STATE OF SOUTH DAKOTA
Frank Farrar, Governor

SOUTH DAKOTA GEOLOGICAL SURVEY
Duncan J. McGregor, State Geologist

Special Report 46

GROUND-WATER INVESTIGATION FOR THE CITY OF LENNOX, SOUTH DAKOTA

by
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Science Center
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INTRODUCTION

Present Investigation

This report contains the results of a special investigation by the South Dakota Geological Survey from July 24 to August 24, 1967, in and around the city of Lennox, Lincoln County, South Dakota (fig. 1). The purpose of this investigation was to assist the city in finding a water source of better quality and in larger quantities than the present wells supply. Lennox now obtains its water from three wells. The oldest well, which is 480 feet deep, is presumed to be drawing water from the Dakota Sandstone; however, buried glacial sand and gravel may also be furnishing water to this well. The second well is 50 feet deep and is located at the southwest corner of town. The water from this well is of fair quality, but production is insufficient. The third well is 293 feet deep and is located in the city building 35 feet away from the first well. This well obtains a sufficient quantity of water from a basal sand and gravel but the water is of very poor quality.

A survey of 112 square miles around Lennox was made in an effort to locate possible future water supplies. The survey consisted of: (1) recording information of many farm wells in the area; (2) drilling 15 rotary test holes; (3) drilling 37 auger test holes; (4) obtaining 15 electric logs from test holes; and (5) collection of 25 water samples for chemical analysis.

As a result of this survey it was determined that the city has several alternatives for improving their water supply: (1) further testing of the shallow outwash aquifers, Area A and Area B (fig. 2); (2) drilling a well into the Dakota Formation in Area C (fig. 2); and (3) in case the first two suggestions fail to provide adequate water, the shallow aquifer in the Vermillion River valley six to eight miles to the west may be further investigated.

The above recommendations are based on the data collected and compiled during this study. The location of data points are shown on figure 3.

The field work and preparation of this report were performed under the supervision of Cleo M. Christensen, research geologist, and Fred Steece, principle geologist, with the South Dakota Geological Survey. The writer also wishes to thank Mayor Fred Courey, Water Commissioner Richard Fokken and the residents in and around Lennox for their cooperation. The valuable information obtained from well drillers Lloyd Verley and Lynn Graves is also acknowledged.

Topography and Drainage

The topography of the Lennox area is typical of youthful glacial deposits, namely rolling hills and valleys with many knobs and potholes; drainage is non-integrated. The main drainage is Long Creek west of town which flows south into the Vermillion River, and Beaver Creek north of town which flows southeast to the Big Sioux River.

GENERAL GEOLOGY

Surficial Deposits

The surficial deposits in the Lennox area are chiefly the results of glaciation late in the Pleistocene Epoch. Glacial deposits are collectively termed drift, which is divided into till and outwash deposits. Till consists of clay- and silt-size particles randomly mixed with sand, pebbles, and boulders which were carried and deposited by the ice itself. Outwash is composed of sand and pebbles with lesser amounts of clay and silt, and only a few cobbles and boulders, which were deposited by meltwater streams from the wasting glaciers. Outwash is present in the Long Creek and Vermillion River valleys and in an elongate area southwest of town (fig. 4).

Alluvium consists of silt- and clay-size particles with minor amounts of sand, deposited by recent streams since the retreat of the glaciers. Alluvium is found along Beaver and Long

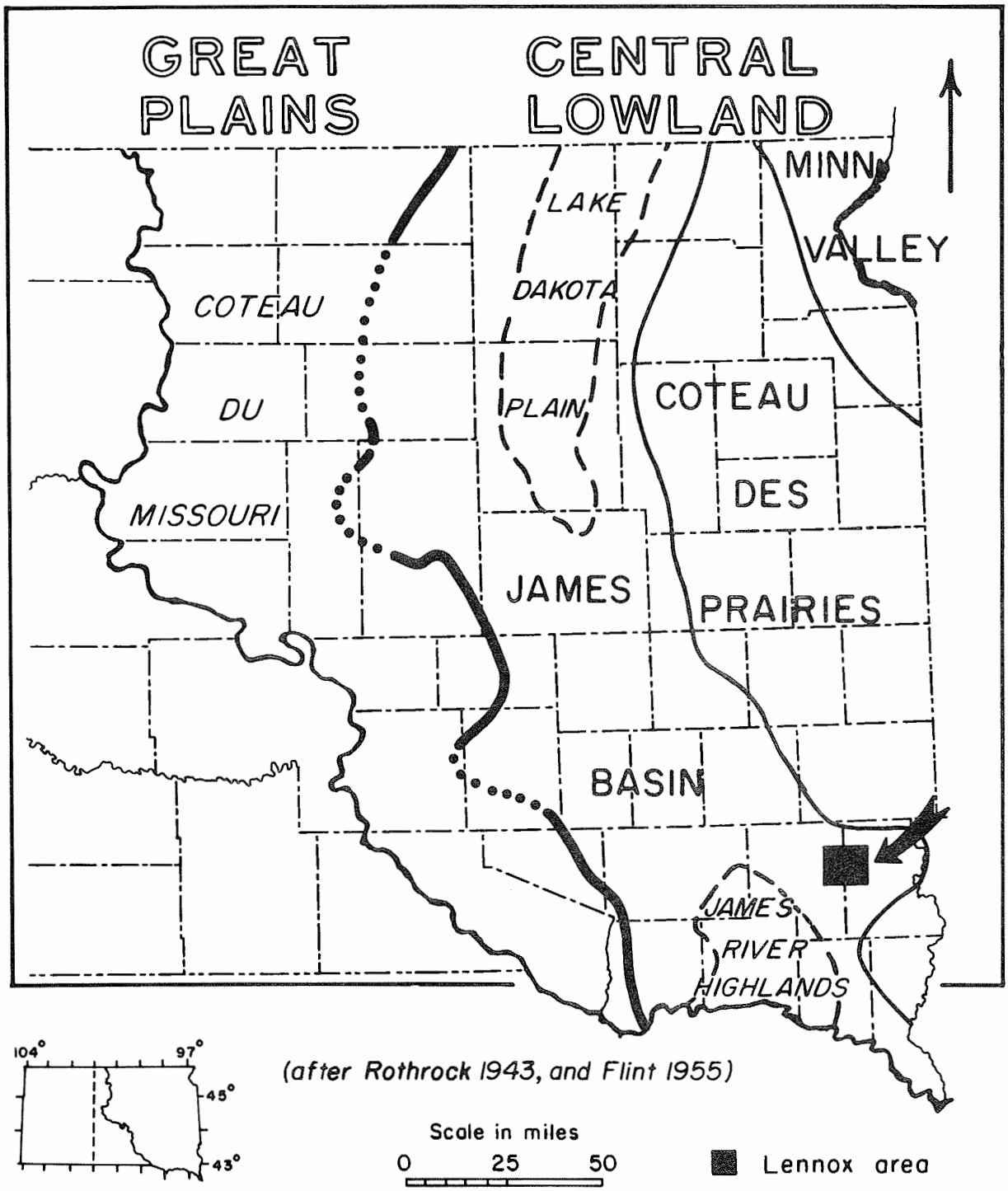

Figure 1. Map of eastern South Dakota showing the major physiographic divisions and location of the Lennox area

EXPLANATION

Area recommended for additional testing for water supply.

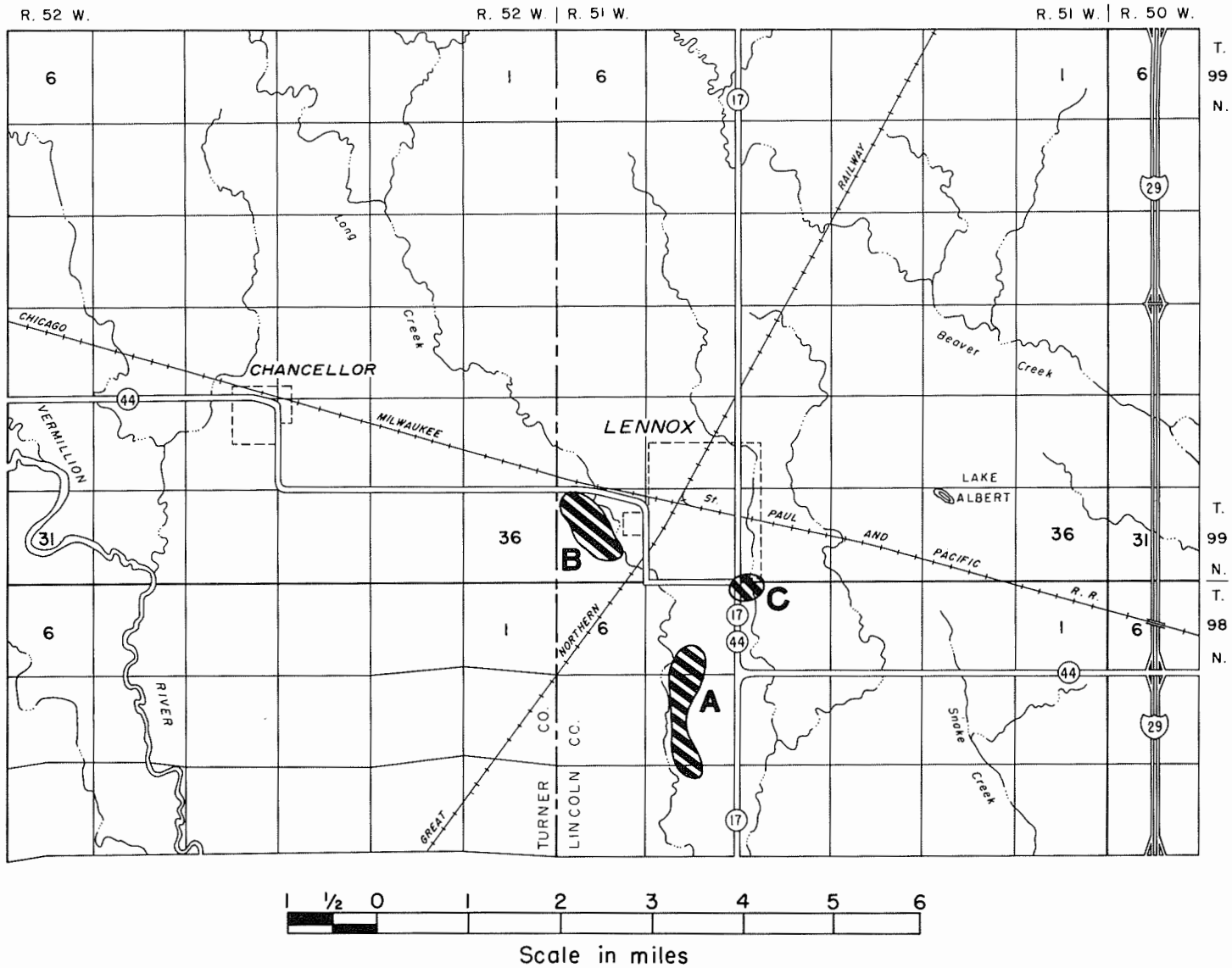

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Figure 2. Map of Lennox and vicinity showing areas recommended for water supplies.

EXPLANATION

● 41W Test hole with a log available; number refers to data number in Appendix A or table 1. "W" indicates a water analysis.

○ 62W Private well with water analysis.

⊕ City well.

A-A', B-B' Lines of cross sections (see figure 6).

