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DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
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GEOLOGICAL SURVEY
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Information Pamphlet No. 45

MAJOR AQUIFERS IN HUTCHINSON AND TURNER COUNTIES, SOUTH DAKOTA

by

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Prepared in cooperation with the
South Dakota Geological Survey,
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East Dakota Water Development District

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ABSTRACT

Eleven glacial and three bedrock aquifers were delineated in Hutchinson and Turner Counties. The glacial aquifers store about 5.2 million acre-ft of water, and the bedrock aquifers store about 18 million acre-ft of water.

The Parker-Centerville, West Fork Vermillion, East Fork Vermillion, and Turkey Ridge Creek aquifers are shallow aquifers with depths to the top of the aquifer less than 65 ft below land surface. The Choteau, Dolton, Turkey Ridge, Wall Lake, and Ethan aquifers are buried aquifers overlain with 35 to 270 ft of till. The Upper Vermillion-Missouri and Lower James-Missouri aquifers are predominantly buried aquifers overlain by as much as 355 ft of till. The areal extent of the glacial aquifers ranges from 6 square miles for the East Fork Vermillion aquifer to 268 square miles for the Lower James-Missouri. The 11 glacial aquifers range in average thickness from 18 ft for the Ethan aquifer to 69 ft for the Lower James-Missouri aquifer. Reported maximum well yields are the largest (1,000 gallons per minute) from the Parker-Centerville, Upper Vermillion-Missouri, Lower James-Missouri, and Choteau aquifers.

The average dissolved-solids concentrations of water from the Parker-Centerville, West Fork Vermillion, East Fork Vermillion, and Turkey Ridge Creek aquifers ranged from 870 to 2,200 milligrams per liter (mg/L), and average hardness concentrations ranged from 670 to 1,400 mg/L. The average dissolved-solids concentrations of water from the Upper Vermillion-Missouri, Lower James-Missouri, Choteau, Dolton, Turkey Ridge, Wall Lake, and Ethan aquifers ranged from 1,190 to 2,100 mg/L, and average hardness concentrations ranged from 280 to 1,200 mg/L.

The three major bedrock aquifers (Niobrara, Codell, and Dakota), which store about 18 million acre-ft of water in Hutchinson and Turner Counties, are under artesian conditions. Estimated maximum well yields are 1,000 gallons per minute for the Niobrara aquifer, 100 gallons per minute for the Codell aquifer, and 250 gallons per minute for the Dakota aquifer. Average dissolved-solids concentrations in water from the bedrock aquifers ranged from 1,450 to 1,510 mg/L and average hardness concentrations ranged from 230 to 670 mg/L.

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 Hutchinson and Turner Counties. Information in this pamphlet is based on data (fig. 1) collected by the U.S. Geological Survey and the South Dakota Geological Survey during 1982 through 1986.

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

The inch-pound units used in this report may be converted to metric units by the following conversion factors:

Multiply	By	To obtain
acre-foot (acre-ft)	1233	cubic meter
foot (ft)	0.3048	meter
gallon (gal)	3.785	liter
gallon per minute (gal/min)	0.06308	liter per second
square mile (mi^2)	2.590	square kilometer

DEFINITION OF TERMS

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.

Artesian aquifer: A confined aquifer in which the water in a well completed in the aquifer rises above the top of the aquifer.

Bedrock: A general term for the rock, usually consolidated, that underlies soil, sand, clay, or other unconsolidated material. In Hutchinson and Turner Counties, glacial aquifers mainly consist of unconsolidated sand and gravel deposited as glacial outwash.

Dissolved solids: The sum of all dissolved material in water, expressed as the weight of solute per unit volume of water. Milligrams per liter (mg/L) are the units used in this report

Glacial aquifer: As used in this report, an aquifer consisting mainly of unconsolidated sand and gravel deposited as outwash from a glacier.

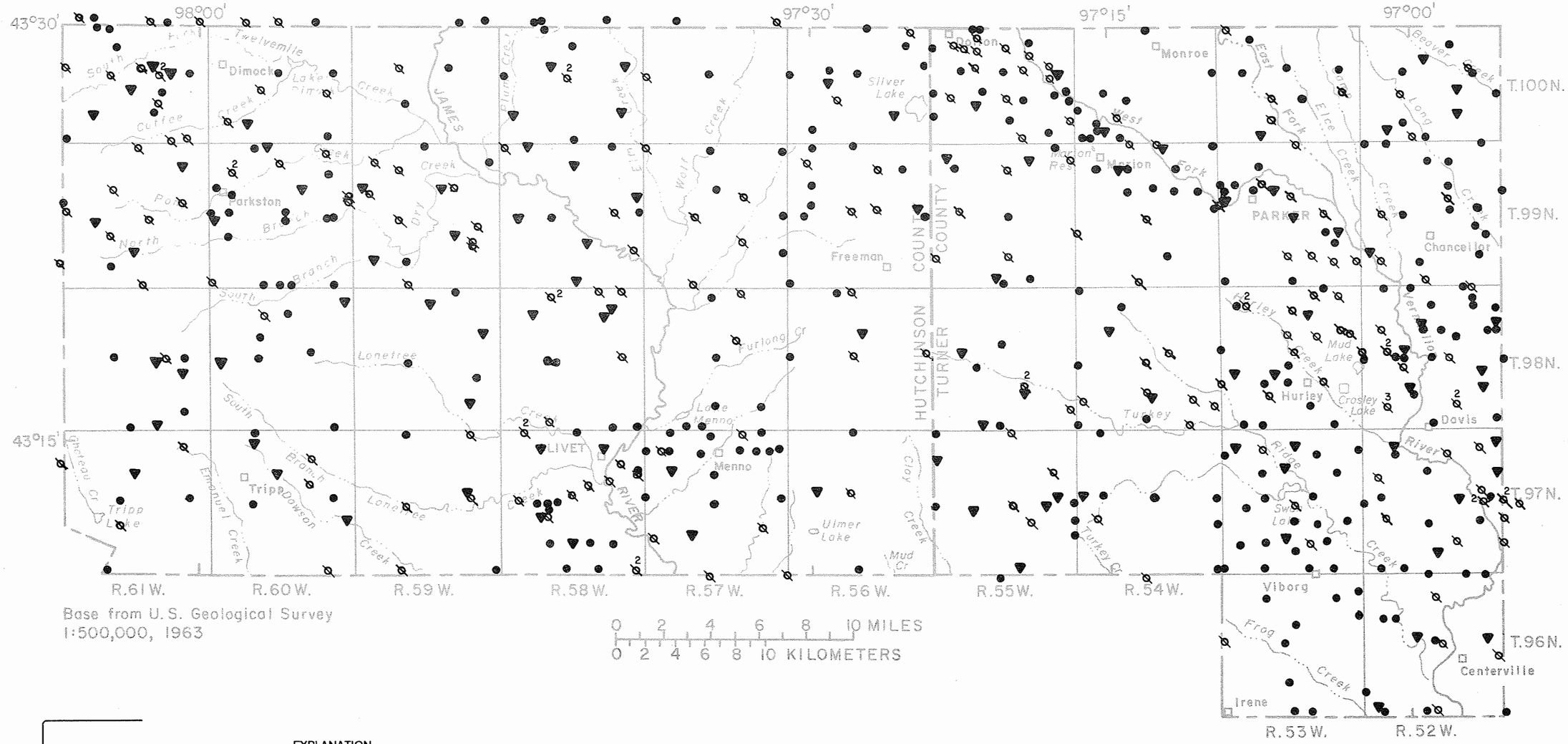
Glacial outwash: Sand, gravel, silt, and clay that was deposited by water from melting ice. In this report, the term is restricted to sand and gravel.

