

United States Geological Survey Programs in Utah



The USGS provides maps, reports, and information to help others meet their needs to manage, develop, and protect America's water, energy, mineral, and land resources. We help find natural resources needed to build tomorrow, and supply scientific understanding needed to help minimize or mitigate the effects of natural hazards and environmental damage caused by human activities. The results of our efforts touch the daily lives of almost every American.

Data Collection and Monitoring Networks

The U.S. Geological Survey (USGS) has been collecting hydrologic data relating to the occurrence, quantity, and quality of water resources in Utah since 1889. The USGS maintains a network of about 200 gaging stations on rivers, streams, lakes, and reservoirs in Utah and parts of Wyoming, Idaho, and Arizona and monitors about 1,100 wells throughout the State (fig. 1). Within this network, water-quality samples are collected at 15 sur-

face-water sites and about 185 wells. Additional water-quality samples are collected throughout Utah as part of investigative studies in which the hydrology of specific areas is examined.

The USGS maintains a publicly accessible computerized data base with information related to more than 2,000 surface-water and 22,000 ground-water sites throughout Utah and parts of Wyoming, Idaho, and Arizona. In Utah, 50 stream-flow-gaging stations are equipped with satellite data-collection platforms to provide immediate information to allow water managers to monitor and allocate water to those holding water rights and to allow commercial rafting companies to plan river trips.

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These unbiased data, spanning more than 100 years, are used by many agencies and local entities within the State to manage current water allocations and to make informed decisions when planning for future demands on the limited water resource. Data from the USGS also are used to improve bridge design for flood conditions and to help in the design of storm-runoff systems in urban environments.

Surface- and ground-water and water-quality data collected by the USGS are compiled and published in a series of annual reports that describe the hydrologic conditions in the State for each water year. Also, since 1964, the USGS, in cooperation with the Utah Department of Natural Resources, Division of Water Resources, has published annual reports that detail the changes in ground-water conditions throughout the State. The reports contain information on well construction, ground-water withdrawals, water use, water-level changes, and related changes in precipitation, stream-flow, and chemical quality of water. Included in the annual report are maps that show ground-water-level contours during a specified period of time, which allow interested parties to keep aware of changing ground-water conditions in local areas.