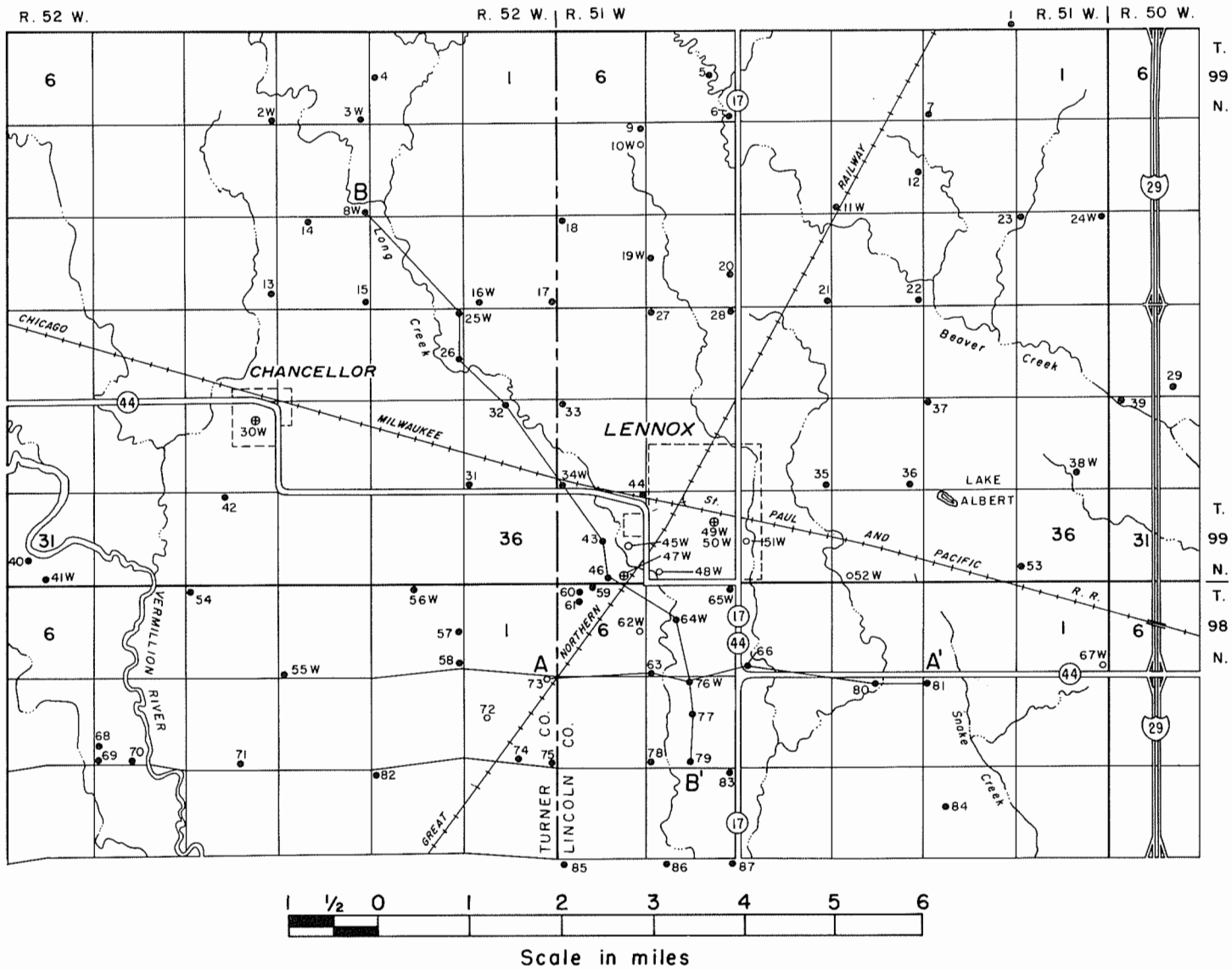

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Figure 3. Map showing location of data points in the Lennox area.

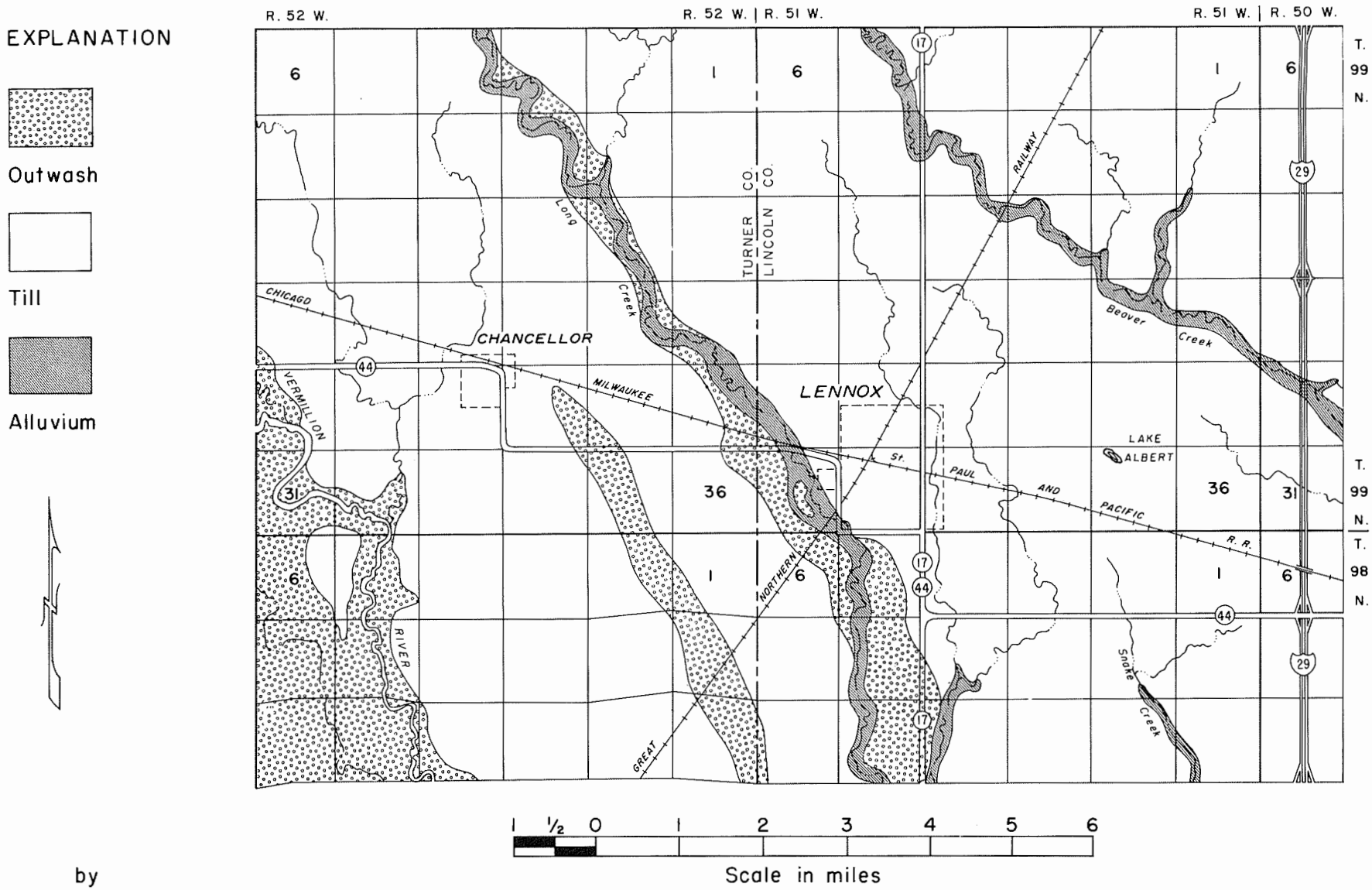

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Figure 4. Generalized geologic map of the Lennox area.

Creeks and some of their tributaries in the Lennox area (fig. 4).

Subsurface Bedrock

Stratified rocks of Cretaceous age lie beneath the glacial deposits throughout most of the Lennox area; however, there are some localities where the glacial drift rests directly on the Sioux Quartzite. The Niobrara Marl occurs immediately beneath the glacial drift in some parts of the area, while the Carlile Shale is usually the first Cretaceous formation encountered beneath the drift where the Niobrara is absent. The Carlile is underlain in descending order by the Greenhorn Limestone, Graneros Shale, and the Dakota Formation, all of which are of Cretaceous age, and the Precambrian Sioux Quartzite.

The Niobrara Marl consists of white to buff massive calcareous chalk containing numerous fossil shells. The thickness of the Niobrara in the Lennox area is unknown as it was not encountered in any test wells drilled by the South Dakota Geological Survey; however, its presence has been reported in some farm wells.

The Carlile Shale consists of a sandstone member and a shale member. The sandstone is composed of a fine-grained, light-colored cemented sand, and the shale is medium- to dark-gray with pyrite concretions and layers of bentonite. Thickness of the Carlile in the Lennox area ranges from 0 to 30 feet, but thickens toward the south and east.

The Greenhorn Limestone is composed of dark-gray shale containing numerous small white calcareous specks and hard buff to white fossiliferous limestone. This unit varies in thickness from 0 to about 50 feet in the Lennox area.

The Graneros Shale is a hard, light- to dark-gray silicious shale that is very thin or absent in the Lennox area.

The Dakota Formation consists of fine to coarse, loose to cemented, light-brown sand or sandstone with alternating layers of shale. In the Lennox area, the Dakota has a maximum thickness of about 200 feet.

Directly beneath the Dakota Formation lies the Sioux Quartzite which is a pink to purple, very hard, quartzitic sandstone, locally called "granite," "Sioux Falls Granite," or "quartzite." A sand and gravel composed almost entirely of Sioux Quartzite fragments, and a thin, partly eroded and highly fractured quartzite is locally present directly overlying the solid quartzite. This zone is commonly referred to as the "quartzite wash."

OCCURRENCE OF GROUND WATER

Principles of Occurrence

Despite the common belief that ground water is found in "veins" crisscrossing the land in a discontinuous maze, it is known that water occurs almost everywhere beneath the land surface, at a depth which varies from a few feet to several tens or even hundreds of feet. The top of this zone of water saturation is known as the water table.

Nearly all ground water is derived from precipitation. Rain or melting snow either percolates down to the water table and becomes ground water, or drains off as surface water. Surface water either evaporates, escapes to the ocean by streams, or percolates downward to the ground-water table. In general, ground water moves laterally down the hydraulic gradient, and is said to be in transient storage.

Recharge is the addition of water to an aquifer (water-bearing material), and is accomplished in one or more of the following ways: (1) direct precipitation of rain or snow on the ground surface; (2) downward percolation from surface bodies of water; and (3) lateral underflow of water in transient storage.

Discharge, or the removal of ground water, is accomplished in one or more of the following ways: (1) evaporation and transpiration by plants; (2) seepage upward or laterally into surface bodies of water; (3) lateral underflow of water in transient storage; and (4) by pumping of wells.

The volume of water capable of being stored in an aquifer is equal to the volume of voids

or pore spaces in the material. A measurement of the capability of a material to store water is called porosity; therefore, porosity is the ratio of the volume of voids in the rock to the rock volume. The shape and arrangement of the grains in a material affect the porosity greatly, but size of the grains has little effect. Sands and gravels usually have porosities of 20 to 40 percent whereas sandstones usually have porosities of 15 to 25 percent; this lower porosity of sandstones is due to closer packing and cementation of the sand grains.

Permeability is the rate at which a fluid will pass through a substance. If the pore spaces of a material are connected, the permeability will be high and vice versa; thus a material may have high porosity and still not yield water readily because of low permeability. Sands and gravels, however, tend to possess both high porosity and high permeability; therefore, the geologist is not concerned with finding a "vein" when looking for a good water supply, but because water occurs nearly everywhere in the ground, he is searching instead for a sand or gravel deposit that lies beneath the water table.

Ground Water in Alluvium

Alluvium is present in Long and Beaver Creeks as well as some of their tributaries (fig. 4). The alluvium was deposited by recent streams and consists of clay and silt with lesser amounts of sand and gravel. The alluvium holds large quantities of water where it is below the water table, but yields the water very slowly because of its low permeability.

Ground Water in Glacial Deposits

Glacial outwash deposits, because they are better sorted and contain less clay- and silt-size particles, yield water much more readily than till.

Three areas of surface outwash are present in the study area (fig. 4). City well number 2 is presently drawing water from the Long Creek outwash. This aquifer varies in thickness from 0 to 50 feet, with the greatest thickness being south of town (figs. 5 and 6).

The elongate outwash deposit southwest of Lennox varies in thickness from 0 to 47 feet but is much less extensive than the Long Creek outwash, and therefore would not sustain high yield wells.