Hardness: Dissolved calcium and magnesium salts in water that decrease 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:

Classification	Milligrams per liter	Grains per gallon
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

Large-capacity well: Defined by South Dakota law as a well capable of yielding at least 18 gallons per minute on a sustained basis.

Specific conductance: The ability of water to conduct an electric current. Generally, this is a measure of the dissolved chemical constituents in water.



EXPLANATION

- TEST-DRILLING SITE. Aquifer description **and** drillers logs are available from U.S. Geological Survey.
- ϕ^2 OBSERVATION-WELL SITE. Records of water-level measurements are available from U.S. Geological Survey. Number indicates number of wells at same site, if more than one.
- WATER-QUALITY SAMPLE SITE. Complete chemical analyses obtained for this study are available from U.S. Geological Survey.

North

Figure 1. Location of test holes, observation wells, and ground water quality sampling sites in Hutchinson and Turner Counties.

Till: A general term applied to all unsorted rock material (clay, sand, gravel, boulders) transported by glaciers and deposited directly on land or in the sea.

Water table: That water surface in an unconfined aquifer at which the pressure is atmospheric. Generally this is the upper surface of the zone of saturation, except where the surface is within a relatively impermeable rock type.

GLACIAL AQUIFERS

Eleven glacial aquifers were delineated in Hutchinson and Turner Counties (figs. 2, 3, and 4). The aquifers are unconsolidated sand and gravel outwash deposited by meltwaters from glaciers. The Parker-Centerville, West Fork Vermillion, East Fork Vermillion, and Turkey Ridge Creek aquifers (fig. 2) are at or near land surface and generally are under water-table conditions. The Upper Vermillion-Missouri, Lower James-Missouri, and Choteau aquifers (fig. 3) are overlain by as much as 355 ft of till and generally are under artesian conditions. The Dolton, Turkey Ridge, Wall Lake, and Ethan aquifers (fig. 4) are buried aquifers overlain by 35 to 165 ft of till. Hydrologic characteristics of the aquifers are given in table 1.

Parker-Centerville Aquifer

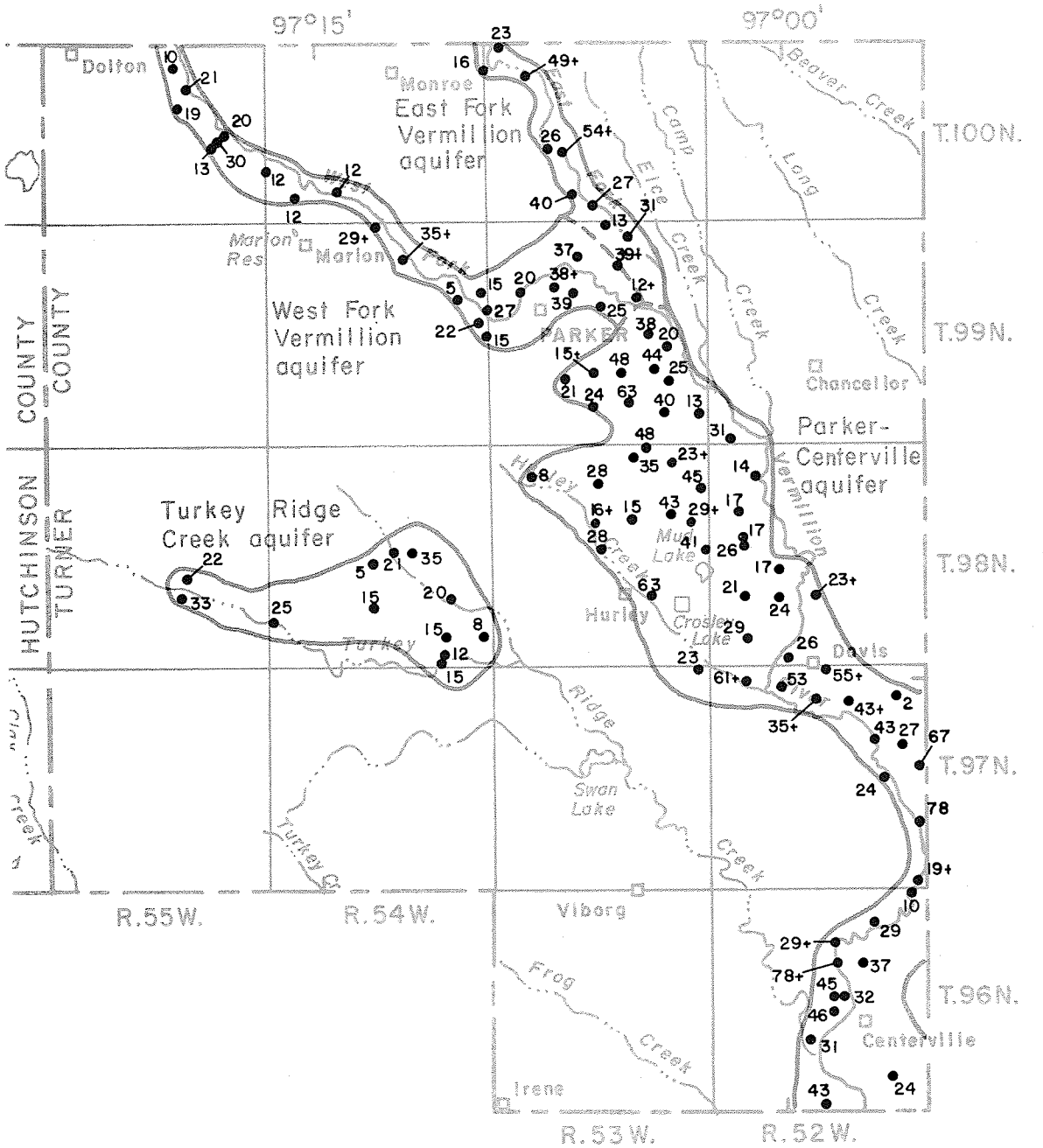
The Parker-Centerville aquifer (fig. 2) underlies 74 mi^2 of eastern Turner County. It is composed of fine sand to coarse-pebble gravel, with some cobble gravel encountered in southern T. 96 N., R. 52 and 53 W. Depth to the top of the aquifer ranges from land surface in the Vermillion River valley to 50 ft below land surface in the southeastern corner of T. 96 N., R. 52 W. where the aquifer is overlain by till. The average aquifer thickness is 34 ft. The Parker-Centerville aquifer is in hydraulic connection with the East and West Fork Vermillion and Upper Vermillion-Missouri aquifers.

