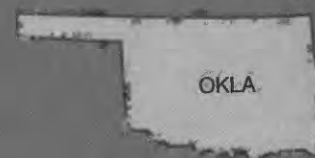


# United States Geological Survey

## Programs in Oklahoma



*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.*

### Oil and Gas Resources

Oklahoma has a long history as a major petroleum producer as do other States in the region. As part of its ongoing National Gas and Oil Assessment project, the U.S. Geological Survey (USGS) has produced a series of detailed maps that outline deep gas and oil-producing zones in the Anadarko Basin and areas in the southern part of the State where the USGS is examining rock porosity in these reservoirs. These studies, many of which are performed in conjunction with the Oklahoma Geological Survey, could indicate that new sources of natural gas can be recovered economically from these deep reservoirs, thus adding to the Nation's energy reserves.

### National Coal Resources Data System

Federal, State, and regional planners, as well as scientists, industry, and other government agencies, require current, credible, understandable, and standardized information on the location, quantity, and quality of the coal resources of the United States to provide the basis for optimum energy development and utilization policies. A joint venture between the USGS and the State geological survey was initiated in 1975 to develop the National Coal Resources Data System (NCRDS). Currently, cooperative projects are ongoing with 22 States representing 98 percent of coal production in the United States. A cooperative project between the USGS and the Oklahoma Geological Survey was initiated in 1984 to collect, evaluate, and correlate drill hole, mine, and outcrop data; encode and enter geologic and geochemical data into the NCRDS; and to access NCRDS data bases and software to generate new maps, reports, and resource assessments for the State. The continued data collection and

support of the NCRDS data bases provides baseline information for annual State resource updates, and as a tool in meeting future needs.

### Flooding

Major floods in Oklahoma have affected many people and have caused economic damage and loss of life (fig. 1). Although floods cannot be prevented, information furnished by the USGS is critical to the operation of flood-warning systems and alerts. Information on the amount of water in reservoirs, river stages, and the arrival of floodwaters aids people in preparing for flooding, thus lessening the destructive effects of floods.

Information furnished by the USGS to the National Weather Service Tulsa River Forecast Center in Oklahoma is used by the Center to predict maximum river heights and the probable extent of flooding. Reservoir managers use the informa-

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tion along with predictive models and past experience to regulate incoming flood waters. Civil defense agencies use this information to warn people in the pathway of flooding so they can avoid the worst of the flood or protect their property against floodwaters.

After flooding has passed, the USGS, in cooperation with Federal, State, tribal, and local agencies, studies the extent of flooding, and the weather patterns and



Photo by U.S. Army Corps of Engineers.

**Figure 1.** The Chikaskia River, southeast of Blackwell, Oklahoma, during the flood of October 10, 1973.

rainfall intensity that led to the flooding. As an important part of its fact-finding efforts, the USGS evaluates and maps the extent of flooding and attempts to determine how often floods of that magnitude may be expected to recur. The USGS also maps the movement of stream banks caused by powerful flood waters; bridges may be washed out or their piers undermined by swiftly flowing water. By using computer models, a prediction can be made of conditions that might weaken or threaten a structure, so that preventive steps can be taken by the appropriate agency to lessen the hazard.

In addition to studying the effects of flooding, the USGS has prepared maps showing the probable extent of flooding for many urban areas throughout Oklahoma. These flood-prone-area maps show the approximate boundaries of what is called the "100-year flood," the area that may, on the average, have 1 chance in 100 that it will be flooded in any year. These maps are used extensively by cities and individuals in planning locations of homes, offices, and industries. Individual studies of specific communities or localities for use in planning and community development are made by the USGS for the Federal Emergency Management Agency.

The USGS also provides information on how often a flood that inundates a specific area may be expected to happen again in any year. This information is useful in designing flood-control structures, such as dams, retarding structures, holding ponds, and spillways. Although flooding may be expected for specific areas, information on the frequency of flooding will aid community planners in flood-plain development. If, for example, an area near a river will be inundated often, then the area can still be used for a public park. Long-term monitoring of streamflow and flood flows will provide the basic data necessary for statistical analyses of floods and the prediction of future flooding.

The USGS, in cooperation with many other Federal, State, and local agencies, studies flooding. Including: the U.S. Army Corps of Engineers; the cities of Oklahoma City, and Tulsa, the Tulsa River Forecast Center of the National

Weather Service, and numerous reservoirs and irrigation and conservancy districts, such as the Grand River Dam Authority. These studies are cooperative projects, with the funding shared equally by the USGS and the agency.

## Surface- and Ground-Water Management

Sharing surface- and ground-water resources is of great importance to the citizens of Oklahoma. The State of Oklahoma depends on information gathered by the USGS and the Oklahoma Water Resources Board and on interpretations of these data to determine water rights.

The determination of the amount of surface-water flow in Oklahoma is of great importance to the irrigators of the State, particularly in western Oklahoma. In eastern Oklahoma, surface water is used by many communities as the primary source of public water supply. Continuous measurements of flow are needed to manage surface water supplies, such as reservoirs used for irrigation supply.