The outwash along the Vermillion River is more extensive than the two mentioned above (fig. 4), but is not as thick (see Appendix A; test holes 40, 41, 68, 69, and 70). For more detailed information on this deposit see Tipton, 1957.

A basal sand and gravel resting on bedrock is present in the Lennox area. City well 3 presently obtains its water from this source at a reported depth of 293 feet. Test hole 44 (fig. 3 and App. A) penetrated 120 feet of aquifer between 172 and 292 feet. A map of this aquifer has not been prepared due to inadequate data and the fact that the aquifer generally has water of inferior quality (see discussion in Quality of Ground Water section of this report).

Other isolated sand and gravel layers are present beneath the surface at various depths and locations in the Lennox area. Many of these layers are providing water to stock and domestic wells but would not furnish an adequate supply for a municipal well.

Figure 6 illustrates the general relationship of the various aquifers in the glacial deposits.

Ground Water in Bedrock

Sandstones of the Dakota Formation, where they are present, constitute an aquifer in the area south and east of Lennox. Test hole 65 pumped 50 gallons per minute from an uncased hole. Maximum production from a cased and developed well would probably be about 100 to 150 gallons per minute. The main drawback to the aquifer in the Dakota Formation is its limited areal extent which might cause an initially high yielding well to rapidly decline in production.

A number of farm wells along with the city well at Chancellor are obtaining water from the Sioux Quartzite or the quartzite "wash" or a combination of both. The wells completed

EXPLANATION

—10— Line connecting points where saturated outwash is of equal thickness.

Line dashed where inferred.

•15 Test hole showing thickness of saturated outwash.

o25 Private well showing thickness of saturated outwash.

x Hand auger hole showing thickness of saturated outwash.

Contour interval = 10ft.

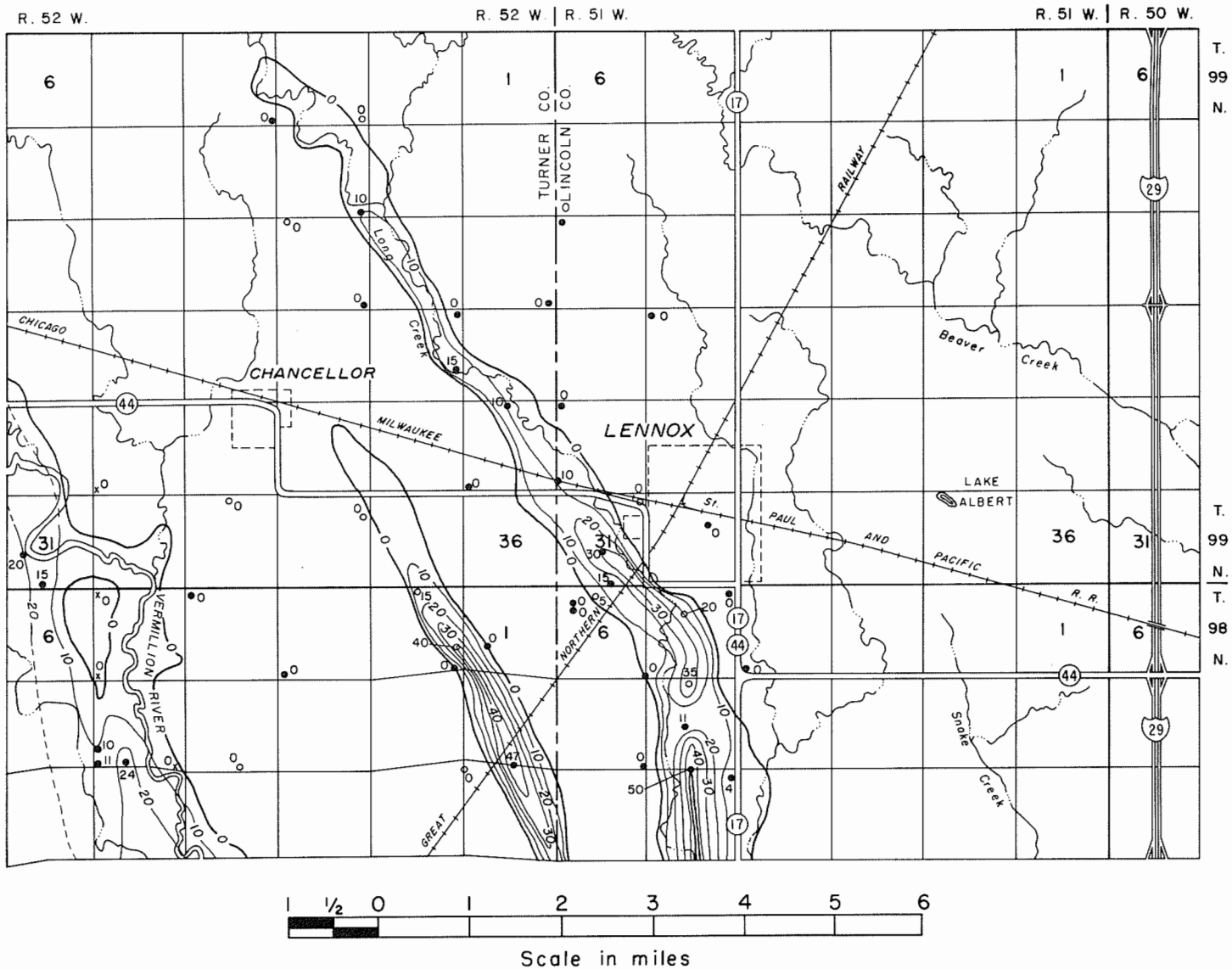

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Figure 5. Map showing thickness of saturated surface outwash in the Lennox area.

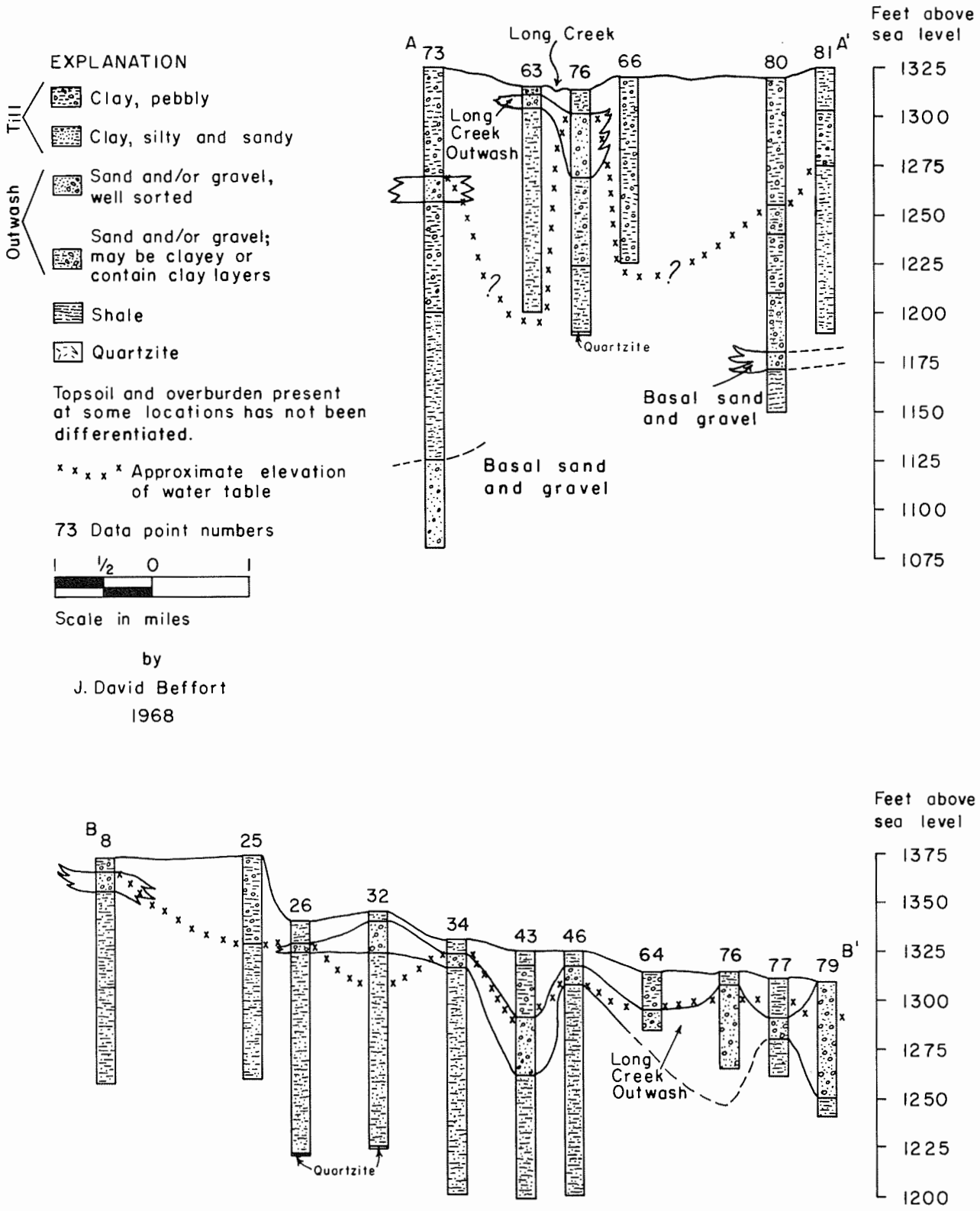

Figure 6. Cross sections showing the relationship of the aquifers in the Lennox area. (See figure 3 for the location of the cross sections.)

in the quartzite may obtain water from cracks and fissures in the rock and the overlying wash; however, the yield of these wells varies greatly depending upon the thickness of the wash and the amount of fractures encountered in the quartzite in any particular well. Records of some of the wells producing from the various formations discussed above are tabulated in Appendix B.

Quality of Ground Water

Rain water is nearly pure before it reaches the ground; however, all ground water contains minerals which are obtained from: (1) the atmosphere; (2) the soil and underlying deposits as the water percolates downward to the water table; and (3) deposits below the water table in which the water is circulating. In general, it can be said that the more minerals a water contains the poorer its quality. Table 1 explains the significance of some chemical and physical properties of water.

Table 2 is a list of water analyses from the Lennox area which are tabulated for comparison with the U. S. Public Health Standards (1962) for drinking water as modified by the South Dakota Department of Health. The data collection point numbers refer to the data map (fig. 3).

Water samples 8, 26, 34, 45, 47, 62, 64, and 76 are from the Long Creek outwash and are listed here as one moves downstream from two miles northeast of Chancellor to one mile south of Lennox. Of these eight samples one has excess magnesium (sample 64), four have excess sulfate (samples 26, 45, 62, and 64), three have excess iron (samples 45, 47, and 64), four exceed the limit on total solids (samples 26, 45, 62, and 64), none have excess chloride, and all are very hard. In addition the only sample checked for manganese was sample 47 and manganese was found in excess of the recommended limits. The best quality water was obtained from test hole 34 one mile west of town and test hole 76 one mile south of town (fig. 3).

Water sample 56 was obtained from the elongate outwash deposit southwest of Lennox. It exceeds the standards set for sulfate, iron and total solids and is also extremely hard.

Water sample 41 was obtained from the outwash along the Vermillion River 6½ miles west of Lennox. Of those minerals tested, only iron was found to be in excess, but this water is very hard.

Water samples 2, 3, 10, 16, 19, 30, 49, 50, 51, 55, and 72 are all believed to have been obtained from a basal sand and gravel which lies on bedrock. Some of these samples were obtained from the Sioux wash, which is part of the basal sand and gravel at certain locations, and some come from that part of the basal sand and gravel which lies on shale. Of these samples, two have excess magnesium, eight have excess sulfate, six exceed the standards set for iron, two have excess manganese, nine are beyond the limits for total solids, none have excess chloride, and all of these water samples have a high hardness content.

