WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

NATIONAL WATER-QUALITY ASSESSMENT PROGRAM—Red River of the North

In 1991, the U.S. Geological Survey (USGS) began to implement a full-scale National Water-Quality Assessment (NAWQA) program. The long-term goals of the NAWQA program are to describe the status and trends in the quality of a large, representative part of the Nation's surface- and ground-water resources, and to provide a sound scientific understanding of the primary natural and human factors affecting the quality of these resources. The program will produce a wealth of water-quality information that will be useful to policy makers and managers at the national, State, and local levels.

Because it would be impractical to assess water quality in every area of the Nation, major activities of the NAWQA program will take place within a set of hydrologic systems called study units. Sixty study units, representative of the diverse water resources of the Nation, will be investigated in the context of local water-quality issues to form the basic framework of the NAWQA program. National and regional water-quality assessments will be made by comparing data and findings from the individual study units. The 60 study units collectively encompass about 45 percent of the land area in the conterminous United States and include 60 to 70 percent of the Nation's water use and population served by public water supply. In 1991, the Red River of the North basin was among the first 20 NAWQA study units selected for study under the full-scale implementation plan.

The Red River of the North basin (fig. 1) was selected as a study unit because the basin represents an important hydrologic region where good-quality water is a valued resource vital to the region's economy; the water quality of the Red River of the North, which flows northward into Manitoba, Canada, is of international concern; the basin represents an important agricultural area in keeping with the President's Water-Quality Initiative; and the northern location and potential interaction of surface and ground water are essential physical factors necessary for a complete national assessment of water quality.

GEOGRAPHIC SETTING OF THE STUDY UNIT

The study-unit area includes all of the 35,530 square-mile surface drainage to the main stem of the Red River of the North within the United States (fig. 1). Most of the surficial glacial-drift aquifers and shallow sedimentary bedrock aquifers located beneath the basin will be investigated to study water-quality relations between surface and ground water.

The general geomorphology and hydrology of the Red River of the North study unit is diverse in ways that could significantly control the occurrence and flow of water and, therefore, the distribution and concentration of water-quality constituents. The relatively low topographic relief (less than 1,350 feet) and gently rolling hills and plains in the study unit are primarily the result of the actions of Ice Age glaciation. Glacial Lake Agassiz left clay-rich sediments in a flat lake plain along the axis of the Red River of the North and a lake-washed till plain in the northeastern part of the study unit (fig. 1). Glaciers and glacial meltwater also left elongated ridges of beach sands and gravels and flat plains of outwash sands. Surficial deposits more recent than glacial origin occur as windblown silts and sands in North Dakota and as river alluvium. Soils derived from these geologic deposits range from heavy, poorly-drained clays and silts in the lakebed areas to light, well-drained sands along beach ridges, outwash plains, and windblown deposits. Heavy organic soils and peat are common in topographic depressions, especially in the lake-washed till plain area.

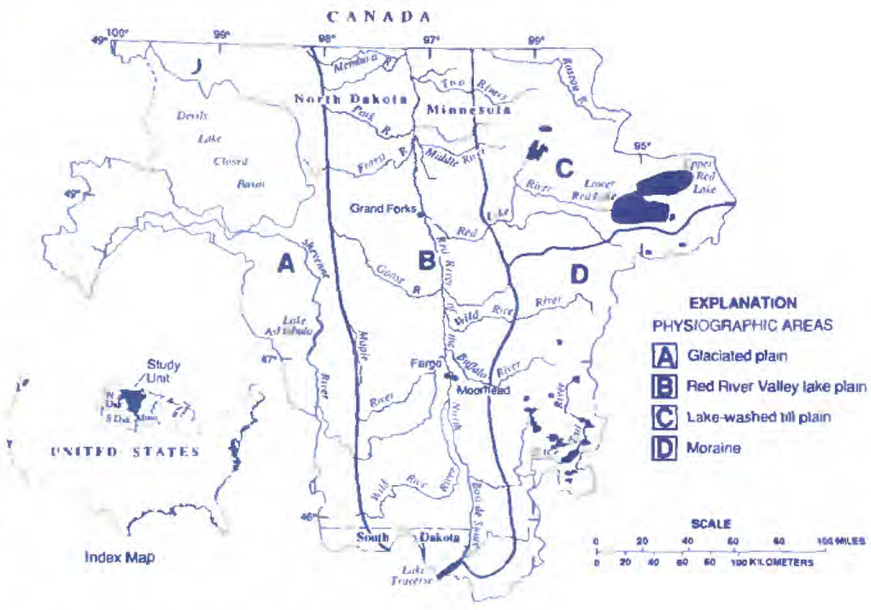

Figure 1. Red River of the North study unit.