Predominant chemical constituents in water from the Parker-Centerville aquifer are calcium, sulfate, and bicarbonate. Dissolved-solids concentrations ranged from 407 to 6,760 mg/L and averaged 1,840 mg/L. Hardness concentrations (as $CaCO_3$) ranged from 270 to 1,700 mg/L and averaged 680 mg/L. Water from the aquifer is used for domestic, municipal, irrigation, and stock-watering purposes.

West Fork Vermillion Aquifer

The West Fork Vermillion aquifer (fig. 2) underlies 18 mi^2 of northern Turner County and is composed of fine sand to coarse-pebble gravel. The aquifer is principally found at or near land surface and under water-table conditions in the West Fork Vermillion River flood plain. In T. 99 N., R. 53 W., north of the West Fork Vermillion River, a portion of the aquifer is confined by as much as 45 ft of till and is under artesian conditions. The average thickness of the aquifer is 22 ft. The West Fork Vermillion aquifer is in hydraulic connection with the East Fork and Parker-Centerville aquifers.

Predominant chemical constituents in water from the West Fork Vermillion aquifer are calcium, sulfate, and bicarbonate. Dissolved-solids concentrations ranged from 550 to 1,200 mg/L and averaged



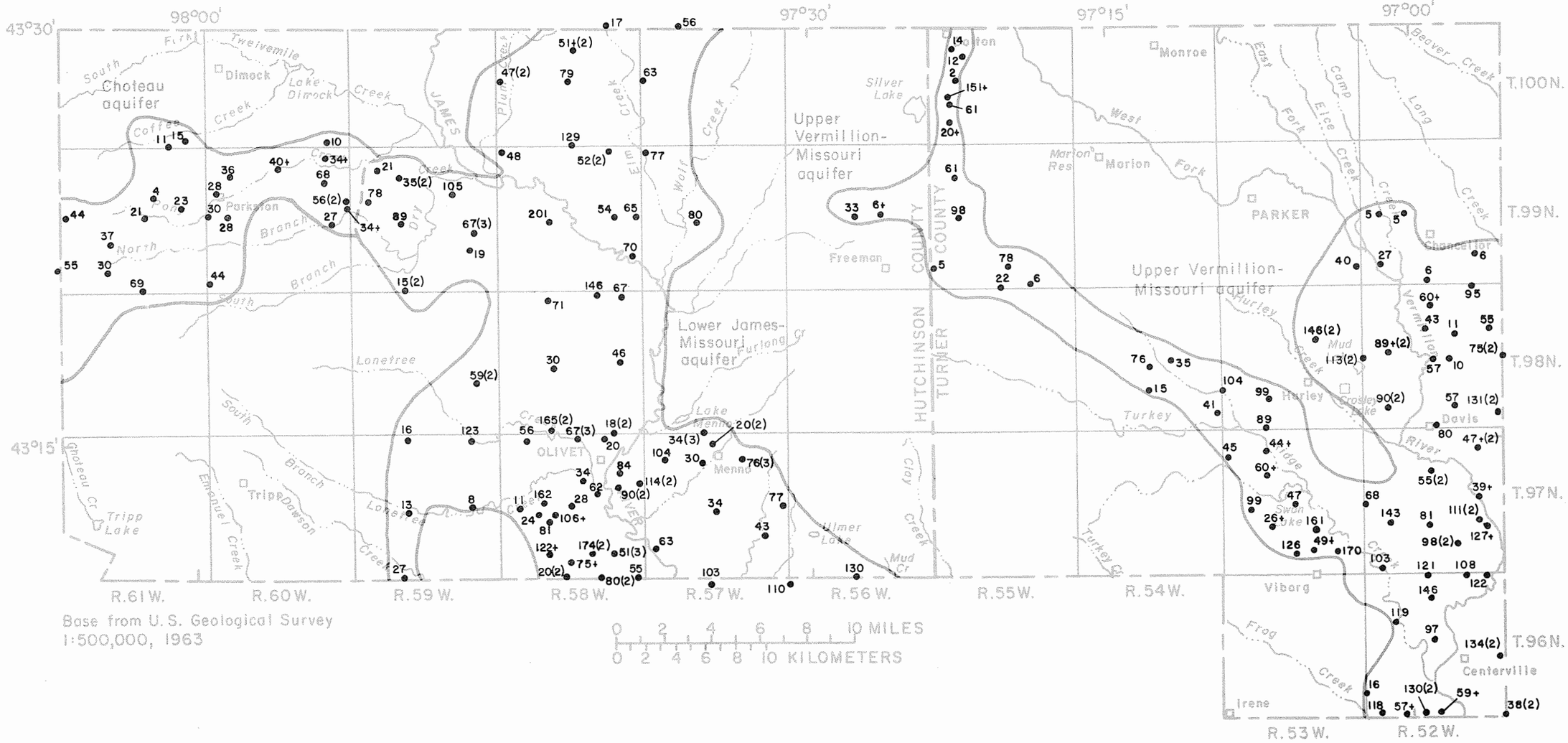
EXPLANATION

16+ TEST HOLE. Number is thickness of sand and gravel, in feet. A plus (+) indicates thickness greater than shown.

AQUIFER BOUNDARY. Dashed where approximately located.

North

Figure 2. Areal extent and thickness of the Parker-Centerville, West Fork Vermillion, East Fork Vermillion, and Turkey Ridge Creek aquifers in Turner County.



