

# United States Geological Survey

## Programs in North Dakota



*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.*

### Coal Resources

The Clean Air Act with its amendments of 1990 has placed a renewed interest on locating coals that are low in hazardous air pollutants and have low sulfur and ash contents. The Tertiary-age coals of Wyoming, Montana, and North Dakota are well known for being low in sulfur and ash, but detailed studies of the distribution of hazardous air pollutants have only recently been undertaken. The U.S. Geological Survey (USGS) has developed models for the distribution based on depositional environment and tectonic controls of these contaminants in coal-forming basins in these States. Presently (1995), the

USGS, in cooperation with scientists of the Office of Surface Mining and the North Dakota Geological Survey (NDGS), is evaluating these models in anticipation of increased production of compliant coal during the next two decades. This is an important step because most of the coal in these States is publicly owned.

### Analysis of Water Levels in Devils Lake

Devils Lake Basin is a 3,810-square mile closed drainage basin (fig. 1). About 3,320 square miles of the drainage area is tributary to Devils Lake. Lake levels were recorded sporadically from 1867 to 1901, when the USGS estab-

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lished a gaging station. For the period of record, the maximum lake level was 1,438 feet above sea level and the minimum lake level was 1,400.9 feet. On January 1, 1995, the lake level was 1,430.0 feet. In response to rising water levels from 1969 through the 1980's, the U.S. Army Corps of Engineers (COE) is conducting a reconnaissance study for a flood-control project to stabilize the level of Devils Lake. The study required analyses of future lake-level probabilities and associated economic damage estimates to evaluate the benefits and costs of proposed flood-control or lake-stabilization projects.

The USGS, in cooperation with the North Dakota State Water Commission (NDSWC), conducted a study to estimate future lake-level probabilities. Probability data were used by the COE to develop damage-frequency relations for Devils Lake.

### Mercury Loading to Devils Lake

In 1991, the North Dakota State Department of Health and Consolidated Laboratories (NDSDH&CL) reported that mercury concentrations in sport fish



Figure 1. Devils Lake Basin.

(as much as 1.84 micrograms per gram in large walleye) collected from Devils Lake (fig. 1) were above background levels. Recreational fishing on Devils Lake is a major tourist industry vital to the economy of the area. However, high concentrations of mercury in fish may represent a potential health risk to segments of the general population.

The USGS, in cooperation with the NDS DH & CL, began evaluating the distribution of mercury in Devils Lake. The results of the study clarify a number of issues, including preindustrial and modern levels of mercury in the bottom sediments of Devils Lakes and the relation of mercury levels in Devils Lake to those in lakes in adjacent States.

### Water Resources on Tribal Lands

Water-resources information is critical for water-management planning, quantification of water rights, and environmental compliance on North Dakota's Indian Reservations. The USGS in cooperation with Tribal governments and the Bureau of Indian Affairs on the Fort Berthold, the Fort Totten, and the Standing Rock Indian Reservations is conducting water-resource studies and basic data-collection activities. Much of the information is being used by the Tribes to develop water-management plans.

### National Water-Quality Assessment Program

A critical factor in understanding water quality is the ability to make comparisons among different locations through time. Nationally consistent and comparable information is needed to make valid regional and national statements about water-quality conditions now and in the future. Assessments are needed that identify the natural and human factors that affect the quality of the Nation's surface- and ground-water resources. The USGS's National Water-Quality Assessment (NAWQA) Program was established to address these needs.

The Red River of the North NAWQA Program study is underway in North Dakota (fig. 2). The study is addressing nonpoint- and point-source contamination issues of local and regional interest in North Dakota and in adjacent states. Such issues as point sources of chemicals from population centers and non-point agricultural runoff of pesticides, nutrients, and sediment, as well as water quality affected by natural ground-water chemistry, are being studied by means of intense monitoring of stream- and ground-water quality and stream biology.

