holes.

Funding source: U.S. Department of Energy.

Paleohydrology (NV 103)



Location: Dixie Valley, Churchill County.
Period of project: 1981 through 1984.
Project leader: Terry Katzer.

Objective: Determine whether fault movement in alluvium occurs repeatedly on the same fault plane or on different planes during separate events, and define the effect of this movement on ground-water flow systems. Determine dates of faulting and establish recurrence intervals.

Approach: Choose study sites where the 1954 earthquake fault coincides with clusters of older faults. Map the alluvial surface in these areas in detail, and excavate many of the faults to determine the seismic activity. Some of the excavations may provide sufficient organic material to allow dating by the carbon-14 technique. Compare the historic flow data for springs and water-level data for wells near these faults in terms of single- and multiple-event seismic activity.

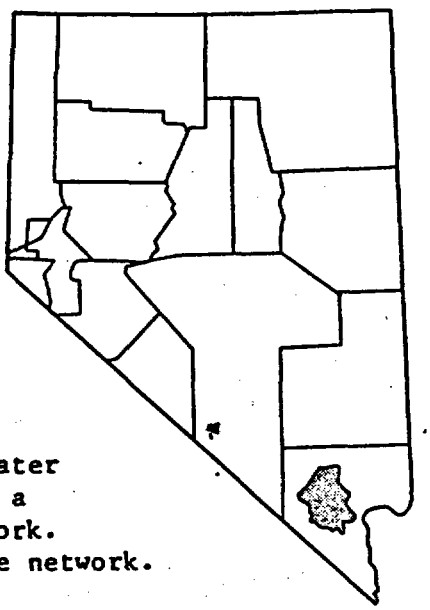
Progress in FY 1982: Mapping of Holocene and pre-Holocene faults and stratigraphy on the IXL Canyon 7½-minute quadrangle was completed.

Plans for FY 1983: Selected sites on faults will be trenched, multiple faults dated, and recurrence intervals established.

Funding sources: Nevada Bureau of Mines and Geology and U.S. Geological Survey.

Las Vegas Valley Ground-Water Quality Network (NV 104)

Location: Clark County.
Period of project: 1982 through 1983.
Project leader: Michael D. Dettinger.



Objective: Design and implement a monitoring network for ground-water quality comprised of selected sampling sites. The network should yield data which will further the understanding of the geochemistry and quality of ground water in the valley. The network will also serve as an "early-warning" system regarding water-quality and pollution hazards to valley water supplies.

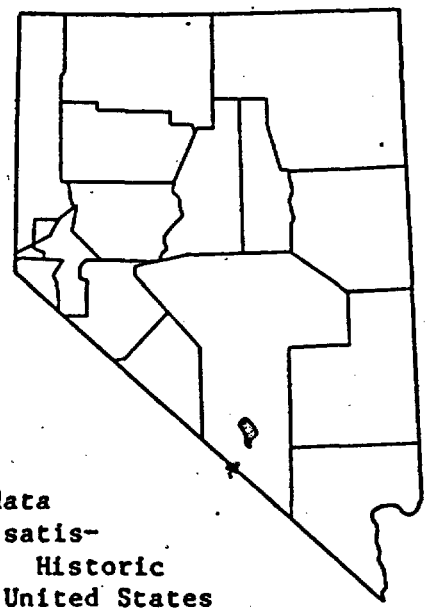
Approach: Collect and analyze existing ground-water quality data for Las Vegas Valley, and implement a preliminary ground-water quality monitoring network. Subsequently, reassess and partially optimize the network.

Progress in FY 1982: A monitoring network to evaluate ground-water quality and geochemical conditions in Las Vegas Valley was designed and implemented. The network, which included 40 wells, was designed (1) to yield information on the geochemical baseline conditions for use in future modeling programs, and (2) to demonstrate the usefulness and ease of implementing a network to provide "early warning" of ground-water pollution problems that may develop beneath this rapidly growing population center. Water samples were obtained from the wells in late spring and late summer, and were analyzed for major and trace constituents as well as several indicator constituents.

Plans for FY 1983: Evaluate the geochemical data and complete report.

Funding sources: Clark County Department of Comprehensive Planning, Las Vegas Valley Water District, and U.S. Geological Survey.

Flood Hazards, Fortymile Wash (NV 105)



Location: Nevada Test Site, Nye County.
Period of project: Continuing since 1981.
Project leader: Robert R. Squires.

Objective: Identify reaches of Fortymile Wash and selected tributaries where flooding could have a hazardous effect on radioactive waste-disposal sites proposed in the Yucca Mountain area. Estimate peak-flow magnitudes expected during 100-year, 500-year, and regional maximum floods. Determine flood-inundation limits.

Approach: Devise or adapt suitable methods of estimating the 100-year, 500-year, and regional maximum floods. Regression equations based on data derived from nearby crest-stage gages may prove satisfactory for the 100-year and 500-year estimates. Historic peak flows from throughout the far southwestern United States may provide the basis for the regional maximum estimates. Hydraulic characteristics for each flood magnitude will be determined by cross-section survey and site inspections.

Progress in FY 1982: Analysis of flood hazards for a 9-mile reach of Fortymile Wash and three of its tributaries was undertaken to aid in the determination of possible sites for the storage of radioactive wastes. The regional maximum flood and the 100-year and 500-year flood peaks were estimated on the basis of data from extreme floods elsewhere in Nevada and surrounding states. Maximum water depths, mean flow velocities, and areas inundated were also defined. Five crest-stage gages and two recording rain gages were installed in the Fortymile Wash drainage area.