Samples 2, 55, and 10 are hard but are within the set standards in all respects with the exception of sample number 10 which has an excess of total solids and iron. These may not have come from the basal sand and gravel because test hole 2 disclosed a sandy clay above bedrock which may not be the true basal sand and gravel. Bedrock was not reached in test holes 9 and 55; however, water sample 10 was obtained from a farm well one-quarter mile south of test hole 9. From this evidence it is possible that water samples 55 and 10 do not represent the quality of water in the basal sand and gravel.

The cross section A-A′ in figure 6 and logs 7, 35, 37, 39, 53, 55, 65, 71, 80, 82, 83, and 84 of Appendix A suggest that isolated sand and gravel layers may be encountered from 17 to 105 feet beneath the land surface, particularly in those areas south and east of Lennox. Water samples 11, 24, 25, 52, and 67 probably come from isolated sand and gravel layers. These samples exhibit a wide range in quality but in general, all except sample 11 are of inferior quality.

Table 1.--Significance of some chemical and physical properties of water.

Chemical Constituents	Significance	Recommended Limits (ppm) [1]
Calcium (Ca) and Magnesium (Mg)	Cause most of the carbonate hardness and scale-forming properties of water by combining with carbonate and bicarbonate present in the water. Seldom can be tasted except in extreme concentrations.	Ca - none Mg - 125
Sodium (Na)	Large amounts in combination with chloride will give water a salty taste. Large amounts will limit water for irrigation and industrial use.	None
Chloride (Cl)	Large amounts in combination with sodium give water a salty taste. Large quantities will also increase corrosiveness of water.	250
Sulfate (SO_4)	Large amounts of sulfate in combination with other ions give a bitter taste to water and may act as a laxative to those not used to drinking it. Sulfates of calcium and magnesium will form hard scale. U.S. Public Health Service recommends 250 ppm maximum concentration.	500 [2]
Iron (Fe) and Manganese (Mn)	In excess will stain fabrics, utensils, and fixtures and produce objectionable coloration in the water. Both constituents in excess are particularly objectionable.	Fe - 0.3 Mn - 0.05
Nitrogen (N)	In excess may be injurious when used in infant feeding. The U.S. Public Health Service regards 45 ppm as the safe limit of nitrate (NO_3) or 10 ppm nitrogen (N).	10
Fluoride (F)	Reduces incidence of tooth decay when optimum fluoride content is present in water consumed by children during period of tooth calcification. Excessive fluoride in water may cause mottling of tooth enamel.	0.9-1.7 [2] [3]
pH	A measure of the hydrogen ion concentration; pH of 7.0 indicates a neutral solution, pH values lower than 7.0 indicates acidity, pH values higher than 7.0 indicate alkalinity. Alkalinity tends to aid encrustation and acidity tends to aid corrosion.	None
Hardness ($CaCO_3$)	Hardness equivalent to carbonate and bicarbonate is called carbonate hardness. Hardness in excess of this amount is noncarbonate hardness. Hardness in water consumes soap and forms soap curd. Will also cause scale in boilers, water heaters, and pipes. Water containing 0-60 ppm hardness considered soft; 61-120 ppm moderately hard; 121-180 ppm hard and more than 180 ppm very hard.	None
Total Solids	Total of all dissolved constitutents. U.S. Public Health Department recommends 500 ppm maximum concentration. Water containing more than 1000 ppm dissolved solids may have a noticeable taste; it may also be unsuitable for irrigation and certain industrial uses.	1000 [2]

1. (ppm) parts per million.
2. Modified for South Dakota by the State Department of Health (written communication, March 20, 1968).
3. Optimum.

Table 2.--Chemical analyses of water samples from the Lennox area.

Data Collection Point Number	Location	Well or Test Hole Number	Depth (feet)	Source [3]	Calcium	Sodium	Magnesium	Chloride	Sulfate	Iron	Manganese	Nitrogen	Fluoride	pH	Hardness as $CaCO_3$	Total Solids
U. S. Public Health Dept. recommended limits for drinking water				---	---	---	125	250	500 [2]	0.3	0.05	10.0	0.9 1.7 [1]	---	---	1000 [2]
47 [4]	SE¼SE¼SW¼SE¼ sec. 31, T. 99 N., R. 51 W.	City Well No. 2	50	LO	171	31	46	6	371	0.9	1.3	0.3	0.4	7.1	620	914
64	SW¼SW¼SE¼NW¼ sec. 5, T. 98 N., R. 51 W.	H. P. Smit	32	LO	543		232	88	2160	4.16				7.4	2300	3150
62	NE¼NE¼NE¼SE¼ sec. 6, T. 98 N., R. 51 W.	W. Simmons	14	LO	233		81	110	505	T				7.5	910	1500
76	NE¼NE¼NE¼NW¼ sec. 8, T. 98 N., R. 51 W.	Auger Test No. 76	20-25	LO	76		15	0	0	0				7.6	250	380
34	SW¼SW¼SW¼SW¼ sec. 30, T. 99 N., R. 51 W.	Auger Test No. 34	130	LO	92		25	0	192	0.13				7.5	330	547
45	SE¼SE¼NW¼SE¼ sec. 31, T. 99 N., R. 51 W.	H. Opheim	12+	LO	200		87	14	648	0.31				7.4	860	1195
8	SE¼SE¼SE¼SE¼ sec. 10, T. 99 N., R. 52 W.	Auger Test No. 8	115	LO	132		37	0	252	0.07				7.5	480	731
26	NE¼NE¼NE¼SE¼ sec. 23, T. 99 N., R. 52 W.	Auger Test No. 26	120	LO	334		85	11	960	0.17				7.2	1180	1580
56	NW¼NW¼NW¼NE¼ sec. 2, T. 98 N., R. 52 W.	F. Oltmans	39	EO	632		85	118	745	0.71				7.6	560	1080
41	SE¼SE¼SE¼SW¼ sec. 31, T. 99 N., R. 52 W.	Auger Test No. 41	145	VO	106		21	O	162	0.96				7.9	350	480
3	SE¼SE¼SE¼SE¼ sec. 3, T. 99 N., R. 52 W.	H. Schoffelman	96	BG	265		37	T	935	0.03				7.8	810	1448
2	SE¼SE¼SE¼SE¼ sec. 4, T. 99 N., R. 52 W.	Auger Test No. 2	105	BG	193		29	T	336	0.24				7.6	600	912
10	SE¼SE¼NE¼NE¼ sec. 7, T. 99 N., R. 51 W.	E. Musch	180	BG	161		40	8	426	2.40				7.6	560	1080
16	SE¼SE¼SW¼SW¼ sec. 13, T. 99 N., R. 52 W.	M. Plucker	161	BG	205		46	25	815	9.20				7.2	700	1399
19	NW¼NW¼NW¼SW¼ sec. 17, T. 99 N., R. 51 W.	G. Rippentrop	400	BG	185		44	13	575	7.6				7.2	640	1212
30	SW¼SW¼NE¼NE¼ sec. 28, T. 99 N., R. 52 W.	City of Chancellor	560	BG	405		140	22	1150	0.07				7.5	1580	2260
49 [4]	NE¼SE¼SW¼NE¼ sec. 32, T. 99 N., R. 51 W.	City Well No. 1	480	BG&D	393	130	103	11	1153	4.5	1.3	0.0	0.4	7.1	1416	2300
50 [4]	NE¼SE¼SW¼NE¼ sec. 32, T. 99 N., R. 51 W.	City Well No. 3	293	BG	365	142	106	13	1164	3.4	1.5	0.0	0.5	7.1	1357	2296
51	SW¼NW¼NW¼SW¼ sec. 33, T. 99 N., R. 52 W.	M. Klinghagen	188	BG	237		51	14	624	2.32				7.3	800	1300
55	SW¼SW¼SW¼SW¼ sec. 3, T. 98 N., R. 52 W.	Auger Test No. 55	150	BG	168		29	0	36	0.17				7.6	560	850
72	NW¼NW¼NE¼SW¼ sec. 12, T. 98 N., R. 52 W.	A. Bossman	99	BG	592		188	T	1950	4.19				7.3	2240	2765
25	NE¼NE¼NE¼NE¼ sec. 23, T. 99 N., R. 52 W.	Auger Test No. 25	115	IL	559	348	590	54	4104	5	0.0	0.1	2.0		3821	6744
67	SE¼SE¼SE¼SE¼ sec. 1, T. 98 N., R. 51 W.	D. Boesel	72	IL	164		34	18	684	1.45				7.5	550	1220
11	SW¼SW¼SW¼SW¼ sec. 10, T. 99 N., R. 51 W.	Auger Test No. 11	105	IL	100		29	8	134	0.11				7.7	370	670
24	NE¼NE¼NE¼NE¼ sec. 13, T. 99 N., R. 51 W.	Auger Test No. 24	105	IL	552		270	10	3060	0.70				7.1	2475	3720
52	SE¼SE¼SW¼SW¼ sec. 34, T. 99 N., R. 51 W.	A. DeVries	27	IL	530		166	140	1440	0.01				7.4	2000	2550
65	NE¼NE¼NE¼NE¼ sec. 5, T. 98 N., R. 51 W.	Rotary Test No. 65	455	D	275		71	7	860	0				7.3	950	1450
38	NW¼SW¼SW¼SE¼ sec. 25, T. 99 N., R. 51 W.	J. Bruns	500	D	84	60	30	10	215	0.44		0			330	600
48	SW¼SW¼SW¼SW¼ sec. 32, T. 99 N., R. 51 W.	Leak in sewage Stabilization pond	0	---	350		67	360	1200	0.04				7.3	1150	2460

1. Optimum
2. Modified for South Dakota by the State Department of Health (written communication, March 20, 1968)
3. LO – Long Creek surface outwash
   EO – Elongate outwash southwest of Lennox
   VO – Vermillion Valley outwash
   BG – Basal sand and gravel (may include Sioux Wash and Sioux Quartzite)
   IL – Isolated layers of sand and gravel
   D – Dakota Formation
4. Public Water Supply Data, 1961
5. Analyzed by State Biochemical laboratory, Brookings, 1959

T – Trace of mineral present

Water samples 65 and 38 were obtained from the Dakota Formation. Sample 65 has excess sulfate and total solids while sample 38 has only excess iron. The water from test hole 65, which was drilled at the southeast corner of Lennox is three times as hard as water sample 38 which was obtained from a farm well 3¾ miles east of Lennox. The reason for the difference in quality of these water samples may be due to the fact that the casing in test hole 65 was not cemented and water from the basal gravel entered the well as it was being pumped.

CONCLUSIONS AND RECOMMENDATIONS

From the data collected during this survey it was found that: (1) surface outwash exists adjacent to Long Creek; in an elongate area southwest of Lennox; and in the Vermillion River valley; (2) a basal gravel exists directly upon the bedrock over nearly all the area; and an area of isolated sand and gravel layers is present south and east of Lennox; and (3) sandstones of the Dakota Formation constitute an aquifer in Lennox, and to the south and east.

From the above conclusions and on the basis of water quality, it is recommended that the city contract with a licensed engineer and a commercial drilling company licensed by the State of South Dakota to: (1) investigate Areas A and B (fig. 2) further by more test drilling to determine the lateral extent of the aquifer and the best location for a test well; (2) install several observation wells around the test well; (3) test pump the aquifer for a minimum of 72 hours to determine the yield, drawdown, and recovery of the well; (4) collect more water samples from the test well and observation wells for analysis. Should Areas A and B prove to be inadequate for water supplies, a test well should be installed, test pumped, and sampled in Area C (fig. 2) to determine the possibilities of a well completed in the Dakota Sandstone.

The city officials should consult the South Dakota Water Resources Commission with regard to obtaining a water right and permit to drill a city well, and the South Dakota Department of Health with regard to biological and chemical suitability of the water.

