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GEOLOGICAL SURVEY
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MAJOR AQUIFERS IN HAND AND HYDE COUNTIES, SOUTH DAKOTA

by

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INTRODUCTION

This information pamphlet is one of a series of reports on water-resources studies of South Dakota counties. It is designed to acquaint the reader with the general distribution, quantity, and quality of ground water available from the major aquifers in Hand and Hyde Counties. A comprehensive report to be published later will contain the basic data collected during the study and much additional information on the hydrology and geology of the area.

Information in this report is based on data (fig. 1) collected by the U.S. Geological Survey and the South Dakota Geological Survey during the period of 1972-75.

Copies of this publication and other county reports may be obtained from the South Dakota Geological Survey as they become available. Persons wishing additional information about the hydrology and geology may contact the U.S. Geological Survey in Huron or the South Dakota Division of Geological Survey in Vermillion.

The English units used in this report may be converted to metric units by the following conversion factors:[1]

DEFINITION OF TERMS

Artesian aquifer.--An artesian aquifer is one in which the water in a well rises above the top of the aquifer.

Bedrock.--A general term for the rock, usually solid, that underlies soil, sand, clay or other unconsolidated material. In Hand and Hyde Counties the uppermost bedrock deposit is shale.

Glacial aquifer.--A water-bearing formation composed of materials derived from a glacier. In this report it is mainly unconsolidated sand and gravel deposited as outwash from a glacier.

Aquifer.--A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Glacial drift.--A collective term applied to all material in transport by glacial ice and deposited by glacial ice.

Glacial outwash.--This is sand, gravel, silt, and clay which is deposited by water from melting ice. For the purposes of this report, outwash is restricted to sand and gravel.

Dissolved solids.--Includes all material in water that is in solution.

Hardness.--Dissolved calcium and magnesium salts that reduce the lathering ability of soap and form scale in boilers and pipes. Hardness is reported as calcium carbonate and is classified by the U.S. Geological Survey as follows:[2]

Properly-constructed well.--One constructed to admit a maximum amount of water from an aquifer without excessive loss of head at the well. This generally requires either installing a well screen or perforating the casing and installing a gravel pack around the casing opposite the depth interval of the aquifer. It also requires pumping the well in such a manner as to remove drilling mud and other fine-grained material from the aquifer adjacent to the well.

Water table.--That surface in an unconfined water

[1]

Multiply English Unit	By	To Obtain Metric Unit
feet (ft)	0.3048	metres (m)
gallons (gal)	3.785	litres (l)
gallons per minute (gal/min)	0.063	litres per second (l/s)
miles (mi)	1.609	kilometres (km)
square miles (mi^2)	2.590	square kilometres (km^2)

[2]

	Milligrams per litre (mg/l)	Grains per gallon (gpg)
Soft	0- 60	0- 3.4
Moderately hard	61-120	3.5- 7.0
Hard	121-180	7.1-10.5
Very hard	More than 180	More than 10.5

body at which the pressure is atmospheric. Generally this is the upper surface of the zone of saturation, except where the surface is formed by a poorly permeable body.

GLACIAL AQUIFERS

Tulare Aquifer

The Tulare aquifer (fig. 2) underlies an area of about 950 mi^2 (2,460 km^2) in northern Hand and Hyde Counties. The aquifer may yield as much as 1,000 gal/min (63 l/s) of water to properly-constructed wells at depths ranging from 10 to 200 ft (3 to 61 m). Aquifer thickness averages about 30 ft (9 m) and ranges from 1 to 124 ft (0.3 to 38 m). Water in the aquifer occurs mostly under artesian conditions except where the aquifer underlies the creeks in eastern Hand County. The depth to water in wells is generally less than 50 ft (15 m) below land surface except in the southern part of Hand County where it is 100 ft (30 m) and more.

Water in the Tulare aquifer is predominantly of calcium bicarbonate or sodium sulfate type with dissolved solids averaging 1,300 mg/l and ranging from 200 to 1,800 mg/l. Water in the upper part of the aquifer generally is calcium bicarbonate type and in the lower part of the aquifer sodium sulfate type. It generally is of suitable quality for domestic, stock, municipal, and irrigation use and is used for those purposes.

Highmore Aquifer

The Highmore aquifer (fig. 2) underlies an area of about 100 mi^2 (260 km^2) in central Hyde County. The aquifer may yield as much as 1,000 gal/min (63 l/s) of water to properly-constructed wells at depths ranging from 20 to 200 ft (6 to 61 m). Water in the aquifer occurs mostly under artesian conditions except where the aquifer underlies the South Fork Medicine Knoll Creek. The depth to water in wells is generally less than 100 ft (30 m) below land surface except in T. 113 N. where it is as much as 150 ft (46 m).

