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DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
Nettie H. Myers, Secretary

DIVISION OF FINANCIAL AND TECHNICAL ASSISTANCE
Kelly A. Wheeler, Director

GEOLOGICAL SURVEY
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OPEN-FILE REPORT 74-UR

EVALUATION OF THE BASAL AQUIFER IN THE VICINITY OF THE HANSON RURAL WATER SYSTEM WELLFIELD

by

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CONTENTS

FIGURES

CONTENTS – continued. Page

TABLES

APPENDIX

INTRODUCTION

During the summer of 1990, an investigation was conducted by the South Dakota Geological Survey for the Hanson Rural Water System and, the TM Rural Water District to analyze the basal outwash aquifer as a potential source of drinking water for the two systems. The results of that investigation are presented in Schulz (1991). The aquifer was found to have the potential to yield water to wells in quantities that could meet the systems' needs, but had inferior water quality compared to the Dolton aquifer from which both systems were obtaining their drinking water supplies.

At the request of Hanson Rural Water System, the South Dakota Geological Survey conducted an additional investigation of the basal outwash aquifer near the system's wellfield. The purpose of this investigation was to further delineate the basal outwash aquifer and to determine the water quality of the aquifer in an area closer to the rural water system's existing water treatment facilities. The results are presented in this report. The investigation was financed by the South Dakota Geological Survey and the Hanson Rural Water System.

Methods of Investigation

Field work began May 11, 1992, and continued through June 3, 1992. Ten test holes were drilled for this investigation using a forward mud rotary drill rig with a bit diameter of 5½ inches. Five of the test holes were completed as observation wells. In addition to the drilling, nine water samples were collected and analyzed for general water quality (fig. 1).The lithologic logs for the test holes and wells completed for this study are given in appendix A. Lithologic logs for the remainder of the test holes or wells used in this report remain on file at the South Dakota Geological Survey in Vermillion, South Dakota.

RESULTS OF INVESTIGATION

Geology

The geology of the study area can be divided into glacial deposits and bedrock. Table 1 shows the geologic unit or formation names, their relative ages, and provides a brief description of each unit known to be present in the study area. Three cross sections (figs. 2, 3, and 4) show the relative positions of the different units. Cross section locations are shown in figure 5.

Bedrock

Bedrock in the study area can be divided into two separate ages. These are (1) Cretaceous sediments, which include the Niobrara Formation, and the Split Rock Creek Formation and (2) Precambrian sediment, which is the Sioux Quartzite (table 1).

In the vicinity of the Hanson Rural Water System treatment plant, a bedrock high consisting of Sioux Quartzite is present (fig. 5). Approximately 1 mile east of the water treatment plant, a bedrock valley is present and is oriented in a northwest to southeast direction. The bedrock encountered along

the valley floor consists predominantly Sioux Quartzite with minor channel fillings of the Split Rock Creek Formation (figs. 2 and 4).

Glacial Deposits

The glacial deposits in the study area consist primarily of till and outwash. Till is the heterogeneous mixture of clay, silt, sand, gravel, and boulders in a predominantly fine grained matrix of clay and silt. Outwash consists mainly of sand and gravel with minor amounts of clay and silt. Two major outwash bodies have been recognized in the study area; one is informally known as the Dolton aquifer and the other has been termed the basal outwash aquifer. Although both of these outwash bodies were encountered in drilling for this project, only the basal outwash aquifer is discussed below.

BASAL OUTWASH AQUIFER

The sands and gravels which comprise the basal outwash aquifer have a variable thickness ranging from 68 feet to 10 feet. Overlying the basal outwash aquifer is unweathered till (figs. 2, 3, and 4). Bedrock is encountered immediately below the basal outwash aquifer.

Hydrology

Basal Outwash Aquifer

The basal outwash aquifer is under confined conditions as indicated by measured water levels in wells completed in this aquifer (table 2). As noted in Schulz (1991), the basal outwash aquifer lies in direct contact with bedrock units that have the potential to influence the water quality, direction of ground water flow, and the quantity of water available in the basal outwash aquifer. The saturated thickness in the study area ranges from 68 feet to 10 feet (fig. 6).

Water quality in the basal outwash aquifer is variable but does not violate any of the enforceable limits for drinking water standards set forth by the U.S. Environmental Protection Agency. However, water quality data from the nine observation wells sampled for this project show that the levels of total dissolved solids, iron, manganese, and sulfate exceed the secondary maximum contaminant levels set forth by the U.S. Environmental Protection Agency. These secondary drinking water standards are suggested limits and are not enforceable limits for public water supplies. Analytical results of the water samples collected for this study are presented in table 3.

DISCUSSION AND CONCLUSIONS

The basal outwash aquifer is a confined aquifer which generally lies within a bedrock valley traversing from the northwest to the southeast. The aquifer is in direct contact with bedrock units that have the potential to impact water quality, ground water flow direction, and quantity of water available. The water quality in the basal outwash aquifer does not violate any of the national interim primary

drinking water standards, although concentrations for total dissolved solids, iron, manganese, and sulfate exceed the secondary maximum contaminant levels.

The thickness of the basal outwash aquifer suggests a potential for development of a supplemental water source for the Hanson Rural Water System. Approximately 2 miles east of the Hanson Rural Water System treatment plant, the saturated thickness reaches 68 feet. This area could be further investigated by drilling a test well and conducting an aquifer test if the Hanson Rural Water System should decide to pursue development of the basal outwash aquifer.

POST-INVESTIGATION WATER USE

Because of a continuous decline of water levels and lower production of water from wells drilled into the Dolton aquifer, the Hanson Rural Water System joined the B-Y Rural Water System on March 15, 1996. The Hanson Rural Water System presently obtains the majority of its water from the B-Y Rural Water System with a small quantity being supplied by the Dolton aquifer.