Plans for FY 1983: Increase streamflow and precipitation data collection. Begin evaluation of prehistoric hydrologic techniques to study flood history.

Funding source: U.S. Department of Energy.

Great Basin Flood Hazards (NV 108)

Location: Statewide and parts of adjacent states in the Great Basin.
Period of project: Continuing since 1981.
Project leader: Otto Moosburner.

Objective: (1) Appraise the merits of the different methods of delineating flood-hazard areas for their possible use in U.S. Bureau of Land Management lands in the Great Basin; (2) make recommendations on which methods are preferred for mountains, for alluvial fans and valleys, and for playas; and (3) present guidelines, mainly by example, on the use of the different suggested methods.

Approach: (1) Develop discharge-frequency relations for each gaged site in the Great Basin. (2) Develop procedures for transferring flood-frequency information from gaged sites to ungaged sites; this mainly involves the development of regression equations. (3) Determine depth-frequency relations for all gaged sites. (4) Develop procedures for transferring depth-frequency information from gaged sites, mainly on the basis of regression equations.

Progress in FY 1982: Analysis of regional discharge frequency was initiated.

Plans for FY 1983: Finish discharge-frequency analysis.

Funding source: U.S. Bureau of Land Management.

Remote Sensing in Hydrology (NV 109)

Location: Statewide.
Period of project: Continuing since 1981.
Project leader: Walter L. Rennick.

Objective: Develop and implement digital remote-sensing techniques that can be used in obtaining water-resources information regularly and reliably.

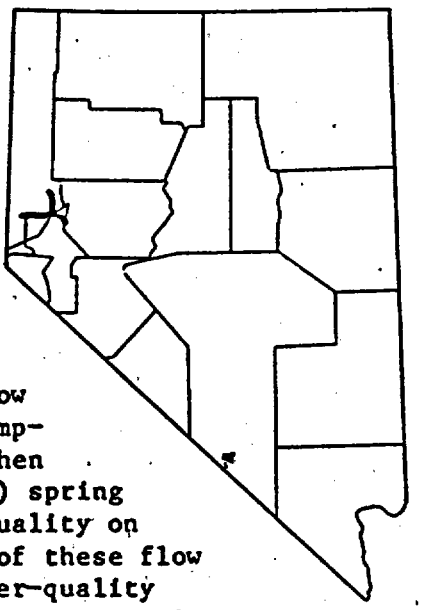
Approach: Develop a water-data analysis system for Nevada using standard remote-sensing methods to obtain statewide water-resources data that can be used to formulate water-management policy. The proposed data-analysis system will (1) provide the means to monitor and inventory land use in Nevada as related to water resources, (2) offer the required flexibility to respond to present and future needs for water-use information, and (3) allow the system to be efficiently tailored to meet information needs depending on the financial and personnel resources available.

Progress in FY 1982: The acquisition and installation of remote-image processing (RIPS) was completed. The analysis of irrigated lands in Paradise and Quinn River Valleys was started. Requirements and specifications for acquiring a larger image processor for supporting regional remote-sensing projects were developed. The specifications were developed in cooperation with the Flagstaff Image Processing Facility, U.S. Geological Survey. Landsat data for Las Vegas, Carson City, and Sacramento were acquired to explore data utilization in urban areas.

Plans for FY 1983: Continue development of RIPS software. Complete test mapping of irrigated lands in Paradise and Quinn River Valleys. Start vegetation mapping in the Carson Range. Start phreatophyte-distribution analysis in the Nevada part of the Great Basin. Continue to implement hardware for a larger image processor that can efficiently handle large data bases.

Funding sources: Nevada Department of Conservation and Natural Resources, Nevada Division of Forestry, and U.S. Geological Survey.

Truckee River Water-Quality Model (NV 111)



Location: Truckee River from Reno to Pyramid Lake, and Truckee Canal from Derby Dam to Lahontan Reservoir.
Period of project: 1982 through 1984.
Project leader: Jon O. Nowlin.

Objective: Predict changes in the concentration of selected constituents along the 56-mile length of the Truckee River from the McCarran Avenue bridge in Reno to Marble Bluff Dam, and along the 31-mile reach of the Truckee Canal from Derby Dam to the Highway 50 bridge upstream from Lahontan Reservoir. Two flow regimens will be modeled under steady-state assumptions: (1) typical late-summer (August) flow, when poor water-quality conditions are likely, and (2) spring runoff (early June), when the impacts of water quality on spawning fish are of primary concern. For each of these flow regimens, model runs will be made simulating river-quality conditions observed during 1979-80 and predicting river-quality responses to alternative modes of expansion for the Reno-Sparks Sewage Treatment Plant. Constituents to be modeled include dissolved oxygen, dissolved solids, biochemical oxygen demand, orthophosphorus, and the nitrogen species (ammonia, nitrite, nitrate, and organic nitrogen).

Approach: Use a computer program that represents a modification of a steady-state river-quality model previously developed by the Geological Survey. Enhancements to this program include (1) a redesign of input and output formats for improved ease of use, (2) inclusion of subroutines to pre-process water-quality and channel-geometry data, and (3) a wider range of options for channel-geometry and reaeration calculations.

Progress in FY 1982: The steady-state river-quality model previously developed by the Geological Survey was modified.

Plans for FY 1983: Calibrate and verify the model.

Funding sources: Cities of Reno and Sparks and U.S. Geological Survey.

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