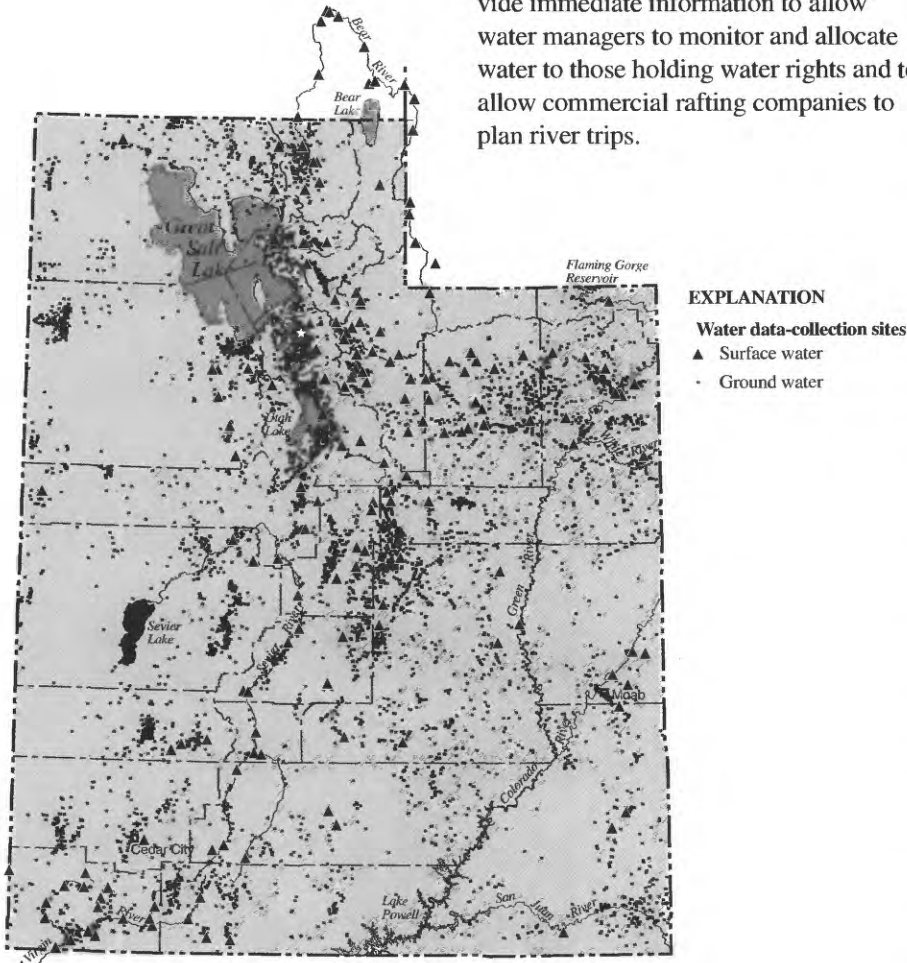


Figure 1. Ground- and surface-water data-collection sites.

National Water-Quality Assessment Program

In 1991, the USGS began implementing a full-scale National Water-Quality Assessment (NAWQA) Program. The long-term goals of the NAWQA Program are to describe the status and trends in the quality of a large representative part of the Nation's surface- and ground-water resources and to provide a sound, scientific understanding of the primary natural and human factors that affect the quality of these resources. In meeting these goals, the NAWQA Program will produce a wealth of water-quality information that will be useful to policymakers and managers at Federal, State, and local levels.

A major design feature of the NAWQA Program enables integration of water-quality information at different areal scales. The basic building-block of the NAWQA Program is the study-unit investigation. The 60 study-unit investigations that make up the Program are hydrologic systems that include principal river basins and aquifer systems throughout the Nation. These study units cover areas from less than 1,000 to greater than 60,000 square miles and incorporate from about 60 to 70 percent of the Nation's water use and population served by public water supply. In 1993, assessment activities began in the Great Salt Lake Basins NAWQA study unit.

Most of the 14,500-square-mile Great Salt Lake Basins study is in Utah but also includes areas in Idaho and Wyoming (fig. 2). The study area encompasses three major river systems that enter Great Salt Lake—the Bear, the Weber, and the Jordan. The study area includes Utah's three largest cities (the Salt Lake City metropolitan area, Ogden, and Provo) and about 1.4 million people, or 85 percent of the population of the State.

Communication and coordination among the USGS and water-management and other water-resource agencies are key components of the Great Salt Lake Basins NAWQA Program in the State. The projects distribute findings in a variety of reports to local, State, and Federal agencies as results become available.

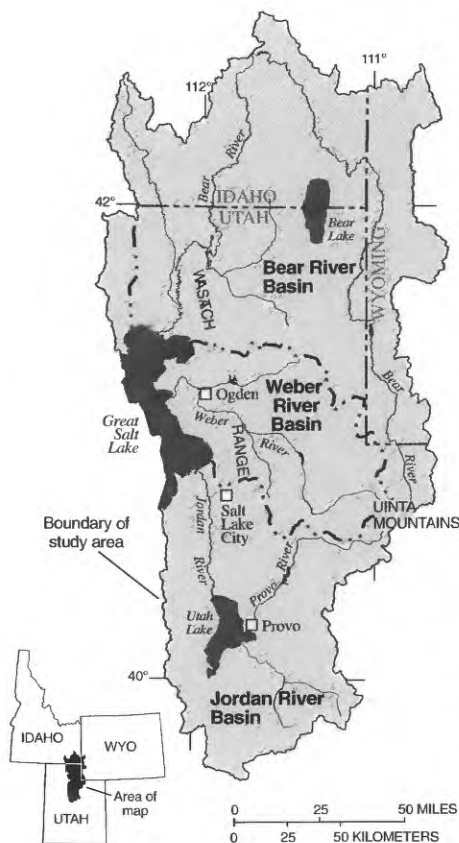


Figure 2. Great Salt Lake Basins National Water Quality Assessment Program study area.