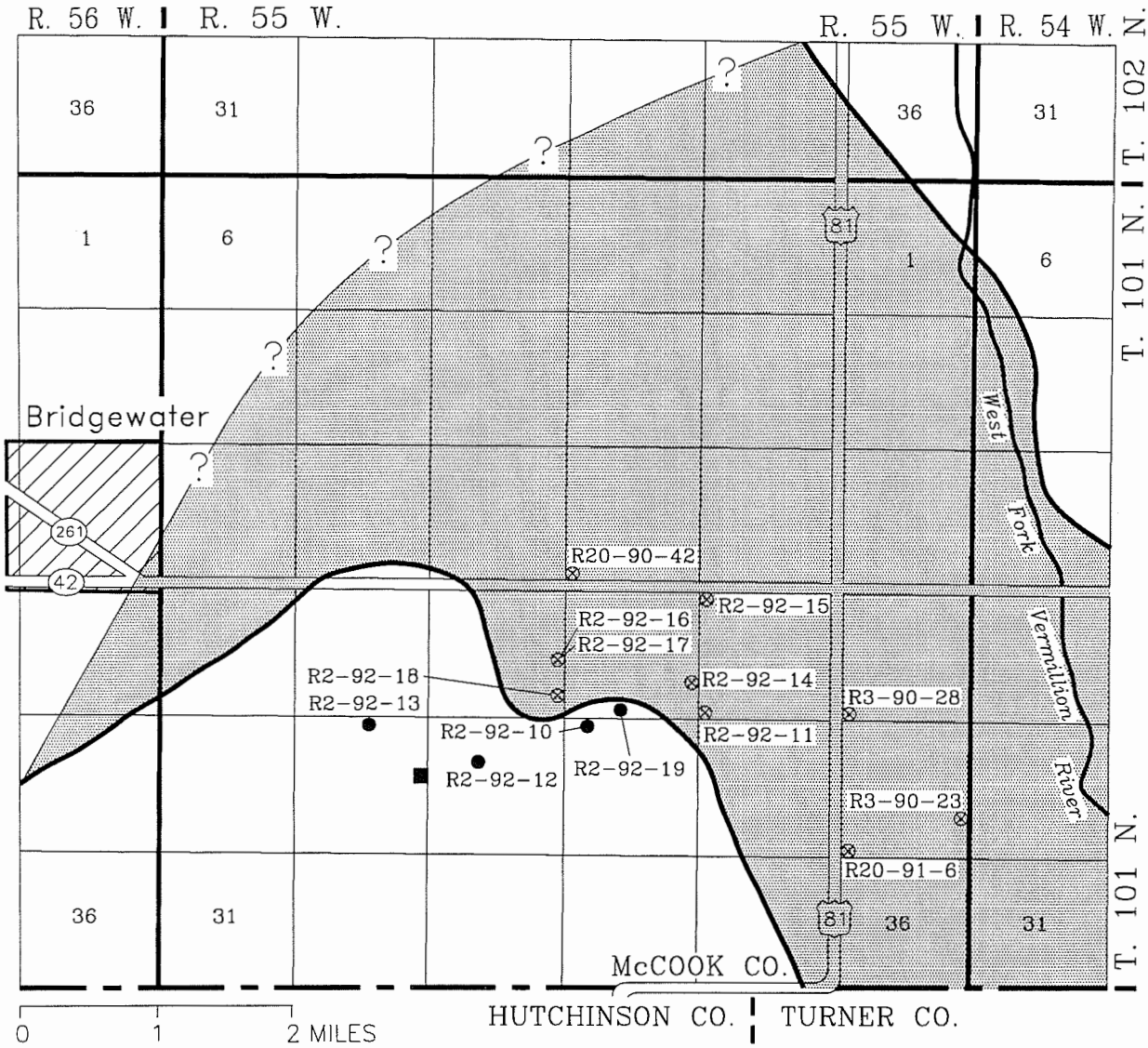
REFERENCES

Christensen, C.M., 1989, *Geology of Davison and Hanson Counties, South Dakota*: South Dakota Geological Survey Bulletin 33.

Schulz, L.D., 1991, *Investigation of the basal outwash in the Dolton Vicinity*: South Dakota Geological Survey Open File Report 64-UR.

U.S. Environmental Protection Agency, November, 1994, *Drinking water regulations and health advisories*.

U.S. Geological Survey, 1964, *Bridgewater East quadrangle*: 7.5 minute series topographic map, scale 1:24000.



⊗ R2-92-18 Observation well sampled for water quality analysis. The letter and numbers are the well identifier.

● Test hole drilled for this project. Letter and numbers denote test hole identification.

Approximate boundary of the basal outwash aquifer.

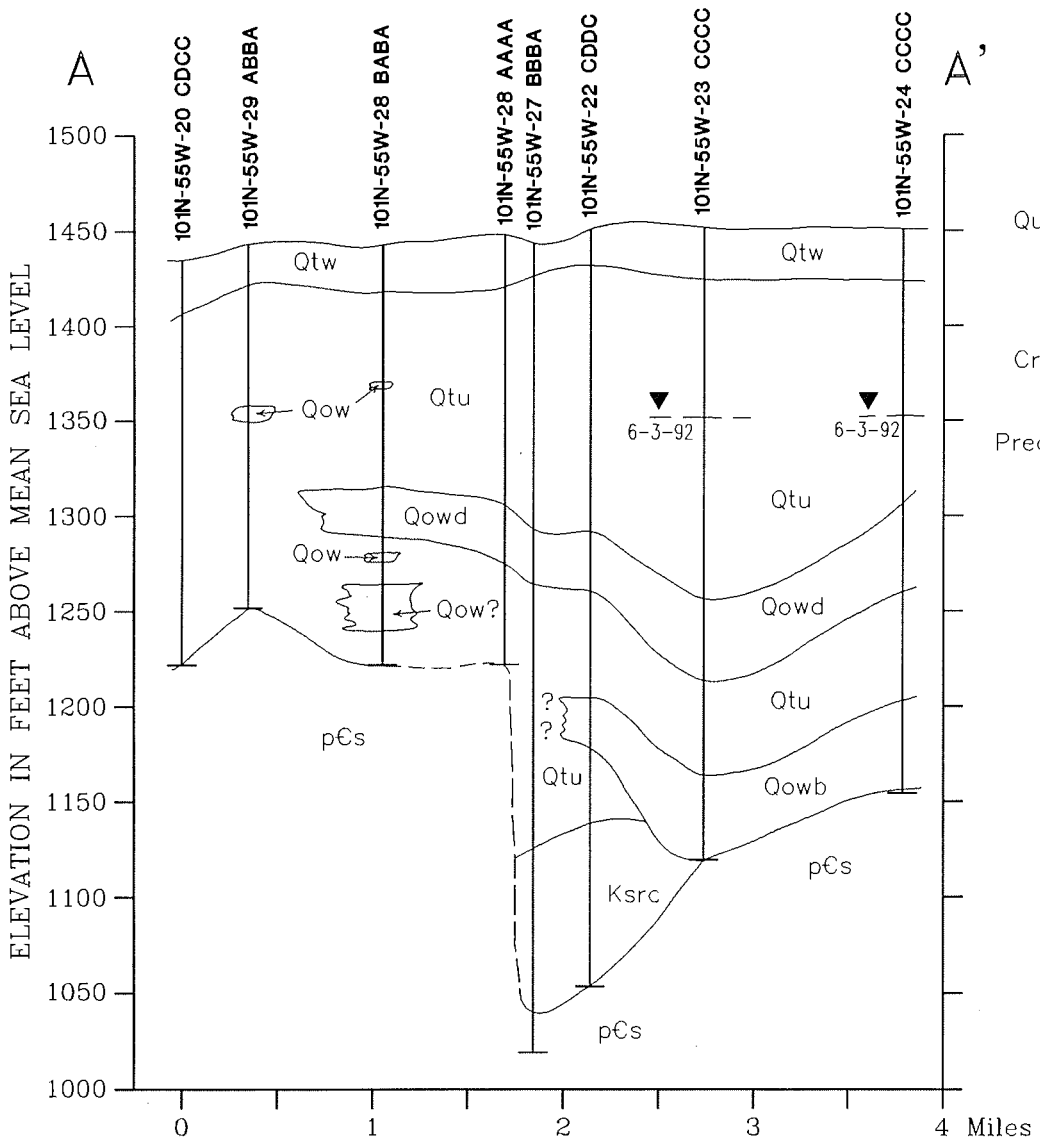
Approximate areal extent of basal outwash aquifer.

■ Hanson Rural Water System treatment plant.

N

Figure 1. Locations of test holes and observation wells.

Figure 2. Geologic cross section A-A'.



