UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER-RESOURCES STUDIES IN UTAH

BY THE U.S. GEOLOGICAL SURVEY,

JULY 1, 1983, TO JUNE 30, 1984

Compiled by Linda S. Hamblin

Open-File Report 84-585

Salt Lake City, Utah
July 1984

UNITED STATES DEPARTMENT OF THE INTERIOR

WILLIAM P. CLARK, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information
write to:

District Chief
U.S. Geological Survey
Water Resources Division
Room 1016 Administration Building
1745 West 1700 South
Salt Lake City, Utah 84104

Copies of this report can
be purchased from:

Open-File Services Section
Western Distribution Branch
U.S. Geological Survey
Box 25425, Federal Center
Denver, Colorado 80225
[Telephone: (303) 234-5888]

CONTENTS

CONTENTS—Continued

CURRENT PROJECTS--Continued

WATER-RESOURCES STUDIES IN UTAH

BY THE U.S. GEOLOGICAL SURVEY,

JULY 1, 1983, TO JUNE 30, 1984

Compiled by Linda S. Hamblin

INTRODUCTION

This report summarizes the progress on water-resources studies in Utah by the U.S. Geological Survey during the period July 1, 1983, to June 30, 1984. Much of the work was done in cooperation with the State of Utah and local agencies. Additional supporting funds were transferred from other Federal agencies or appropriated directly to the Geological Survey.

The State and local cooperators were:

Utah Department of Natural Resources
- Division of Water Rights
- Division of Water Resources
- Division of Wildlife Resources
- Division of Oil, Gas, and Mining
- Geological and Mineral Survey

Bear River Commission
Utah Department of Transportation
Salt Lake County
Salt Lake County Division of Flood Control and Water Quality
Central Utah Water Conservancy District
Lower Gunlock Reservoir Corp.

The Federal cooperators were:

Bureau of Land Management
Bureau of Reclamation
Federal Energy Regulatory Commission
Federal Emergency Management Agency
Office of Surface Mining

The program in Utah during the reporting period consisted of 21 projects, and a discussion of each project, including 2 projects discontinued during the year, is given in the following pages. Short descriptions are given at the end of the report for three proposed projects to be started on or after July 1, 1984.

In addition to the 24 projects mentioned above, work is being completed on reports for 8 other projects. The status of the reports is as follows:

UT 139 "Determination of vertical hydraulic conductivity and specific storage of a confining bed using the Hantush modified and Neuman and Witherspoon ratio methods." In review.

UT 140 "Ground-water conditions in the Kaiparowits area, Utah and Arizona, with emphasis on the Navajo Sandstone." In review.

UT 142 "Quality and quantity of runoff and atmospheric deposition in the urban area of Salt Lake County, Utah, 1980-81." In press as U.S. Geological Survey Water-Resources Investigations Report 84-4011.

UT 143 "Projected effects of a three-dimensional digital-computer model of ground-water withdrawals in northern Utah Valley, Utah." In review.

UT 144 "Reconnaissance of toxic substances in the Jordan River, Salt Lake County, Utah." In press as U.S. Geological Survey Water-Resources Investigations Report 84-4155.

"Water-quality investigations of the Jordan River, Salt Lake County, Utah, 1980-82." In review.

"Dissolved-oxygen regime of the Jordan River, Salt Lake County, Utah." In press as U.S. Geological Survey Water-Resources Investigations Report 84-4056.

UT 149 "Ground water in Utah's densely populated Wasatch Front area--The challenge and the choices." In press as U.S. Geological Survey Water-Supply Paper 2232.

UT 151 "Hydrology of Area 56, Northern Great Plains and Rocky Mountain Coal Provinces, Utah and Colorado." In press as U.S. Geological Survey Water-Resources Investigations/Open-File Report 83-38.

"Hydrology of Area 57, Northern Great Plains and Rocky Mountain Coal Provinces, Utah and Colorado." In press as U.S. Geological Survey Water-Resources Investigations/Open-File Report 84-068.

UT 155 "Water-quality reconnaissance of the Virgin River basin from headwaters in Utah to Littlefield, Arizona." In review.

THE FOLLOWING REPORTS WERE RELEASED TO THE OPEN FILE:

Ground-water hydrology and projected effects of ground-water withdrawals in the Sevier Desert, Utah: U.S. Geological Survey Open-File Report 83-688.

Ground-water resources of northern Utah Valley, Utah: U.S. Geological Survey Open-File Report 84-455.

Floods of May-June, 1983 along the northern Wasatch Front, Salt Lake City to North Ogden, Utah: U.S. Geological Survey Open-File Report 84-456.

Hydrologic reconnaissance of the Kolob, Alton, and Kaiparowits Plateau coal fields, south-central Utah: U.S. Geological Survey Open-File Report 84-071.

Surface-water and climatologic data, Salt Lake County, Utah, water year 1981, with selected data for water years 1980 and 1982: U.S. Geological Survey Open-File Report 83-694 (duplicated as Utah Hydrologic-Data Report 40).

Selected hydrologic data, Kolob-Alton-Kaiparowits coal-fields area, south-central Utah: U.S. Geological Survey Open-File Report 83-871 (duplicated as Utah Hydrologic-Data Report 41).

Techniques for determining recharge to the Navajo Sandstone, lower Dirty Devil River basin, Utah: U.S. Geological Survey Water-Resources Investigations Report 84-4154.

The ground-water system and possible effects of underground coal mining in the Trail Mountain area, central Utah: U.S. Geological Survey Open-File Report 84-067.

Water-resources studies in Utah by the U.S. Geological Survey, July 1, 1982, to June 30, 1983: U.S. Geological Survey Open-File Report 83-531.

THE FOLLOWING REPORTS WERE PUBLISHED:

Availability of selected trace elements in the White River, southeastern Uinta Basin, Utah and Colorado, in Program of Abstracts, Symposium of trace element mobilization in western energy regions, Denver, Colorado, November 1982.

Bedrock aquifers in the northern San Rafael Swell area, Utah, with special emphasis on the Navajo Sandstone: Utah Department of Natural Resources Technical Publication 78.

Ground-water conditions in Utah, spring of 1983: Utah Division of Water Resources Cooperative Investigations Report 23.

Plan of study for the regional aquifer systems analysis of the Upper Colorado River Basin in Colorado, Utah, and Wyoming: U.S. Geological Survey Water-Resources Investigations Report 83-4184.

Potential hydrologic impacts of a tar-sand industry in 11 Special Tar Sand Areas in eastern Utah: U.S. Geological Survey Water-Resources Investigations Report 83-4109.

Reconnaissance of geohydrology of the Moab-Monticello area, Western Paradox basin, Grand and San Juan Counties, Utah: U.S. Geological Survey Water-Resources Investigations Report 83-4098.

Reconnaissance of geothermal resources of Utah: U.S. Geological Survey Professional Paper 1044-H.

Reconnaissance of the quality of surface water in the Weber River basin, Utah: Utah Department of Natural Resources Technical Publication 76.

Reconnaissance of the shallow-unconfined aquifer in Salt Lake Valley, Utah: U.S. Geological Survey Water-Resources Investigations Report 83-4272.

Regional hydrology of the Dolores River basin, Eastern Paradox basin, Colorado and Utah: U.S. Geological Survey Water-Resources Investigations Report 83-4217.

Sanitary quality of the Jordan River in Salt Lake County, Utah: U.S. Geological Survey Water-Resources Investigations Report 83-4252.

Three-dimensional digital-computer model of the principal ground-water reservoir of the Sevier Desert, Utah: U.S. Geological Survey Water-Resources Investigations Report 83-4179.

Turbidity and suspended sediment in the Jordan River, Salt Lake County, Utah: U.S. Geological Survey Water-Resources Investigations Report 84-4019.

Water-level and water-quality changes in Great Salt Lake, Utah: U.S. Geological Survey Circular 913.

Water resources data for Utah, water year 1982: U.S. Geological Survey Water-Data Report UT-82-1.

CURRENT PROJECTS

COLLECTION OF BASIC RECORDS - SURFACE WATER

Number: UT 00-001-F01CL

Cooperating Agencies: U.S. Bureau of Reclamation; U.S. Bureau of Land Management; Federal Energy Regulatory Commission; Utah Division of Water Rights; Utah Division of Water Resources; Bear River Commission; Salt Lake County; Central Utah Water Conservancy District; Lower Gunlock Reservoir Corp.; Salt Lake County Division of Flood Control and Water Quality; Office of Surface Mining; Utah Geological and Mineral Survey.

Staff: R. W. Cruff, Hydrologist, Project Chief (part time)
Other District personnel as assigned

Period of Project: Continuing

Objective: To obtain data on stream discharge or stage and reservoir or lake stage at selected sites throughout Utah.

Approach: Standard methods for the operation and maintenance of gaging stations and for the computation, computer storage, and publication of streamflow records were used.

Progress: Data collection and computation necessary for the publication of records for 202 streamflow stations, 15 reservoirs, and 2 lake-stage stations continued during the year. The stations are classified as follows:

Current purpose or project related	131
Hydrologic	55
Benchmark or long-term change	12
Regulated	4
Reservoirs (long-term management)	15
Lake stage	2

Gaging stations discontinued were:

Uinta River near Neola
Ashley Creek near Jensen

Gaging stations started were:

Bull Creek near Hanksville
Indian Creek near Monticello
Floy Wash near Green River
Cottonwood Wash near Green River

Plans for Next Year: Continue operation of network. Prepare 1984 water-year records for publication.