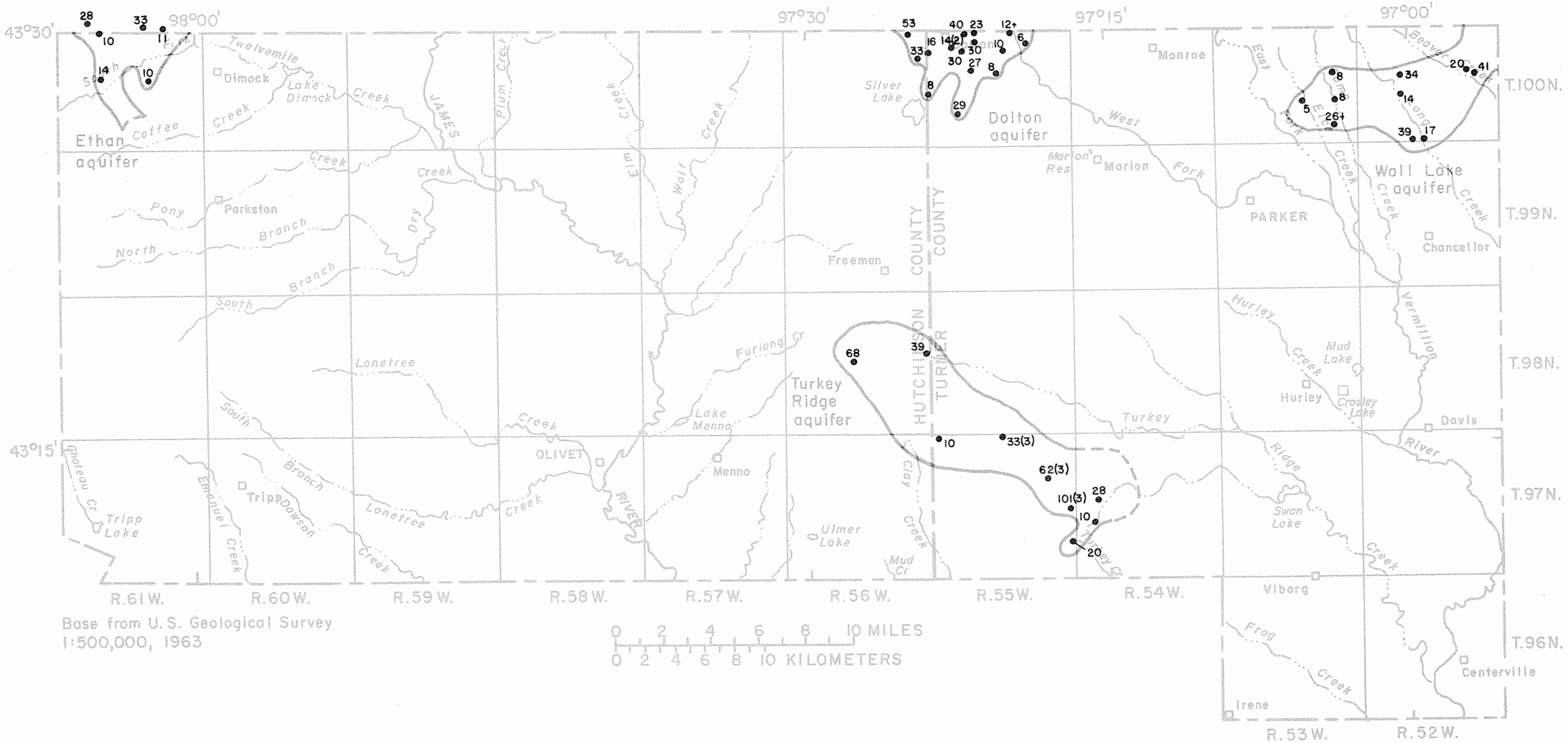
EXPLANATION

56(2) TEST HOLE. Number is thickness of sand and gravel, in feet. Numbers in parenthesis refer to number of layers of sand and gravel, if more than one layer is present. A plus (+) indicates thickness greater than shown.

AQUIFER BOUNDARY. Dashed where approximately located.

North

Figure 3. Areal extent and thickness of the Upper Vermillion-Missouri, Lower James-Missouri, and Choteau aquifers in Hutchinson and Turner Counties.



EXPLANATION

● 14(2) TEST HOLE. Number is thickness of sand and gravel, in feet. Numbers in parenthesis refer to number of layers of sand and gravel, if more than one layer is present. A plus (+) indicates thickness greater than shown.

AQUIFER BOUNDARY. Dashed where approximately located.

North

Figure 4. Areal extent and thickness of the Dolton, Turkey Ridge, Wall Lake, and Ethan aquifers in Hutchinson and Turner Counties.

Table 1. Summary of the hydrologic characteristics of major aquifers in Hutchinson and Turner Counties

Aquifer name	Areal extent (square miles)	Maximum thickness [1] (feet)	Average thickness (feet)	Range of depth of top of aquifer unit below land surface [1] (feet)	Range of water level below land surface (feet)	Water-table (WT) and/or artesian (A) aquifer	Estimated maximum volume of water in storage [2] (acre-feet)	Estimated maximum well yield (gallons per minute)
				GLACIAL AQUIFERS				
Parker-Centerville	74	78+	34	0- 50	0- 20	WT,A	322,000	1,000
West Fork Vermillion	18	39+	22	0- 45	7- 15	WT,A	51,000	500
East Fork Vermillion	6	54+	29	0- 5	4- 14	WT	22,000	500
Turkey Ridge Creek	18	35	19	0- 65	0- 36	WT,A	44,000	500
Upper Vermillion-Missouri	207	170	68	0-355	6-179	A	1,802,000	1,000
Lower James-Missouri	268	201	69	0-245	0-134	WT,A	2,367,000	1,000
Choteau	65	69	33	105-270	F[3]-144	A	275,000	1,000
Dolton	12	53	22	45-165	5- 93	A	34,000	400
Turkey Ridge	44	101	41	55-160	27-219	WT,A	231,000	50
Wall Lake	24	41	21	35-140	5- 63	A	65,000	500
Ethan	9	33	18	50-115	40- 53	A	21,000	400
Total of glacial aquifers							5,234,000	
				BEDROCK AQUIFERS				
Niobrara	729	370	75	0-510	F[3]-235	A	6,998,000	1,000
Codell	230	80	40	0-500+	23-235	A	1,178,000	100
Dakota	949	341	81	180-900+	F[3]-187	A	9,839,000	250
Total of bedrock aquifers							18,015,000	
TOTAL							23,249,000	

[1] A "+" indicates value greater than shown.

[2] Storage was estimated by multiplying average aquifer thickness times areal extent times an estimated porosity of 0.2.

[3] F indicates flowing well.

870 mg/L. Hardness concentrations ranged from 410 to 930 mg/L and averaged 670 mg/L. Water from the aquifer is used for domestic, municipal, irrigation, and stock-watering purposes.

East Fork Vermillion Aquifer

The East Fork Vermillion aquifer (fig. 2) underlies about 6 mi^2 of northeastern Turner County. The aquifer is composed of fine sand to medium-pebble gravel, is limited to the flood plain of the East Fork Vermillion River, and is encountered at or near land surface. The aquifer is hydraulically connected to the West Fork Vermillion and Parker-Centerville aquifers. The average aquifer thickness is 29 ft.

Predominant chemical constituents in water from the East Fork Vermillion aquifer are calcium, sulfate, and bicarbonate. Dissolved-solids concentrations ranged from 930 to 1,600 mg/L and averaged 1,260 mg/L. Hardness concentrations ranged from 730 to 1,100 mg/L and averaged 850 mg/L. Water from the aquifer is used for domestic, irrigation, and stock-watering purposes.

Turkey Ridge Creek Aquifer

The Turkey Ridge Creek aquifer (fig. 2) underlies about 18 mi^2 of southwestern Turner County. The aquifer is composed of fine sand to coarse-pebble gravel that lies directly on till. The aquifer is under water-table conditions near Turkey Ridge Creek, but is under confined conditions away from the creek where the aquifer is overlain by till. It may be connected hydraulically to the underlying Niobrara aquifer. The depth to the top of the aquifer ranges from land surface near Turkey Ridge Creek to 65 ft below land surface. The average aquifer thickness is 19 ft.

