



WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY GROUND-WATER STUDIES IN TEXAS

GROUND-WATER ISSUES

Ground-water resources supply almost 60 percent of the freshwater used in Texas, excluding withdrawals for thermoelectric-power generation (less than 3 percent). About 73 percent of the ground water withdrawn is used for irrigation, about 17 percent for public supply, and about 7 percent for industrial, rural domestic, and livestock uses. About 8 million people, or 48 percent of the population of Texas, depend on ground water as a public or rural domestic supply. The dependence on ground water is greatest in the arid northwestern part of the State, where most of the water is used for irrigation. This area contains 70 percent of all irrigated land in Texas, and uses about 85 percent of the total ground water withdrawn for irrigation. The major issues related to ground water in Texas are:

- Decreasing supplies in critical areas, especially during drought conditions,
- Chemical contamination from agricultural chemicals, or from landfills or other waste-disposal sites, some of which may contain hazardous materials, and
- Land subsidence and saltwater intrusion caused by ground-water pumpage.

U.S. GEOLOGICAL SURVEY PROGRAMS

The U.S. Geological Survey (USGS) established in 1879, is the principal source of scientific and technical expertise in the earth sciences within the Federal government. USGS activities include research and services in the fields of geology, hydrology, and cartography. The mission of the Water Resources Division of the USGS is to develop and disseminate scientific information on the Nation's water resources. The activities of the Water Resources Division in Texas are conducted by scientists, technicians, and support staff in offices in Austin, Houston, San Antonio, Fort Worth, San Angelo, Wichita Falls, and El Paso.

Hydrologic-data stations are maintained at selected locations throughout Texas to record data on stream discharge and stage, reservoir and lake storage, ground-water levels, land subsidence, well and spring discharge, precipitation, and the quality of surface and ground water. Water-resources data are stored in the USGS National Water Data Storage and Retrieval System data base. These data are used by water planners and others involved in decisions that affect the water resources of Texas.

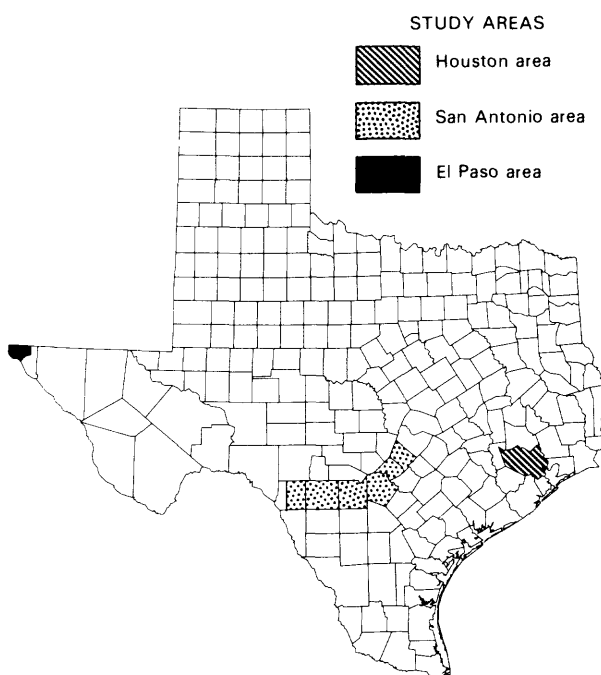
During 1988, the USGS maintained about 1,200 observation wells in the Houston, Orange County, San Antonio, Austin, and El Paso areas. These wells complement the statewide ground-water-monitoring program maintained by the Texas Water Development Board. In addition, 13 compaction monitors to measure land-surface subsidence are operated in the Houston area. Water-level measurements are used to monitor water-level fluctuations and determine ground-water level trends.

The USGS has conducted more than 100 detailed hydrologic investigations in Texas. During fiscal year 1988, the USGS

entered into agreements with more than 70 Federal, State, and local agencies involving 29 hydrologic investigations in Texas; 15 of these included studies of ground water. Three hydrologic investigations conducted by the USGS that address specific ground-water issues in Texas are discussed in the following sections.

Potentiometric-Surface Declines and Land-Surface Subsidence in the Houston Area

Large-scale ground-water withdrawals in the greater Houston area began before the turn of the century. The demand for water increased slowly until the late 1930's, and then increased rapidly owing to industrial development. Ground-water withdrawals had increased to more than 500 million gallons per day (Mgal/d) by 1978, when an alternate source of water was obtained from the Trinity River (by 1987, ground-water withdrawals had been reduced to about 415 Mgal/d). Between 1943 and 1978, ground-water withdrawals have caused artesian pressure declines of as much as 250 feet in wells in the shallow aquifer and as much as 300 feet in the deep aquifer. These pressure declines are the principal cause of the compaction of subsurface materials and subsidence of the land surface. More than 5,000 square miles of land area has subsided at least 1 foot and as much as 10 feet in the central part of the area adjacent to the Houston



Ship Channel. With Trinity River water available since 1978, ground-water pumpage has decreased and ground-water levels have risen as much as 140 feet. The rate of subsidence now is insignificant in the central part of the Houston area, but continues in other locations, especially in the western part of the area. The USGS has collected and interpreted data since 1930 to define the ground-water resources of the area. The studies, conducted in cooperation with the cities of Houston and Galveston and with the Texas Water Development Board (TWDB) and its predecessor agencies, show a direct relation between ground-water-level declines and land-surface subsidence. The Texas Legislature, recognizing the need for an agency to regulate ground-water withdrawals and control subsidence, created the Harris-Galveston Coastal Subsidence District (HGCSD) in 1976. Under continuing cooperative agreements with the HGCSD, the USGS operates and maintains 13 compaction monitors at 11 sites, conducts inventories of water wells and pumpage, and measures water levels annually in about 500 wells.