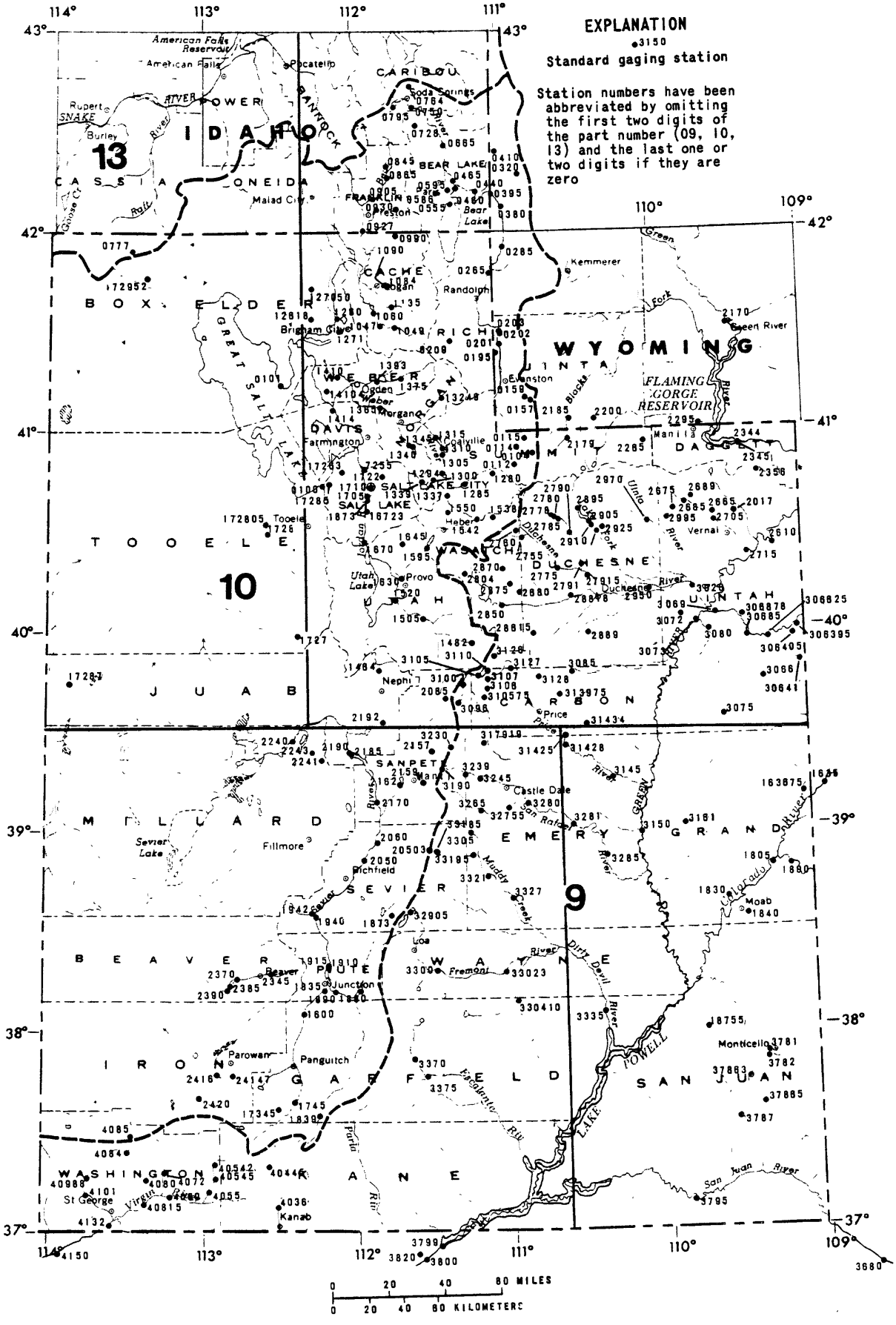
Reports:

Water resources data for Utah, water year 1982: U.S. Geological Survey Water-Data Report UT-82-1.

Water resources data for Utah, water year 1983: U.S. Geological Survey Water-Data Report UT-83-1 (in press).

"Streamflow and reservoir contents in upper Colorado River Basin" is issued monthly.

Lindskov, K. L., 1984, Floods of May-June, 1983 along the northern Wasatch Front, Salt Lake City to North Ogden, Utah: U.S. Geological Survey Open-File Report 84-456.



Location of gaging stations in Utah, September 1983.

pg. 9 follows

COLLECTION OF BASIC GROUND-WATER RECORDS AND GROUND-WATER CONDITIONS IN UTAH

Number: UT 00-002-FC

Cooperating Agencies: Utah Division of Water Rights;
Utah Division of Wildlife Resources;
Utah Department of Transportation

Staff: L. R. Herbert, Hydrologic Technician, Project Chief (part time)
M. S. Elizondo, Hydrologic Technician (part time)
C. B. Burden, Hydrologic Technician (part time)
C. F. Avery, Hydrologist, Editor of annual ground-water report (part time)
R. L. Seiler, Hydrologist (part time)
Other District personnel as assigned

Period of Project: Continuing

Objectives: To obtain long-term records on ground-water levels, to determine water-level changes for a yearly or other periods, and to determine withdrawals from and status of development of ground-water reservoirs over the State.

Approach: Measure water levels annually or semiannually (normally February-March and September) and operate continuous water-level recorders on selected wells. Visit selected pumped irrigation wells, measure discharge, determine the ratio of water produced to energy consumed, and use the ratio along with energy-consumption data to compute total discharge. Visit selected flowing wells and measure discharge. Obtain estimates of ground water withdrawn by wells for public supply and industrial use from the Utah Division of Water Rights. Obtain additional estimates of industrial use of water from wells from users or by rating pumps and using the water produced/energy consumed ratio with energy-consumption records. Determine the number and sizes of new wells from well drillers' reports to the Division of Water Rights. Prepare an annual report on ground-water conditions in Utah which includes data, graphs, and maps showing water-level changes, withdrawals from wells, number of wells drilled for defined ground-water basins or areas, and a discussion of yearly ground-water conditions in each basin or area. Store water-level data in computer files and publish selected data in the annual water-resources data report.

Progress: Water levels were measured in about 1,100 wells in February or March, of which about 500 also were measured in September. Thirty-six wells were equipped with continuous water-level recorders. During the irrigation season about 600 pumped irrigation wells were visited, discharge was measured at about one-half of the wells, and water-production/energy-consumption ratios were determined. Natural-flow discharge was measured at 50 selected wells. Number and sizes of new wells drilled were calculated. The twenty-first in the series of annual reports on ground-water conditions in Utah was completed.

Plans for Next Year: Collecting, recording, and publishing of data on water levels, ground-water withdrawals, and wells drilled will continue. The twenty-second in the series of annual ground-water reports will be submitted in 1985.

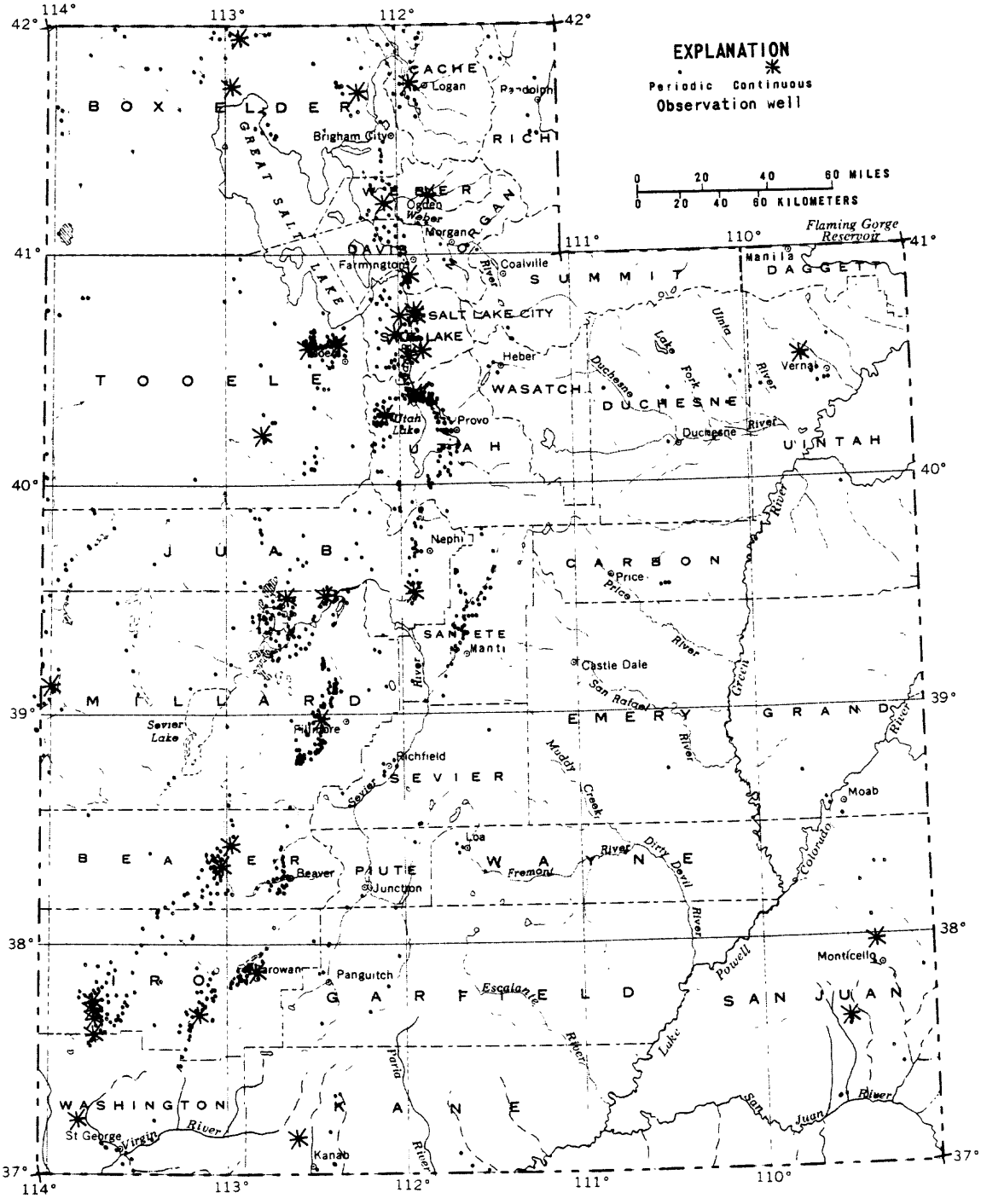
Reports:

Water resources data for Utah, water year 1982: U.S. Geological Survey Water-Data Report UT-82-1.

Water resources data for Utah, water year 1983: U.S. Geological Survey Water-Data Report UT-83-1 (in press).

Water-level-change maps, February or March 1984, for 15 areas in Utah--issued April 1 as local press releases and distributed to interested individuals.

Avery, Charles, and others, 1984, Ground-water conditions in Utah, spring of 1984: Utah Division of Water Resources Cooperative-Investigations Report 24.



Location of observation wells in Utah where ground-water levels were measured.

page 13 follows

COLLECTION OF BASIC RECORDS--WATER QUALITY AND FLUVIAL SEDIMENT

Number: UT 00-003-F01C; UT 00-004-F01C

Cooperating Agencies: Utah Division of Water Rights;
Utah Division of Water Resources;
Utah Division of Wildlife Resources;
Utah Geological and Mineral Survey;
U.S. Bureau of Land Management;
U.S. Bureau of Reclamation

Staff: R. W. Cruff, Hydrologist, Project Chief (part time)
Other District personnel as assigned

Period of Project: Continuing

Objectives: To obtain long-term records of the quality of water at selected stream sites, springs, and wells and of sediment at selected stream sites in Utah; and to obtain shorter-term records for use by other Federal or State agencies involved in development of water resources or environmental protection.

Approach: Standard methods for the collection and analysis of chemical-quality and fluvial-sediment samples and computer storage and publication of data were used.

Progress: Water-quality data were collected at 48 surface-water sites in Utah. Chemical-quality records were collected daily at 9 stream sites and periodically at 19 stream sites. Specific conductance values were obtained at an additional 155 stream-gaging stations in Utah. Sediment data were collected daily at 4 sites and periodically at 21 sites. Water-temperature data were obtained daily at 10 stream sites and monthly at about 155 stream sites. Data on the quality of ground water were collected at about 205 wells in Utah.