Mineral-Resource Assessments of the Great Basin Province

The Great Basin Province, occupying the western one-third of Utah, contains the majority of mineral deposits of the State and has the greatest potential for remaining undiscovered deposits. The USGS, in collaboration with the Utah Geological Survey, has had a continuing program of regional and local mineral-resource assessments for the Province. The collaborative work has resulted in updating and recompilation of mineral resource information throughout the Province, which are valuable long-term data bases for governmental agencies and private industry. In addition, many new geologic maps have been produced at various scales for supporting multipurpose land-management evaluations. Preliminary mineral-resource assessments have been completed for the Tooele and the Cedar City 2-degree quadrangles, a final assessment has been completed for the Richfield quadrangle, and an assessment of the Delta quadrangle is nearing completion. Recently, during studies for the Delta project, USGS scientists identified a

previously unrecognized volcanic feature, which apparently is related geologically to the Tintic mining district; this prompted renewed mineral industry exploration interest in western Utah.

Cache Valley Water Supply

The increasing population in the Cache Valley is resulting in an increasing demand for ground water for public supply. The USGS recently completed a study in the Cache Valley and adjacent parts of Idaho that identifies and characterizes existing ground-water resources, including the ability of the ground-water system to yield water to wells. As part of the study, a computer model of the ground-water system in the Cache Valley was constructed and calibrated by using data collected during the study and data collected as part of the USGS statewide ground- and surface-water monitoring programs. The model is a tool being used by water managers to determine the effects of ground-water development on springs and streams in the Cache Valley.

The model and results of the USGS studies will provide water managers in Utah and Idaho with a tool to project the potential effects of current and future ground-water development. For example, in areas where ground-water development affects the flow of spring and streams, water managers can project the effects of various ground-water withdrawal alternatives and make sound decisions on how to minimize the effects on the water resources and citizens of the Cache Valley.

Wasatch Front Ground-Water Recharge

The most densely populated areas in Utah extend for almost 100 miles along the base of the Wasatch Range and contain 85 percent of the State's population. The water supply for this metropolitan area is from rivers flowing out of the mountains and from aquifers that underlie the cities and towns.

Aquifers get their water from recharge areas where water from rain, snow, or in streams infiltrates into the aquifers. These areas are highly susceptible to contamination because water moves rapidly from the land surface to the ground water and, thus, can carry contaminants spilled on the surface to the water aquifers.

The USGS, in cooperation with the Utah Department of Environmental Quality, mapped the ground-water-recharge areas along the most densely populated areas in Utah to provide State and local agencies with detailed scientific data for developing ground-water protection initiatives.

The USGS study provides information to State, local, and municipal governments; private firms; and citizens for use in planning and zoning for protection of ground-water supplies in the most populated areas of the State. The protection of ground-water supplies from contamination is critical for providing potable water to the citizens of Utah and for economic development and future growth.

Earthquake Hazards

About 80 percent of Utah's 2 million residents live within 6 to 10 miles of the Wasatch Fault Zone. Since the mid-1980's, seismologists at the USGS and the University of Utah and Utah State agencies, including the Utah Geological Survey, have been cooperatively involved in a wide variety of research on earthquake seismology, geology, and damage-mitigation studies along the fault zone. One or more large earthquakes on the fault zone could cause thousands of deaths and bil-

ions of dollars in damage. Fortunately, recent research has vastly increased understanding of the timing and location of past major earthquakes on the fault zone (fig. 3) and has raised public awareness of their potential effect. Such heightened awareness stimulated the Utah Legislature to establish the Utah Seismic Safety Commission in 1994, which will promote loss-reduction strategies and provide earthquake information to concerned citizens.

The National Earthquake Information Center in Golden, Colorado, collects, processes, and distributes information from more than 20,000 seismic events each year. This information is distributed in the form of alerts, bulletins, and catalogs to emergency management officials at the Federal and State levels, operators of critical facilities, news media, the general public, and the earthquake research community.