Water in the Highmore aquifer is predominantly of calcium bicarbonate or sodium sulfate type with dissolved solids ranging from 500 to 2,000 mg/l. It generally is of suitable quality for domestic, stock, municipal, and irrigation use and is used for those purposes.

Elm Creek Aquifer

The Elm Creek aquifer (fig. 3) underlies an area of 30 mi^2 (78 km^2) in southwestern Hand County and southeastern Hyde County. The aquifer may yield as much as 1,000 gal/min (63 l/s) of water to properly-constructed wells at depths ranging 20 to 100 ft (6 to 30 m). Water in the aquifer occurs under artesian conditions. The depth to water in wells is generally less than 30 ft (9 m) below land surface.

Water in the Elm Creek aquifer is predominantly of calcium bicarbonate or calcium sulfate type with dissolved solids averaging 850 mg/l and ranging from 500 to 1,000 mg/l. It is of suitable quality for domestic, stock, municipal, and irrigation use. It is being used extensively for domestic, stock, and irrigation use.

Bad-Cheyenne River Aquifer

The Bad-Cheyenne River aquifer (fig. 3) underlies an area of about 200 mi^2 (520 km^2) in Hyde and Hand Counties. It crosses north-central Hyde County and extends to the southeast across Hand County. The aquifer may yield as much as 1,000 gal/min (63 l/s) of water to properly-constructed wells at depths ranging mostly from 250 to 330 ft (76 to 101 m). The aquifer occurs within 150 ft (46 m) of land surface in the topographically low area at the Hand-Beadle County line. Water in the aquifer occurs under artesian conditions. The depth to water in wells ranges from 10 to 210 ft (3 to 64 m) below land surface.

Water in the Bad-Cheyenne River aquifer is of the sodium bicarbonate type with dissolved solids ranging from 1,300 to 1,800 mg/l. It is of suitable quality for stock and domestic uses. Based on chemical analyses of water in Hyde County it is not suitable for irrigation use. It is presently being used for domestic and stock use from only three wells in western Hyde County. Chemical quality data are not available for water in the southeastern part of the aquifer.

BEDROCK AQUIFERS

The major bedrock aquifers which underlie Hand and Hyde Counties are the sandstones which are at depths greater than 900 ft (275 m) below land surface. They are found, in order of increasing depth, the Dakota, Fall River, Sundance, and Minnelusa Formations. The Dakota aquifer ranges in thickness from 200 to 280 ft (61 to 85 m) at depths greater than 900 ft (275 m) below land surface in eastern Hand County to depths greater than 2,000 ft (610 m) below land surface in western Hyde County. The Fall River, Sundance, and Minnelusa Formations are hydraulically connected and act as a single aquifer. The Fall River-Sundance-Minnelusa aquifer has an average thickness of about 200 ft (60 m) at depths greater than 1,400 ft (430 m) below land surface in eastern Hand County to depths greater than 2,400 ft (730 m) in western Hyde County.