All water-quality records were compiled for inclusion in the annual water-resources data report.

Plans for Next Year: Continue collecting and processing data and preparing records for publication.

page 15 follows

Reports:

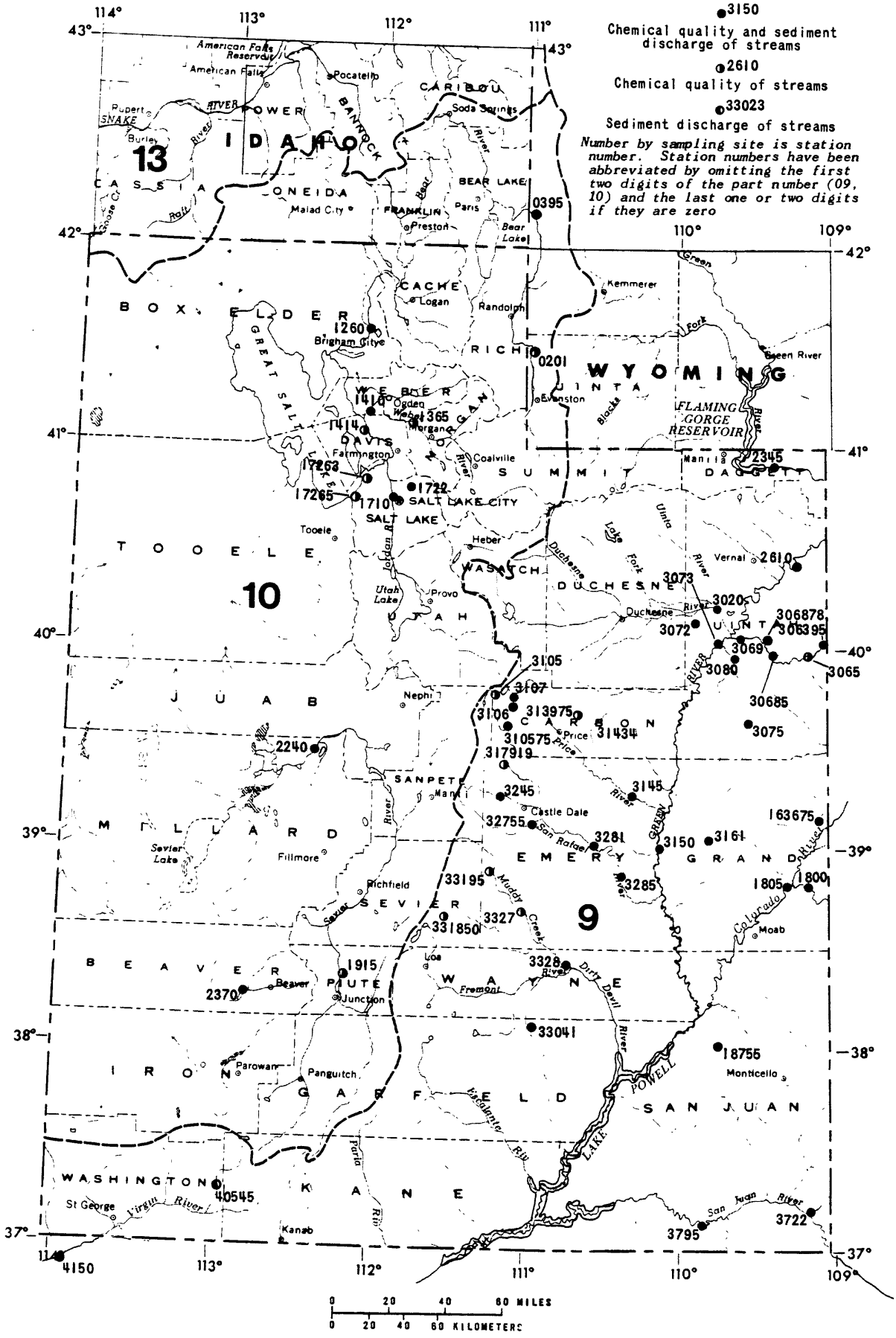
Water resources data for Utah, water year 1982: U.S. Geological Survey Water-Data Report UT-82-1.

Water resources data for Utah, water year 1983: U.S. Geological Survey Water-Data Report UT-83-1 (in press).

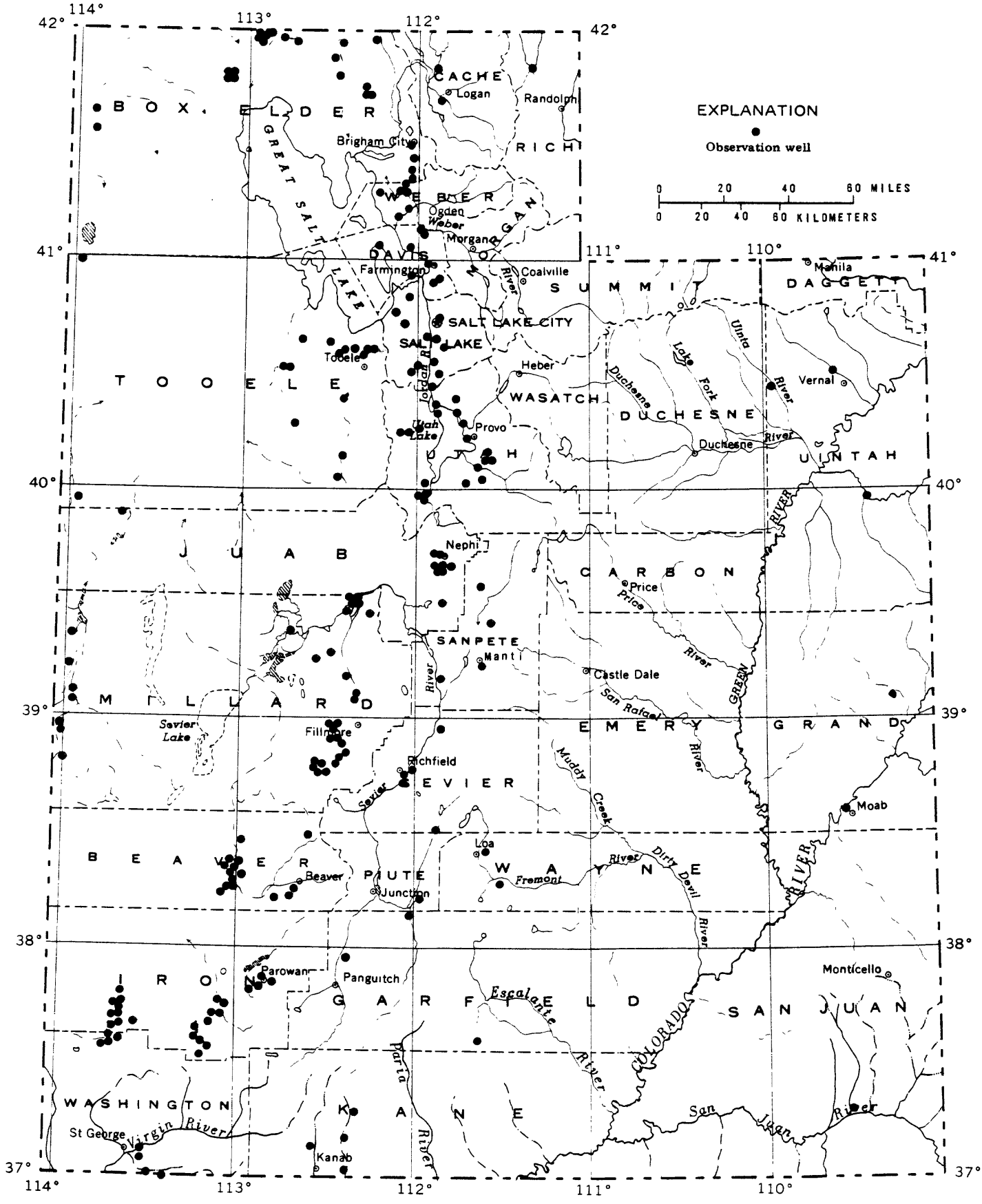
Thompson, K. R. (in review), Annual suspended-sediment loads in the Green River at Green River, Utah: U.S. Geological Survey Water-Resources Investigations Report.

Thompson, K. R. (in review), Annual suspended-sediment loads in the Colorado River near Cisco, Utah, 1930-82: U.S. Geological Survey Water-Resources Investigations Report.

Price, Don (in preparation), Ground-water quality monitoring in Utah--A summary of data collected through 1983: Utah Department of Natural Resources Information Bulletin.



Location of surface-water quality stations in Utah, September 1983.



Location of observation wells in Utah where samples for monitoring water quality were collected.

page 19 follows

FLOOD MAPPING

Number: UT 00-006-0

Cooperating Agency: Federal Emergency Management Agency (FEMA)

Staff: R. W. Cruff, Hydrologist, Project Chief (part time)
Other District personnel as assigned

Period of Project: Began May 1983, continuing

Objectives: To delineate the parts of areas assigned by FEMA which are subject to inundation by floods of selected recurrence intervals, primarily the 100-year flood. The information is needed by FEMA to assist State and local agencies in discouraging development in the flood-plain areas and to determine rates for the flood-insurance program.

Approach: Determine areas subject to inundation by floods of selected magnitude by ground surveys or photogrammetric methods. Determine frequency relationships using local historical information, gaging-station records, or other applicable information. Determine water-surface profiles at flood stage using step-backwater models or by other acceptable methods and furnish the results in reports prepared to FEMA specifications.

Progress: Estimates of cost to make surveys of 12 communities in Utah have been made.

Plans for Next Year: Conduct flood-mapping studies in Utah for communities requested by FEMA.

Reports: None.

STATEWIDE WATER USE

Number: UT 00-007-C

Cooperating Agency: Utah Division of Water Rights

Staff: R. W. Cruff, Hydrologist, Project Chief (part time)
G. E. Pyper, Hydrologic Technician
R. L. Baskin, Hydrologic Technician (part time, WAE)
D. Hooper, Engineer, Utah Division of Water Rights
Other State personnel as assigned

Period of Project: Began July 1977, continuing

Objective: To obtain Statewide information about withdrawals and return flows of water for various uses, and consumptive use of water in connection with each type of withdrawal.

Approach: Field inventory and measurement of surface-water diversions and some types of ground-water diversions, verification of user measurements and records, and acreage and crop surveys to aid in computing consumptive use by irrigation. A pilot study will be made in Tooele Valley to determine the best way of estimating water use for irrigation for the State. State personnel are collecting data on public-supply and industrial use; Geological Survey personnel are collecting data for irrigation use.

Progress: Mail surveys were made to determine water use by 350 public suppliers and 129 major self-supplied and public-supplied industries. Approximately 30 public suppliers were visited during the year to verify the data. The 1982 data report on water use by public suppliers and industry is being prepared. Data are being prepared for entry into the State and National water-use systems. Work has begun on comparing various methods, including satellite photography, to determine water use for irrigation in Tooele County, Utah.