Quaternary
- Qtw.....weathered till
- Qtu.....unweathered till
- Qow.....undifferentiated outwash
- Qowd.....outwash, Dolton aquifer
- Qowb.....outwash, basal outwash aquifer

Cretaceous
- Ksrc.....Split Rock Creek Formation

Precambrian
- p€s.....Sioux Quartzite

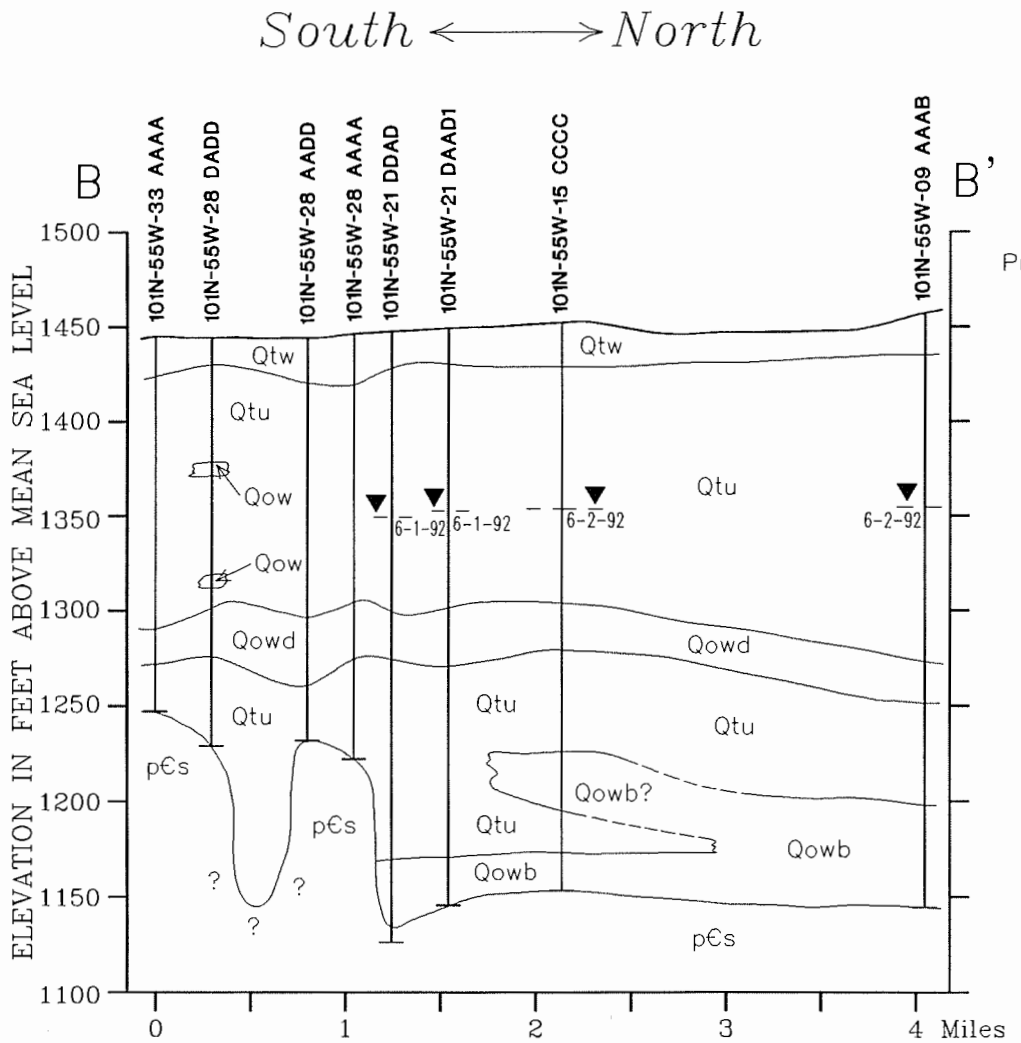
101N-55W-23 CCCC Well or test hole. Letters and numbers are the location. All logs are on file at the South Dakota Geological Survey. See figure 5 for cross section locations. See appendix A for location explanation.

Geologic contact. Dashed where appraximate.

6-3-92 Static water level. Number represents the date measured. See table 2 for explanation of water level data.

Vertical exaggeration = 50x.

Figure 3. Geologic cross section B-B'.



Quaternary
- Qtw.....weathered till
- Qtu.....unweathered till
- Qow.....undifferentiated outwash
- Qowd.....outwash, Dolton aquifer
- Qowb.....outwash, basal outwash aquifer

Precambrian
- p€s.....Sioux Quartzite

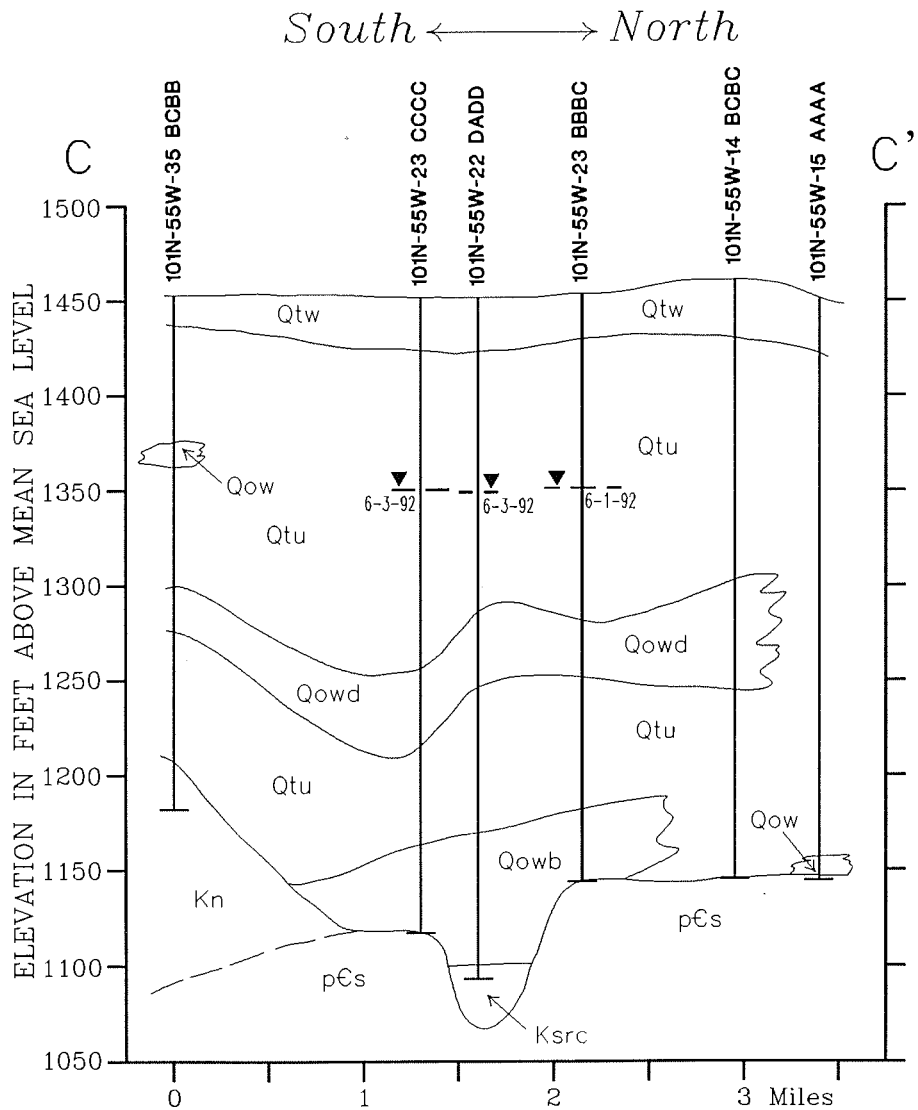
101N-55W-15 CCCC Well or test hole. Letters and numbers are the location. All logs are on file at the South Dakota Geological Survey. See figure 5 for cross section locations. See appendix A for location explanations.