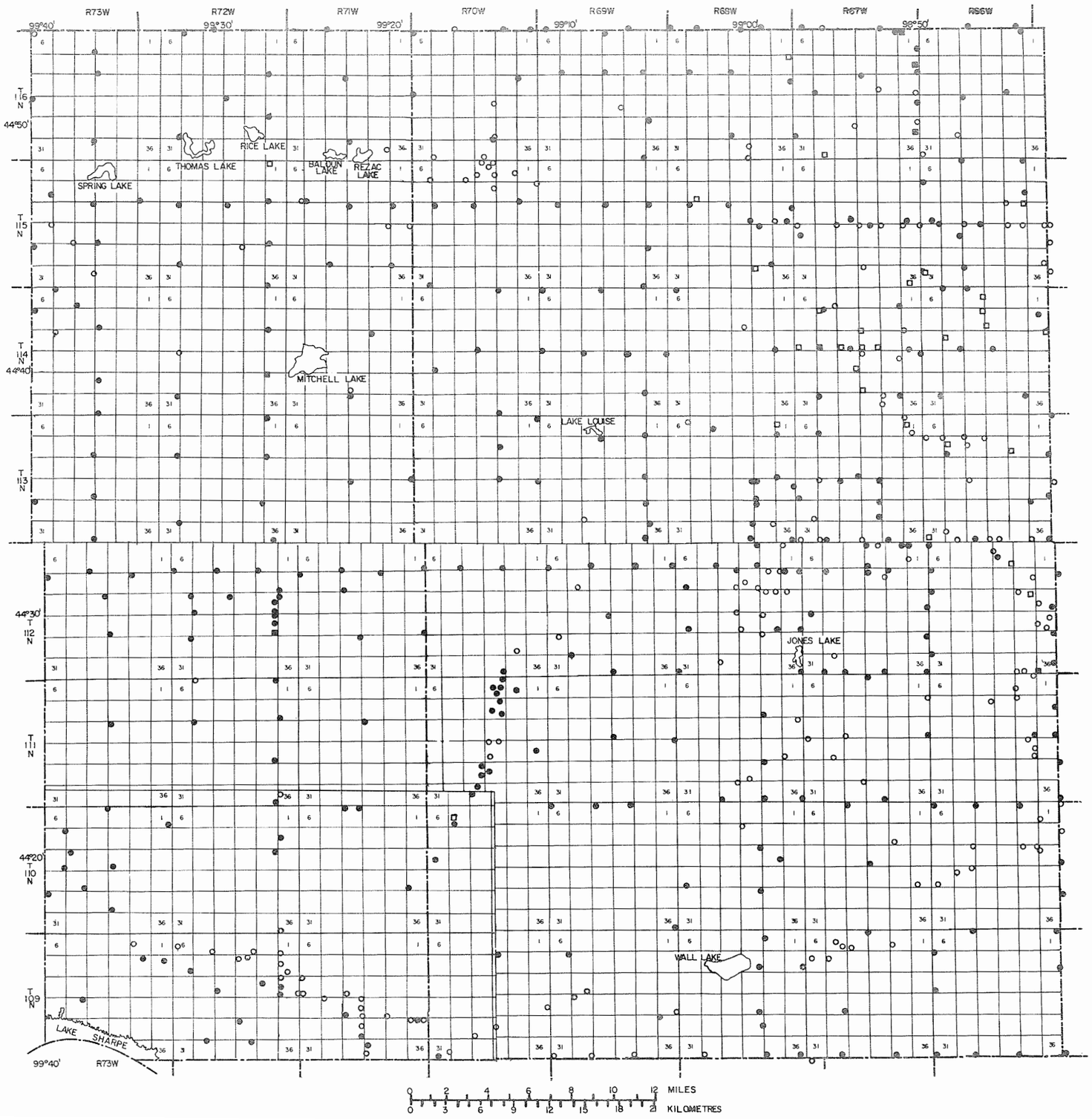
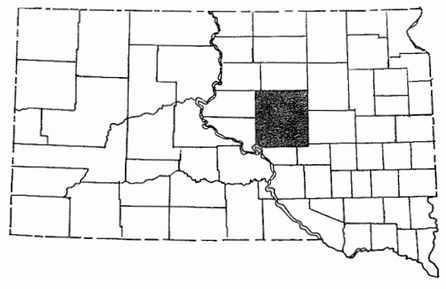


Figure 1--Locations of test holes and wells for which geologic, electric, or driller's logs are available in Hand and Hyde Counties.

EXPLANATION

- ○ TEST HOLE OR WELL not drilled to bedrock.
- ◉ TEST HOLE OR WELL drilled to bedrock.
- □ ▣ OBSERVATION WELLS water-level-measurement site.

Base from South Dakota Department of Highways



INDEX MAP OF SOUTH DAKOTA SHOWING LOCATION OF HAND AND HYDE COUNTIES.