The climate of the Red River of the North basin ranges from dry subhumid in the western part of the basin to subhumid in the eastern part. Air masses from different source regions that commonly pass over the Red River of the North basin cause frequent and rapid changes in weather. The average annual temperature is 37 to 43 degrees Fahrenheit. The average monthly temperature ranges from -1 degree Fahrenheit in January to 71 degrees Fahrenheit in July. Average annual precipitation increases from about 17 inches in the west to about 26 inches in the east (fig. 2). About three-fourths of the annual precipitation falls from April through September.

The estimated population in the largely rural study unit is 418,000 people. Almost one-third of the people live in the cities of Fargo and Grand Forks, N. Dak., and Moorhead, Minn. About 12,000 Native Americans live on the Fort Totten, Red Lake, Sisseton, Turtle Mountain, and White Earth Indian Reservations, which are either wholly or partly within the study unit.

About 74 percent of the land area in the study unit is used for agricultural purposes (66 percent cropland and 8 percent pasture and rangeland). Principal crops include wheat, barley, oats, sugar beets, potatoes, corn, beans, hays, and sunflowers. The remaining 26 percent of the study unit consists of forests (about 12 percent); water and wetlands (about 4 percent); urban land use (3 percent); and other categories (7 percent).

WATER RESOURCES

The Red River of the North receives most of its flow from its eastern tributaries largely as result of regional patterns in precipitation, evapotranspiration, soils, and topography. Annual runoff varies greatly, but most

runoff occurs in spring and early summer from rains falling on saturated soils. Flooding is a major problem aggravated by the flat slope of the Red River of the North. Channel obstructions such as ice jams, felled trees, and man-made structures can cause backwater that increases flood elevations locally. Major reservoirs, operated by the U.S. Corps of Engineers for flood control and water supply, include Lake Traverse (storage capacity 137,000 acre-feet), Lake Ashtabula (69,100 acre-feet), and Upper and Lower Red Lakes (1,547,000 acre-feet). Natural lakes, ranging in surface area from 10 to 13,800 acres, occur at a density of greater than 10 lakes per 10 square miles in the southeastern part of the study unit. The study unit also contains thousands of natural wetlands.

Ground water that is discharged to streams and springs or is pumped from wells primarily comes from sand and gravel aquifers near land surface or buried within the glacial drift that mantles the entire study unit. In the western half of the unit, small supplies of ground water also are available from bedrock aquifers (sandstone, limestone, and shale) beneath the glacial drift. Water enters the ground-water system through direct infiltration to surficial aquifers (fig. 2) or by slow leakage through overlying silt and clay.