National Mapping Program

Among the most popular and versatile products of the USGS are its 1:24,000-scale topographic maps (1 inch on the map represents 2,000 feet on the ground). These maps depict basic natural and cultural features of the landscape, such as lakes and streams, highways and railroads, boundaries, and geographic names. Landscape contour lines are used to depict the elevation and shape of terrain. Utah is covered by 1,537 maps at this scale, which is useful for civil engineering, land-use planning, natural-resource monitoring, and other technical applications. These maps have long been favorites with the general public for outdoor uses, including hiking, camping, exploring, and back-country fishing expeditions.

In addition to published maps, basic map data and open-file products are available. These include aerial photographs, satellite imagery, advance and reproducible map materials, geodetic control data, geographic names data, microfilm map copies, and digital map products.

With the expansion of computer-based mapping software, the USGS is providing digital renditions of data for use by the general public. Digital data for 1:100,000 and smaller scale maps are widely available for the entire Nation and are complete for the State of Utah.

Geologic Mapping

The corridor of rapid population growth along Interstate I-15 from Cedar City through St. George and adjacent communities commonly is subjected to landslides, slumps, and rockfalls, which move rocks down weak unstable slopes. On September 2, 1992, visitors at the Zion National Park and local residents at Springdale were reminded of these slides when a magnitude 5.8 earthquake (epicenter, 8 miles southeast of St. George) reactivated a past landslide, blocked State Highway 9 into the park, and cut electrical power and phone lines into the park. Structures built on the slide area were damaged as they slid downhill with the slide. These landslides commonly are reactivated by periods of prolonged or heavy rainfall. This particular landslide had a history of moving after such rainy periods.

Fortunately, past landslides can be readily identified from geologic maps of landslide-prone areas. In a cooperative geologic mapping program with the Utah Geological Survey, the USGS is creating a series of geologic maps along the I-15 corridor that particularly emphasize geologic hazards. These maps include texts that specifically address geologic hazards, such as potential flooding, wind-blown sands, swelling clays, earthquake epicenters, active faults, and resultant landslides and rockfalls. Counties and municipalities can use this information to aid in zoning decisions that can minimize potentially expensive damage to private and public buildings and roads.

Irrigation Water Quality

Following the 1983 incidences of mortality, birth defects, and reproductive failure in waterfowl at Kesterson National Wildlife Refuge in California, there was national concern that problems adversely affecting human health and wildlife could be related to selenium or other contaminants in water from U.S. Department of Interior irrigation projects throughout the West.

The USGS, in cooperation with the U.S. Fish and Wildlife Service (FWS) and the Bureau of Reclamation (BOR), identified 20 areas in 13 States that had potential water-quality problems resulting from selenium contamination. Subsequently,

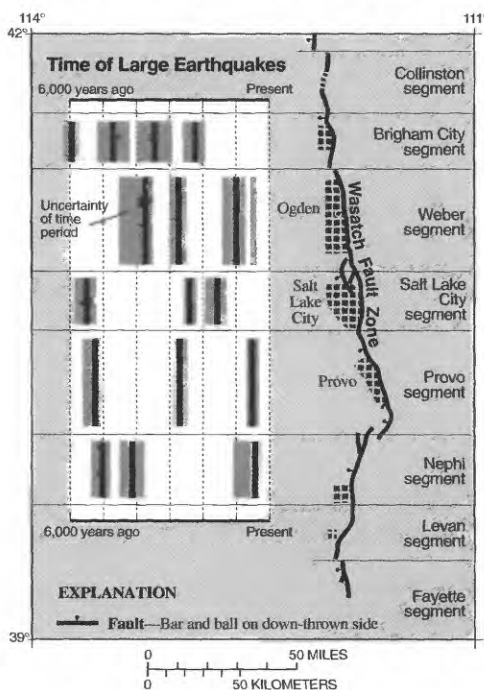


Figure 3. Estimates of distribution and ages of prehistoric, large-magnitude (7-7.5) earthquakes along the Wasatch Fault Zone in the past 6,000 years.

the USGS, in cooperation with the FWS, the BOR, and the Bureau of Indian Affairs, conducted studies to determine the sources, transport, and biological effects that result primarily from the occurrences of selenium in National Wildlife Refuges and several State waterfowl-management areas.