REFERENCES CITED

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APPENDIX A

Logs of test holes and wells in the Lennox area

(for location see figure 3)

Well No. 1
Driller's Log
Location: SE¼SE¼SE¼SE¼ sec. 35, T. 100 N., R. 51 W.
Surface elevation: 1470 feet
Depth to water: not measured

0- 53	Clay, yellow
53- 63	Clay, blue and coarse sand
63- 73	Clay, yellow and coarse sand
73- 78	Sand, some water
78- 82	Clay, yellow, firm
82- 90	Chalk rock
90- 96	Clay, some sand
96-128	Shale
128-134	Clay, blue, very hard, won't mix
134-146	Chalk rock
146-188	Clay, blue
188-208	Clay, black, smells like crude oil
208-212	Hard pan
212-218	Hard pan with fine sand
218-220	Sand rock; some water
220-239	Rock, lime cemented
239-244	Pipestone
244-437	Quartzite; 1 foot pipestone at 268 feet, 18 inches black clay at 306 feet, 6 inches black clay at 325 feet, brown clay at 345 feet

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Test Hole No. 2
SDGS Auger
Location: SE¼SE¼SE¼SE¼ sec. 4, T. 99 N., R. 52 W.
Surface elevation: 1425 feet
Depth to water: 77 feet

0- 1	Topsoil
1- 27	Clay, brown, pebbly
27- 52	Clay, gray, pebbly
52- 57	Clay, brown, pebbly
57- 77	Clay, gray, sandy
77- 92	Sand, clayey, fine grained
92-105	Shale, black

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Well No. 3
Driller's Log
Location: SE¼SE¼SE¼SE¼ sec. 3, T. 99 N., R. 52 W.
Surface elevation: 1415 feet
Depth to water: 66 feet

0- 76	Clay
76- 96	Shale
96-	Quartzite

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Well No. 4
Driller's Log
Location: NW¼NW¼NW¼SW¼ sec. 2, T. 99 N., R. 52 W.
Surface elevation: 1440 feet
Depth to water: not measured

0- 18	Clay, yellow
18- 35	Clay, blue
35- 40	Clay, yellow, soft and fine sand
40- 55	Clay, blue; hard
55- 60	Rock
60- 64	Sand
64- 65	Sand, cemented
65- 71	Clay, blue, hard
71- 79	Boulder
79- 86	Sand, coarse and blue clay
86- 90	Gravel and blue clay
90- 91	Sand and gravel

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Well No. 5
Driller's Log
Location: NE¼NE¼NW¼SE¼ sec. 5, T. 99 N., R. 51 W.
Surface elevation: 1410 feet
Depth to water: not measured

0- 2	Topsoil
2- 45	Clay, blue
45- 80	Gravel and blue clay
80-124	Clay, blue
124-126	Sand, coarse

* * * *

Test Hole No. 6
SDGS Auger
Location: SE¼SE¼SE¼SE¼ sec. 5, T. 99 N., R. 51 W.
Surface elevation: 1400± feet
Depth to water: 9 feet

0- 4	Topsoil
4- 27	Clay, brown, sandy
27-105	Clay, gray, sandy

* * * *

Test Hole No. 7
SDGS Rotary
Location: SW¼SW¼SW¼SW¼ sec. 2, T. 99 N., R. 51 W.
Surface elevation: 1430± feet
Depth to water: not measured

0- 35	Clay, yellowish brown, pebbly, from 20 to 35 feet rocks in spots, some cuttings look like loess
35- 65	Clay, gray, pebbly, from 50 to 65 feet little sand and coal layer
65- 89	Clay, gray, silty, pebbly, thin sand layers, rocks and cobbles
89-108	Gravel, coarse, some very hard rocks
108-110	Clay, light brown to yellow, silty
110-113	Gravel, coarse
113-125	Bedrock (Carlile Shale)

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Test Hole No. 8
SDGS Auger
Location: SE¼SE¼SE¼SE¼ sec. 10, T. 99 N., R. 52 W.
Surface elevation: 1372± feet
Depth to water: 7 feet

0- 7	Road fill
7- 17	Sand, brown, medium grained
17- 32	Clay, brown, sandy
32-107	Clay, gray, sandy
107-115	Clay, white; with red banding (old lake deposits?)

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Test Hole No. 9
SDGS Rotary
Location: NE¼NE¼NE¼NE¼ sec. 7, T. 99 N., R. 51 W.
Surface elevation: 1420 feet
Depth to water: not measured

0- 15	Clay, brown, pebbly, silty
15- 20	Clay, brownish gray, pebbly
20- 65	Clay, gray, pebbly, very tough
65- 70	No sample
70- 78	Sand and gravel, coarse
78- 84	Clay, gray, pebbly
84- 90	Gravel
90- 95	Clay, gray
95-110	Clay and gravel stringers
110-125	Clay, gray with sand and gravel stringers
125-155	Clay, gray, silty, gravelly in spots
155-162	No sample, drilled like coarse gravel
162-168	Shale? (some black organic rich(?) sand)
168-200	Clay, gray, silty, pebbly, black organic(?) clay
200-230	Sandstone(?)
230-265	Sand, cemented, clay stringers, pyrite, organic(?) black clay and very sandy brown clay
265-270	Abundant pyrite and white marl-like cuttings

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Well No. 10
No log available
Location: SE¼SE¼NE¼NE¼ sec. 7, T. 99 N., R. 51 W.
See Table 2 for water analysis

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Test Hole No. 11
SDGS Auger
Location: SW¼SW¼SW¼SW¼ sec. 10, T. 99 N., R. 51 W.
Surface elevation: 1380± feet
Depth to water: 14 feet

0- 2	Road fill
2- 17	Clay, brown, silty
17- 27	Sand, brown, fine grained, with some clay
27- 37	Clay, gray, pebbly
37-105	Clay, gray, sandy

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Well No. 12
Driller's Log
Location: NE¼NE¼NE¼SE¼ sec. 10, T. 99 N., R. 51 W.
Surface elevation: 1410 feet
Depth to water: 98 feet

0-119	Clay
119-200	Shale
200-	Quartzite

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Test Hole No. 13
SDGS Auger
Location: NE¼SE¼SE¼SE¼ sec. 16, T. 99 N., R. 52 W.
Surface elevation: 1375± feet
Depth to water: no water (?)

0- 1	Topsoil
1- 37	Clay, brown, silty, pebbly
37- 92	Clay, gray, pebbly, silty
92- 97	No sample, drills like shale

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Well No. 14
Driller's Log
Location: NW¼NE¼NE¼NW¼ sec. 15, T. 99 N., R. 52 W.
Surface elevation: 1420 feet
Depth to water: not measured

0 -82.5	Unreported
82.5-86.5	Sand
86.5-88.7	Clay, blue
88.7-	Quartzite

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Test Hole No. 15
SDGS Auger
Location: SE¼SE¼SE¼SE¼ sec. 15, T. 99 N., R. 52 W.
Surface elevation: 1400± feet
Depth to water: 62 feet

0- 2	Topsoil
2- 37	Clay, brown
37- 47	Clay, dark brown
47- 62	Sand, fine grained, light brown (Codell Member?)

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Well No. 16
Driller's Log
Location: SE¼SE¼SW¼SW¼ sec. 13, T. 99 N., R. 52 W.
Surface elevation: 1380 feet
Depth to water: 131 feet(?)

0-155	Clay
155-161	Sand and clay
161-	Quartzite

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Test Hole No. 17
SDGS Auger
Location: SE¼SE¼SE¼SE¼ sec. 13, T. 99 N., R. 52 W.
Surface elevation: 1398± feet
Depth to water: 67 feet

0- 3	Topsoil
3- 37	Clay, brown, pebbly
37- 82	Clay, gray, pebbly
82-100	Clay, gray, sandy

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Test Hole No. 18
SDGS Rotary
Location: NW¼NW¼NW¼NW¼ sec. 18, T. 99 N., R. 51 W.
Surface elevation: 1408 feet
Depth to water: not measured

0- 17	Clay, brown, silty, pebbly
17- 35	Clay, gray, pebbly
35- 95	Clay, gray, silty, pebbly, from 65 to 80 feet slightly sandy in spots
95-125	Clay, gray, silty, pebbly; no sample from 110 to 125 feet, drills like sand in spots
125-132	Sand, (western origin?), some very hard rocks
132-155	Bedrock, (Carlile Shale)

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Well No. 19
No log available
Location: NW¼NW¼NW¼SW¼ sec. 17, T. 99 N., R. 51 W.
See Table 2 for water analysis

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Well No. 20
Driller's Log
Location: SE¼NE¼NE¼SE¼ sec. 17, T. 99 N., R. 51 W.
Surface elevation: 1410 feet
Depth to water: not measured

0- 10	Topsoil
10- 20	Clay, yellow
20- 45	Clay, brown
45-105	Clay, blue
105-120	Sand, brown
120-136	Sand, fine, and yellow clay
136-145	Sand, blue, and yellow clay
145-146	Clay, blue
146-180	Iron pyrite layer
180-192	Sandrock

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Test Hole No. 21
SDGS Auger
Location: SE¼SE¼SE¼SE¼ sec. 16, T. 99 N., R. 51 W.
Surface elevation: 1388± feet
Depth to water: no water

0- 2	Topsoil
2- 42	Clay, brown, pebbly
42-115	Clay, gray, sandy

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Test Hole No. 22
SDGS Auger
Location: SE¼SE¼SE¼SE¼ sec. 15, T. 99 N., R. 51 W.
Surface elevation: 1380± feet
Depth to water: 30 feet

0- 3	Topsoil
3- 30	Clay, brown, pebbly
30- 72	Clay, brown, sandy
72- 95	Clay, gray, sandy

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Test Hole No. 23
SDGS Auger
Location: NW¼NW¼NW¼NW¼ sec. 13, T. 99 N., R. 51 W.
Surface elevation: 1400± feet
Depth to water: no water

0- 4	Topsoil, black
4- 17	Clay, brown, sandy
17- 95	Clay, gray, sandy

* * * *

Test Hole No. 24
SDGS Auger
Location: NE¼NE¼NE¼NE¼ sec. 13, T. 99 N., R. 51 W.
Surface elevation: 1415± feet
Depth to water: 42 feet

0- 1	Topsoil
1- 37	Clay, dark brown, few pebbles
37- 92	Clay, gray, sandy
92- 97	No sample, drills like shale
97-105	No sample, drills like sand
105-	Sioux Quartzite

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Test Hole No. 25
SDGS Auger
Location: NE¼NE¼NE¼NE¼ sec. 23, T. 99 N., R. 52 W.
Surface elevation: 1374± feet
Depth to water: 47 feet

0- 2	Topsoil
2- 42	Clay, brown, pebbly
42- 47	Clay, dark brown, pebbly
47-115	Clay, gray, sandy

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Test Hole No. 26
SDGS Auger
Location: NE¼NE¼NE¼SE¼ sec. 23, T. 99 N., R. 52 W.
Surface elevation: 1340± feet
Depth to water: 13 feet

0- 1	Topsoil
1- 7	Clay, brownish black
7- 12	Clay, brown, sandy
12- 17	Sand, clayey
17- 77	Clay, gray, sandy
77- 92	Clay, brown, very sandy
92-100	Clay, brown, sandy
100-120	Clay, gray, sandy
120-	Sioux Quartzite

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Test Hole No. 27
SDGS Auger
Location: NW¼NW¼NW¼NW¼ sec. 20, T. 99 N., R. 51 W.
Surface elevation: 1403± feet
Depth to water: 37 feet

0- 1	Topsoil
1- 22	Clay, brown, pebbly
22- 77	Clay, gray, pebbly

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Test Hole No. 28
SDGS Auger
Location: NE¼NE¼NE¼NE¼ sec. 20, T. 99 N., R. 51 W.
Surface elevation: 1407± feet
Depth to water: 72 feet

0- 2	Topsoil
2- 42	Clay, brown, pebbly
42- 72	Clay, gray, pebbly
72- 82	Sand, brown, fine grained
82-100	Clay, black, dry (Shale)

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Well No. 29
Driller's Log
Location: SE¼SW¼SW¼SE¼ sec. 19, T. 99 N., R. 50 W.
Surface elevation: 1380 feet
Depth to water: not measured