Resource Management and Protection in the San Antonio Area

The Edwards aquifer, a major ground-water resource in south-central Texas, serves as the principal source of water for much of a five-county area around San Antonio and as the sole source of water for the city. As the population in the area has grown, the demand for water and the potential for contamination of the aquifer has increased. To protect the quality of water in the aquifer and ensure an equitable supply for all users, the Texas Legislature established the Edwards Underground Water District (EUWD) in 1959. The EUWD, the San Antonio City Water Board, the city of San Antonio Department of Environmental Management, the TWDB, the Texas Water Commission (TWC), the USGS, and several local and county water agencies have cooperated in many investigations and data-collection programs designed to provide the hydrologic information needed to assess and manage the water resources of the Edwards aquifer. USGS studies of the aquifer began in 1895 with the measurement of discharge from Comal Springs. Monitoring of water levels began in 1910 and continuous recording of water levels began in 1934. Currently (1988), water levels are being monitored in a network of about 150 wells distributed throughout the aquifer. Information on recharge to the aquifer is obtained from about 35 stream-flow and 25 rainfall measuring sites. Discharge from the aquifer is estimated from measurements at major springs, pumpage data, and irrigated acreage.

Availability and Management of Water in the El Paso Area

The availability of water for municipal and industrial supplies in the El Paso and Ciudad Juarez (Mexico) area is of concern not only to the residents, but also the State and Federal governments. El Paso, Ciudad Juarez, Fort Bliss, and Biggs Air Base all depend on local ground-water resources; however, fresh ground-water resources now available in the area are projected to be depleted between the years 2013 and 2033. Owing to the importance of the limited freshwater resources, the USGS has been monitoring and investigating the water resources in the area in cooperation with the city of El Paso, the U.S. Army, and the TWDB since the 1930's. Data and reports resulting from these investigations describe the status of the resource and are used to plan for the future. The city of El Paso proposes to meet future water demands by securing rights to ground-water resources in Mesilla and Hueco basins in the State of New Mexico. All parties involved in the proposed transfer of water from New Mexico to the El Paso area have made extensive use of USGS data and reports that provide comprehensive, current,

and unbiased and accurate data on which future legal, planning, and management decisions can be based.

GROUND-WATER MANAGEMENT

In Texas, ground water belongs to the owner of the land above it and the owner may use it or sell it as private property. An owner's use or sale of ground water is limited when such activity may involve trespass on a neighbor's property, intent to injure or damage a neighbor, wasteful use of artesian water, contamination of a neighbor's well, and land-surface subsidence and damage to a neighbor's property. Underground water conservation districts may be created to conserve, protect, recharge, and prevent waste of ground water. This is accomplished by regulating well spacing, enjoining wasteful water-use practices, and conducting public-education programs. A district can be formed by local voters or, in critical areas, by the TWC if there is a lack of voter support.

Several State agencies share the responsibilities of ground-water management. The TWC is charged with the major responsibility for ground-water protection programs. The Texas Department of Health regulates public water-supply systems. The Railroad Commission is responsible for preventing ground-water contamination from oil and gas activities, as well as from coal and uranium mining. The Texas Department of Agriculture regulates the use of agricultural chemicals. The TWDB is responsible for financial-assistance programs, long-range water planning, and ground-water-data collection and studies. All of the agencies, and especially the TWDB, use ground-water data and the results of ground-water studies provided by the USGS to meet their responsibilities.

During fiscal year 1988, the following Federal, State and local agencies entered into interagency or cooperative cost-sharing agreements with the USGS to conduct ground-water investigations in Texas:

Cities of Austin, Georgetown, and Houston
Colorado River Municipal Water District
Counties of Fort Bend, Galveston, Orange, and Pecos
Edwards Underground Water District
El Paso Public Service Board
Harris-Galveston Coastal Subsidence District
Lower Colorado River Authority
San Antonio City Water Board
Texas Water Development Board
U.S. Air Force
U.S. Army
U.S. National Park Service

SELECTED REFERENCES

- Bush, P.W., 1986, Planning report for the Edwards-Trinity regional aquifer analysis in central Texas, southeast Oklahoma, and southwest Arkansas: U.S. Geological Survey Water-Resources Investigations Report 86-4343.
- Buszka, P.M., 1987, Relation of water chemistry of the Edwards aquifer to hydrology and land use, San Antonio, Texas: U.S. Geological Survey Water-Resources Investigations Report 87-4116, 100 p.
- Mitchell, A.A., 1988, Water-resources activities of the U.S. Geological Survey in Texas—Fiscal year 1987: U.S. Geological Survey Open-File Report 88-100.
- U.S. Geological Survey, 1984, National water summary 1983—Hydrologic events and issues: U.S. Geological Survey Water-Supply Paper 2250, 243 p.
- , 1985, National water summary 1984—Hydrologic events, selected water-quality trends, and ground-water resources: U.S. Geological Survey Water-Supply Paper 2275, 467 p.

Information on technical reports and data related to ground water in Texas can be obtained from:

District Chief	Chief, Water Data and Studies
U.S. Geological Survey	Texas Water Development Board
Water Resources Division	P.O. Box 13231
300 E. 8th Street	Capitol Station
Austin, Texas 78701	Austin, Texas 78711-3231
Open-File Report 88-158	Larry F. Land, 1988