One of the principal continuing duties of the USGS throughout the United States is the measurement of flow in the Nation's rivers and streams. In Oklahoma, the USGS maintains an extensive network of about 150 surface-water-flow-monitoring stations (fig. 2). Many of these stations transmit data by satellite; these data have proved valuable in flood monitoring and prediction. Daily flow values from all Oklahoma stations are published yearly.

The USGS, in cooperation with the Oklahoma Water Resources Board, monitors water levels in key wells throughout the State. Water levels in other wells are measured in conjunction with specific projects. Many additional wells are measured annually by the Oklahoma Water Resources Board.

The USGS, in cooperation with State and local agencies, has completed appraisals of ground-water availability and quality in many areas of the Oklahoma. Many of the aquifers have been studied by the USGS using the USGS-developed computer model called MODFLOW. For instance, a projection of water-level changes in the Antlers aquifer in southeastern Oklahoma was made by forecasting various pumping rates at 10-year increments for several decades in the next century.

## Water Contamination

Contamination of our surface-water and ground-water resources has become one of the most pressing issues in the management of the Nation's natural resources. The USGS has sampled the rivers, wells, and springs at about 25,000 sites in Oklahoma (fig. 3); these samples have been analyzed for a broad range of inorganic and organic substances, including pesticides and herbicides, that might affect the suitability of the water for human consumption or nonconsumptive use. Results of chemical analyses of ground-water samples generally are published at the end of a project; surface-water analyses are published annually.

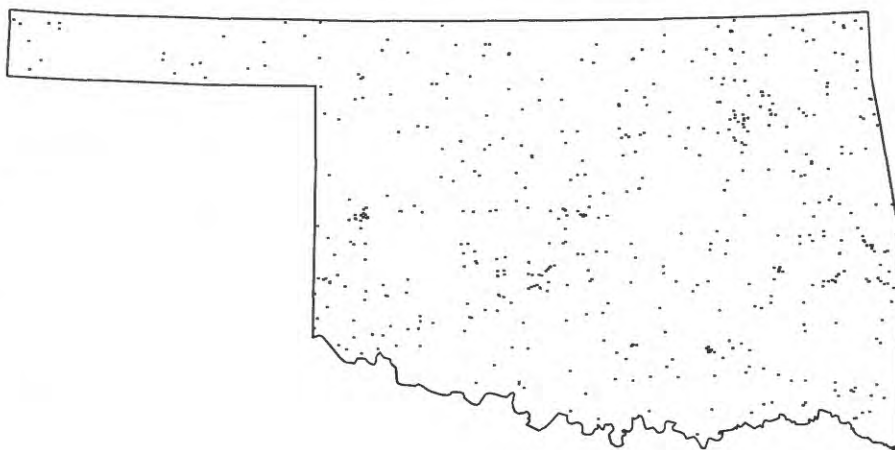
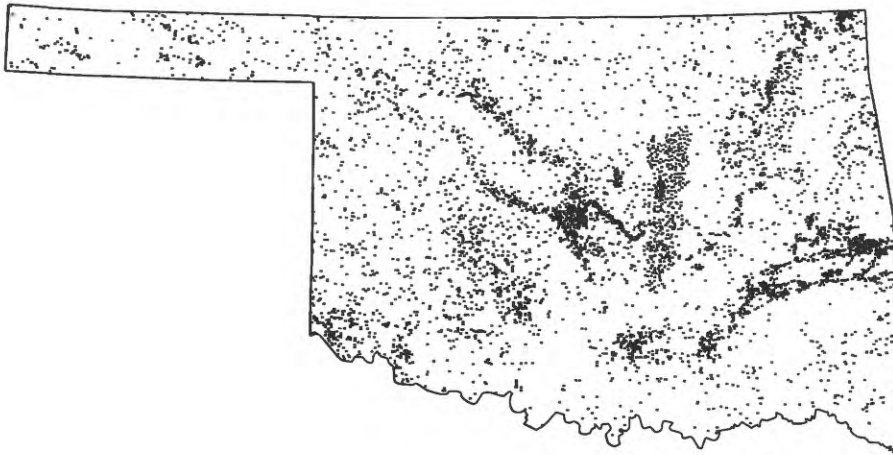


Figure 2. Surface-water data-collection sites in Oklahoma.



**Figure 3.** Water-quality data-collection sites in Oklahoma:

The USGS is investigating possible ground- and surface-water contamination at many sites in Oklahoma. At Altus Air Force Base in southwestern Oklahoma, the USGS, in cooperation with the U.S. Army Corps of Engineers and the U.S. Air Force, is studying possible ground-water contamination resulting from past use of solvents and cleaning solutions for aircraft maintenance and repair activities at the air base. The presence and concentration of contaminants on Federal lands, such as Altus Air Force Base, will be used to determine the necessity for remediation of the contamination. The USGS has just completed a study of water quality and water movement within the aquifer underlying the central Oklahoma area. Determination of natural movement and chemical change within the aquifer was a primary objective of the project. It was found that most of the aquifer is uncontaminated and that further development is possible. The USGS, in cooperation with the city of Norman, is studying the processes controlling movement of possible contaminants within and from an old landfill near Norman.

