88-110

WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY GROUND-WATER STUDIES IN NORTH DAKOTA

WATER AVAILABILITY

North Dakota generally is a water-poor State. Only the parts of the State served by the Missouri River have a dependable surface-water supply. Approximately 60 percent of the State depends on ground water. The principal ground-water resources that are suitable for drinking and irrigation are surficial aquifers in unconsolidated glacial deposits that blanket the State east of the Missouri River. Water from bedrock aquifers, such as those that comprise the principal water resources of southwestern North Dakota, generally is unsuitable for drinking or irrigation without treatment.

A multiyear cooperative investigation, funded jointly by various North Dakota agencies and by the U.S. Geological Survey (USGS), has provided basic information on ground-water availability and quality for each county in the State. This data base has been instrumental for defining the State's ground-water issues.

GROUND-WATER ISSUES

Limited availability of water suitable for most uses is the principal water-management issue in North Dakota. Water managers are increasingly concerned about the potential for contamination of this limited resource.

Water in surficial aquifers in North Dakota is replenished mainly by meltwater from snow that accumulates in topographic depressions. Many of these depressions are occupied by prairie-pothole wetlands. Drainage of these wetlands has diminished ground-water availability. Additionally, differences in snowfall and melt conditions cause recharge to vary widely from year to year. Improved understanding of the processes that control recharge is allowing water managers to develop methods for increasing recharge. Among these new methods are techniques to maximize accumulation of snow in depressions, and techniques of artificial recharge to aquifers when water is temporarily in excess.

The water in the surficial aquifers is susceptible to contamination from industry, energy development, and agriculture. As water is recharged through surface depressions, it can transport dissolved contaminants downward to the aquifers.

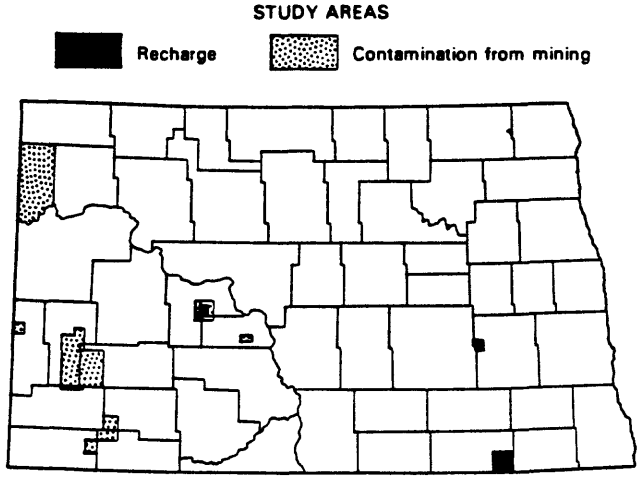
Since 1887, the USGS has conducted more than 80 ground-water investigations in all parts of North Dakota. These investigations have provided the information needed by Federal, State, and local water agencies to manage the State's water resources.

CASE STUDIES

Recharge

In 1980, the USGS began a study of the physical processes that control recharge in North Dakota. The purpose of the project is to assist the U.S. Bureau of Land Management with estimates of the quantity of water that would infiltrate a strip-mined landscape and reach the water table. Methods developed to predict recharge within small basins were uncertain, partly owing to difficulties in estimating snow volumes available for melt and partly owing to the lack of knowledge of water movement through frozen soils. The National Oceanic and Atmospheric Administration, with assistance from the USGS, has used remote-sensing methods to determine snow water equivalent, and the USGS, in cooperation with the North Dakota State Water Commission, has conducted energy- and moisture-budget studies during freeze-thaw periods near Oakes to develop methods to predict flow through frozen soils.

Improved understanding of ground-water recharge has permitted water managers to consider artificial recharge of aquifers that are overdeveloped. The U.S. Bureau of Reclamation funded a joint investigation by the State Water Commission and the USGS to evaluate the feasibility of artificial recharge to a surficial aquifer near Oakes. This aquifer supports irrigation. Planned irrigation increases would either deplete the aquifer or require the completion of the Garrison Diversion Unit irrigation project. The USGS and the State Water Commission have designed and



operated a test facility to recharge the Oakes aquifer using excess spring flood flows in the nearby James River. A full-scale artificial recharge facility could reduce the water-delivery requirements and possibly reduce the cost of the proposed Garrison Diversion Unit.

Contamination from Mining Activities

Most coal beds in North Dakota also serve as aquifers, although water quality usually is marginal for most uses. USGS investigations at several sites in western North Dakota, conducted in cooperation with the North Dakota Geological Survey or jointly with the North Dakota Public Service Commission, demonstrates that mining increases the concentrations of dissolved solids in ground water. Numerous mining and reclamation practices that can reduce this contamination were identified. Most of these practices have been adopted in State mining and reclamation laws.

Some coal beds in Billings, Stark, and Slope Counties were mined for uranium in the 1950's and 1960's. The mines were abandoned when less expensive sources of uranium were discovered elsewhere. Flooding of mine pits contaminated adjacent aquifers. Owing to the risk from elevated levels of radioactivity and contaminated sources of drinking water at these abandoned mine sites, the State ranks these mines as having the highest priority for reclamation.

USGS ground-water studies on the occurrence and transport of uranium were jointly funded with the Public Service Commission. The results of these investigations were used by a committee of representatives from the Public Service Commission, the North Dakota State Department of Health, the U.S. Environmental Protection Agency (EPA), and the USGS to develop reclamation plans for the sites. The plans were tested at a mine near Belfield in 1986. Monitoring by the USGS at the reclaimed mine indicates that environmental conditions have improved. The knowledge gained in these investigations has been used by the EPA to formulate guidelines for the reclamation of uranium mines nationwide.

Contamination from Agricultural Activities

The USGS and the State Water Commission jointly operate a 1,020-well network to monitor changes in ground-water levels and water quality statewide. Preliminary analysis of water samples for common agricultural chemicals, nitrate and pesticides, collected from this network indicates that contamination of surficial aquifers occurs statewide; however, only limited areas in the principal aquifers are affected. The expense of analysis of most agrichemicals has delayed more extensive assessment of this contamination.

USGS has funded programs at the North Dakota Water Resources Research Institute in Fargo to investigate advanced analytical techniques that may reduce both the cost and the time required to assess agrichemical pollution. Portable equipment is being developed that can be used to identify and quantify 90 percent of the organic pollutants on the National Priority Pollutants List. The equipment will be evaluated at a hazardous-waste site currently under study by the USGS where more conventional techniques are being used. Techniques also being developed at Fargo may provide analytical means to determine extremely small concentrations (parts per trillion) of selected pesticides.

The ground water in many areas around Lidgerwood, in southeastern North Dakota, is unsuitable for drinking owing to arsenic contamination. The contamination at this Superfund Site is partly due to applications of pesticides for grasshopper control in the 1930's and 1940's. In cooperation with the North Dakota Geological Survey, the USGS is studying other potential sources of arsenic from organic-rich shales underlying many surficial aquifers in eastern North Dakota that could lead to similar contamination elsewhere.

COOPERATION WITH STATE MANAGEMENT AGENCIES

The USGS assists and jointly funds projects with most of the principal water-management agencies in the State. These agencies include the North Dakota State Water Commission (water quantity), the North Dakota State Department of Health (water quality), and the North Dakota Public Service Commission (effects of energy development).

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