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# WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

## U.S. GEOLOGICAL SURVEY GROUND-WATER STUDIES IN NEBRASKA

### GROUND-WATER ISSUES

Ground water in Nebraska is abundant and supplied about 59 percent of all water used in 1980. All public water-supply systems in Nebraska, except for four communities, use ground water exclusively. Ninety-four percent of the ground water used is pumped from more than 71,000 wells to irrigate approximately 6.5 million acres. The major issues related to ground water in Nebraska are:

- Distribution of the resource, and
- Deterioration of water quality.

An estimated 2.13 billion acre-feet of recoverable ground water of potable quality underlies Nebraska (enough to cover the State to an average depth of 40 feet). There are some areas where the supply of ground water is limited, however, and other areas with significant water-level declines. The declines occur in an area of about 3 million acres, with maximum declines exceeding 50 feet from predevelopment levels. Water-level rises also occur in an area of about 1.2 million acres.

Water in the principal aquifers in Nebraska is generally suitable for most uses; however, contamination, principally from agricultural activities, has occurred in some areas. Concentrations of nitrate as nitrogen exceed the Environmental Protection Agency standard of 10 milligrams per liter in some areas. One of these areas includes about 500 square miles in the Platte River valley. Pesticides also are found in the ground water in many areas in Nebraska.

The water table in Nebraska commonly is at shallow depths, and the aquifer is directly connected to streams and other surface-water bodies where water moves back and forth between surface water and ground water. Precipitation and irrigation water applied to the land surface infiltrates and percolates downward to the aquifers. Owing to the relation between surface and ground water in Nebraska, hydrologic investigations must include the study of surface water, ground water, and water quality conjunctively.

### 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 information

on the Nation's water resources. The activities of the Water Resources Division in Nebraska are conducted by scientists, technicians, and support staff at offices in Lincoln and Ord.

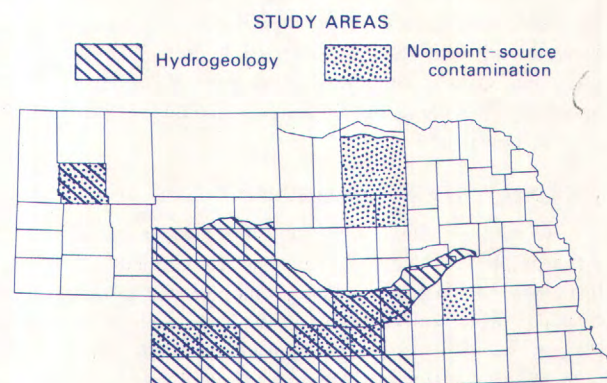
Hydrologic-data stations are maintained at selected locations throughout Nebraska to record data on stream discharge and stage, reservoir and lake storage, ground-water levels, well discharge, and the quality of surface and ground water. Water-resources data are stored in the USGS National Water Data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

In 1987, the USGS, in cooperation with Federal, State, and local agencies, maintained a network of about 3,600 observation wells in Nebraska to monitor fluctuations in water levels. Ground-water-quality data are collected annually from about 150 wells.

During fiscal year 1987, the USGS entered into agreements with 10 Federal, State, and local agencies involving 16 hydrologic investigations in Nebraska; 11 investigations included studies of ground-water quantity and quality. These investigations provide information needed to answer hydrologic questions that are specific to the State's principal ground-water issues. Some of the investigations also provide information on statewide, multistate, and national hydrologic problems. Two examples of USGS projects that deal with ground-water issues in Nebraska are discussed in the following sections.

### Hydrogeology, South-Central Nebraska

The hydrologic system in south-central Nebraska has been altered by irrigation. Since 1940, seepage from the application





of surface water for irrigation has caused water-level rises in the underlying aquifer of as much as 110 feet. In areas where the use of ground water for irrigation has increased significantly, the rise of the water table has been slowed or water levels have declined. Benefits, such as reduced pumping costs, and detriments, such as an increase in areas with water-logged soils, can result from water-level rises. Water-level declines increase the cost of pumping. Additional information on the effects of irrigation in south-central Nebraska was needed for water management purposes. The USGS, in cooperation with the Nebraska Natural Resources Commission and the Lower Republican Natural Resources District, conducted a study of south-central Nebraska to provide this information. The project included data collection from 23 test holes, ground-water-quality samples from 68 sites, measurements of water levels during three different time periods, inventory of land use, and detailed studies at 18 sites to determine the amount of water pumped for different crops, soils, and climatic conditions. A computer model of ground-water flow was developed and used to simulate the effects of different management plans on the aquifer. This information has been used by public and private water-management agencies to develop water-management plans.

### Nonpoint-Source Contamination

Man-made chemicals, especially pesticides and fertilizers, are the major threat to ground-water quality in Nebraska. Laboratory analysis of water samples for organic chemicals is expensive; this has restricted monitoring for these chemicals in ground water and limited research to determine the factors that influence their presence in ground water. Agencies responsible for monitoring or regulating ground-water quality needed simple methods to determine where to sample. Therefore, the USGS has conducted several projects that examine the movement of agricultural chemicals in ground water by identifying the magnitude and trends of ground-water contamination by agricultural chemicals, defining the movement or transport of these chemicals through the unsaturated zone to the aquifer, and identifying land use and hydrologic and climatic factors that influence the concentrations of contaminants in ground water. Twelve counties in Nebraska that are underlain by the High Plains aquifer have been extensively sampled for nitrates and the pesticide atrazine. In Buffalo County, detailed research is being conducted to trace the movement of pesticides through the hydrogeologic system. At each sampling site, the hydrologic, climatic, soil, and land-use characteristics that might affect the presence of pesticides in ground water are being studied. The results of the study will be used by Federal, State, and local agencies to identify other areas of possible contamination. Areas susceptible to contamination also can be identified so that precautionary management by Federal, State and (or) local agencies can be considered.

### GROUND-WATER MANAGEMENT

State agencies with principal ground-water management responsibilities in Nebraska are the Department of Water Resources, which has regulatory functions for ground-water development and well registrations; the Natural Resources Commission, which is in charge of water planning and review functions; the Department of Environmental Control, which has

jurisdiction over the protection and improvement of ground-water quality; and the Department of Health, which is responsible for regulating drinking-water supplies. Local agencies, including the Natural Resources Districts, are responsible for local water-management programs. These agencies use ground-water data and the results of ground-water studies provided by the USGS to carry out their functions. 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 Nebraska:

Conservation and Survey Division, University of Nebraska-Lincoln  
 Natural Resources Districts: Central Platte, Little Blue, Lower Loup,  
 Lower Platte South, Lower Republican, Middle Republican, North  
 Platte, South Platte, Twin Platte, Upper Elkhorn, Upper Loup,  
 Upper Niobrara-White, and Upper Republican  
 Nebraska Department of Environmental Control  
 Nebraska Department of Water Resources  
 U.S. Bureau of Indian Affairs  
 U.S. Bureau of Reclamation  
 U.S. Fish and Wildlife Service  
 U.S. Environmental Protection Agency

### SELECTED REFERENCES

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- McKinney, J.E., and Engberg, R.A., 1985, Water-resources activities of the U.S. Geological Survey in Nebraska, 1984: U.S. Geological Survey Open-File Report 85-181, 33 p.
- Peckenpaugh, J.M., Dugan, J.T., Kern, R.A., and Schroeder, W.J., 1987, Hydrogeology of the Tri-Basin and parts of the Lower Republican and Central Platte Natural Resources Districts, Nebraska: U.S. Geological Survey Water-Resources Investigations Report 87-4176, 117 p.
- 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 Nebraska can be obtained from:

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