The predominant chemical constituents in water from the Turkey Ridge Creek aquifer are calcium and sulfate. Dissolved-solids concentrations ranged from 1,900 to 2,800 mg/L and averaged 2,200 mg/L. Hardness concentrations ranged from 1,000 to 1,700 mg/L and averaged 1,400 mg/L. Water from the aquifer is used for domestic and stock-watering purposes.

Upper Vermillion-Missouri Aquifer

The Upper Vermillion-Missouri aquifer (fig. 3) underlies about 240 mi^2 in Turner and eastern Hutchinson Counties. It is composed of fine sand to medium-pebble gravel. In T. 98 N., R. 52 W., the aquifer occurs as two layers of medium sand and gravel separated by as much as 40 ft of till. The aquifer is at or near land surface in T. 96 N., R. 52 W. at the Clay-Turner County line and is in hydraulic connection with the Parker-Centerville aquifer. In T. 99 N., R. 55 W., the top of the aquifer is as much as 355 ft below land surface. The average aquifer thickness is 68 ft; however, the thickness does exceed 100 ft in the southeastern part of T. 96 N., R. 52 W. where the aquifer is composed primarily of cobble gravel.

The predominant chemical constituents in water from the Upper Vermillion-Missouri aquifer are calcium and sulfate. The water-quality characteristics of water from the aquifer have complex areal

variations that may be caused by mixing of water from other aquifers. Dissolved-solids concentrations ranged from 528 to 8,600 mg/L and averaged 1,720 mg/L. Hardness concentrations ranged from 71 to 1,500 mg/L and averaged 740 mg/L. Dissolved-solids and hardness concentrations generally were highest in the northeastern part of the aquifer near the Turner-Lincoln County line. Water from the aquifer is used for domestic, municipal, irrigation, and stock-watering purposes.

Lower James-Missouri Aquifer

The Lower James-Missouri aquifer (fig. 3) underlies about 268 mi^2 of Hutchinson County and areally is the most extensive glacial aquifer in the study area. The aquifer is composed of fine sand to cobble gravel, intermixed in some places with discontinuous layers of till as much as 25 ft thick. Depth to the top of the aquifer ranges from land surface in the James River flood plain in T. 97 N. and T. 98 N. to 245 ft below land surface. The aquifer is in hydraulic connection with the Choteau aquifer in T. 99 N., R. 59 W. and the Niobrara aquifer in T. 97 N., R. 57 W. The average aquifer thickness is 69 ft.

The predominant chemical constituents in water from the Lower James-Missouri aquifer are calcium and sulfate. Dissolved-solids concentrations ranged from 776 to 3,300 mg/L and averaged 1,630 mg/L. Hardness concentrations ranged from 430 to 2,700 mg/L and averaged 920 mg/L. Water from the aquifer is used for domestic, irrigation, and stock-watering purposes.

Choteau Aquifer

The Choteau aquifer (fig. 3) underlies about 65 mi^2 in northwestern Hutchinson County. It is composed of fine sand to fine-pebble gravel, with some medium-pebble gravel near the eastern boundary, and is overlain by till. Depth to the top of the aquifer ranges from 105 ft in the eastern part of the aquifer to 270 ft near the Douglas-Hutchinson County line. The average thickness of the Choteau aquifer is 33 ft.

Predominant chemical constituents in water from the northern part of the Choteau aquifer are sodium and sulfate. The predominant chemical constituents in water in the west-central part of the aquifer are calcium and sulfate. Dissolved-solids concentrations ranged from 1,380 to 2,570 mg/L and averaged 1,720 mg/L. Hardness concentrations ranged from 320 to 1,000 mg/L and averaged 620 mg/L. Water from the aquifer is used for domestic, municipal, irrigation, and stock-watering purposes.

Dolton Aquifer

The Dolton aquifer (fig. 4) underlies 12 mi^2 of northwestern Turner County and the extreme northeastern corner of Hutchinson County. It is composed of fine sand to medium-pebble gravel and is overlain by till. Depth to the top of the aquifer ranges from 45 ft below land surface near the West Fork Vermillion River to 165 ft below land surface near the western and southern aquifer boundaries. The average thickness of the aquifer is 22 ft.

Predominant chemical constituents in water from the Dolton aquifer are sodium, sulfate, and bicarbonate. Dissolved-solids concentrations ranged from 610 to 2,110 mg/L and averaged 1,190 mg/L. Hardness concentrations ranged from 60 to 810 mg/L and averaged 280 mg/L. Water from the aquifer is used for domestic, municipal, and stock-watering purposes.

Turkey Ridge Aquifer

The Turkey Ridge aquifer (fig. 4) underlies 44 mi^2 in southwestern Turner and southeastern Hutchinson Counties. It is composed of fine sand to fine-pebble gravel and is underlaid by Pierre Shale. The northwestern part of the aquifer is interbedded with thin, silty clay layers. In the northeastern part of T. 97 N., R. 55 W. and south-central part of T. 98 N., R. 55 W., the aquifer is composed of two sand and gravel layers separated by silty clay layers. The upper sand and gravel layer usually is dry. In the northwestern and the southeastern parts of the aquifer, the lower sand layer is absent, and the upper layer is confined by gray, pebbly till. Depth to the top of the aquifer ranges from 55 to 160 ft. The average aquifer thickness is 41 ft.

The predominant chemical constituents in water from the Turkey Ridge aquifer are calcium and sulfate. Dissolved-solids concentrations ranged from 1,300 to 2,400 mg/L and averaged 1,780 mg/L. Hardness concentrations ranged from 930 to 1,500 mg/L and averaged 1,200 mg/L. Water from the aquifer is used for domestic and stock-watering purposes. Although water from the aquifer is suitable for irrigation, the yield to wells (table 1) is not sufficient to supply enough water for irrigation purposes.