Geologic contact. Dashed where approximate.

6-2-92 Static water level. Number represents the date measured. See table 2 for explanation of water level data.

Vertical exaggeration = 50x.

Figure 4. Geologic cross section C-C'.



Quaternary
- Qtw.....weathered till
- Qtu.....unweathered till
- Qow.....undifferentiated outwash
- Qowd.....outwash, Dolton aquifer
- Qowb.....outwash, basal outwash aquifer

Cretaceous
- Kn.....Niobrara Farmation
- Ksrc.....Split Rock Creek Formation

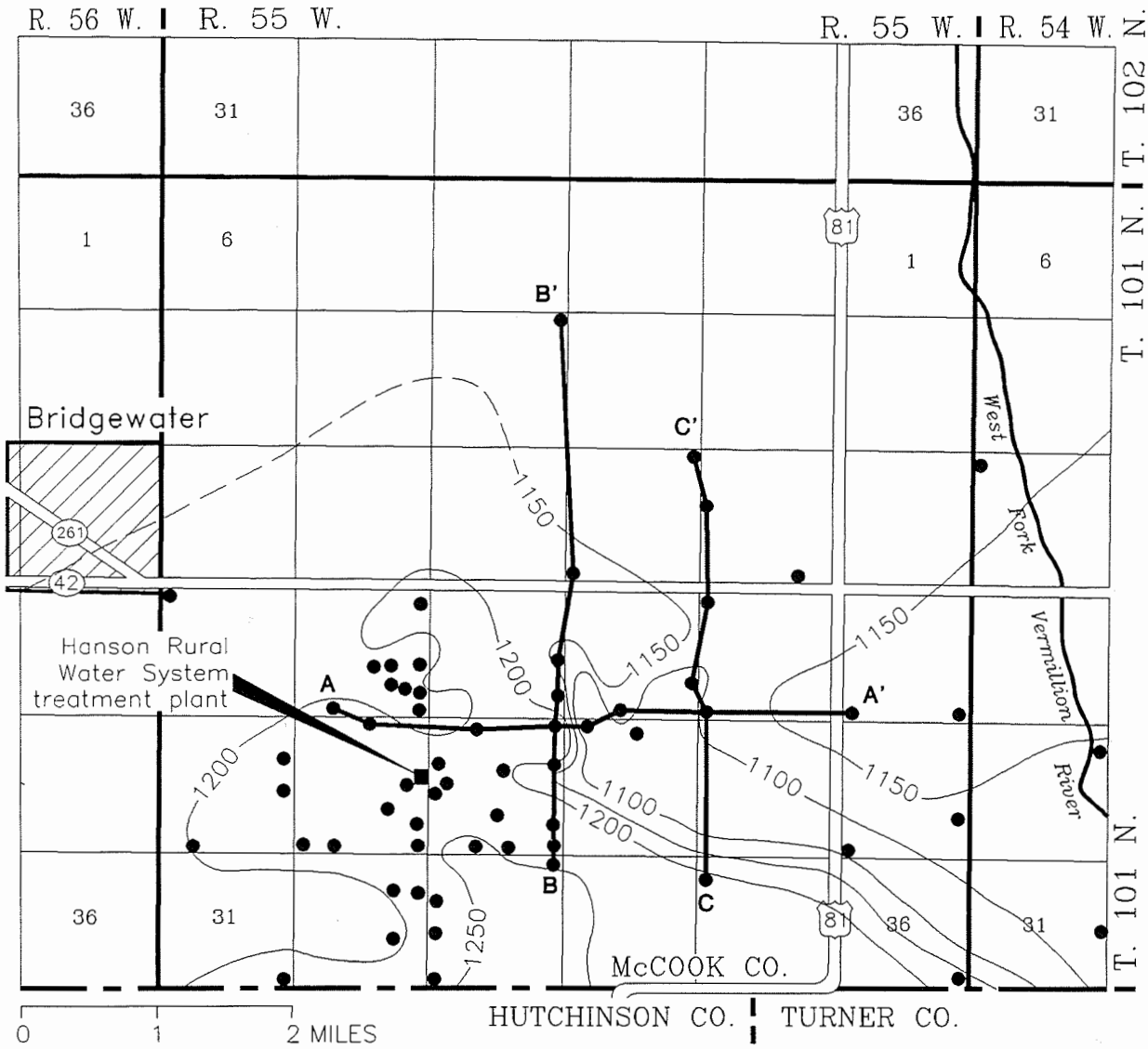
Precambrian
- p€s.....Sioux Quartzite

101N-55W-23 BBBC — Well or test hole. Letters and numbers are the location. All logs are on file at the South Dakota Geological Survey. See figure 5 for cross section locations. See appendix A for location explanation.

Geologic contact. Dashed where approximate.

6-3-92 — Static water level. Number represents the date measured. See table 2 for explanation of water level data.

Vertical exaggeration = 50x.



● Test hole or observation well used to determine the bedrock surface elevation.