Plans for Next Year: Data for public-supply and industrial uses will continue to be collected and verified. Data will be submitted to the National water-use data base in Reston. Work will continue on determining areas of irrigated acreage and water use by irrigation. A report will be prepared on the pilot study to determine irrigation use in Tooele Valley.

Reports:

Hooper, David (In preparation), Utah water-use data, public and industrial water supplies, 1982: Utah Department of Natural Resources, Utah Water-Use Report.

CANAL-LOSS STUDIES

Number: UT 74-107-C

Cooperating Agency: Utah Division of Water Rights

Staff: R. W. Cruff, Hydrologist, Project Chief (part time)
L. R. Herbert, Hydrologic Technician (part time)
Other District personnel as assigned

Period of Project: July 1973 to June 1984

Objectives: To determine the quantity of water lost by seepage from canals in irrigated areas throughout the State. This information will contribute to current and future cooperative areal investigations as well as to location and measurement of water losses for the users.

Approach: Gaging-station and measuring sites are selected, based on a reconnaissance of the canals. Seepage runs are made three to five times during an irrigation season. The seepage measurements are adjusted for fluctuations in stage of the canal during the course of each seepage run. Each set of canal studies spans a 2-year period.

Progress: Seepage measurements were completed on the Draper Irrigation, East Jordan, and Jordan-Salt Lake Canals on the east side of Salt Lake Valley. The data were analyzed and the report prepared.

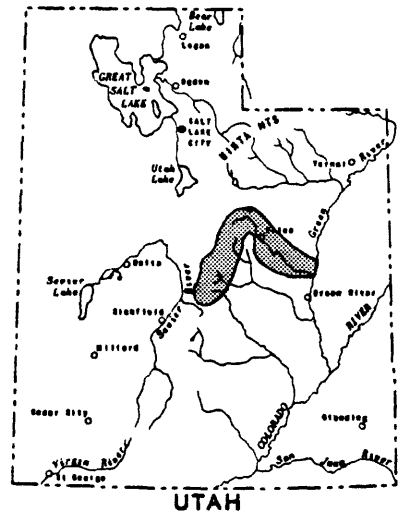
Plans for Next Year: None. Future canal-loss studies will be done in conjunction with projects on specific areas, and they will be included under project UT-00-001-F01CL.

Reports:

Herbert, L. R., Cruff, R. W., and Waddell, K. W. (in review), Seepage study of Utah and Salt Lake Canal, Utah Lake Distributing Canal, Provo Reservoir Canal, Draper Irrigation Canal, East Jordan Canal, and Jordan and Salt Lake Canal: Utah Department of Natural Resources Technical Publication.

WATER-RESOURCES MONITORING - CENTRAL UTAH COAL REGION

Number: UT 77-129-F



Staff: R. W. Cruff, Hydrologist, Project Chief (part time)
Don Price, Hydrologist (part time)
G. G. Plantz, Hydrologic Technician (part time)
Other District personnel as assigned

Period of Project: August 1978 to September 1984

Objectives: To determine the characteristics of the regional surface-water system and to detect and document changes in water quantity and quality that may be associated with coal mining.

Approach: Evaluate the existing basic-data collection program for its regional surveillance value and add additional data sites or upgrade existing sites as needed. Evaluate the data as they are collected so that changes due to coal mining may be detected and documented.

Progress: The operation of seven gaging stations continued. Data on flow, water quality, and suspended sediment were collected during the 1983 and 1984 water years. All data were included in the annual water-resources data report. A draft of a report on the data collected during the entire life of the project will be completed by November 1984.

Plans for Next Year: None other than processing final report. After September 30, 1984, all stations will be discontinued.

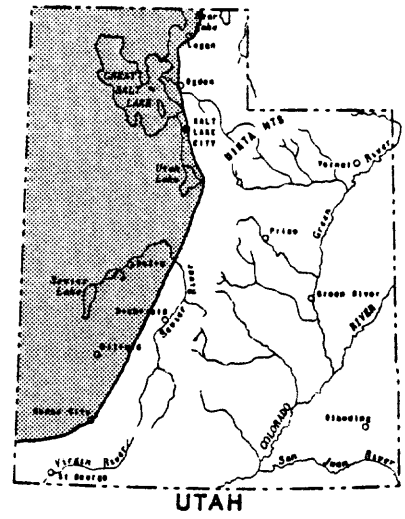
Reports:

Water resources data for Utah, water year 1982: U.S. Geological Survey Water-Data Report UT-82-1.

Water resources data for Utah, water year 1983: U.S. Geological Survey Water-Data Report UT-83-1 (in press).

GREAT BASIN REGIONAL AQUIFER SYSTEMS ANALYSIS

Number: UT 81-147-F



Staff: J. L. Mason, Hydrologist, Project Chief
J. S. Gates, Hydrologist (part time)
J. W. Atwood, Hydrologic Technician (part time, WAE)
P. R. Gallagher, Hydrologic Technician (part time, WAE)

Period of Project: October 1980 to September 1985

Objectives: This study is one in a series of National studies of regional aquifer systems that together will cover much of the United States. The Great Basin study is headquartered in Carson City, Nevada, with part of the work located in the Utah District office. The overall objective is to assemble hydrologic information and create predictive capabilities necessary for effective management. The Great Basin is made up of individual basins that have basin-fill aquifers of similar origin, but these aquifers are either not connected hydrologically or have limited connection, sometimes by way of consolidated-rock aquifers underlying the uplands that separate basins. Specific objectives are to establish common principles governing occurrence, recharge, movement, discharge, and quality of water in the aquifers of the Great Basin, and to construct digital-computer ground-water models of representative basins or groups of hydrologically-connected basins. The models will be used to help understand the natural (pre-development) flow and geochemical systems and to predict effects of future development and differences in the effects of various management strategies.

Approach: Computer simulation will be the main tool used to analyze the existing hydrogeologic regime and to provide the capabilities of predicting the effects of future development. The simulations will incorporate hydraulic effects, and will be initiated early in the study to help determine the overall nature of the flow system, to identify sensitive parameters and data needs, and to determine what segments of the system, if any, can be treated independently. Assembling available hydrogeologic data on the Great Basin is an important part of the work, and collection of new data needed for successful simulation may require fieldwork. The present distribution of water quality throughout the area will be described using available and project-collected data. These data will be used to interpret the water-quality distribution in terms of the original flow pattern and geochemical processes, and an effort will be made to predict water-quality changes in response to future development, waste disposal, or artificial recharge.

Progress: Test holes around Sevier Lake were jetted and water levels were measured 6 months later. Preliminary results show a ground-water gradient toward the lakebed on the east and a gradient away from the lakebed to the southwest, west, and northwest. Water-level measurements in three test holes in the north end of the Milford area indicate ground-water flow toward the south end of Sevier Lake through the Beaver Lake Mountains area. The digital-computer model of the Milford area is nearing completion. The pumpage inventory of the Milford area continued during the 1983 irrigation season. A second seismic-refraction profile was completed in Tule Valley. Resistivity data from Tule Valley were interpreted and computer-generated cross sections were completed. Bedrock profiles of Tule Valley were generated from the gravity data.

Plans for Next Year: Contingent on funding for the fifth year of the Great Basin RASA Phase I, the following work is planned. Revise Tule Valley digital-computer model using interpretations of hydrogeology from geophysical data and prepare report. Evaluate existing or establish new discharge monitoring systems at Fish Springs, Blue Lake Springs, and Gandy Warm Springs. Prepare proposals for possible Phase II of Great Basin RASA. Studies may include (a) intensive studies of processes and paths of recharge along Wasatch Front, (b) intensive studies of natural discharge along Wasatch Front (evapotranspiration and seepage to streams), (c) intensive study of water-table zone and its part in recharge, system storage, and water quality, (d) comprehensive aquifer tests to determine confining-bed properties necessary for multi-layer digital-computer modeling, and (e) construction of southern Utah Valley model to give complete coverage of Wasatch Front.

Reports:

Gates, J. S. (in review), Hydrogeology of northwestern Utah and adjacent parts of Idaho and Nevada: For publication in the guidebook for the 1984 Utah Geological Association Field Conference.

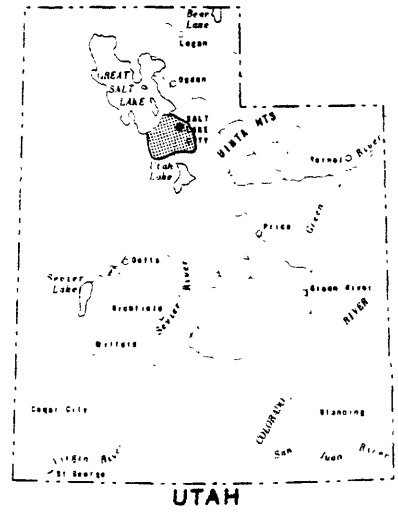
Atwood, J. W., Buettner, P. L., and Mason, J. L. (in preparation), Well data from MX-missile drilling program, Tooele, Juab, Millard, Beaver, and Iron Counties, Utah: U.S. Geological Survey Open-File Report (to be duplicated as Utah Hydrologic-Data Report).

GROUND-WATER CONDITIONS IN SALT LAKE VALLEY, WITH ANALYSIS BY FLOW AND SOLUTE-TRANSPORT MODELS

Number: UT 81-150-C

Cooperating Agencies: Utah Division of Water Rights; local water-management agencies and municipalities

Staff: K. M. Waddell, Hydrologist, Project Chief
R. L. Seiler, Hydrologist
M. D. Santini, Hydrologic Technician (part time, WAE)
D. K. Solomon, Hydrologic Technician (part time, WAE)



Period of Project: July 1981 to June 1985

Objectives: (1) To determine the current state of the Salt Lake Valley's ground-water system in terms of water levels, recharge, movement, discharge, water quality, and volumes of water of various qualities in storage; (2) to construct digital-computer models of the system that will be able to simulate ground-water flow and transport of dissolved solids; and (3) to determine, at least in a preliminary sense, the potential for land subsidence related to water-level declines.

Approach: (1) Update files of data on water levels, withdrawals and natural discharge, and water quality; (2) supplement available information with additional data collected on water levels and quality, recharge and discharge, aquifer and confining-bed parameters, and water in storage; (3) construct a three-dimensional digital model of the system to simulate ground-water flow and several cross-section solute-transport models to simulate movement of dissolved solids. Use the models to simulate changes in water levels and chemical quality resulting from potential ground-water development; and (4) publish results as a Utah Department of Natural Resources Technical Publication.

Progress: Completed calibration of digital model and draft of report for model. Use model to predict effects of increased pumping on existing water levels and water budget.

Plans for Next Year: Complete water-quality phase and prepare final report for project.