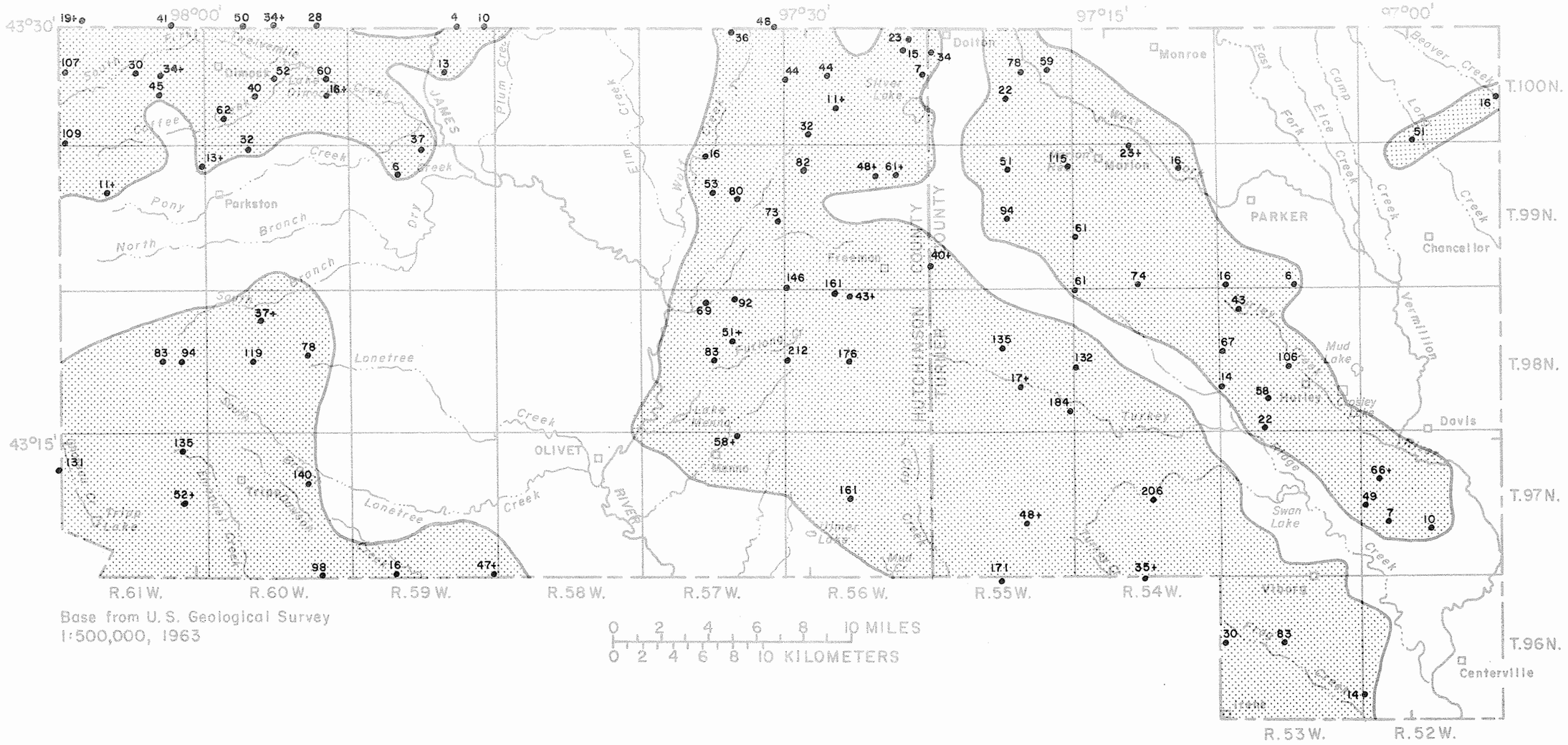
Wall Lake Aquifer

The Wall Lake aquifer (fig. 4) underlies 24 mi^2 in northeastern Turner County. The aquifer is composed of fine sand to fine-pebble gravel, overlies the Sioux Quartzite, and is overlain by till. Depth to the top of the aquifer ranges from 35 ft near the western and southern aquifer boundaries to 140 ft below land surface near the Lincoln-Turner County line. The average aquifer thickness is 21 ft.

The predominant chemical constituents in water from the Wall Lake aquifer are calcium and sulfate. Dissolved-solids concentrations ranged from 1,200 to 1,800 mg/L and averaged 1,550 mg/L. Hardness concentrations ranged from 700 to 1,300 mg/L and averaged 1,000 mg/L. Water from the aquifer is used for domestic and stock-watering purposes.

Ethan Aquifer

The Ethan aquifer (fig. 4) underlies about 9 mi^2 in northwestern Hutchinson County. The aquifer is composed of fine sand to fine-pebble gravel and is overlain by till. Depth to the top of the aquifer ranges from 50 ft near the Davison-Hutchinson County line to 115 ft near the southern aquifer boundary. The Ethan aquifer may be in hydraulic connection to the Choteau aquifer in T. 100 N., R. 61 W. and the underlying Niobrara aquifer.



EXPLANATION

● 13+ TEST HOLE. Number is thickness of aquifer, in feet. A plus (+) indicates thickness greater than shown.

AQUIFER BOUNDARY.

AREA OF AQUIFER

North

Figure 5. Areal extent and thickness of the Niobrara aquifer in Hutchinson and Turner Counties.

Predominant chemical constituents in water from the Ethan aquifer are sodium and sulfate. Dissolved-solids concentrations ranged from 1,800 to 2,700 mg/L and averaged 2,100 mg/L. Hardness concentrations ranged from 590 to 1,300 mg/L and averaged 840 mg/L. Water from the aquifer is used for domestic and stock-watering purposes.

BEDROCK AQUIFERS

Three major bedrock aquifers underlie much of the study area. In order of increasing geologic age, they are the Niobrara aquifer in the Upper Cretaceous Niobrara Formation, the Codell aquifer in the Upper Cretaceous Codell Sandstone Member of the Carlile Shale, and the Dakota aquifer in the Upper Cretaceous Dakota Formation. The bedrock aquifers store about 18 million acre-ft of water (table 1), which is more than 3 times the volume of water stored in all of the glacial aquifers.

The Codell aquifer occurs primarily in western Hutchinson County, with a few small areas found east of the James River. The Codell aquifer is the major source of water in southwestern Hutchinson County because there are no major glacial aquifers present. The Niobrara and Dakota aquifers underlie about 50 and 66 percent of the study area, respectively, and are extensively used in eastern Hutchinson and western Turner Counties where major glacial aquifers underlie only a small percentage of the area.

Niobrara Aquifer

The Niobrara aquifer underlies 729 mi^2 (about 50 percent) of Hutchinson and Turner Counties (fig. 5). The aquifer is composed of a fractured, calcareous marl, interbedded with calcareous claystone and is referred to as "chalk rock" by local drillers. The aquifer is at or near land surface in the vicinity of Wolf Creek in northeastern Hutchinson County, and is as much as 510 ft below land surface in southwestern Hutchinson County.

Predominant chemical constituents in water from the Niobrara aquifer are calcium, sodium, and sulfate. Dissolved-solids concentrations ranged from 560 to 2,490 mg/L and averaged 1,510 mg/L. Hardness concentrations ranged from 110 to 1,300 mg/L and averaged 650 mg/L. Water from the aquifer is used for domestic, municipal, irrigation, and stock-watering purposes.

Codell Aquifer

The Codell aquifer underlies 230 mi^2 (about 28 percent) of Hutchinson County (fig. 6). The aquifer is composed of a fine- to medium-grained, moderately cemented sandstone interbedded with layers of siltstone and mudstone. Depth to the top of the aquifer ranges from land surface near the James River in central and northern Hutchinson County (where the Codell Sandstone crops out) to 95 ft in northwestern Hutchinson County and more than 500 ft in southwestern Hutchinson County.