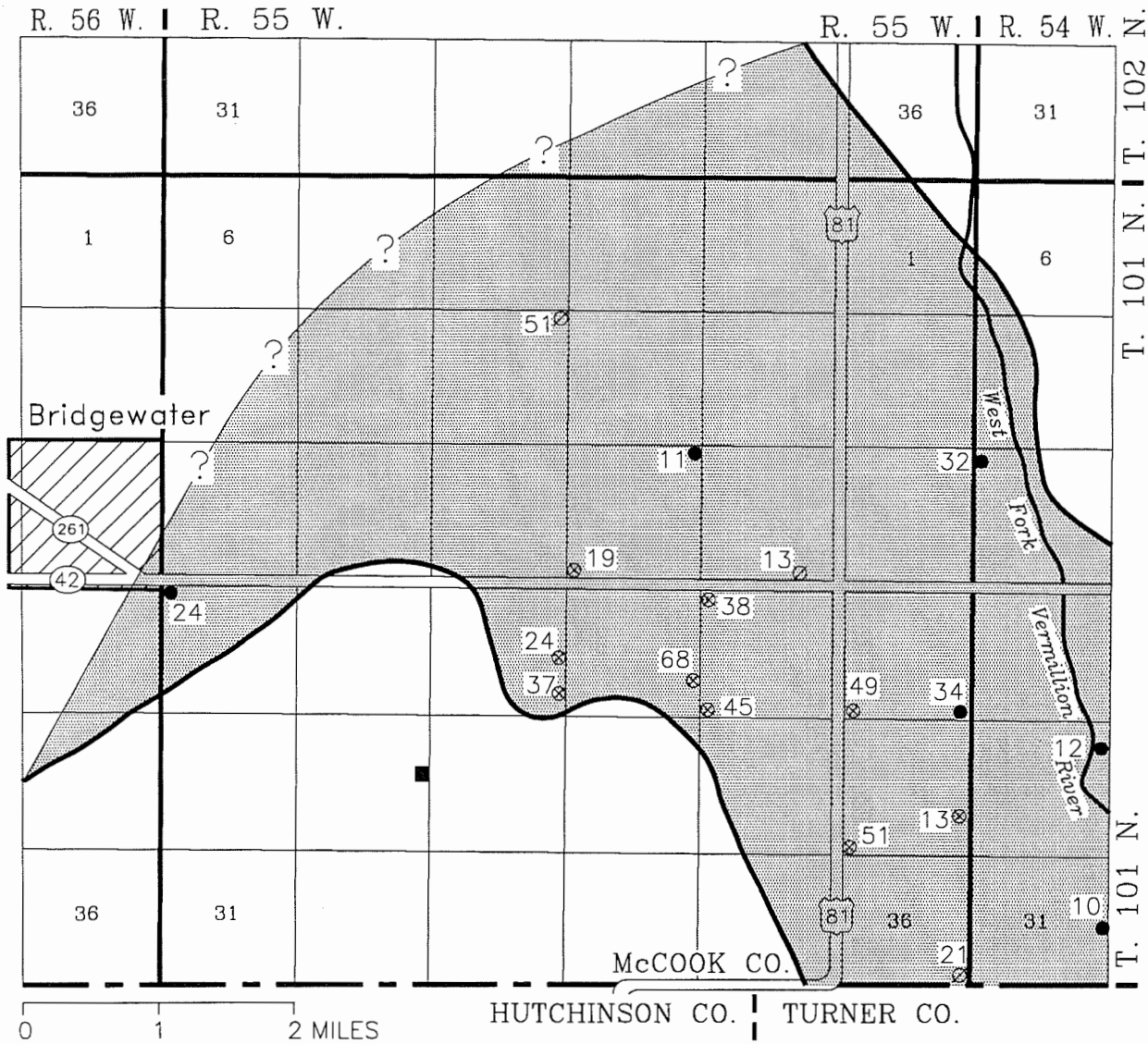
1150 Contour line representing equal points of elevation. The number represents the elevation in feet above mean sea level. Contour interval = 50 feet.

■ Hanson Rural Water System treatment plant.

A — A' Cross section location.

N

Figure 5. Cross section locations and configuration of the bedrock surface.



38 ⊗ Observation well used to determine the saturated thickness and sampled for water quality analysis. The number represents the thickness of saturated outwash in feet.

21 ⌀ Observation well used to determine the saturated thickness, but not sampled for water quality analysis. The number represents the thickness of saturated outwash in feet.

34 ● Test hole used to determine the saturated thickness. The number represents the thickness of saturated outwash in feet.

Approximate boundary of the basal outwash aquifer.

Approximated areal extent of the basal outwash aquifer.

■ Hanson Rural Water System treatment plant.

Figure 6. Saturated thickness of the basal outwash aquifer.

Table 1. Description of geologic units

Geologic age from youngest to oldest	Geologic unit or formation name	Designation used on the cross sections	Description[1]
Quaternary undifferentiated	Till	Qtw or Qtu	Heterogeneous mixture of clay, silt, sand, pebbles, and boulders.
	Outwash	Qow, Qowd, or Qowb	Mixture of sand and gravel with minor amounts of silt and clay.
Cretaceous	Niobrara Formation	Kn	Light to medium blue-gray marl and white to cream-colored calcareous, fossiliferous limestone; weathers white to dark yellowish-orange.
	Split Rock Creek Formation	Ksrc	Dark-gray to black organic shale and silt, weakly calcareous.
Precambrian	Sioux Quartzite	p€s	Pink to red; extremely hard, fine to medium grained, well rounded quartz sand, silica cemented orthoquartzite; sometimes conglomeritic and jointed.

[1] Modified from Christensen (1989)

Table 2. Static water levels

Well name	Location[1]	Depth to water[2]	Water level elevation[3]	Date measured
R3-90-23	101N-55W-25DADA	90.08	1349.42	6/2/92
R3-90-28	101N-55W-24CCCC	98.62	1353.34	6/3/92
R20-90-42	101N-55W-15CCCC	100.27	1353.73	6/2/92
R20-91-06	101N-55W-25CCCC 2	95.72	1351.23	6/2/92
R2-92-11	101N-55W-23CCCC	99.51	1352.49	6/3/92
R2-92-14	101N-55W-22DADD	102.56	1349.44	6/3/92
R2-92-15	101N-55W-23BBBC	101.97	1351.03	6/1/92
R2-92-17	101N-55W-21DAAA	96.55	1354.45	6/1/92
R2-92-18	101N-55W-21DDAD	96.92	1351.08	6/1/92

[1] See appendix A for explanation of location format.

[2] Depth to water measured in feet below casing top.

[3] Water level elevations are in feet above mean sea level and are based on an estimation of land surface elevation from a topographic map (U.S. Geological Survey, 1964). Elevations are accurate to within plus or minus 5 feet.

Table 3. Chemical analyses of water samples

Legal location	Well name	Date collected	Well depth[2]	Conductivity[3]	Parameter[1] and concentration in milligrams per liter													
					Alk-T	HCO_3	Ca	Cl	F	Fe	K	Mg	Mn	Na	NO_3-N + NO_2-N	SO_4	TDS	Hardness as $CaCO_3$
								250[4]	2.4[5]	0.3[4]			0.05[4]		10[5]	250[4]	500[4]	
SW SW SW SW sec. 15, T. 101 N., R. 55 W.	R20-90-42	6/2/92	302	1730	339	413	181	11.0	0.40	2.07	12	62	1.56	148	<0.04	660	1430	707
NE NE NE SE sec. 21, T. 101 N., R. 55 W.	R2-92-17	6/1/92	305	1530	356	434	153	13.0	0.37	1.91	11	45	1.18	142	<0.04	510	1190	567
SE NE SE SE sec. 21, T. 101 N., R. 55 W.	R2-92-18	6/1/92	322	1460	342	417	160	11.0	0.35	0.07	12	46	1.25	122	<0.04	487	1150	589
SE SE NE SE sec. 22, T. 101 N., R. 55 W.	R2-92-14	6/3/92	359	1510	338	412	171	11.0	0.40	0.18	12	49	2.00	119	<0.04	530	1220	629
SW NW NW NW sec. 23, T. 101 N., R. 55 W.	R2-92-15	6/1/92	312	1600	339	413	176	12.0	0.41	0.10	11	49	1.85	138	<0.04	580	1280	641
SW SW SW SW sec. 23, T. 101 N., R. 55 W.	R2-92-11	6/3/92	333	1480	352	429	183	10.0	0.42	2.75	13	51	2.09	106	<0.04	522	1220	667
SW SW SW SW sec. 24, T. 101 N., R. 55 W.	R3-90-28	6/3/92	293	1340	338	412	167	8.6	0.36	<0.05	11	49	1.36	79	<0.04	440	1080	619
SW SW SW SW sec. 25, T. 101 N., R. 55 W.	R20-91-06	6/2/92	316	1430	342	417	162	9.8	0.42	1.73	11	47	1.25	111	<0.04	470	1110	598
NE SE NE SE sec. 25, T. 101 N., R. 55 W.	R3-90-23	6/2/92	289	1240	318	388	127	12.0	0.55	<0.05	13	40	1.29	105	<0.04	364	920	482
			Average:	1480	340	415	164	10.9	0.41	1.26	12	49	1.54	119	<0.04	507	1178	611

[1] **Alk-T** - total alkalinity; **HCO_3** - bicarbonate; **Ca** - calcium; **Cl** - chloride; **F** - fluoride; **Fe** - iron; **K** - potassium; **Mg** - magnesium; **Mn** - manganese; **Na** - sodium; **NO_3-N + NO_2-N** - nitrate + nitrite as nitrogen; **SO_4** - sulfate; **TDS** - total dissolved solids; **Hardness as $CaCO_3$** - calcium carbonate.