Reports:

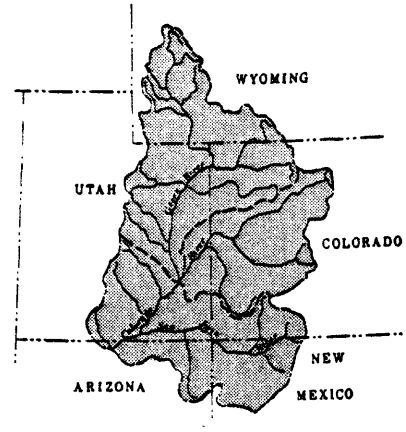
Seiler, R. L., and Waddell, K. M., 1983, Reconnaissance of the shallow-unconfined aquifer in Salt Lake Valley, Utah: U.S. Geological Survey Water-Resources Investigations Report 83-4272.

Waddell, K. M., Seiler, R. L., and Santini, M. D. (in preparation), Digital-computer model of ground-water flow in Salt Lake Valley, Utah: U.S. Geological Survey Water-Resources Investigations Report.

REGIONAL AQUIFER SYSTEMS ANALYSIS-MESOZOIC SANDSTONE AQUIFERS IN THE UPPER COLORADO RIVER BASIN

Number: UT 81-154-F

Staff: J. W. Hood, Hydrologist
G. W. Freethey, Hydrologist, Acting Project Chief
B. E. Thomas, Hydrologist
J. F. Weigel, Hydrologist
E. J. Weiss, Hydrologist (Colorado District, part time)
B. A. Kimball, Hydrologist (Colorado District, part time)
G. E. Cordy, Hydrologic Technician (part time, WAE)
L. N. Thurgood, Hydrologic Technician (part time, WAE)



Period of Project: October 1981 to September 1985

Objectives: This study is one of the series of National studies of regional aquifer systems that together will cover much of the United States. In the Upper Colorado River Basin, aquifers that are truly regional include the complex of thick sandstones of Jurassic and Triassic age and carbonate and sandstone aquifers of Mississippian and Permian age. This study will target the thick sandstones of the Mesozoic System and locally related aquifers of lesser extent. The study is intended to (1) provide a basin-wide data base; (2) define and quantify recharge, occurrence, movement, discharge, and quality of ground water; (3) model the system(s) in order (a) to understand the natural (pre-development) flow and geochemical system(s) and (b) to evaluate or predict the effects of future development and differences in these effects due to various management strategies.

Approach: Computer simulation will be the main tool used to analyze the hydrogeologic regimen of the Mesozoic aquifers system. The results of prior local, areal, and regional studies will be collected and combined, and basic data from those studies will be updated. Concurrently, subregional-flow models will be constructed in order to test provisional hypotheses and show areas where additional data are needed. Following will be a period of data collection, during which the models will be updated as field data are obtained. Final analyses will incorporate consideration of the effects of development on the ground-water flow regimen and storage, on surface-water flow, and on possible water-quality changes that would accompany development. Results of the study will appear as a planning document, data report(s), hydrologic atlases, model documentation, and a final interpretive report.

Progress: Stratigraphic and hydrologic data continue to be compiled, updated, and entered into computer storage. Using plotting techniques developed last year, isopach, structural-configuration, dissolved-solids concentration, and water-level contour maps have been constructed for the principal Mesozoic aquifer systems. An atlas presenting these maps is in review. Rock samples collected last year have been analyzed and the information added to the data

base. Two subregional numerical simulations of ground-water flow in the Navajo Sandstone are completed and the reports are in review. An extensive compilation of hydraulic and lithologic data is being prepared to use as support information for a statistical and modeling analysis. This analysis will determine the controls on the lateral and vertical distribution of hydraulic properties in Mesozoic formations. Work on a third subregional ground-water flow model for the Four Corners area has begun. The model will examine various ground-water flow concepts for the area and be used to analyze and quantify vertical flow between aquifers.

Plans for Next Year: The analysis of the hydraulic-property distribution in the Mesozoic system will continue and a report prepared. The Four Corners model will be completed and a report on results and model documentation prepared. The compilation of hydraulic and lithologic data will be completed and presented in a report. If the project deadline is extended 1 year, a regional steady-state model to test the conceptual distribution of hydraulic properties will be constructed. Impacts from projected development will be analyzed with this regional model.

Reports:

Freethey, G. W., Kimball, B. A., Wilberg, D. E., and Hood, J. W. (in review), General hydrogeology of aquifers of Mesozoic age, Upper Colorado River Basin, Colorado, Utah, Wyoming, and Arizona: U.S. Geological Survey Hydrologic Investigations Atlas.

Kimball, B. A. (in preparation), Mixing and chemical reaction of ground water in the Navajo Sandstone aquifer, Dirty Devil River basin, Utah: Journal Article.

Taylor, O. J., Hood, J. W., and Zimmerman, E. A., 1983, Plan of study for the regional aquifer systems analysis of the Upper Colorado River Basin in Colorado, Utah, and Wyoming: U.S. Geological Survey Water-Resources Investigations Report 83-4184.

Taylor, O. J. Hood, J. W., and Zimmerman, E. A. (in review), Hydrogeologic framework of the Upper Colorado River Basin in Colorado, Utah, Wyoming, and Arizona: U.S. Geological Survey Hydrologic Investigations Atlas.

Thomas, B. E. (in review), Simulation analysis of the interaction of the Navajo Sandstone aquifer and Lake Powell near Wahweap Bay, Utah and Arizona: U.S. Geological Survey Water-Resources Investigations Report.

Weigel, J. F. (in preparation), Selected hydraulic and lithologic data for the Mesozoic formations of the Upper Colorado River Basin in Colorado, Utah, Wyoming, and Arizona: U.S. Geological Survey Water-Resources Investigations Report.

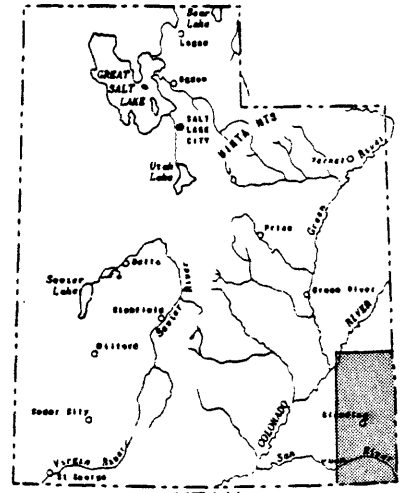
Weiss, E. J. (in review), Ground-water flow model for the Navajo Sandstone in southeast Utah: U.S. Geological Survey Water-Resources Investigations Report.

WATER IN BEDROCK IN EASTERN SAN JUAN COUNTY, WITH SPECIAL EMPHASIS ON THE NAVAJO SANDSTONE AND RELATED AQUIFERS

Number: UT 81-156-C

Cooperating Agency: Utah Division of Water Rights

Staff: C. F. Avery, Hydrologist, Project Chief
Other District personnel as assigned



Period of Project: July 1981 to June 1984

Objectives: To determine: (1) occurrence of ground water and its quality in the area, (2) potential yields of water from wells in the major aquifers, (3) whether those yields can be sustained for the production of fresh or otherwise usable water, and (4) what effect sustained, large, well withdrawals will have on water levels and water in the Colorado River.

Approach: Define the general hydrologic system using methods of general areal studies, and locate all available ground-water data and utilize results of all previous studies. Integrate field operations with the Upper Colorado River Basin RASA (UT-154) where possible. Concentrate field-data collection on determining recharge and discharge rates, aquifer coefficients, the potentiometric surface, and ground-water quality. Preliminary digital-computer modeling of the aquifer will be used to guide data acquisition.

Progress: Data collection was completed in November 1983. Seepage runs were made on the Montezuma Creek and McElmo Creek drainages. A test hole was drilled about 10 miles northeast of Monticello to a total depth of 1,620 feet. Water-level, water-sample, and specific-capacity values were obtained for the Wingate Sandstone from the test hole. The final report has been completed and is in review.

Plans for Next Year: None.

Reports:

Avery, Charles (in review), Bedrock aquifers of eastern San Juan County, Utah, with emphasis on the Navajo Sandstone and associated water-bearing formations: Utah Department of Natural Resources Technical Publication.

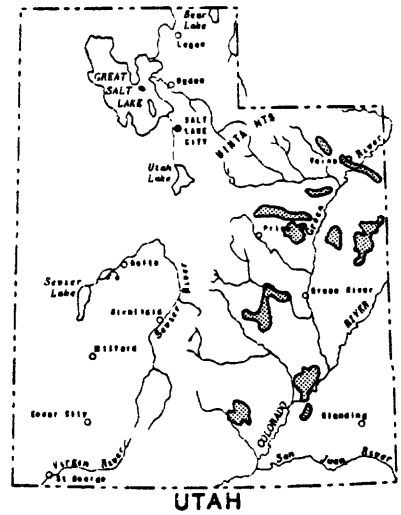
HYDROLOGY OF 11 TAR-SAND AREAS IN EASTERN UTAH

Number: UT 82-157-I

Cooperating Agency: U.S. Bureau of Land Management

Staff: K. L. Lindskov, Hydrologist, Project Chief
H. F. McCormack, Hydrologist
B. J. Stolp, Hydrologic Technician (part time, WAE)

Period of Project: July 1982 to September 1983



Objectives: Describe the existing hydrologic system in 11 Special Tar-Sand Areas, and prepare hydrologic maps for the Argyle Canyon--Willow Creek and Sunnyside Special Tar-Sand Areas. Where possible, predict hydrologic impacts of tar-sand production.

Approach: Describe the hydrologic system by utilizing available hydrologic information, mainly from oil-shale studies and all other previous studies in and near the 11 areas. Prepare a report for submission to BLM by April 1, 1983, which describes the hydrology, primarily using existing data and interpretations available from previous studies. During the summer of 1983, update existing well and spring inventories and collect additional samples, where needed, to further refine definition of the chemical quality of surface and ground water in the Argyle Canyon--Willow Creek and Sunnyside areas. Prepare a series of four hydrologic maps, for the Price 30 x 60-minute quadrangle (Argyle Canyon--Willow Creek and Sunnyside areas). Maps for normal annual precipitation and average annual runoff, and sediment yield, quality of ground water, and quality of streamflow will be included.

Progress: Well and spring inventories were completed for the Argyle Canyon--Willow Creek and Sunnyside areas. Measurements of flow and water-quality samples were obtained for 25 springs. Drafts of the four hydrologic maps of the Price Quadrangle were completed.

Plans for Next Year: None. Study was terminated in September 1983 because of lack of funds. Funding may be provided to finish review of and to publish the hydrologic maps of the the Price Quadrangle.