The Red River of the North NAWQA Program study area is producing water-

quality information useful to policymakers and water managers at local, State, and national levels. For example, current information on land use and land cover is being compiled to determine their effect on water quality. Study results are distributed for use by policymakers and water managers in a variety of reports and through liaison committees. The NAWQA Program study has fostered cooperation among State agencies in North Dakota and Minnesota and various Provincial and Federal Canadian agencies and has worked to develop a consistent basin-wide approach using biological methods to monitor the health of streams in the Red River of the North Basin. As an example of the multi-agency cooperation, several State, Federal, and Canadian agencies helped guide studies of the occurrence of land-applied nutrients and stream sediment and the mechanisms that cause natural saline ground water to enter the Red River of the North.

### Geologic Mapping

North Dakota faces long-term challenges related to land-use and land-management practices and engineering construction. Use of the land contributes to environmental changes (erosion, reservoir siltation) and natural hazards (floods, landslides, swelling and collapsing soils). The USGS, in cooperation with the NDGS, is involved in studies to provide information about the distribution of geologic resources and to identify potential consequences of land-use and land-management practices. The distribution, thickness, and chemical, physical, and engineering characteristics of surficial geologic deposits are being mapped as part of the compilation of the *Quaternary Atlas of the United States*. Bedrock geology, areas of active surface processes (erosion, deposition), areas of geologic hazards, and other aspects of geology and hydrology that affect or are affected by continued development of the land surface in parts of North Dakota are being mapped in detail as part of a regional study of environmental change in the Missouri River drainage basin.



Figure 2. Red River of the North Basin and NAWQA study area.

## National Coal Assessment

As the United States emerges into the next century, coal will continue to play a major role as an energy source. Coal usage accounts for one-third of the total energy and more than one-half of the electricity generated in the United States. Even with substantial increases in energy conservation and in the use of natural gas to meet increased demand for energy, coal will continue to be a major contributor. New technologies to use coal will require resources that fit very defined quality parameters. Therefore, the location, quantity, and quality of the Nation's coal resources to be consumed during the next 20 years, classified particularly by its best end use, will be necessary information for national and regional planners. In the National Coal Assessment, the USGS will be working with NDGS to identify the location of coal resources on public and private lands, including coal potentially suitable for the export market. These resources will be identified and characterized with regard to quality. Products resulting from the National Coal Assessment will be useful for government at all levels, including regulatory, information, and land-management agencies, as well as industrial and academic research teams.

## Water-Resources Appraisals

The USGS, in cooperation with the NDSWC and the NDGS has completed reconnaissances appraisals of groundwater availability and quality in each county in North Dakota. The county ground-water studies determined the availability, movement, recharge, discharge, and quality of water in glacial and bedrock aquifers. Information from the county studies has provided a scientific basis for addressing many ground-water issues, such as water availability and water allocation.

In 1993, the USGS, in cooperation with the NDSWC, began a new series of studies to describe the water resources of the State by river basin. The first study, to be done in the James River Basin, will describe the hydrologic system of the basin and will include analysis of the major rivers and related reservoirs, wetlands, major types of aquifers, soil sys-

tem, and climate. Study results will be used by water-management officials and the public to make informed decisions about water projects or other issues related to North Dakota's water resources.

## Water-Resources Data Collection

The USGS, in cooperation with more than 20 local, State, and Federal agencies, operates an extensive hydrologic data-collection program. During 1994, the program provided for the collection of data at 144 streamflow and lake-level stations, 750 ground-water observation wells, 129 water-quality and sediment stations, and 2 atmospheric deposition stations. Current-year data, which are published annually, are critical for daily administrating and managing of water resources, for determining the extent and severity of droughts, for characterizing and predicting conditions during floods, and for monitoring the effects of human activities on streamflow, ground water, and water quality. The data also are essential to interpretive studies that provide information for making decisions about water issues that potentially affect all North Dakotans. Locations where water-quality data have been collected over the years by the USGS are shown in figure 3.