[2] Well depth is presented in feet below casing top.

[3] Numbers are presented in micromhos per centimeter.

[4] U.S. Environmental Protection Agency (November 1994). Secondary maximum contaminant level. Recommended limit.

[5] U.S. Environmental Protection Agency (November 1994). Maximum contaminant level. Enforceable limit.

APPENDIX A

Lithologic logs of test holes and observation wells completed by the South Dakota Geological Survey for this investigation

LEGAL LOCATION and LOCATION

The logs are listed by smallest township number, then the smallest range number, the smallest section number, and then by quarter section: NE = A; NW = B; SW = C; SE = D. A comparison of a **LEGAL LOCATION** and a **LOCATION** is as follows. A **LEGAL LOCATION** of NE NE NE SE sec. 21, T. 101 N., R. 55 W. is the same as a **LOCATION** of 101N-55W-21DAAA. In some locations, the smallest quarter section is followed by the number 1 or 2 which indicates that more than one log may exist for that particular location.

LATITUDE and LONGITUDE

The format is **DD.MMSS** where **D** is degrees, **M** is minutes, and **S** is seconds.

DRILLING COMPANY

SDGS is an abbreviation for South Dakota Geological Survey.

TOTAL DRILL HOLE DEPTH, SCREEN LENGTH, and TOTAL CASING AND SCREEN

The numbers are presented in feet.

CASING STICK-UP

The number is presented in feet above ground surface.

SCREEN TYPE and CASING TYPE

PVC is an abbreviation for polyvinyl chloride. **MFG.** is an abbreviation for manufactured and indicates a product that is commercially available. **SLOT SIZE** is the size, in inches, of the openings on the screen.

GROUND SURFACE ELEVATION

The number is presented in feet above mean sea level. **T** - the elevation was estimated using a 7.5 minute series topographic map.

CASING DIAMETER

The number is presented in inches.

County: MCCOOK
Location: 101N-55W-21DAAA
Legal Location: NE NE NE SE sec. 21, T. 101 N., R. 55 W.
Latitude: 43.3208
Longitude: 97.2540
Land Owner:
Project: HANSON BURIED AQUIFER
Drilling Company: SDGS
Driller: G. JENSEN
Driller's Log:
Geologist: L. SCHULZ
Geologist's Log: X
Date Drilled: 05-20-1992
Drilling Method: ROTARY
Ground Surface Elevation: 1448 T
Total Drill Hole Depth: 217
Test Hole Number: R2-92-16
USGS Hydrological Unit Code: 10160011
Electric Log Information:
Spontaneous Potential:
Single Point Resistivity:
Natural Gamma:
Extra:
Samples:

0	-	17	Clay, brown, silty, sandy, pebbly; oxidized (till)
17	-	19	Clay, dark-brown, silty, sandy, pebbly; partly oxidized (till)
19	-	60	Clay, gray, silty, sandy, pebbly; unoxidized (till)
60	-	89	Sand, gray, medium to coarse; clean, mainly quartz and carbonates, much coal
89	-	147	Clay, gray, silty, sandy, pebbly; unoxidized (till)
147	-	178	Sand and gravel, brown, fine to medium sand, medium gravel; mainly quartz and carbonates; some coal (Dolton outwash)
178	-	215	Silt, gray; some sand
215	-	217	Rock; very hard, could not penetrate, granite boulder, moved rig ahead and redrilled

County: MCCOOK
Location: 101N-55W-21DAAA 1
Legal Location: NE NE NE SE sec. 21, T. 101 N., R. 55 W.
Latitude: 43.3208
Longitude: 97.2540
Land Owner:
Project: HANSON BURIED AQUIFER
Drilling Company: SDGS
Driller: G. JENSEN
Driller's Log:
Geologist: L. SCHULZ
Geologist's Log: X
Date Drilled: 05-20-1992
Drilling Method: ROTARY
Ground Surface Elevation: 1448 T
Total Drill Hole Depth: 302.5
Test Hole Number: R2-92-17
Water Rights Well:
SDGS Well Name: R2-92-17
Other Well Name:
Basin: JAMES
Aquifer:
Management Unit:
Screen Type: PVC, MFG., SLOT SIZE 0.020 IN.
Screen Length: 5.0
Casing Type: PVC
Casing Diameter: 2.0
Casing Top Elevation: 1451 T
Casing Stick-up: 3.00
Total Casing and Screen: 305.0
Well Maintenance Date:
USGS Hydrological Unit Code: 10160011
Electric Log Information:
Spontaneous Potential:
Single Point Resistivity: X
Natural Gamma: X
Extra:
Samples:

Well Information: Well screened from 305 to 300 feet below casing top. Filter pack from 302 to 270 feet below land surface. Bentonite grout from 270 feet to land surface. Neat cement grout from 20 feet below land surface to ground level. 1 steel well protector installed.

0	-	19	Clay, brown, silty, sandy, pebbly; oxidized (till)
19	-	60	Clay, gray, silty, sandy, pebbly; unoxidized (till)
60	-	88	Clay, gray, very silty, sandy, pebbly, gravelly; unoxidized (till)
88	-	147	Clay, gray, silty, sandy, pebbly; unoxidized (till)
147	-	178	Sand and gravel, brown, fine to medium sand, medium gravel; mainly quartz and carbonates, some coal (Dolton outwash)
178	-	226	Silt, gray; some fine sand
226	-	237	Sand and gravel, gray, coarse sand; much drill chatter; clean
237	-	278	Clay, gray, silty, sandy, pebbly (till)
278	-	302	Sand and gravel, gray to brown-gray, fine to medium sand, medium gravel; mainly quartz and carbonates, some coal
302	-	302.5	Quartzite; hard layer, could not penetrate, many pink ortho-quartzite chips received in cuttings (Sioux Quartzite)

County: MCCOOK
Location: 101N-55W-21DDAD
Legal Location: SE NE SE SE sec. 21, T. 101 N., R. 55 W.
Latitude: 43.3154
Longitude: 97.2540
Land Owner:
Project: HANSON BURIED AQUIFER
Drilling Company: SDGS
Driller: M. THOMPSON
Driller's Log:
Geologist: L. SCHULZ
Geologist's Log: X
Date Drilled: 05-26-1992
Drilling Method: ROTARY
Ground Surface Elevation: 1446 T
Total Drill Hole Depth: 321
Test Hole Number: R2-92-18
Water Rights Well:
SDGS Well Name: R2-92-18
Other Well Name:
Basin: JAMES
Aquifer:
Management Unit:
Screen Type: PVC, MFG., SLOT SIZE 0.020 IN.
Screen Length: 5.0
Casing Type: PVC
Casing Diameter: 2.0
Casing Top Elevation: 1449 T
Casing Stick-up: 2.00
Total Casing and Screen: 323.0
Well Maintenance Date:
USGS Hydrological Unit Code: 10160011
Electric Log Information:
Spontaneous Potential:
Single Point Resistivity: X
Natural Gamma: X
Extra:
Samples:

Well Information: Well has a 20 foot blank added on the bottom. Screened interval from 301 to 296 feet below casing top. Filter pack from 321 to 273 feet below land surface. Bentonite grout from 273 feet to land surface. Neat cement grout from 20 feet below ground level to land surface. 1 steel well protector installed.