Rural residents of western Oklahoma use ground water primarily for drinking supplies. The USGS has recently compiled data for nitrogen and phosphorus concentrations in aquifers in western Oklahoma. The statistical results produced can be used in setting priorities for ground-water protection.

The State of Oklahoma regulates the discharge of pollutants to streams so that

streams do not exceed a permissible limit for pollutants. To set a limit on the effluent discharge concentration, the chemical content and flow of the effluent-receiving streams must be known. Data collected, analyzed, recorded, and distributed by the USGS help to determine values used in issuing discharge permits.

Data collected by the USGS can help regulatory agencies to maintain or improve the chemical quality of water in aquifers and streams within Oklahoma by providing baseline data against which changes may be compared and evaluated. Agencies rely upon data furnished by the USGS to design protection strategies for water use. Evaluation of water-quality information will help water users realize the full potential of the water—how, for what, and in what quantities it might be used and the possible effects of using the water.

Determination of water quality in Oklahoma's lakes, streams, and aquifers has become increasingly important with population growth and need for usable water. The USGS, in cooperation with the Oklahoma Water Resources Board, the Oklahoma Geological Survey, the cities of Tulsa and Oklahoma City, and the U.S. Army Corps of Engineers and the U.S. Air Force, has collected extensive data on water quality within Oklahoma for use by these agencies.

### **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), with 1,240 maps covering Oklahoma. These maps have long been favorites with the general public for outdoor uses, including hiking, camping, exploring, and back-country fishing expeditions.

The USGS in cooperation with Federal and State agencies, is producing current base cartographic data in digital format for Oklahoma. The National Mapping Program uses Congressional appropriations to produce cartographic data for use in the public domain. The cooperative production of data provides cost efficiency for several groups, increases the amount of data available, and reduces redundant data production.

The USGS in cooperation with the Oklahoma Department of Transportation (OK DOT) is producing and revising topographic maps and digital line graphs (DLG's). The maps are used for development, planning, and management decisions about the transportation network in Oklahoma.

The USGS cooperates with the Oklahoma State University's Department of Agronomy for the production of digital elevation models that can be used with hydrologic data for modeling water flow, inundation studies, and hydrologic planning and management decisions.

The USGS cooperates with the Oklahoma Water Resources Board to produce DLG hydrography from 1:24,000-scale source. These DLG's can be used with DEM data for watershed delineation and hydrologic planning and management decisions by Federal, State, Tribal, and local agencies.

### **Earth Observation Data**

Through its EROS Data Center near Sioux Falls, South Dakota, the USGS distributes a variety of aerial photographs and satellite image data products that cover Oklahoma. Mapping photographs of some sites go back about forty years. Satellite images from 1972 can be used to study changes in regional landscapes.



## Providing Information to the Public

The mission of the USGS is to provide information needed to understand, manage, and use the Nation's natural resources. Geologic, ground- and surface-water, and water-quality data collected by the USGS have been used by other Federal, State, Tribal, and local agencies and individuals for a variety of purposes. USGS methodology, computer programs, and data are used widely by others. For example, the Oklahoma Department of Environmental Quality (DEQ) uses USGS methods of calculating peak discharge for sites being considered for solid waste disposal. The DEQ bases their definition of "seismic impact zone" on maps published by the USGS; flood-prone-area maps prepared by the USGS are used to define the 100-year flood plain; and the USGS 7.5- and 15-minute topographic maps are used for location of sites.

Because citizens living in rural areas commonly have individual wells as their sole source of water, they are intensely interested in the quality of their water supplies. Individuals building new homes in rural areas need to know where and how deep to drill, the expected yield from a well, and whether the water is suitable for its intended use. The USGS usually can furnish information from its files that allows the person to make an informed decision on well location. Requests for this type of information are answered by the USGS on a regular basis.

The USGS gathers these data under cooperative agreements with local, State, Tribal, and Federal agencies in Oklahoma, including the Oklahoma Water Resources Board, the Oklahoma Geological Survey, the U.S. Army Corps of Engineers, the Bureau of Reclamation, the cities of Oklahoma City and Tulsa, and irrigation and conservation districts throughout the State. USGS offices in

Oklahoma City, Tulsa, and Woodward provide assistance to the public seeking water-resources information.

## Cooperative Programs

USGS activities in Oklahoma are completed in cooperation with various Federal, State, and local agencies and Indian Tribes. A few examples not mentioned above are: the Oklahoma Conservation Commission, the Oklahoma State Department of Health, the U.S. Agricultural Research Service, the U.S. Natural Resource Conservation Service, the Ponca Tribe, the Sac and Fox Nation, and the Cheyenne and Arapaho Tribes of Oklahoma.

The USGS provides support to the Oklahoma Water Research Institute at Stillwater, Oklahoma, which conducts a program of research, education, and information and technology transfer.

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### For more information contact any of the following:

#### For water information

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#### For map information

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(314) 341-0880

#### For geologic information

Assistant Chief Geologist  
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Denver, Colorado 80225  
(303) 236-5438

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.