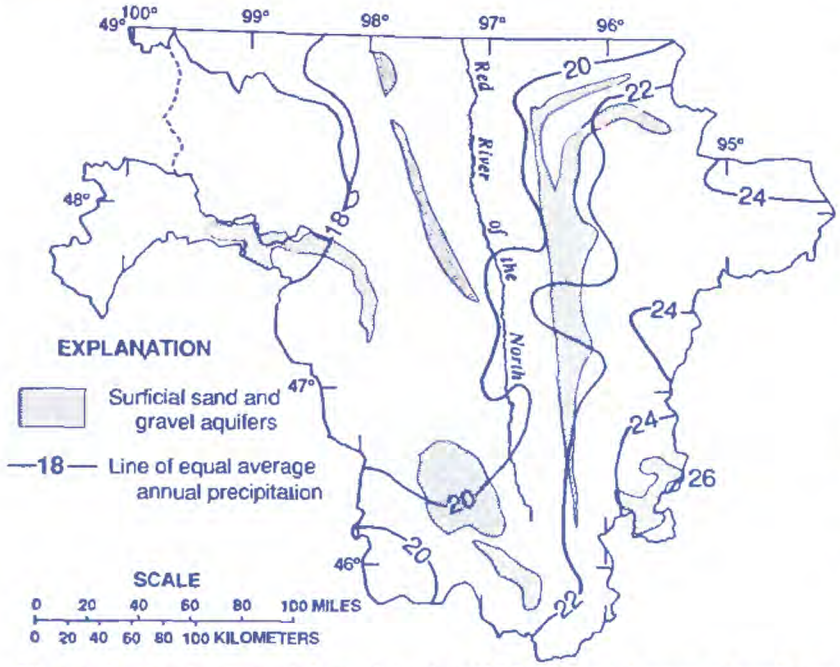

Figure 2. Average annual precipitation (1951–80) and areas of surficial aquifers. (Precipitation from State Climatology Offices, Minnesota and North Dakota.)

The table below shows that most of the water use is for public supply and irrigation with nearly equal proportions from surface- and ground-water sources.

Reported water use (1985), in million gallons per day

Category	Ground water	Surface water
Public supply	20	32
Rural	10	0
Irrigation	36	26
Self-supplied industrial	1	5
Total	67	63

WATER-QUALITY CONCERNS AND ISSUES

Some of the major water-quality concerns and issues that will be considered during the study in the Red River of the North basin include:

- Eutrophication—Nitrate and phosphate in surface runoff from cropland fertilizers and industrial and municipal sewage effluent accelerates enrichment of nutrients in lakes, reservoirs, and streams.

- Recreational quality—Mercury has been detected in game fish at levels sufficient to evoke consumption advisories for humans in the Red River of the North and the Red Lake River.

- Salinity—Mineralized water (especially from bedrock aquifers in the western and northern parts of study unit) could migrate upward into glacial-drift aquifers and streams during conditions of drought or large ground-water withdrawals from glacial-drift aquifers. Diversion of water from the Missouri River basin through the Devils Lake closed basin (fig. 1) into the Sheyenne River may, at times, increase salinity of the Sheyenne River. Return flows from irrigation also may increase salinity to surface and ground water in the drier western part of the study unit.

- Sanitary quality—Treated and small amounts of untreated sewage effluent from municipalities and industrial wastes (from sugar beet, grain, and meat processing) are discharged to the mainstem of the Red River of the North.

- Soil erosion/sedimentation—Large quantities of fine-textured soil in the western and central parts of the basin are eroded by wind and water and transported as suspended sediment by streams.

- Toxic contamination—Leachate from landfills, pesticides and nitrogen fertilizers from croplands, and hydrocarbons from crude-oil pipelines have contaminated or have the potential to contaminate surface waters and ground-water recharge areas. The occurrence and causes of pesticides in water resources also will be a key part of national and regional analysis and comparison. Water in the Red River of the North generally is low in mineral concentration, but cadmium, lead, mercury, and selenium have been found in concentrations that exceed EPA drinking-water standards.

COMMUNICATION AND COORDINATION FOR THE STUDY

Communication and coordination between USGS personnel and other interested scientists and water-management organizations are critical components of the NAWQA program. Each of the study-unit investigations will have a local liaison committee consisting of representatives from Federal, State, and local agencies, universities, and the private sector who have water-resources responsibilities. Specific activities of each liaison committee will include the exchange of information about water-quality issues of regional and local interest; the identification of sources of data and information; assistance in the design and scope of project products; and the review of project planning documents and reports. The liaison committee for the Red River of the North study unit will be formed and a detailed work plan will be developed in 1991.

SELECTED REFERENCES

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Miller, J.E., and Frink, D.L., 1984, Changes in flood response of the Red River of the North basin, North Dakota-Minnesota: U.S. Geological Survey Water-Supply Paper 2243, 103 p.

Souris-Red-Rainy River Basins Commission, 1972, The combined report—Type I framework study, v. 1, 216 p.

Information on technical reports and hydrologic data related to the NAWQA program can be obtained from:

District Chief, Water Resources Division
U.S. Geological Survey
702 Post Office Building
St. Paul, Minnesota 55101

Open-File Report 91–151 J.D. Stoner, 1991

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