0	-	1	Topsoil
1	-	17	Clay, brown, silty, sandy, pebbly; oxidized (till)
17	-	150	Clay, gray, silty, sandy, pebbly; unoxidized (till)

150	-	173	Sand and gravel, brown, fine to coarse sand, medium to coarse gravel; clean, mainly quartz and carbonates, many shale pebbles, some lignitic coal (Dolton outwash)
173	-	186	Silt, gray; some sand and clay
186	-	226	Clay, gray, silty, sandy, pebbly; unoxidized (till)
226	-	229	Rock; hard drilling
229	-	278	Clay, gray, silty, sandy, pebbly; unoxidized (till)
278	-	314	Sand and gravel; poor return
314	-	315	Rocks
315	-	321	Quartzite; hard layer, many pink ortho-quartzite chips received after rock bit was put on (Sioux Quartzite)

County: MCCOOK
Legal Location: SW SE SE SW sec. 22, T. 101 N., R. 55 W.
Latitude: 43.3145
Land Owner:
Project: HANSON BURIED AQUIFER
Drilling Company: SDGS
Driller: M. THOMPSON
Geologist: L. SCHULZ
Date Drilled: 05-27-1992
Ground Surface Elevation: 1451 T
Total Drill Hole Depth: 400
USGS Hydrological Unit Code: 10160011
Electric Log Information:
Spontaneous Potential:
Natural Gamma: X
Samples:

Location: 101N-55W-22CDDC
Longitude: 97.2506
Driller's Log:
Geologist's Log: X
Drilling Method: ROTARY
Test Hole Number: R2-92-19
Single Point Resistivity: X
Extra:

0	-	1	Topsoil
1	-	17	Clay, brown, silty, sandy, pebbly; oxidized (till)
17	-	21	Clay, dark-brown, silty, sandy, pebbly; partly oxidized (till)
21	-	161	Clay, gray, silty, sandy, pebbly; unoxidized (till)
161	-	192	Sand and gravel, brown, medium sand, medium gravel; mainly quartz and carbonates, many shale pebbles, much lignitic coal (Dolton outwash)
192	-	248	Clay, gray, silty, sandy, pebbly; unoxidized (till)
248	-	268	Sand, gray, fine-grained; much clay
268	-	275	Rocks
275	-	312	Clay, gray, silty, sandy, pebbly; some shale cuttings(?)
312	-	399	Shale and silt interbedded, black shale, dark-black silt; silts are weakly calcareous (Split Rock Creek Formation)
399	-	400	Quartzite; hard layer, could not penetrate, much white kaolinitic clay received in cuttings (Sioux Quartzite)

County: MCCOOK
Legal Location: SE SE NE SE sec. 22, T. 101 N., R. 55 W.
Latitude: 43.3203
Land Owner:
Project: HANSON BURIED AQUIFER
Drilling Company: SDGS
Driller: G. JENSEN
Geologist: L. SCHULZ
Date Drilled: 05-18-1992

Location: 101N-55W-22DADD
Longitude: 97.2428
Driller's Log:
Geologist's Log: X
Drilling Method: ROTARY

Ground Surface Elevation: 1450 T
Total Drill Hole Depth: 358
Water Rights Well:
Other Well Name:
Basin: JAMES
Management Unit:
Screen Type: PVC, MFG., SLOT SIZE 0.020 IN.
Casing Type: PVC
Casing Top Elevation: 1452 T
Casing Stick-up: 2.00
Well Maintenance Date:
USGS Hydrological Unit Code: 10160011
Electric Log Information:
Spontaneous Potential:
Natural Gamma: X
Samples:

Test Hole Number: R2-92-14
SDGS Well Name: R2-92-14

Aquifer:

Screen Length: 5.0
Casing Diameter: 2.0

Total Casing and Screen: 360.0

Single Point Resistivity: X
Extra:

Well Information: Well has 20 foot blank placed on the bottom. Screened interval is from 338 feet to 333 feet below casing top. Unable to place filter pack due to hole collapse. Bentonite grout from 163 feet to land surface. Neat cement grout from 20 feet below land surface to ground level. 1 steel well protector.

0	-	28	Clay, brown, silty, sandy, pebbly; oxidized (till)
28	-	162	Clay, gray, silty, sandy, pebbly; unoxidized (till)
162	-	202	Sand and gravel, brown, fine to coarse sand, medium gravel; mainly quartz and carbonates, many shale pebbles (Dolton outwash)
202	-	283	Clay, gray, very silty, sandy, pebbly; many rocks, unoxidized (till)
283	-	351	Sand and gravel, brown, fine sand, coarse gravel; mainly quartz and carbonates, some shale pebbles
351	-	358	Clay, dark-gray-black; greasy (Split Rock Creek Formation)

County: MCCOOK
Legal Location: SW NW NW NW sec. 23, T. 101 N., R. 55 W.
Latitude: 43.3229
Land Owner:
Project: HANSON BURIED AQUIFER
Drilling Company: SDGS
Driller: G. JENSEN
Geologist: L. SCHULZ
Date Drilled: 05-19-1992
Ground Surface Elevation: 1453 T
Total Drill Hole Depth: 310.5
Water Rights Well:
Other Well Name:
Basin: JAMES
Management Unit:
Screen Type: PVC, MFG., SLOT SIZE 0.020 IN.
Casing Type: PVC
Casing Top Elevation: 1455 T
Casing Stick-up: 2.00
Well Maintenance Date:
USGS Hydrological Unit Code: 10160011
Electric Log Information:

Location: 101N-55W-23BBBC

Longitude: 97.2423

Driller's Log:
Geologist's Log: X
Drilling Method: ROTARY

Test Hole Number: R2-92-15
SDGS Well Name: R2-92-15

Aquifer:

Screen Length: 10.0
Casing Diameter: 2.0

Total Casing and Screen: 312.0

Spontaneous Potential:
Natural Gamma: X
Samples:

Single Point Resistivity: X
Extra:

Well Information: Well screened from 312 to 302 feet below casing top. Filter pack from 312 to 272 feet below casing top. Bentonite grout from 270 feet below land surface to ground level. Neat cement grout placed from 20 feet below ground level to land surface. 1 steel well protector installed.