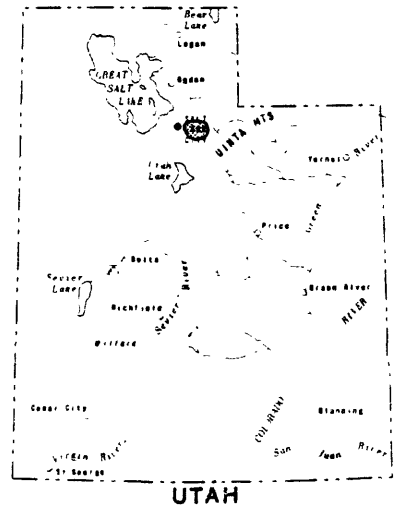
Reports:

Lindskov, K. L., and others, 1983, Hydrologic impacts of a tar-sand industry in 11 Special Tar Sand Areas in eastern Utah: U.S. Geological Survey Water-Resources Investigations Report 83-4109.

McCormack, H. F., Lindskov, K. L., and Stolp, B. J. (in review), Hydrologic maps of the Price 30 x 60-minute quadrangle, Utah: U.S. Geological Survey Water-Resources Investigations Report.

HYDROLOGY OF THE PARK CITY AREA

Number: UT 82-158-C



Cooperating Agency: Utah Division of Water Rights

Staff: W. F. Holmes, Hydrologist, Project Chief
M. Enright, Hydrologic Technician
K. R. Thompson, Hydrologist (part time)

Period of Project: July 1982 to June 1985

Objectives: Define the surface-water and ground-water hydrology and the relationship between them. Characterize consolidated and unconsolidated rock aquifers. Determine the effects of ground-water withdrawals from both aquifers and the effects of surface-water diversions and construction of a large reservoir on the system. Determine ground-water quality and the effects of continued development on water quality.

Approach: Define surface-water hydrology using existing records, additional monitoring sites, and two new gages, to estimate average surface-water inflow and outflow in the study area and their quality. Estimate evapotranspiration by mapping phreatophytes, water surfaces, and wetland. Inventory all wells, drain tunnels, mines, and springs. Conduct seepage runs along major canals and streams to determine recharge or discharge. Determine direction of ground-water movement by measuring water levels in existing wells. Determine geologic characteristics such as strike, dip, fracturing or jointing, that may control ground-water occurrence and its flow direction. Determine hydraulic characteristics of aquifers by testing. Collect samples from wells and springs, surface water, and mines for chemical analysis; and determine water quality for all parts of the system. Characterize ground-water quality in both aquifers, and use data to infer source and movement of ground water. If feasible, construct a ground-water model to test the conceptualized ground-water system. If funds are available, drill test holes in both unconsolidated and consolidated rocks.

Progress: Gaging stations and partial-record sites have been operated for 2 years. Water levels in about 20 observation wells have been obtained on a monthly basis for 1 year. Estimates of evapotranspiration have been made. Wells, springs, and tunnels have been inventoried. Seepage runs on major streams have been completed. Several aquifer tests have been conducted. All water-quality sampling is complete.

Plans for Next Year: Complete water-level measurements in those wells that were inaccessible in the spring of 1984, and continue operation of gaging stations and partial-record sites through September 1984. Complete computer storage of ground-water data. Participate in testing a large-diameter production well. Prepare draft of final report on study by January 1985.

Reports: None.

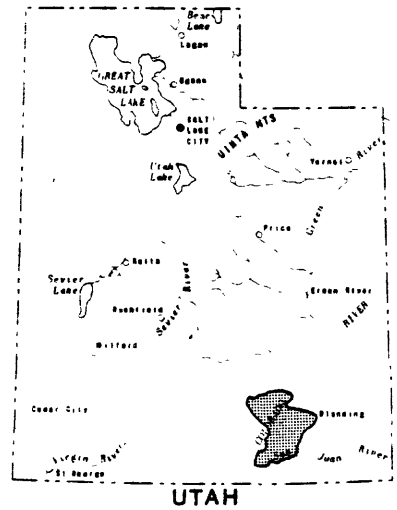
BEDROCK AQUIFERS IN THE LAKE POWELL AREA, UTAH, WITH EMPHASIS ON THE NAVAJO SANDSTONE

Number: UT 82-159-C

Cooperating Agency: Utah Division of Water Rights

Staff: P. J. Blanchard, Hydrologist, Project Chief
Other District personnel as assigned

Period of Project: July 1982 to June 1984



UTAH

Objectives: Determine the occurrence, recharge, movement, discharge, and quality of water in bedrock aquifers, with emphasis on the Navajo Sandstone. Additionally, determine hydraulic characteristics of the Navajo Sandstone and other significant aquifers and the relationships between surface water and ground water.

Approach: Existing data from the files of the U.S. Geological Survey, Utah Division of Water Rights, other government agencies, and private sources (including petroleum companies) will be integrated with data collected in the field. Field-data collection will include well and spring inventories, borehole geophysical logging, seepage studies on selected stream reaches, shallow-core sampling and laboratory analyses of cores for hydraulic properties, and both ground- and surface-water samples for chemical analysis. Abandoned oil-tests will be converted to observation wells, if feasible. Short-term aquifer tests will be performed where possible. The assembled data will be used to determine a hydrologic budget, potentiometric surface, and structural surface of the Navajo Sandstone; and the occurrence, amount, movement, and quality of water in the Navajo. If feasible, a simplified digital-computer model of the ground-water system will be prepared, and an attempt will be made to determine the relations between Lake Powell and the ground-water system.

Progress: Fieldwork was completed in November 1983. Draft of final report was prepared and is in review.

Plans for Next Year: None.

Reports:

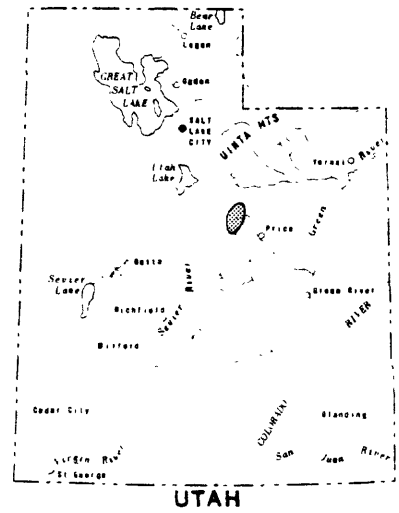
Blanchard, P. J. (In review), Ground-water conditions in the Lake Powell area, Utah, with emphasis on the Navajo Sandstone: Utah Department of Natural Resources Technical Publication.

SEDIMENT AND TRACE-METALS TRANSPORT IN STREAMS IN THE PLEASANT VALLEY COAL-RESOURCE AREA, CENTRAL UTAH, AND THEIR EFFECTS ON SCOFIELD RESERVOIR

Number: UT-83-160-I

Cooperating Agency: U.S. Bureau of Land Management

Staff: D. W. Stephens, Hydrologist, Project Chief (part time)
K. R. Thompson, Hydrologist (part time)
J. B. Wangsgard, Hydrologic Technician (part time, WAE)



Period of Project: October 1982 to September 1985

Objectives: Determine sediment and common trace-metal loads in selected streams in the Pleasant Valley coal-resource area and determine if coal-mining and coal-washing operations have increased loads. Determine loads entering Scofield Reservoir and their effects on reservoir geochemistry.

Approach: Monitor and compute sediment loads at existing gaging stations on (1) Pleasant Valley Creek near its point of inflow to Scofield Reservoir and (2) in Eccles Canyon (a tributary to Pleasant Valley Creek) downstream from an extensive area clearcut for mining and associated roads and downstream from a coal-washing plant. Also construct and maintain a gaging station and sediment-monitoring site on one other tributary to Pleasant Valley Creek that is unaffected by mining; or on Fish Creek, which has experienced no mining, and is the major inflow source for Scofield Reservoir. Analyze for the types and weights of metal oxides attached to selected sediment samples in order to compute trace-metal loads. Collect a set of reservoir-sediment core samples and analyze for trace-metal content; and collect soil samples in undisturbed areas and areas disturbed by mining and analyze for available ions. Analytical work will be performed in the U.S. Geological Survey Central Laboratory. Predict effects of present and future sediment and trace-metal transport into Scofield Reservoir on reservoir geochemistry. Prepare interpretive report by October 1985.

Progress: Reservoir cores were collected at five sites, with chemical analysis of five segments of each core, and age dating using cesium-127 and lead-210. Preliminary data indicate the cores contain very low concentrations of arsenic, cadmium, and mercury; and concentrations of common trace metals generally decrease with sediment depth. Isotope-dating methods worked well for stable, midlake areas with sediment-deposition rates ranging from 500 to 1,500 millimeters per year. Dating methods were not as successful for two locations where considerable sediment is deposited during part of the year by two major inflowing streams, and later the streams scour some of the sediment and move it further into the reservoir.

Sediment core-leachate tests indicated a gradual release of dissolved iron, manganese, and zinc over a 700-hour period in cores incubated aerobically. Release rates for dissolved manganese and dissolved phosphorus were an order-of-magnitude greater in cores incubated anaerobically as compared to aerobic incubation.

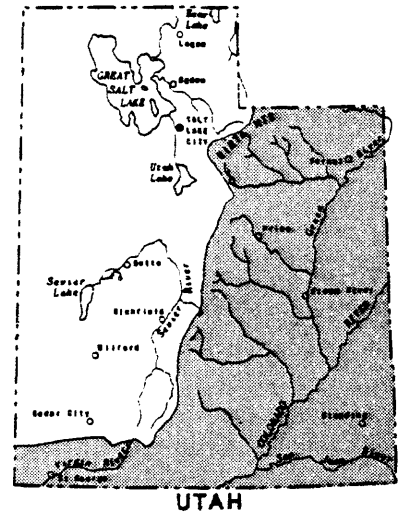
The break of a beaver dam partially destroyed one gaging station and spring flooding interrupted the station record at three other sites. All sites were put back into operation by late summer, and water-quality data collection continued throughout the year.

Plans for Next Year: Complete data collection and analyses and write final report.

Reports: None.

SUMMARY OF AND REGIONALIZATION OF STREAMFLOW CHARACTERISTICS FOR THE COLORADO RIVER BASIN, UTAH

Number: UT 83-161-I



Cooperating Agency: U.S. Bureau of Land Management

Staff: R. C. Christensen, Hydrologist, Project Chief
E. B. Johnson, Hydrologist (part time)
G. G. Plantz, Hydrologic Technician (part time)
L. S. Conroy, Hydrologic Technician (part time, WAE)

Period of Project: October 1982 to September 1984

Objectives: (1) Compute and summarize streamflow characteristics for gaging stations in the Colorado River Basin, Utah. Using standard techniques, compute frequency curves for peak flow, 1-, 3-, 7-, and 15-day flood flow, and 1-, 7-, 14-, 30-, 60-, and 90-day low flow. (2) Provide methods for transferring streamflow characteristics from gaged to ungaged sites.