0 - 59	Clay, yellow, sand and gravel
59 -128	Clay, blue
128 -130	Sand and gravel
130 -157	Boulders
157 -164	Mud
164 -168	Gravel and boulders
168 -183	Sand, fine and clay
183 -215	Sandrock
215 -261	Sand, fine, water bearing
261 -267	Clay, blue
267 -322.9	Hardpan layers
322.9-421.4	Shale
421.4-439	Shale, hard pan layers at 422 and 438 feet
439 -440	Shale, thin sand layers
440 -451	Clay, soft and layered
451 -475	Sand rock

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Well No. 30
No log available
Location: SW¼SW¼NE¼NE¼ sec. 28, T. 99 N., R. 52 W.
See Table 2 for analysis

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Test Hole No. 31
SDGS Rotary
Location: SW¼SW¼SW¼SW¼ sec. 25, T. 99 N., R. 52 W.
Surface elevation: 1352 feet
Depth to water: not measured

0- 15	Clay, brown
15- 37	Clay, gray brown
37- 38	Chalk, weathered
38- 50	Clay, gray
50- 80	Clay, gray, sandy, silty, several sand layers
80- 88	Clay, gray
88- 95	Clay, gray, gravel layers
95-105	Clay, gray, pebbly
105-125	Clay, yellow brown, sandy from 110 to 125 feet
125-140	Sand, silty and clayey, less silt and clay downwards
140-155	Clay, brown
155-170	Clay, gray, soft (alluvium?), gravelly at bottom
170-176	Gravel
176-179	Rock, tough, hard (sandstone?)
179-181	Quartzite

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Test Hole No. 32
SDGS Auger
Location: NE¼NE¼NE¼NW¼ sec. 25, T. 99 N., R. 52 W.
Surface elevation: 1345± feet
Depth to water: 36 feet

0- 5	Clay, brown
5- 22	Gravel, brown
22- 57	Clay, gray and sandy, fine to medium grained
57- 65	Clay, gray, sandy
65-120	Clay, brown, sandy
120-122	Sioux Quartzite, fractured

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Test Hole No. 33
SDGS Rotary
Location: NW¼NW¼NW¼NW¼ sec. 30, T. 99 N., R. 51 W.
Surface elevation: 1360± feet
Depth to water: not measured

0- 31	Clay, brown
31- 80	Clay, gray, a few sand layers
80- 85	Sand (glacial)
85- 87	Silt, gray
87- 88	Gravel
88-110	Clay, yellowish-brown
110-130	Clay, gray
130-140	Gravel
140-147	Gravel, poorly sorted
147-151	Clay, light gray (Carlile)

Test Hole No. 33 -- continued.

151-158	Clay, black, calcareous, (Greenhorn)
158-160	Bentonite, very hard layers
160-163	Sand, pink, coarse, loosely consolidated
163-	No sample, drills like quartzite

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Test Hole No. 34
SDGS Auger
Location: SW¼SW¼SW¼SW¼ sec. 30, T. 99 N., R. 51 W.
Surface elevation: 1330± feet
Depth to water: 7 feet

0- 7	Clay, sand
7- 14	Gravel
14-130	Clay, gray, sandy

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Test Hole No. 35
SDGS Rotary
Location: SE¼SE¼SE¼SE¼ sec. 28, T. 99 N., R. 51 W.
Surface elevation: 1350 feet
Depth to water: not measured

0- 5	Topsoil, black
5- 16	Clay, light gray
16- 22	Clay, dark gray, pebbly
22- 25	Gravel, coarse
25- 43	Gravel and clay interbedded
43- 50	Clay, gray
50- 71	Clay, gray with thin gravel stringers
71- 80	Gravel
80-102	Clay, very silty, sandy with a few thin gravel stringers
102-108	Gravel, very coarse with rocks and cobbles
108-125	Clay, gray, silty, pebbly
125-148	Clay, gravelly
148-162	Gravel, very coarse
162-168	Clay, gray, silty, pebbly
168-199	Gravel, with clay stringers
199-215	Bedrock, shale

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Test Hole No. 36
SDGS Auger
Location: SE¼SE¼SE¼SE¼ sec. 27, T. 99 N., R. 51 W.
Surface elevation: 1350± feet
Depth to water: no water

0- 1	Topsoil
1- 12	Clay, brown, pebbly
12- 27	Clay, brown, sandy
27- 90	Clay, gray, silty

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Test Hole No. 37
SDGS Rotary
Location: NW¼NW¼NW¼NW¼ sec. 26, T. 99 N., R. 51 W.
Surface elevation: 1370± feet
Depth to water: not measured

0- 5	Clay, light gray, creamy, sandy, silty
5- 15	Clay, light-yellow-brown to brown, calcareous, pebbly
15- 65	Clay, gray
65- 80	Clay, silty or sandy
80- 95	Clay, gravelly
95-100	Gravel, clean, pea-size
100-125	Clay, gray
125-140	Gravel, clayey or clay, gravelly
140-155	Shale, poor samples, drills like Carlile
155-185	Clay, light medium gray, Carlile, soft

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Well No. 38
Driller's Log
Location: NW¼SW¼SW¼SE¼ sec. 25, T. 99 N., R. 51 W.
Surface elevation: 1355 feet
Depth to water: not measured

0 -182	Unreported
182 -204	Sand, fine and gravel
204 -212	Boulder, large
212 -454	Clay, blue
454 -459.5	Sandstone
459.5-460	Sandstone (Dakota)
460 -469.7	Clay, blue
469.7-500	Sandstone

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Test Hole No. 39
SDGS Rotary
Location: NW¼NW¼NW¼NW¼ sec. 30, T. 99 N., R. 50 W.
Surface elevation: 1350± feet
Depth to water: not measured

0- 2	Clay, black, alluvium
2- 4	Clay, brown, alluvium
4- 10	Clay, light-gray to cream colored
10- 17	Sand, (glacial)
17- 63	Clay, gray
63- 65	Sand, (glacial)
65-105	Clay, gray
105-135	Gravel, coarse, (glacial)
135-155	Clay, gray
155-183	Clay, gray, pebbly
183-235	Gravel, very coarse toward bottom
235-260	Clay, medium gray, soft, Carlile

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Test Hole No. 40
Driller's Log
Location: SW¼SW¼NE¼SW¼ sec. 31, T. 99 N., R. 52 W.
Surface elevation: 1335 feet
Depth to water: 12 feet

0- 1	Topsoil
1- 4	Sand, fine
4- 5	Sand
5- 32	Sand, angular
32- 33	Clay, blue

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Test Hole No. 41
SDGS Auger
Location: SE¼SE¼SE¼SW¼ sec. 31, T. 99 N., R. 52 W.
Surface elevation: 1285± feet
Depth to water: 18 feet

0- 1	Topsoil
1- 17	Gravel and sand, interbedded, brown
17- 32	Sand, gray, medium grained
32-145	Clay, gray, sandy

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Well No. 42
Driller's Log
Location: NW¼NW¼NW¼NE¼ sec. 33, T. 99 N., R. 52 W.
Surface elevation: 1340 feet
Depth to water: not measured

0- 6	Topsoil
6- 45	Clay, yellow
45-100	Clay, blue with sand and gravel
100-105	Boulder, yellow clay and sand
105-121	Sand

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Test Hole No. 43
SDGS Auger
Location: NW¼NW¼NW¼SE¼ sec. 31, T. 99 N., R. 51 W.
Surface elevation: 1324± feet
Depth to water: 28 feet

0- 4	Topsoil
4- 6	Clay, gray brown, silty (loess?)
6- 35	Clay, brown, silty, pebbly, sandy
35- 42	Gravel, gray, fine grained
42- 65	Sand, gray, coarse, silty
65-125	Clay, brownish-gray, sandy

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Test Hole No. 44
SDGS Rotary
Location: NE¼NE¼NE¼NE¼ sec. 31, T. 99 N., R. 51 W.
Surface elevation: 1350± feet
Depth to water: not measured

0- 33	Clay, brown, pebbly, tough
33- 46	Clay, gray, pebbly
46- 49	Gravel, with much clay
49- 65	Clay, gray, pebbly
65- 80	Clay, gray, silty, pebbly, sand and gravel layers
80- 95	Sand and gravel, coarse, clay layers
95-133	Clay, yellow-brown, silty, pebbly
133-172	Clay, gray, pebbly, very tough
172-292	Gravel, coarse, angular, quartzite chips; gravel and rocks from 185 to 200 feet; very coarse from 200 to 215 feet; quartz sand from 260 to 275 feet

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Well No. 45
No log available
Location: SE¼SE¼NW¼SE¼ sec. 31, T. 99 N., R. 51 W.
See Table 2 for water analysis

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Test Hole No. 46
SDGS Auger
Location: SE¼SW¼SW¼SE¼ sec. 31, T. 99 N., R. 51 W.
Surface elevation: 1325± feet
Depth to water: 18 feet

0- 8	Clay, brown, silty
8- 17	Sand, brown, fine grained
17-125	Clay, gray, sandy, silty

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Well No. 47
No log available
Location: SE¼SE¼SW¼SE¼ sec. 31, T. 99 N., R. 51 W.
See Table 2 for water analysis

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Well No. 48
No log available
Location: SW¼SW¼SW¼SW¼ sec. 32, T. 99 N., R. 51 W.
See Table 2 for water analysis

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Well No. 49
No log available
Location: NE¼SE¼SW¼NE¼ sec. 32, T. 99 N., R. 51 W.
See Table 2 for water analysis

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Well No. 50
Driller's Log
Location: NE¼SE¼SW¼NE¼ sec. 32, T. 99 N., R. 51 W.
Surface elevation: 1345 feet
Depth to water: not measured

0- 3	Topsoil and fill
3- 38	Clay, yellow
38- 68	Clay, blue
68- 77	Sand and blue clay layers; lime boulder at 72 feet
77- 95	Clay, blue
95-115	Clay, yellow
115-120	Sand and gravel
120-143	Clay, blue
143-153	Sand, fine
153-170	Clay, gray
170-180	Clay, yellow
180-245	Clay, blue, hard
245-292	Sand, medium to coarse

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Well No. 51
No log available
Location: SW¼NW¼NW¼SW¼ sec. 33, T. 99 N., R. 51 W.
See Table 2 for water analysis

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Well No. 52
No log available
Location: SE¼SE¼SW¼SW¼ sec. 34, T. 99 N., R. 51 W.
See Table 2 for water analysis

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Test Hole No. 53
SDGS Rotary
Location: NW¼SW¼SW¼SW¼ sec. 36, T. 99 N., R. 51 W.
Surface elevation: 1340± feet
Depth to water: not measured

0- 10	Clay, light gray, lake deposit(?)
10- 15	Clay, brown
15- 20	Clay, gray
20- 65	Clay, gray
65- 80	Sand, fine, with sandy clay interbedded
80-125	Clay (gray), sandy, silty; drills very easy; a few sand and gravel layers from 110 to 125 feet

Test Hole No. 53 – continued.

125-150	Clay, gray, tough, rocky and pebbly, drills easier from 140 to 150 feet
150-155	Gravel, pea-size
155-160	Clay, dark gray (Carlile?)
160-170	Clay, light to medium gray, (Carlile)

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Test Hole No. 54
SDGS Auger
Location: NW¼NW¼NW¼NW¼ sec. 4, T. 98 N., R. 52 W.
Surface elevation: 1310± feet
Depth to water: 14 feet

0- 4	Topsoil
4- 40	Clay, brown, sandy
40- 82	Clay, gray, pebbly
82-118	Clay, gray, sandy
118-	Quartzite

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Test Hole 55
SDGS Auger
Location: SW¼SW¼SW¼SW¼ sec. 3, T. 98 N., R. 52 W.
Surface elevation: 1307± feet
Depth to water: 17 feet

0- 1	Topsoil
1- 22	Clay, brown, sandy
22- 90	Clay, gray, pebbly
90-112	Sand, gray, small amount of clay
112-150	Sand, brown, clean, fine grained

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Well No. 56
Driller's Log
Location: NW¼NW¼NW¼NE¼ sec. 2, T. 98 N., R. 52 W.
Surface elevation: not available
Depth to water: 24 feet

0- 9	Topsoil and gravel
9- 24	Gravel
24- 39	Sand, water bearing

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Well No. 57
Driller's Log
Location: SE¼NE¼NE¼SE¼ sec. 2, T. 98 N., R. 52 W.
Surface elevation: not available
Depth to water: 20 feet

Well No. 57 – continued.