Predominant chemical constituents in water from the Codell aquifer are sodium and sulfate. Dissolved-solids concentrations ranged from 1,270 to 1,720 mg/L and averaged 1,450 mg/L. Hardness

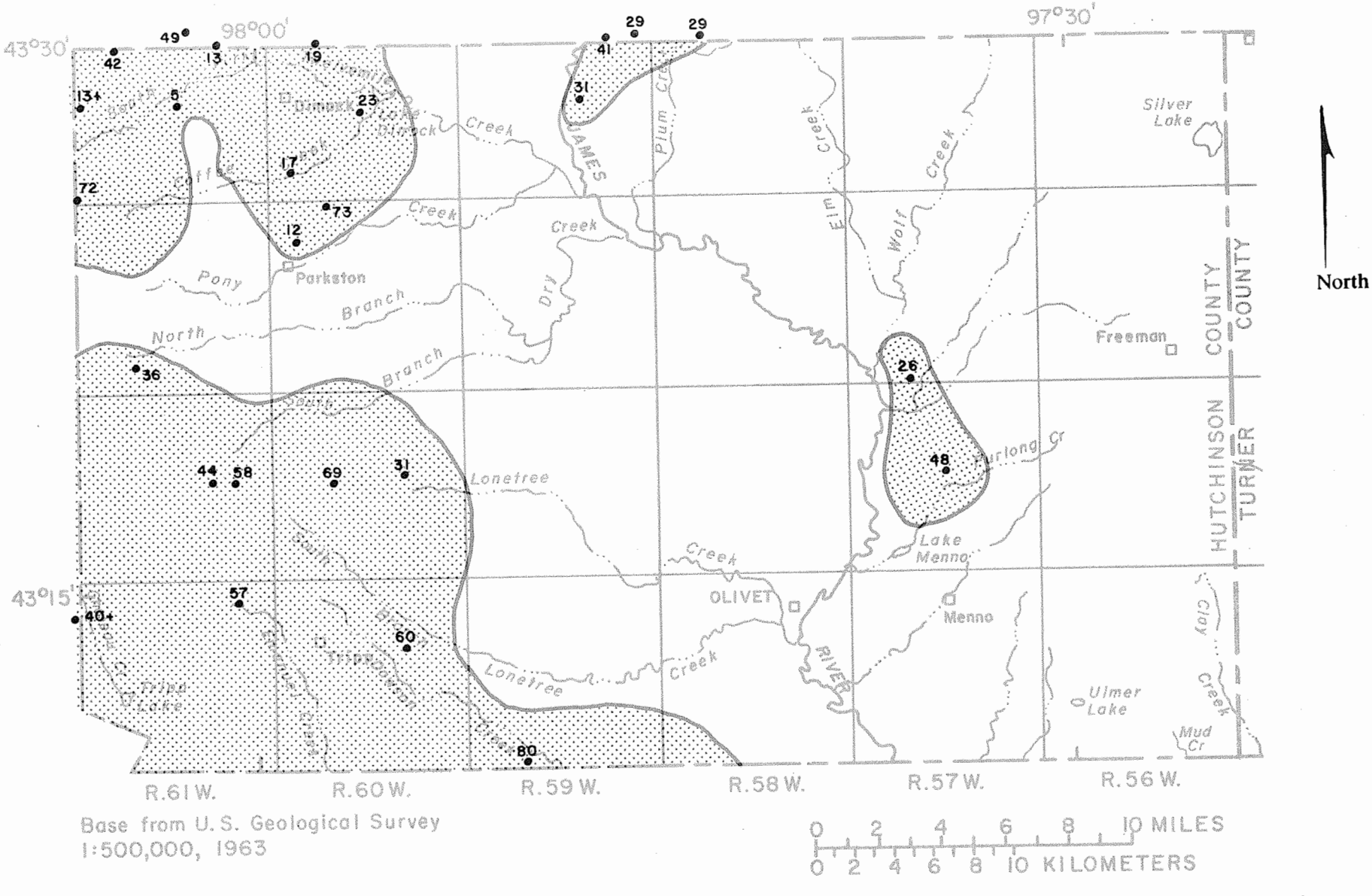


Figure 6. Areal extent and thickness of the Codell aquifer in Hutchinson County.

concentrations ranged from 85 to 440 mg/L and averaged 230 mg/L. It should be noted that hardness concentrations in the portion of the aquifer just north of the town of Parker (fig. 6) ranged from 320 to 440 mg/L, compared to an average concentration of 160 mg/L for the rest of the Codell aquifer. Water from the Codell aquifer is used for domestic, municipal, and stock-watering purposes. Yields from wells screened in the Codell aquifer in southwestern Hutchinson County range from 2 to 10 gal/min.

Dakota Aquifer

The Dakota aquifer underlies 949 mi^2 (about 66 percent) of Hutchinson and Turner Counties (fig. 7). The aquifer is composed of a very fine- to medium-grained, friable to well-cemented, quartzose sandstone interbedded with claystone layers. A pink, very fine to coarse-grained quartzose sand underlies the Dakota and overlies the Sioux Quartzite. Depth to the top of the aquifer ranges from 180 ft in T. 99 N. to more than 900 ft in southwestern Hutchinson County. At most locations, the top of the aquifer is greater than 400 ft below land surface.

Predominant chemical constituents in water from the Dakota aquifer are calcium, sodium, and sulfate. Dissolved-solids concentrations ranged from 784 to 2,100 mg/L and averaged 1,460 mg/L; hardness concentrations ranged from 250 to 1,200 mg/L and averaged 670 mg/L. Hardness concentrations ranged from 980 to 1,200 mg/L west of the James River and from 250 to 560 mg/L east of the James River. Water from the Dakota aquifer is used for domestic, municipal, and stock-watering purposes.

LARGE-CAPACITY WELLS

The best possibilities for obtaining large-capacity wells capable of supplying more than 500 gal/min are in the areas where the aquifers are composed of coarse sand and gravel and are more than 20 ft thick. Before wells are constructed, test holes often are drilled to determine the thickness of the aquifer and to provide samples for determining the grain size of the aquifer material. This information helps in the selection of the proper slot size and length of screen to be used in the construction of a well. Controlled pumping of the well for at least several hours indicates the yield of the aquifer at that locality and provides a representative water sample for chemical analysis. Measurement of the recovery of water level in the well provides information that is useful for estimating the yield of a well during longer pumping periods. If the well is to be used for irrigation, knowledge of the type of soil, subsoil, and topography are also important in selecting the most suitable irrigation system. Increased ground-water development, especially in stream valleys, may decrease streamflow.

WATER USE

Use of water from glacial and bedrock aquifers in Hutchinson and Turner Counties during 1985 was estimated to be about 3.9 billion gallons. Ninety-one percent of the water used was withdrawn from glacial aquifers and 9 percent was withdrawn from bedrock aquifers. Eighty-three percent of the

water withdrawn from the aquifers was used for irrigation. Eighty-seven percent of the water used for irrigation was withdrawn from the Parker-Centerville and Upper Vermillion-Missouri aquifers. Twenty-six percent of the water used for stock and rural domestic purposes was withdrawn from the Lower James-Missouri and Upper Vermillion-Missouri aquifers and 56 percent was withdrawn from the bedrock aquifers.