At 37 of the streamflow stations, data are relayed by satellite to a USGS computer in Bismarck where they can be accessed immediately to help make

water-management decisions. The importance of the streamflow network was demonstrated during the floods of July and August 1993, when streamflow data from satellite telemetry were used by several agencies to manage storage and releases from reservoirs and to make flood forecasts. Also, the USGS, in cooperation with several local, State, and Federal agencies, is collecting streamflow, lake-level, and water-quality data from an extensive network in the Devils Lake Basin (fig. 1) to understand the reasons for the dramatic lake-level and water-quality variability.

## Relations of Wetlands to Weather and Hydrology

Information on the functions of wetlands in the landscape is needed by the U.S. Environmental Protection Agency (USEPA) in the assessment of the risks of various environmental and man-made stress on waterfowl production and water quality. Of particular interest in North Dakota is the response of prairie-pothole wetlands to the wet and dry weather patterns that result from natural climate variability. The USGS, in cooperation with the USEPA, investigated the relations of wetlands open-water areas to weather, ground-water levels, and regional water balances at selected sites in North Dakota. Aerial photographs of wetland areas provided a historical record of wetland conditions. Regression equations were developed to describe wetland conditions over larger physiographic regions of North Dakota.



Figure 3. Water-quality data-collection sites in North Dakota.

The USGS/USEPA investigation is being expanded to determine the relations of wetlands conditions and hydrology in wetlands located within the USEPA Environmental Monitoring and Assessment Program study sites. The USGS is monitoring water levels, basic water quality, and precipitation in wetlands. The investigation is being coordinated with the Northern Prairie Wildlife Research Center, which plans to study wetland biological processes. Results from the investigation will provide information on wetlands hydrology that can be used to explain findings in wetlands biology. Data from the monitoring program will be used by USEPA and local, State, and Federal agencies to guide wetlands management decisions.

### 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. Mapping photographs of some sites go back at about 40 years. Satellite images dating from 1972 can be used to study changes in regional landscapes.

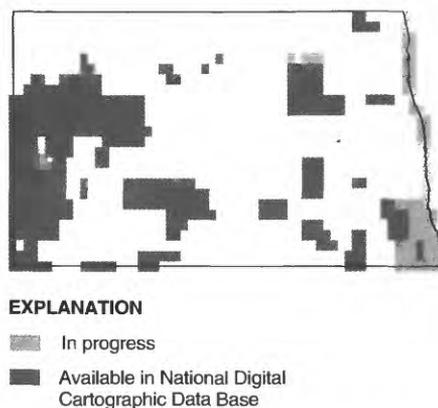
### National Mapping Program

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. Contour lines are used to depict the elevation and shape of terrain. North Dakota is covered by 1,464 maps at this scale, which are 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.

### Computerized Cartographic Data

The USGS has been working with State and Federal representatives to coordinate production of computerized (digital) cartographic data in selected areas of North Dakota (fig. 4). Its geographic



**Figure 4.** Digital Elevation Model coverage at the 1:24,000 scale for North Dakota.

location in the northern Great Plains, mixture of mineral resources and agriculture, and segmented population distribution are important factors that affect natural-resource and habitat management issues. The availability of basic category

of digital cartographic data, such as elevation, hydrologic, and transportation data sets, will allow for improved natural resource management, hydrographic investigations, and data modeling of various physical processes by using geographic information system technology.

The USGS, in cooperation with the NDGS, has produced a broad range of standard cartographic and digital products to meet a variety of user needs. These activities in North Dakota exemplify how government agencies can work together to reduce duplication of effort and resources used, while increasing efficiency in managing their respective responsibilities.

### Cooperative Programs

To conduct its activities in North Dakota, the USGS cooperates with more than 30 local, State, and Federal agencies and Indian Tribes. When local and State agencies are involved, activities typically are funded on a matching-funds basis. In addition to agencies already mentioned, the USGS cooperates with the city of Minot, the Devils Lake Basin Joint Water Resource Board, the North Dakota Department of Transportation, the North Dakota Game and Fish Department, the Bureau of Reclamation, and the U.S. Fish and Wildlife Service, to name only a few.

The USGS provides support to the North Dakota Water Resources Research Institute, which conducts a program of research, education, and information and technology transfer.

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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>".

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