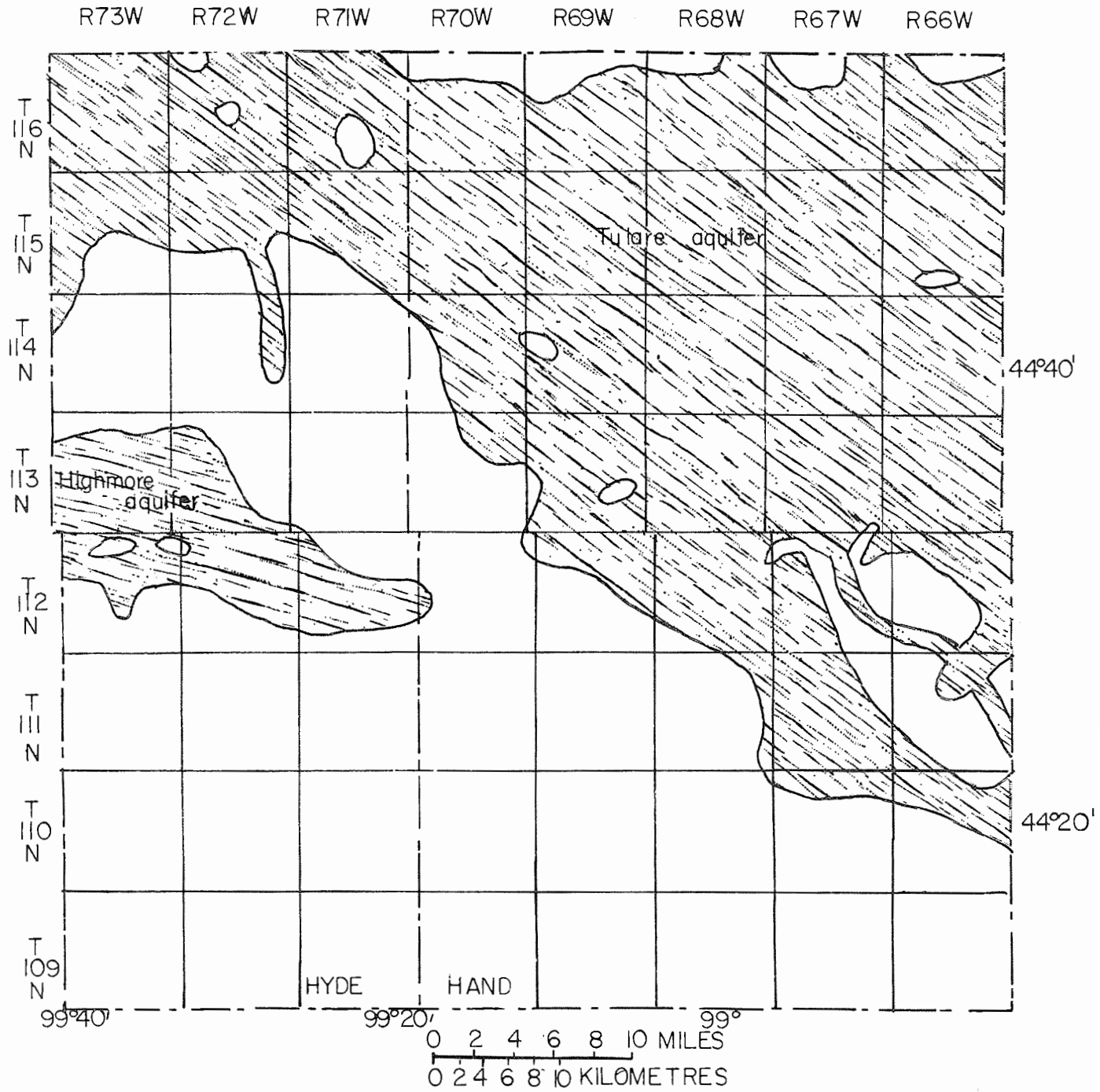


Figure 2.-- Locations of the Tulare and Highmore aquifers.