Approach: (1) Using Geological Survey computer programs, data in the WATSTORE files will be processed and statistics tabulated for all stations in the Colorado River Basin, Utah. The statistics will include listings of high- and low-flow summaries, flow duration, variability of monthly and annual flow values for active and discontinued stations with 1 or more complete years of daily flow, and annual peaks for all stations including the crest-stage partial records. Frequency curves will be computed for stations with 10 or more years of record and the high- and low-flow values will be tabulated depending on record length for recurrence intervals of 2, 5, 10, 25, 50, and 100 years. The information will be published in an interim report with a short manuscript for each station followed by the statistics. A brief text will define terms and give examples of how to use the data. (2) The second phase will be the regionalization of selected flow characteristics. The equations will be developed by relating flow to basin characteristics using multiple-regression techniques. Accuracy of these relations for transferring flow characteristics from gaged to ungaged sites will be compared to equivalent years of record at gaging stations. Derived relations will be matched and adjusted to available results from adjacent states. A final report will outline procedures for using the relations to determine flow characteristics at ungaged sites.

Progress: The interim report (objective 1), a compilation of streamflow characteristics for gaging stations in the Colorado River Basin in Utah, has been completed. A draft of the final report (objective 2) has been written. The report outlines methods for estimating average discharge and the annual maximum 1-, 7-, and 15-day mean discharges for 10-, 50-, and 100-year recurrence intervals at gaged and ungaged sites on natural-flow streams.

Plans for Next Year: Complete processing of all reports by October 1984.

Reports:

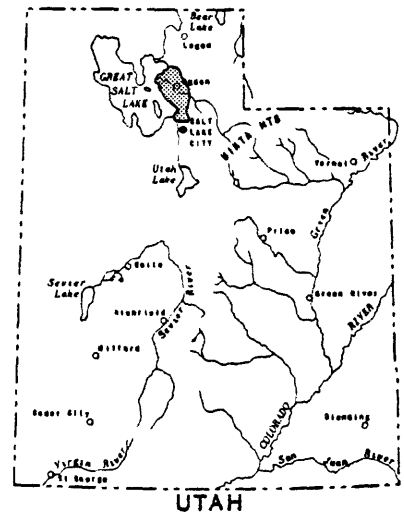
Christensen, R. C., Johnson, E. B., and Plantz, G. G. (in review), Streamflow characteristics of the Colorado River Basin in Utah through September 1981: U.S. Geological Survey Open-File Report (to be duplicated as Utah Hydrologic-Data Report).

Christensen, R. C., Johnson, E. B., and Plantz, G. G. (in review), Manual for estimating streamflow characteristics of natural-flow streams, Colorado River Basin in Utah: U.S. Geological Survey Water-Resources Investigations Report.

GROUND-WATER HYDROLOGY OF THE EAST SHORE AREA

Number: UT 83-162-C

Cooperating Agency: Utah Division of Water Rights



Staff: D. W. Clark, Hydrologist, Project Chief
C. L. Appel, Hydrologist

Period of Project: July 1983 to June 1986

Objectives: (1) To assess current conditions in terms of recharge, movement, and discharge of ground water, water levels, ground-water quality, and volumes of water of various qualities in storage. (2) To increase knowledge and understanding of the ground-water system of the East Shore area and how it functions. (3) To construct a digital-computer model of the system that can simulate its past and current conditions and potential future effects of changes in discharge and recharge.

Approach: (1) Update well and spring data, including water-level and water-quality data, and put them in computer storage. (2) Conduct a comprehensive inventory of ground-water discharge, including that from wells and springs; to drains, streams, and sewers; by evapotranspiration by phreatophytes; and to Great Salt Lake. (3) Estimate recharge, where feasible, by streams, irrigation, precipitation, and by subsurface flow from consolidated rock. (4) Conduct aquifer tests to add to knowledge on hydraulic characteristics of the basin fill. (5) Construct three-dimensional digital models covering the area to simulate ground-water flow and effects of changes in the system. (6) Prepare basic-data and model reports and an overall interpretive report, for publication by the Utah Department of Natural Resources.

Progress: The planning document was prepared and new page-size and plate-size base maps have been designed and are being compiled. All available well-drillers' logs have been compiled and wells prioritized for inventory. Historic water-level and well-discharge data have been organized according to their potential importance. Field inventory of new large-diameter wells and wells in strategic locations has begun. Updating of an expanded observation-well network continues. Discharge measurements on wells and at surface-water sites is underway. Preliminary work on two separate digital models (one for the Bountiful area and one for the Weber Delta area) has begun.

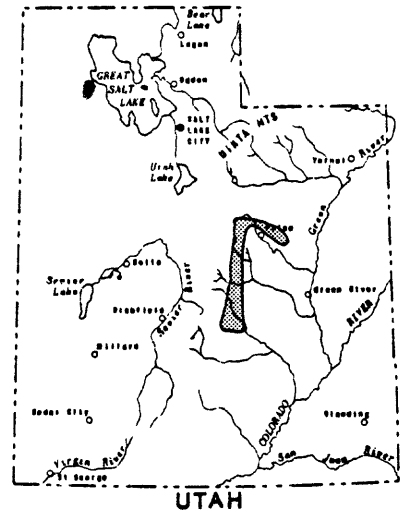
Plans for Next Year: Continue to make bimonthly measurements of water levels in selected observation wells. Continue the inventory of important wells. Measure discharge of selected wells, drains, and springs. Conduct seepage-loss studies in areas where recharge from irrigation canals and from streams near the mountains may be occurring. Sample a small number of wells and springs for water-quality analysis. Conduct aquifer tests where possible. Measure water levels in early 1985 in all wells in the expanded observation-well network. Continue work on the two digital models.

Reports: None.

ROCK FRACTURES AND COAL CLEATS AND THEIR EFFECTS ON GROUND-WATER HYDRAULICS IN COAL FIELDS OF CENTRAL UTAH

Number: UT 83-163-I

Cooperating Agency: U.S. Bureau of Land Management



Staff: G. C. Lines, Hydrologist, Project Chief
Other District personnel as assigned

Period of Project: October 1983 to September 1986

Objectives: In the Wasatch Plateau, Book Cliffs, and Emery coal fields, determine the general frequency, orientation, and continuity of rock fractures and coal cleats and their relation to faults and folds, to lineaments identified on aerial photographs, to depth of burial, to lithology, and to land subsidence related to coal mining. Where possible, determine the effects of fractures and cleats on aquifer permeabilities and anisotropy, on local and regional movement of ground water, and on inflow to underground mines.

Approach: (1) Literature search and review on rock fracturing and land subsidence. (2) Review of existing aquifer tests, spring inventories, and lab-permeability data in the project area. (3) Identify lineaments on aerial photographs (Landsat and low level), field check, and relate to geologic features shown on geologic maps. (4) Map fractures and coal cleats on outcrops concentrating on nine mine areas distributed throughout the study area (Emery, Dog Valley, SUFCo, Trail Mountain, Wilberg-Deer Creek, Coop, Skyline, Soldier Creek, and Sunnyside Mines) and unleased tracts along Muddy Creek and near Scofield. (5) Map coal-cleat orientation and bedrock fractures in nine underground mines. (6) Map subsidence features and relate to mine orientation and to local fracture patterns. (7) Study water production in mines and relate to fractures and cleats and to mine orientation. (8) Locate springs with large discharges and relate to geologic setting, and local and regional movement of ground water. (9) Conduct aquifer tests on selected wells. (10) Prepare interpretive report for review by March 31, 1986.

Progress: Extensive literature search and review nearly completed. Existing aquifer tests, spring inventories, and lab-permeability data have been identified. Lineaments have been delineated on Landsat images, and field checking was started. Fracture and coal-cleat orientations have been mapped in the Emery coal field, and sites have been selected to measure frequency and aperture of fractures in the Emery field.

Plans for Next Year: Study suspended in May 1984 because of lack of funds; may be reactivated in October 1984.

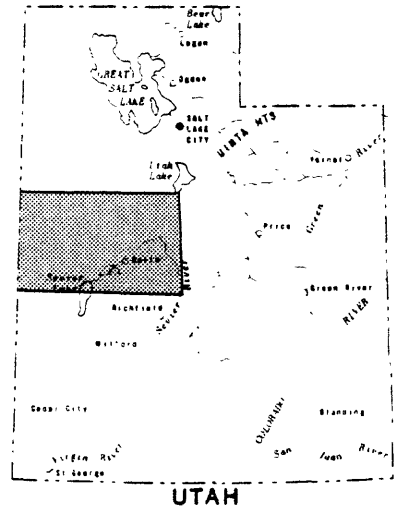
Reports: None.

DISCHARGE AND CHEMICAL QUALITY OF WATER FROM SELECTED SPRINGS IN PARTS OF JUAB, MILLARD, AND UTAH COUNTIES

Number: UT 84-164-I

Cooperating Agency: U.S. Bureau of Land Management

Staff: W. F. Holmes, Hydrologist,
Technical Supervisor
D. E. Wilberg, Hydrologic Technician (WAE),
Project Chief
B. J. Stolp, Hydrologic Technician
(part time, WAE)
Other District personnel as assigned



Period of Project: December 1983 to March 1985

Objectives: To provide the Bureau of Land Management (BLM) with data concerning water quality, discharge, geologic source, and permanence for 79 selected springs in parts of Juab, Millard, and Utah Counties. The data from the lab analysis and field inventory will be used to evaluate the suitability of water from each spring for stock, wildlife, and human consumption and to provide BLM with information they can use in the water-rights adjudication process.

Approach: The sampling procedure will require two visits to each of the 79 selected springs; one during the seasonal high-flow period of spring and one during the low-flow period of summer and early fall. The high-flow visit will include determination of location, collection of water sample for laboratory analysis, measurement of discharge, interpretation of geologic source and a description of the structure that may control the existence of a spring at a particular location, titration of spring water to determine field alkalinity, and measurement of specific conductance, pH, and temperature. The second visit will include a measurement of discharge as a basis for seasonal variability, determination of temperature and specific conductance, and a panoramic photograph to document the spring setting. If there is a large discrepancy in specific conductance between the first and second visits, another water sample will be collected for laboratory analysis.

Progress: The initial sampling and inventory of the 79 springs is planned to be completed by the end of June. Completion of sampling has been delayed slightly due to inexcessibility of springs at higher elevations. The format for the chemical-quality and spring-record tables has been approved. Each table format has been entered onto the computer and is updated periodically as data are obtained or lab analyses are received. An up-to-date copy of these tables will be give to the BLM on June 30 and September 20, 1984.

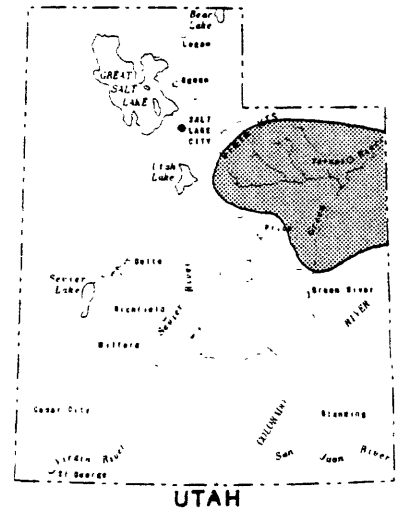
Plans for Next Year: Complete visits to the spring sites during periods of low flow, compile tables of chemical analyses and records of selected springs, and write final report.