In northeastern Utah, concentrations of selenium in Ashley Creek were greater than 14 times the standard concentration used for wildlife protection. The source of selenium contamination probably is shallow ground and surface water that originates as seepage from a sewage-lagoon system. The tissue of waterfowl exposed to this water contained concentrations of selenium as large as 3 to 10 times the concern level for bioconcentration in the food chain.

Midway through the Utah study, selenium contamination of fish and waterfowl was determined to be severe enough for the State to issue a health advisory that limited the consumption of fish and waterfowl in the area. The USGS, working with the BOR, the FWS, and the public, formulated and narrowed the options to remediate the selenium problem at Stewart Lake down to five alternatives. Identification of the potential sources of selenium to the Green River will help guide future irrigation projects, salinity control, and fisheries improvement.

Earth Observation Data

Through its Earth Resources Observation Systems Data Center near Sioux Falls, South Dakota, the USGS distributes a variety of aerial photographs and satellite image data products that cover the entire State. Aerial photographs of some

sites go back about 40 years. Satellite images dating from 1972 can be used to study changes in regional landscapes. The USGS has been providing technical support in the use of a statewide block of Landsat satellite image data acquired recently. State resource-management agencies use the satellite data as a cost-effective source for interpreting land-cover characteristics.

Cooperative Programs

The USGS supports an extensive variety of cooperative programs designed to assist State and local governments in answering critical natural-resource questions. These efforts frequently involve multi-State and multi-agency cooperation and are an important aspect of many local, State, and Federal programs (fig. 4).

Cooperative activities include water-resources-data collection, interpretive water-availability and water-quality studies, mineral-resource assessments, earthquake and hazards monitoring, and mapping efforts.

When local and State agencies are involved in a cooperative effort, activities typically are financed on a matching-funds basis. Reports published as a result of these cooperative efforts serve as records for future reference and study. Many early USGS maps and reports are valuable sources of information and are referenced in public and private-sector investigations.

Cooperators include county and municipal public-works departments, public-health agencies, natural-resource agencies, water-conservancy districts, emergency-preparedness groups, Federal agencies, and many others. During the

past 5 years, the USGS has cooperated with the Bear River Commission, the Weber Basin Water Conservancy District, the Utah Department of Environmental Quality, the Utah Geological Survey, the Utah Department of Natural Resources, the U.S. Air Force, and others to collect data or conduct geologic and hydrologic studies in Utah.

The USGS also provides support to the Utah Center for Water Resources Research Laboratory at Utah State University. The Laboratory conducts a program of research, education, and information and technology transfer.

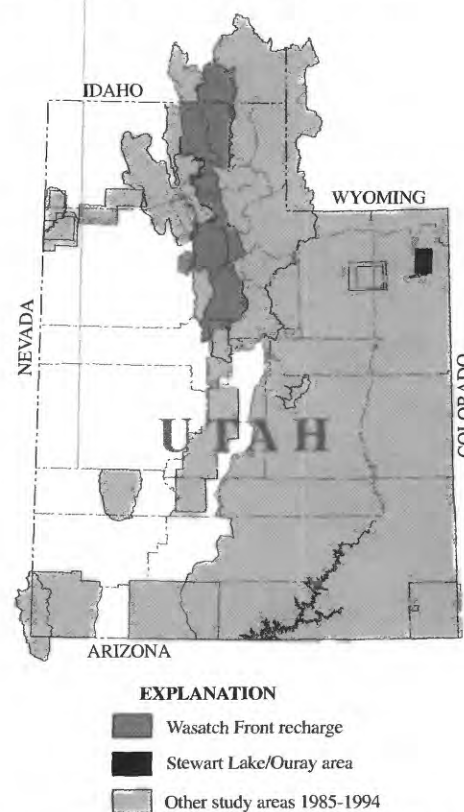


Figure 4. Location of recent cooperative studies.

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Additional earth science information can be found by accessing the USGS "Home Page" on the World Wide Web at "<http://www.usgs.gov>".

For more information on all USGS reports and products (including maps, images, and computerized data) call 1-800-USA-MAPS.