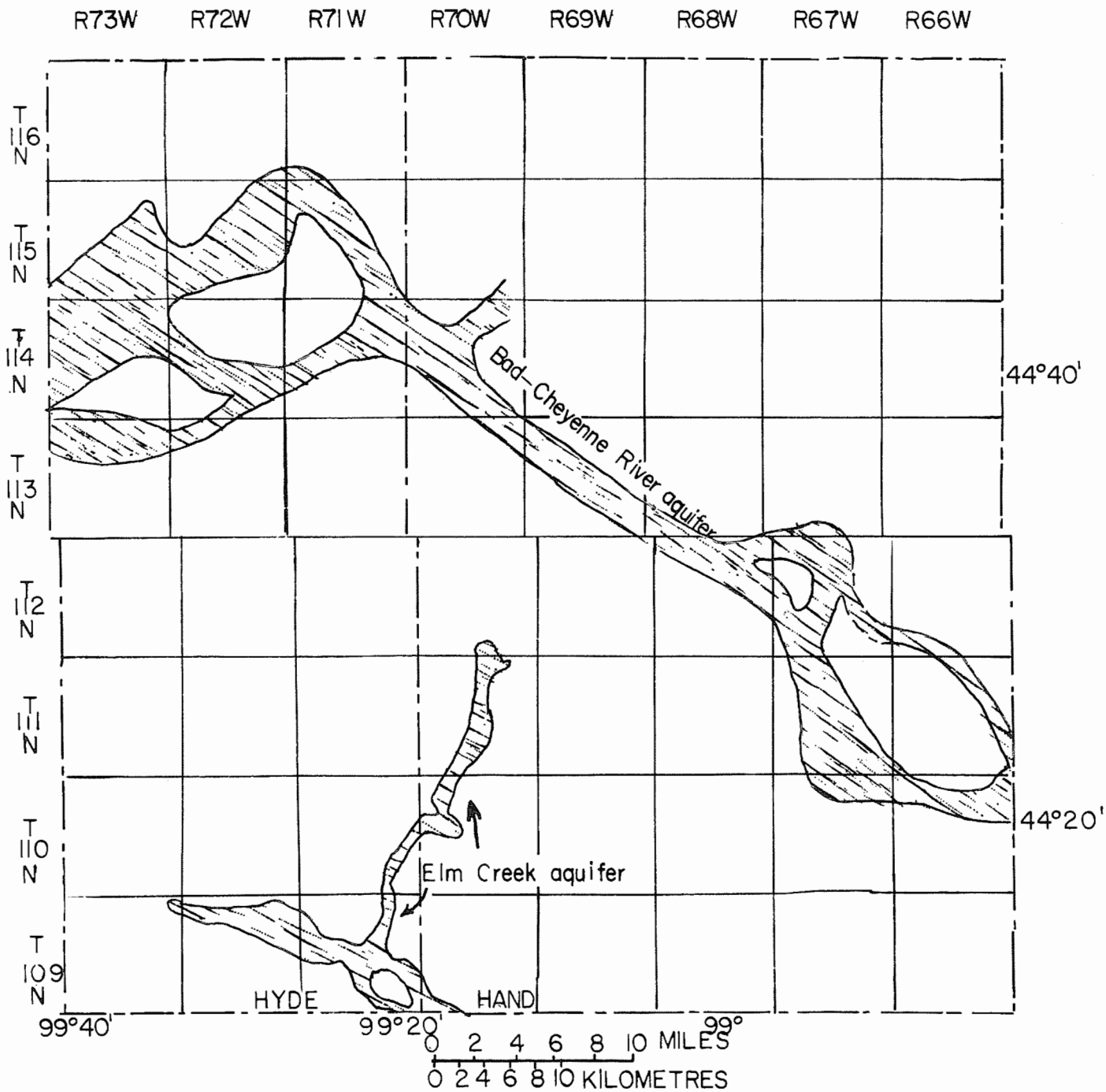


Figure 3.-- Locations of the Elm Creek and Bad-Cheyenne River aquifers.

Water in the bedrock aquifers occurs under artesian conditions. Wells in the Dakota aquifer flow in northeastern Hand County and east central Hyde County. Elsewhere water levels in wells developed in the Dakota range from 30 ft (9 m) below land surface in Hyde County to 400 ft (122 m) below land surface in southeastern Hand County. Wells in the Fall River-Sundance-Minnelusa aquifer flow in most of the area except for the topographically high area in southeastern Hand County where water levels in wells are as much as 150 ft (46 m) below land surface.

The Dakota water is a sodium chloride type with dissolved solids ranging from 1,500 to 2,600 mg/l. Hardness ranges from soft (12 mg/l) to very hard (1,300 mg/l) in the Dakota water. Fall River-Sundance-Minnelusa water is a calcium sulfate type with dissolved solids ranging from 1,900 to 2,200 mg/l; hardness is very high (about 1,400 mg/l).

The water in bedrock aquifers is used for domestic, stock, and municipal purposes. Its poor chemical quality makes it unsuitable for irrigation use.

POSSIBILITIES FOR OBTAINING WATER FOR IRRIGATION WELLS

The best possibilities for obtaining wells capable of supplying sufficient yields needed for irrigation are in the areas where the aquifer thickness is greater than 30 ft (9 m). Before irrigation wells are constructed, a test hole should be drilled at the selected location to determine the thickness of the aquifer and to provide samples for determining the grain size of the aquifer material. This information will help in the selection of the proper slot size and length of screen to be used in the construction of the test well. Pumping the test well shows the yield of the aquifer at that locality and provides a water sample for chemical-quality analysis. A knowledge of the type of soil and subsoil and the topography are also important in determining the suitability of the land for irrigation, and in selecting the most suitable irrigation system.