Reports:

Wilberg, D. E., and Stolp, B. J. (in preparation), Discharge, chemical quality of water, and physical characteristics of selected springs in parts of Juab, Millard, and Utah Counties, Utah: U.S. Geological Survey Water-Resources Investigations Report.

DEPTH TO BASE OF MODERATELY SALINE GROUND WATER, UINTA BASIN

Number: UT 84-166-C



UTAH

Cooperating Agency: Utah Division of Oil, Gas, and Mining

Staff: L. W. Howells, Hydrologist, Project Chief
Other District personnel as assigned

Period of Project: April 1984 to June 1986

Objectives: To determine the depth to the base of ground water containing 10,000 milligrams per liter or less of dissolved solids in the Uinta Basin; to portray the depth on three maps (Greater Altamont-Bluebell oil-field, western Uinta Basin, and eastern Uinta Basin); and to prepare a report including at least the latter two of the maps, tables of ground-water data used in preparing the maps, a discussion of how the maps were prepared, and a brief summary of the basin's hydrogeology.

Approach: The files of the Utah Division of Oil, Gas, and Mining, Utah Division of Water Rights, U.S. Geological Survey, Bureau of Land Management, and oil companies will be searched to locate data on ground-water quality, borehole-geophysical logs that could be interpreted to indicate ground-water quality, and geologic information related to hydrogeology. A map of the Greater Altamont-Bluebell oil-field will be prepared first to develop techniques. Data on water production from oil-fields in the basin will be updated. Empirical relations between water quality and formation resistivity (from resistivity logs) will be developed. Maps showing contours of the depth to the base of water with 10,000 milligrams per liter or less of dissolved solids will be prepared using water samples, empirical relations between resistivity and water quality, and theoretical determination of water quality from resistivity data, and geologic information. Cross sections will be prepared from the maps to illustrate complex changes in water quality.

Progress: Planning and compilation of the data for the study have been started. A letter has been sent to oil companies requesting their assistance in obtaining water samples and analyses.

Plans for Next Year: Complete the compilation of data on water quality and availability of resistivity logs. Select techniques for determining water quality from resistivity. Prepare a draft of the map of the Greater Altamont-Bluebell oil-field.

Reports: None.

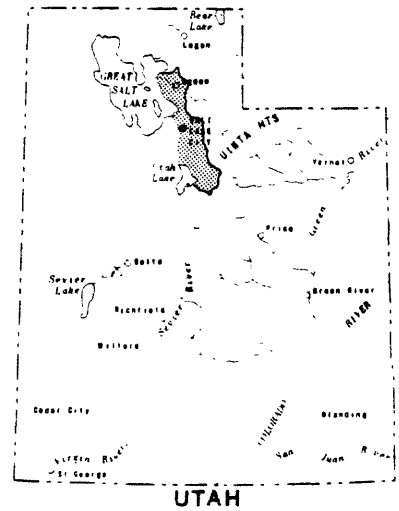
PROPOSED PROJECTS

FLOOD CHARACTERISTICS OF URBAN WATERSHEDS

Number: UT 84-165-C

Cooperating Agency: Utah Department of Transportation

Staff: K. L. Lindskov, Hydrologist, Project Chief (part time)
L. R. Herbert, Hydrologic Technician (part time)
M. L. Palmer, Hydrologic Technician (part time, WAE)
G. J. Smith, Hydrologic Technician (part time, WAE)
Other District personnel as assigned



Period of Project: July 1984 to September 1987

Objectives: (1) Obtain hydrologic data for 12 representative urban watersheds to define frequency relations of peak flow and volumes of flood flow. The results will be used to determine the impacts of urban development on floods along the Wasatch Front (Salt Lake, Davis, and parts of Utah and Weber Counties). (2) Develop methods for determining peak flow and volumes of flood flow for selected recurrence intervals for ungaged urban watersheds. (3) Complete summaries of increases or decreases in peak flow between the canyon mouth and the stream mouth for major streams that receive most of their flow from mountain snowmelt, flow through the urban areas, and are tributary to the Jordan River, Utah Lake, and the Great Salt Lake. This will provide methods for combining the snowmelt runoff with the thunderstorm runoff contributed by the intervening area.

Approach: Flood and rainfall data will be obtained at sites in 12 representative urban watersheds over a 3-year period. The data for about 20 storms will be used to calibrate an urban rainfall-runoff model for each site. The model will be used, along with long-term rainfall data, to simulate a long period of flood flows. After the data collection and record simulation are complete, various schemes will be investigated for transferring the information from gaged to ungaged sites. One scheme would be to relate flow characteristics to basin and climatic characteristics using multiple-regression techniques. Case histories will be compiled by comparing peak flow at the canyon mouth with peak flow at points where selected larger streams empty into the Jordan River, Utah Lake, and the Great Salt Lake. This will allow for modifying the snowmelt peak flow as measured at the canyon mouth.

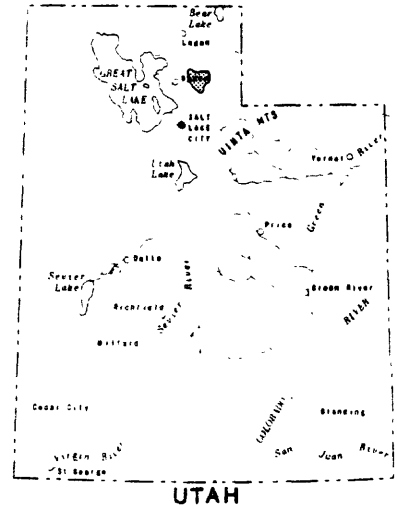
Plans for Next Year: Maintain the 12 urban stream sites that have been selected and instrumented for measuring flood runoff, review the records monthly, and process the data for input to a rainfall-runoff model. Long-term records of rainfall intensity for the Salt Lake International Airport will be obtained from the National Oceanic and Atmospheric Administration. Begin determining basin characteristics and urban development factors for the 12 urban watersheds.

WATER RESOURCES OF OGDEN VALLEY, WEBER COUNTY, WITH EMPHASIS ON GROUND WATER

Cooperating Agency: Utah Division of Water Rights

Staff: Charles Avery, Hydrologist, Project Chief
Other District personnel as assigned

Period of Project: July 1984 to June 1987



Objectives: Assess current conditions in Ogden Valley in terms of recharge, movement, and discharge of ground water, surface water-ground water relationships, ground water in storage, and general water quality. Gain a better understanding of the hydrologic system and its operation, and estimate the effects of potential changes in discharge from the ground-water reservoir. A reconnaissance of ground-water occurrence will be conducted in the drainage basin upstream of Ogden Valley.

Approach: Conduct a well and spring inventory in Ogden Valley, including collection of water-level, discharge and specific capacity, and water-quality data. Inventory wells and major springs, and determine the general occurrence of ground water in the upstream drainage basin. This information will be placed in the WATSTORE data base. Conduct a survey of ground-water discharge (on a probable annual basis) in Ogden Valley, including that from wells, springs, base flow in streams, and evapotranspiration by phreatophytes. Also estimate by various methods the discharge from the artesian aquifer to Pineview Reservoir, including effects on discharge due to stage changes in the reservoir. Estimate recharge to Ogden Valley, where feasible, including that from streams, irrigation, precipitation, and subsurface flow from consolidated rocks. Establish an observation-well network, including wells near surface-water bodies. Use surface geophysics to map the base of the valley fill. Conduct aquifer tests to more precisely determine the hydraulic characteristics of the valley fill. Construct a digital-computer model of the valley to simulate ground-water flow and effects of changes in the system.

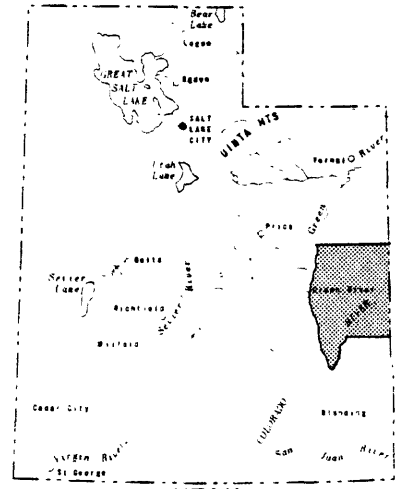
Plans for Next Year: Prepare a planning document. Collect and compile existing data. Begin the well and spring inventory in Ogden Valley.

GROUND-WATER CONDITIONS IN GRAND COUNTY AND NORTHWESTERN SAN JUAN COUNTY, UTAH, WITH EMPHASIS ON THE ENTRADA, NAVAJO, AND WINGATE SANDSTONES

Cooperating Agency: Utah Division of Water Rights

Staff: P. J. Blanchard, Hydrologist, Project Chief
Other District personnel as assigned

Period of Project: July 1984 to June 1987



Objectives: (1) To increase knowledge and understanding of the ground-water system(s) in Grand County, including areas and rates of recharge, movement, and discharge. (2) To determine the hydrologic characteristics of the aquifers. (3) To determine the chemical quality of ground water. (4) To estimate the hydrologic effects of increased extraction of energy resources and related withdrawals of ground water. The upland areas of northern Grand County (Book and Roan Cliffs) will be investigated in less detail than the lower areas in southern Grand County.

Approach: (1) Inventory wells, springs, and exploration holes and enter data into computer storage. Wells and springs in the Entrada-Navajo-Wingate sequence will have first priority. (2) Estimate recharge to the ground-water system(s) from precipitation, streams, and interformational movement. (3) Prepare potentiometric surface maps to define ground-water movement. (4) Estimate discharge from the ground-water system(s) from wells, springs, evapotranspiration, seepage to streams, and by interformational movement. (5) Determine aquifer characteristics from aquifer tests and laboratory analysis of shallow-core samples and outcrop samples. (6) Estimate the amount of usable water in storage based on thickness data from well logs and estimates of saturated thickness from measured water levels in wells. (7) Determine the chemical quality of ground water by collecting and analyzing water samples from wells and springs, and attempt to identify the sources of constituents in the water. Investigate natural contamination by saline ground water from the Paradox Formation. (8) Attempt to determine (a) the hydrologic effects of increased energy resource extraction, and (b) the effects of related large-scale withdrawals on the quantity and quality of ground water. (9) Construct a digital model of the area or parts of the area, if the data base is adequate and modeling is judged to be feasible, to simulate past and current conditions and predict future conditions. (10) Drill one to three test holes in areas where data are deficient, if funds are available.

Plans for Next Year: Search files of the Division of Water Rights and the Bureau of Land Management, Branch of Oil and Gas, for data concerning ground water; conduct a literature search; inventory wells and springs and collect water samples for chemical analysis; select potential sites for aquifer tests and seepage runs; and conduct shallow coring to collect samples of aquifer material for laboratory analysis of hydraulic properties.