0- 2	Topsoil
2- 11	Gravel
11- 50	Sand

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Test Hole No. 58
SDGS Auger
Location: SE¼SE¼SE¼SE¼ sec. 2, T. 98 N., R. 52 W.
Surface elevation: 1327± feet
Depth to water: dry hole

0- 17	Clay, brown, silty
17- 32	Clay, dark brown, silty, pebbly
32- 55	Clay, dark brown, sandy

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Well No. 59
Driller's Log
Location: NE¼NE¼NW¼NW¼ sec. 6, T. 98 N., R. 51 W.
Surface elevation: not available
Depth to water: 7 feet

0- 13	Sand and gravel

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Test Hole No. 60
SDGS Auger
Location: SE¼SE¼NE¼NW¼ sec. 6, T. 98 N., R. 51 W.
Surface elevation: 1325± feet
Depth to water: no water

0- 2	Topsoil
2- 27	Clay, light brown, silty
27- 42	Clay, dark brown
42- 52	Clay, gray

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Test Hole No. 61
SDGS Auger
Location: SE¼SE¼NW¼NW¼ sec. 6, T. 98 N., R. 51 W.
Surface elevation: 1325± feet
Depth to water: no water

0- 3	Topsoil
3- 17	Clay, brown, sandy
17- 52	Clay, gray, silty
52- 72	Clay, gray, sandy

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Well No. 62
No log available
Location: NE¼NE¼NE¼SE¼ sec. 6, T. 98 N., R. 51 W.
See Table 2 for water analysis

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Test Hole No. 63
SDGS Auger
Location: SW¼SW¼SW¼SW¼ sec. 5, T. 98 N., R. 51 W.
Surface elevation: 1315± feet
Depth to water: no water

0- 1	Topsoil
1- 4	Clay, brown
4- 12	Gravel, brown, medium grained
12- 57	Clay, gray, sandy to silty
57-115	Clay, gray, silty

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Well No. 64
Driller's Log
Location: SW¼SW¼SE¼NW¼ sec. 5, T. 98 N., R. 51 W.
Surface elevation: 1315± feet
Depth to water: 20 feet

0- 20	Clay and gravel
20- 32	Sand

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Test Hole No. 65
SDGS Rotary
Location: NE¼NE¼NE¼NE¼ sec. 5, T. 98 N., R. 51 W.
Surface elevation: 1330 feet
Depth to water: not measured*

0- 17	Clay, yellowish-brown
17- 65	Clay, gray, sandy and silty in spots; gravelly around 60 feet
65- 80	Gravel, poorly sorted
80- 95	Silt, gray, sandy (alluvium)
95-110	Clay, gray (till)
110-125	Silt, gray, some gravel layers (alluvium)
125-155	Clay, gray, pebbly
155-170	Clay, green, sandy with gravel layers (alluvium)
170-185	Clay, greenish gray, red and brown
185-190	Clay, gray, some black organic(?) clay
190-200	Gravel, pea-size
200-230	Clay, gray, soft (drills like shale)
230-245	Clay, medium gray, blocky, slightly calcareous (shale)
245-260	Clay, black, hard, blocky, calcareous

Test Hole No. 65 – continued.

260-273	Clay, gray, soft, some sand, slightly calcareous
273-278	Clay, black, hard, brittle, calcareous
278-280	Limestone, crystalline
280-305	Sandstone
305-313	Sandstone, shale layers becoming thicker
313-318	Shale, very tough
318-375	Sandstone, cemented; shale layers near 335 feet, more shale at depth
375-395	Shale, compact, some sand layers
395-420	Shale and sandstone interbedded
420-435	Shale, dark gray, very tough, some black oily material
435-452	Shale, drills easy to 441 feet, then harder drilling
452-455	Sand, very loose; lost circulation

* Cased off glacial drift to 211 feet and pumped hole for approximately 12 hours getting about 50 gpm.

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Test Hole No. 66
SDGS Auger
Location: SW¼SW¼SW¼SW¼ sec. 4, T. 98 N., R. 51 W.
Surface elevation: 1320± feet
Depth to water: no water

0- 50	Clay, olive-brown, pebbly
50- 95	Clay, gray, silty, pebbly

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Well No. 67
No log available
Location: SE¼SE¼SE¼SE¼ sec. 1, T. 98 N., R. 51 W.
See Table 2 for water analysis

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Test Hole No. 68
Driller's Log
Location: NW¼SW¼NW¼SW¼ sec. 8, T. 98 N., R. 52 W.
Surface elevation: not available
Depth to water: 16 feet

0- 8	Topsoil
8- 13	Sand, fine
13- 17	Gravel, coarse
17- 26	Gravel and red clay
26-	Clay, blue

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Test Hole No. 69
Driller's Log
Location: SW¼SW¼SW¼SW¼ sec. 8, T. 98 N., R. 52 W.
Surface elevation: not available
Depth to water: 20 feet

0- 2	Topsoil
2- 7	Sand
7- 12	Sand and gravel
12- 17	Gravel
17- 31	Gravel and red clay
31-	Clay, blue

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Test Hole No. 70
Driller's Log
Location: SE¼SE¼SE¼SW¼ sec. 8, T. 98 N., R. 52 W.
Surface elevation: not available
Depth to water: 17 feet

0- 4	Topsoil, sandy
4- 14	Alluvium, clay, sandy
14- 43	Sand and gravel
43-	Clay, blue

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Well No. 71
Driller's Log
Location: SW¼SE¼SW¼SE¼ sec. 9, T. 98 N., R. 52 W.
Surface elevation: 1285 feet
Depth to water: 19 feet

0- 2	Topsoil
2- 20	Clay, yellow
20- 54	Clay, blue, with sand from 50 to 54 feet
54- 95	Sand, dry
95- 97	Sand, coarse and clay
97-105	Shale, green
105-109	Shale, sandy, dry
109-112	Chalk rock
112-113	Clay, hard
113-125	Chalk, soupy
125-127	Sand, brown, fine, water-bearing
127-137	Sand, gray, fine, sharp
137-144	Boulder
144-156	Fracture, yellow mud and sand
156-164	Clay (feed in)
164-169	Shale
169-	Pipestone

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Well No. 72
No log available
Location: NW¼NW¼NE¼SW¼ sec. 12, T. 98 N., R. 52 W.
See Table 2 for water analysis

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Test Hole No. 73
SDGS Rotary
Location: NE¼NE¼NE¼NE¼ sec. 12, T. 98 N., R. 52 W.
Surface elevation: 1325 feet
Depth to water: not measured

0- 20	Clay, yellow, silty, pebbly
20- 56	Clay, gray, silty, pebbly
56- 68	Sand and gravel, very coarse
68- 80	Till, gravelly, then gray clay, silty, pebbly
80- 95	Clay, gray, very silty in spots, sandy, pebbly
95-125	Clay, gray, silty, pebbly, a few thin gravel and sand stringers
125-200	Clay, gray, silty, sandy; drills very tough from 140 to 155 feet; clay, with very fine sand, drills easier from 155 to 185 feet; drills like very sandy clay with a few thin gravels from 185 to 200 feet
200-245	Gravel, coarse, lots of quartz in sample; lost circulation from 230 to 245 feet

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Test Hole No. 74
SDGS Auger
Location: SW¼SW¼SW¼SE¼ sec. 12, T. 98 N., R. 52 W.
Surface elevation: 1307± feet
Depth to water: 20 feet

0- 1	Topsoil
1- 12	Clay, brown, sandy
12- 20	Sand, brown, fine grained
20- 67	Sand, brown, fine grained, silty
67-102	Clay, gray, sandy, rocks between 67 and 85 feet
102-120	Clay, gray, pebbly

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Test Hole No. 75
SDGS Auger
Location: SE¼SE¼SE¼SE¼ sec. 12, T. 98 N., R. 52 W.
Surface elevation: 1300± feet
Depth to water: 8 feet

0- 27	Clay, light brown, silty, pebbly
27-100	Clay, gray, silty, pebbly, trace of sand, many large rocks

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Test Hole No. 76
SDGS Auger
Location: NE¼NE¼NE¼NW¼ sec. 8, T. 98 N., R. 51 W.
Surface elevation: 1314± feet
Depth to water: 12 feet

0- 6	Clay, brown
6- 50	Sand, medium to coarse with some fine gravel

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Test Hole No. 77
SDGS Auger
Location: SW¼SW¼SW¼NE¼ sec. 8, T. 98 N., R. 51 W.
Surface elevation: 1311± feet
Depth to water: 13 feet

0- 20	Clay, brown, sandy; some gravel at surface
20- 31	Sand, coarse, clayey
31- 50	Clay, gray, sandy

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Test Hole No. 78
SDGS Auger
Location: SW¼SW¼SW¼SW¼ sec. 8, T. 98 N., R. 51 W.
Surface elevation: 1303± feet
Depth to water: no water

0- 1	Topsoil
1- 32	Clay, brown, sandy
32- 80	Clay, gray, sandy (very hard drilling)

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Test Hole No. 79
SDGS Auger
Location: SE¼SE¼SE¼SW¼ sec. 8, T. 98 N., R. 51 W.
Surface elevation: 1310± feet
Depth to water: 16 feet

0- 6	Sand, rust-colored, clayey
6- 60	Sand, coarse and fine gravel, well-sorted
60- 70	Clay, gray, sandy, pebbly

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Test Hole No. 80
SDGS Rotary
Location: NE¼NE¼NE¼NW¼ sec. 10, T. 98 N., R. 51 W.
Surface elevation: 1320 feet
Depth to water: not measured

0- 25	Clay, yellow, pebbly; turning to brown at 15 feet
25- 80	Clay, gray, silty, pebbly; rocky from 50 to 65 feet; gravelly from 65 to 80 feet

Test Hole No. 80 – continued.

80-110	Clay, gray, silty, pebbly
110-140	Till, gravelly
140-148	Gravel, well sorted, coarse, some rocks
148-170	Shale

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Test Hole No. 81
SDGS Auger
Location: NW¼NW¼NW¼NW¼ sec. 11, T. 98 N., R. 51 W.
Surface elevation: 1325± feet
Depth to water: 50 feet

0- 1	Topsoil
1- 22	Clay, brown, sandy
22- 50	Clay, gray, pebbly
50-135	Clay, gray, sandy

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Test Hole No. 82
SDGS Rotary
Location: NW¼NW¼NW¼NW¼ sec. 14, T. 98 N., R. 52 W.
Surface elevation: 1300 feet
Depth to water: not measured

0- 25	Clay, yellow-brown, chalk from 10 feet
25- 35	Clay, gray, silty, pebbly
35- 65	Clay, gray, few gravel layers, shale pebbles; gravelly till from 50 to 65 feet
65- 70	Sand and gravel, well sorted
70- 95	Till, gravelly
95-110	Silt, brown, fine, some gravel
110-121	Gravel, coarse
121-140	Shale

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Test Hole No. 83
SDGS Rotary
Location: NE¼NE¼NE¼NE¼ sec. 17, T. 98 N., R. 51 W.
Surface elevation: 1295 feet
Depth to water: not measured

0- 4	Gravel
4- 50	Clay, gray, silty, pebbly
50- 65	Limestone, chalk, brown, hard; some fine sand
65- 80	Clay, gray, silty, sandy, pebbly
80- 93	Gravel, well sorted, peanut-size
93-140	Clay, gray, silty, sandy, pebbly, gravel layers from 125 to 140 feet
140-150	Clay, gray, silty, pebbly
150-159	Gravel, very coarse with large rocks
159-185	Shale

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Well No. 84
Driller's Log
Location: NE¼NE¼NW¼SW¼ sec. 14, T. 98 N., R. 51 W.
Surface elevation: 1315 feet
Depth to water: not measured