SUMMARY

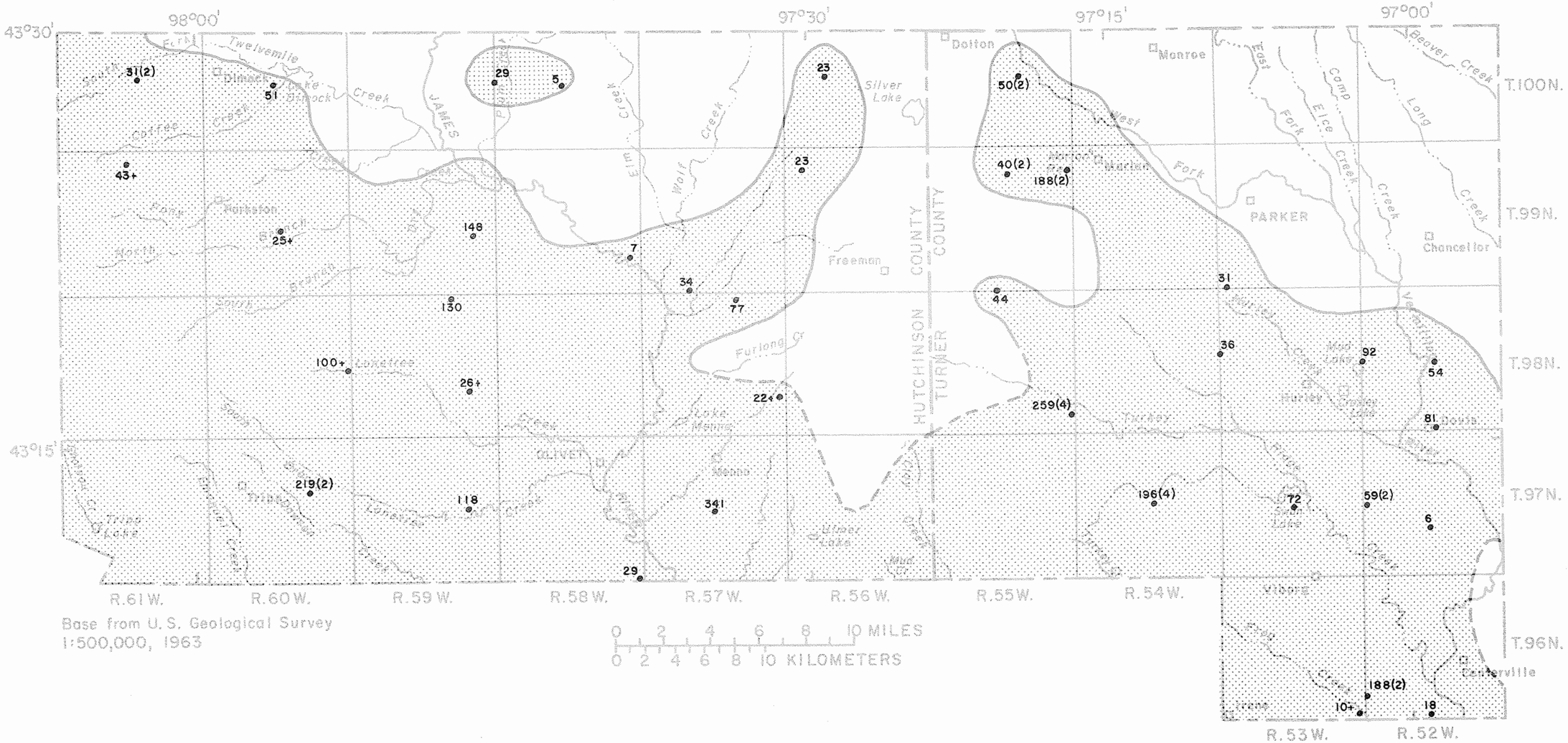
Eleven glacial aquifers and three major bedrock aquifers were delineated in Hutchinson and Turner Counties. The glacial aquifers are composed primarily of unconsolidated sand and gravel outwash and contain about 5.2 million acre-ft of water in storage. The three bedrock aquifers store about 18 million acre-ft of water in Hutchinson and Turner Counties.

The Parker-Centerville, West Fork Vermillion, East Fork Vermillion, and Turkey Ridge Creek aquifers are shallow aquifers with depths to the top of the aquifer less than 65 ft below land surface. These aquifers have average thicknesses ranging from 19 to 34 ft. The Choteau, Dolton, Turkey Ridge, Wall Lake, and Ethan aquifers are buried aquifers overlain with 35 to 270 ft of till. The average thickness for these aquifers ranges from 18 to 68 ft. The Upper Vermillion-Missouri and Lower James-Missouri aquifers are predominantly buried aquifers overlain with 0 to 355 ft of till; the average thicknesses of these aquifers are almost 70 ft. The areal extent of the glacial aquifers ranges from 6 mi^2 for the East Fork Vermillion aquifer to 268 mi^2 for the Lower James-Missouri. Reported maximum well yields are the largest (1,000 gal/min) from the Parker-Centerville, Upper Vermillion-Missouri, Lower James-Missouri, and Choteau aquifers.

The average dissolved-solids concentrations of water from the shallow aquifers (Parker-Centerville, West Fork Vermillion, East Fork Vermillion, and Turkey Ridge Creek) ranged from 870 to 2,200 mg/L, and average hardness concentrations ranged from 670 to 1,400 mg/L. The average dissolved-solids concentrations of water from the buried (Upper Vermillion-Missouri, Lower James-Missouri, Choteau, Dolton, Turkey Ridge, Wall Lake, and Ethan) aquifers ranged from 1,190 to 2,100 mg/L, and average hardness concentrations ranged from 280 to 1,200 mg/L.

The three major bedrock aquifers are the Niobrara, Codell, and Dakota. The average thicknesses are about 75 ft for the Niobrara, 40 ft for the Codell, and 81 ft for the Dakota. Estimated maximum well yields are 1,000 gal/min for the Niobrara aquifer, 100 gal/min for the Codell aquifer, and 250 gal/min for the Dakota aquifer. Average dissolved-solids concentrations of water from the bedrock aquifers ranged from 1,450 to 1,510 mg/L and average hardness concentrations ranged from 230 to 670 mg/L.

Use of water from glacial and bedrock aquifers in Hutchinson and Turner Counties in 1985 was estimated to be about 3.9 billion gallons. Ninety-one percent of the water used was withdrawn from glacial aquifers and 9 percent was withdrawn from bedrock aquifers.



EXPLANATION

31(2) TEST HOLE. Number is thickness of aquifer, in feet. Numbers in parenthesis refer to number of layers of sand and gravel, if more than one layer is present. A plus (+) indicates thickness greater than shown.

AQUIFER BOUNDARY. Dashed where approximately located.

AREA OF AQUIFER

North

Figure 7. Areal extent and thickness of the Dakota aquifer in Hutchinson and Turner Counties.