0	-	17	Clay, brown, silty, sandy, pebbly; oxidized (till)
17	-	23	Clay, dark-brown, silty, sandy, pebbly; partly oxidized (till)
23	-	174	Clay, gray, silty, sandy, pebbly; some small gravel stringers throughout, unoxidized (till)
174	-	204	Sand and gravel, brown, fine to coarse sand, medium to coarse gravel; mainly quartz and carbonates, many lignitic coal fragments (Dolton outwash)
204	-	272	Clay, gray, very silty; some fine sand, calcareous
272	-	310	Sand and gravel, brown, coarse sand, medium to coarse gravel; mainly quartz and carbonates, some coal
310	-	310.5	Quartzite(?); hard layer, could not penetrate, no cuttings received, the elevation is consistent with the quartzite surface in this area (Sioux Quartzite)

County: MCCOOK
Legal Location: SW SW SW SW sec. 23, T. 101 N., R. 55 W.
Latitude: 43.3146
Land Owner:
Project: HANSON BURIED AQUIFER
Drilling Company: SDGS
Driller: G. JENSEN
Geologist: L. SCHULZ
Date Drilled: 05-12-1992
Ground Surface Elevation: 1450 T
Total Drill Hole Depth: 334
Water Rights Well:
Other Well Name:
Basin: JAMES
Management Unit:
Screen Type: PVC, MFG., SLOT SIZE 0.020 IN.
Casing Type: PVC
Casing Top Elevation: 1452 T
Casing Stick-up: 2.00
Well Maintenance Date:
USGS Hydrological Unit Code: 10160011
Electric Log Information:
Spontaneous Potential:
Natural Gamma: X
Samples:

Location: 101N-55W-23CCCC

Longitude: 97.2424

Driller's Log:
Geologist's Log: X
Drilling Method: ROTARY

Test Hole Number: R2-92-11
SDGS Well Name: R2-92-11

Aquifer:

Screen Length: 10.0
Casing Diameter: 2.0

Total Casing and Screen: 333.0

Single Point Resistivity: X
Extra:

Well Information: Well screened from 333 to 323 feet below casing top. Hole collapsed at 294 feet. No filter pack added. Bentonite grout from 294 feet to land surface. Cement grout from 20 feet below land surface to ground level. One steel well protector installed.

0	-	26	Clay, brown, silty, sandy, pebbly; oxidized (till)
26	-	196	Clay, gray, silty, sandy, pebbly; unoxidized (till)
196	-	238	Sand and gravel, brown, fine to coarse sand, fine gravel; mainly quartz and carbonates, many shale pebbles, some lignitic coal fragments (Dolton outwash)

238	-	288	Clay, gray, silty, sandy, pebbly; becoming more silty with depth (till)
288	-	333	Sand and gravel, brown to gray-brown, medium sand, coarse gravel; mainly quartz and carbonates, some lignitic coal fragments in cuttings
333	-	334	Quartzite; hard layer, could not penetrate, many pink ortho-quartzite chips in cuttings (Sioux Quartzite)

County: MCCOOK
Location: 101N-55W-27BBBA
Legal Location: NE NW NW NW sec. 27, T. 101 N., R. 55 W.
Latitude: 43.3143
Longitude: 97.2529
Land Owner:
Project: HANSON BURIED AQUIFER
Drilling Company: SDGS
Driller: G. JENSEN
Driller's Log:
Geologist: L. SCHULZ
Geologist's Log: X
Date Drilled: 05-12-1992
Drilling Method: ROTARY
Ground Surface Elevation: 1442 T
Total Drill Hole Depth: 425
Test Hole Number: R2-92-10
USGS Hydrological Unit Code: 10160011
Electric Log Information:
Spontaneous Potential:
Single Point Resistivity: X
Natural Gamma: X
Extra:
Samples:

0	-	16	Clay, brown, silty, sandy, pebbly; oxidized (till)
16	-	152	Clay, gray, silty, sandy, pebbly; unoxidized (till)
152	-	181	Sand and gravel, brown, fine to coarse sand, medium to pea-size gravel; mainly quartz and carbonates; much coal (Dolton outwash)
181	-	222	Clay, gray, very silty; some fine sand
222	-	261	Clay, gray, silty, sandy, pebbly; many rocks, much wood in cuttings (till)
261	-	278	Clay and gravel, gray clay, brown gravel, silty; some sand (till)
278	-	286	Clay, gray, silty, sandy, pebbly, gravelly (till)
286	-	318	Clay and gravel, gray clay, brown gravel, silty; some sand (till)
318	-	356	Clay, dark-gray-black; greasy, organic (Split Rock Creek Formation)
356	-	370	Sand(?); poor return, this interval interpreted from electric log
370	-	404	Clay and silt interbedded, gray to black; silts are calcareous and organic (Split Rock Creek Formation)
404	-	424	Quartzite; much white kaolinite in cuttings, some soft pink clay; weathered (Sioux Quartzite)
424	-	425	Quartzite; hard, could not penetrate, many pink ortho-quartzite chips received in cuttings (Sioux Quartzite)

County: MCCOOK
Location: 101N-55W-28BDDA
Legal Location: NE SE SE NW sec. 28, T. 101 N., R. 55 W.
Latitude: 43.3126
Longitude: 97.2717
Land Owner:
Project: HANSON BURIED AQUIFER
Drilling Company: SDGS
Driller: G. JENSEN
Driller's Log:
Geologist: L. SCHULZ
Geologist's Log: X
Date Drilled: 05-13-1992
Drilling Method: ROTARY
Ground Surface Elevation: 1439 T
Total Drill Hole Depth: 240
Test Hole Number: R2-92-12

USGS Hydrological Unit Code: 10160011
Electric Log Information:
Spontaneous Potential:
Natural Gamma: X
Samples:

Single Point Resistivity: X
Extra:

0	-	27	Clay, brown, silty, sandy, pebbly; oxidized (till)
27	-	144	Clay, gray, silty, sandy, pebbly; unoxidized (till)
144	-	165	Sand and gravel, brown, coarse sand, fine gravel; mainly quartz and carbonates (Dolton outwash)
165	-	193	Clay, gray, silty, sandy, pebbly; unoxidized (till)
193	-	236	Sand and gravel, brown, coarse sand, medium gravel; mainly quartz and carbonates
236	-	240	Quartzite; hard layer, could not penetrate, many pink ortho-quartzite chips received in cuttings (Sioux Quartzite)

County: MCCOOK
Location: 101N-55W-29ABBA
Legal Location: NE NW NW NE sec. 29, T. 101 N., R. 55 W.
Latitude: 43.3143
Longitude: 97.2718
Land Owner:
Project: HANSON BURIED AQUIFER
Drilling Company: SDGS
Driller: G. JENSEN
Driller's Log:
Geologist: L. SCHULZ
Geologist's Log: X
Date Drilled: 05-13-1992
Drilling Method: ROTARY
Ground Surface Elevation: 1442 T
Total Drill Hole Depth: 198
Test Hole Number: R2-92-13
USGS Hydrological Unit Code: 10160011
Electric Log Information:
Spontaneous Potential:
Natural Gamma: X
Samples:

Single Point Resistivity: X
Extra:

0	-	21	Clay, brown, silty, sandy, pebbly; oxidized (till)
21	-	85	Clay, gray, silty, sandy, pebbly; unoxidized (till)
85	-	94	Sand, brown, fine-grained
94	-	141	Clay, gray, silty, sandy, pebbly; unoxidized (till)
141	-	193	Silt, clayey; some fine sand
193	-	198	Quartzite; hard layer, could not penetrate, many pink ortho-quartzite chips received in cuttings (Sioux Quartzite)