0- 84	Glacial drift
84- 90	Sand
90- 99	Chalk
	Lost all circulation at 99 feet

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Well No. 85
Driller's Log
Location: NW¼NW¼NW¼NW¼ sec. 19, T. 98 N., R. 51 W.
Surface elevation: not available
Depth to water: 15 feet

0- 3	Topsoil
3- 35	Sand

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Test Hole No. 86
SDGS Auger
Location: NW¼NW¼NE¼NW¼ sec. 20, T. 98 N., R. 51 W.
Surface elevation: 1297± feet
Depth to water: 14 feet

0- 32	Clay, light brown, silty, sandy
32- 65	Clay, gray, sandy, pebbly

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Test Hole No. 87
SDGS Auger
Location: NE¼NE¼NE¼NE¼ sec. 20, T. 98 N., R. 51 W.
Surface elevation: 1291± feet
Depth to water: dry hole

0- 25	Clay, light brown, silty, pebbly
25- 60	Clay, gray, silty, sandy
60- 95	Clay, gray, silty, pebbly

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APPENDIX B

Records of wells in the Lennox area

Geologic Source: N, Niobrara; Kd, Dakota; G, Glacial sand or gravel; Gt, Glacial till; S, Sioux wash; SQ, Sioux Quartzite
Use: D, Domestic; S, Stock

Name	Location	Depth of Well	Geologic Source	Use
Vietor, M.	NE¼NW¼NW¼NW¼ sec. 18, T. 98 N., R. 50 W.	189	N	S
Urdahl, W.	SW¼SW¼SW¼NW¼ sec. 1, T. 98 N., R. 51 W.	410	Kd	S
Boesel, D.	SE¼SE¼SE¼SE¼ sec. 1, T. 98 N., R. 51 W.	72	G	S&D
Fodness, D.	NE¼NE¼NE¼NE¼ sec. 3, T. 98 N., R. 51 W.	150	Gt	S
Kuper, H.	SE¼SE¼SE¼NE¼ sec. 5, T. 98 N., R. 51 W.	112	G	S
Smit, H. P.	SW¼SW¼SE¼NW¼ sec. 5, T. 98 N., R. 51 W.	32	G	S
Tipton, L.	NE¼NE¼NW¼NW¼ sec. 6, T. 98 N., R. 51 W.	13	G	S&D
Simmons, W.	NE¼NE¼NE¼SE¼ sec. 6, T. 98 N., R. 51 W.	14	G	S
Meyer, E.	NW¼NW¼NW¼NW¼ sec. 11, T. 98 N., R. 51 W.	30	G	S
Zell, E.	NE¼NE¼NE¼NW¼ sec. 12, T. 98 N., R. 51 W.	120	G	S
Gedstad, O. K.	SW¼SW¼SW¼SW¼ sec. 12, T. 98 N., R. 51 W.	150	G	S
Kuper, M.	SE¼NW¼NW¼NW¼ sec. 15, T. 98 N., R. 51 W.	450	Kd	S&D
Kuper, A.	NE¼NE¼NE¼SE¼ sec. 16, T. 98 N., R. 51 W.	480	Kd	S&D
Bultena, B.	NW¼NW¼NE¼NE¼ sec. 18, T. 98 N., R. 51 W.	125	G	S

Name	Location	Depth of Well	Geologic Source	Use
Buus, H.	NW¼NW¼NW¼NW¼ sec. 19, T. 98 N., R. 51 W.	35	G	S
Hoffman, J.	SE¼SE¼SE¼NE¼ sec. 20, T. 98 N., R. 51 W.	18	G	S&D
Murra, A.	NW¼NW¼NW¼NW¼ sec. 20, T. 98 N., R. 51 W.	186	G	S&D
Elock, E.	NE¼NE¼NE¼NE¼ sec. 28, T. 98 N., R. 51 W.	458	Kd	S&D
Elock, C.	SW¼SW¼NW¼NW¼ sec. 28, T. 98 N., R. 51 W.	400	Kd	S&D
Mechels, C.	NE¼NE¼NW¼SW¼ sec. 1, T. 98 N., R. 52 W.	120	G	S&D
Oltmans, F.	NW¼NW¼NW¼NE¼ sec. 2, T. 98 N., R. 52 W.	39	G	S
Poppenga, R. D.	SE¼NE¼NE¼SE¼ sec. 2, T. 98 N., R. 52 W.	50	G	S
Kock, F.	NE¼NE¼NW¼NW¼ sec. 3, T. 98 N., R. 52 W.	108	S	S
Buseman, E.	NW¼SW¼SW¼SW¼ sec. 3, T. 98 N., R. 52 W.	85	G	S
Harms, H.	NW¼NW¼NE¼NE¼ sec. 4, T. 98 N., R. 52 W.	120	G	S
Victor, L.	NW¼NW¼NW¼NE¼ sec. 8, T. 98 N., R. 52 W.	100	G	S&D
Stoddard, M.	SE¼SE¼SE¼SE¼ sec. 8, T. 98 N., R. 52 W.	150	G	S&D
Victor P.	NW¼NW¼NW¼NW¼ sec. 9, T. 98 N., R. 52 W.	125	G	S
Plucker, V.	SE¼SW¼SW¼SE¼ sec. 9, T. 98 N., R. 52 W.	169	S	S&D
Victor, H.	NE¼NE¼NE¼NW¼ sec. 10, T. 98 N., R. 52 W.	130	G	S
Bossman, B.	NE¼NE¼NE¼NW¼ sec. 11, T. 98 N., R. 52 W.	140	G	S
Poppenga, R. B.	SW¼SW¼SW¼NW¼ sec. 11, T. 98 N., R. 52 W.	109	G	S

Name	Location	Depth of Well	Geologic Source	Use
Bossman, A.	NW¼NW¼NE¼SW¼ sec. 12, T. 98 N., R. 52 W.	99	S?	S
Bossman, A.	NW¼NW¼NE¼SW¼ sec. 12, T. 98 N., R. 52 W.	20	G	S
Buse, W.	SE¼SE¼SE¼NE¼ sec. 13, T. 98 N., R. 52 W.	20	G	S&D
Kuper, A.	NW¼NW¼NW¼NW¼ sec. 13, T. 98 N., R. 52 W.	120	G	S&D
Kuper, N.	SW¼SW¼SW¼SE¼ sec. 15, T. 98 N., R. 52 W.	120	G	S&D
Meyer, P.	SE¼NE¼NE¼NE¼ sec. 23, T. 98 N., R. 52 W.	200	G	S&D
Schriever, D.	NW¼SW¼NE¼NW¼ sec. 7, T. 99 N., R. 50 W.	140	G	S&D
Stoffers, E.	SE¼SE¼SE¼SW¼ sec. 19, T. 99 N., R. 50 W.	80	G	S
Bruns, J.	NE¼SE¼SE¼SE¼ sec. 30, T. 99 N., R. 50 W.	120	G	S
Schmidt, G.	SW¼SE¼SE¼NE¼ sec. 31, T. 99 N., R. 50 W.	90	G	S
Poppens, H.	SW¼SW¼NW¼NW¼ sec. 2, T. 99 N., R. 51 W.	20	G	S&D
Schoffelman, J.	NW¼NE¼NE¼NW¼ sec. 4, T. 99 N., R. 51 W.	128	G	S
Groeneveld, O.	NE¼NE¼SE¼SE¼ sec. 4, T. 99 N., R. 51 W.	154	G	S
Plucker, R.	NW¼NW¼SE¼NE¼ sec. 6, T. 99 N., R. 51 W.	171	G	S
Musch, E.	SE¼SE¼NE¼NE¼ sec. 7, T. 99 N., R. 51 W.	180	G	S&D
Brass, E.	SW¼SW¼NW¼NW¼ sec. 10, T. 99 N., R. 51 W.	130	G	S
Fokken, E.	SE¼SE¼SE¼SW¼ sec. 10, T. 99 N., R. 51 W.	12	G	D
Poppens, W.	NE¼NE¼NE¼SE¼ sec. 10, T. 99 N., R. 51 W.	200	S	S

Name	Location	Depth of Well	Geologic Source	Use
Knock, L.	SE¼NE¼NE¼NE¼ sec. 11, T. 99 N., R. 51 W.	300	SQ	S
Poppens, L.	NW¼NE¼NE¼NE¼ sec. 13, T. 99 N., R. 51 W.	90	S	S
Blumhoff, L.	NE¼NE¼NE¼NE¼ sec. 14, T. 99 N., R. 51 W.	150	S	S
Hoogestraat, S.	SW¼SE¼NW¼NW¼ sec. 16, T. 99 N., R. 51 W.	55	G	S
Rippentrop, G.	NW¼NW¼NW¼SW¼ sec. 17, T. 99 N., R. 51 W.	400	SQ	S&D
Ludens, A.	SW¼SE¼SE¼SE¼ sec. 19, T. 99 N., R. 51 W.	106	G	S
Javers, T.	NW¼NW¼NW¼NE¼ sec. 20, T. 99 N., R. 51 W.	18	Gt	S&D
Skie, H.	NE¼SE¼SE¼SE¼ sec. 20, T. 99 N., R. 51 W.	126	G	S
Ulberg, J.	NE¼SE¼SE¼SE¼ sec. 22, T. 99 N., R. 51 W.	165	G	S
Oltmans, B.	NW¼NW¼NW¼NW¼ sec. 23, T. 99 N., R. 51 W.	140	G	S
Naatjes, H.	SE¼SE¼SW¼SE¼ sec. 23, T. 99 N., R. 51 W.	100	G	S
Kaastra, C.	SW¼SW¼NW¼NW¼ sec. 24, T. 99 N., R. 51 W.	20	G	S&D
Bruns, J.	NW¼SW¼SW¼SE¼ sec. 25, T. 99 N., R. 51 W.	500	Kd	D
Bick, R.	SE¼SW¼SW¼SW¼ sec. 26, T. 99 N., R. 51 W.	30	G	S&D
Poppens, M.	SE¼SE¼SW¼SW¼ sec. 28, T. 99 N., R. 51 W.	16	G	S
Brass, H.	SW¼SW¼SE¼SE¼ sec. 28, T. 99 N., R. 51 W.	153	G	S
Simonsen, A.	SW¼SW¼NW¼NW¼ sec. 30, T. 99 N., R. 51 W.	150	G	S
Harms, W.	NW¼NW¼NW¼NW¼ sec. 31, T. 99 N., R. 51 W.	30	G	S&D

Name	Location	Depth of Well	Geologic Source	Use
Klinghagen, M.	SW¼NW¼NW¼SW¼ sec. 33, T. 99 N., R. 51 W.	188	G	S
Johnson, R. G.	SW¼SW¼SE¼SE¼ sec. 33, T. 99 N., R. 51 W.	140	Gt	S&D
Johnson, R. G.	SW¼SW¼SE¼SE¼ sec. 33, T. 99 N., R. 51 W.	15	G	S
DeVries, A.	SE¼SE¼SW¼SW¼ sec. 34, T. 99 N., R. 51 W.	27	G	S&D
Valentien, J.	NE¼NE¼NW¼NW¼ sec. 36, T. 99 N., R. 51 W.	170	Gt	S
VanLoh, B.	NW¼SW¼SW¼SE¼ sec. 36, T. 99 N., R. 51 W.	14	G	S
Albers, H.	SE¼SE¼SE¼SW¼ sec. 1, T. 99 N., R. 52 W.	90	G	S
Meyer, F.	SE¼SE¼NE¼NE¼ sec. 3, T. 99 N., R. 52 W.	90	G	S
Schoffelman, H.	SE¼SE¼SE¼SE¼ sec. 3, T. 99 N., R. 52 W.	96	S	S&D
Klock, V.	NE¼NE¼SE¼NE¼ sec. 4, T. 99 N., R. 52 W.	45	G	S
Smith, M.	SE¼SE¼NE¼NE¼ sec. 5, T. 99 N., R. 52 W.	60	G	S&D
Heibult, E.	SE¼SW¼SW¼SW¼ sec. 8, T. 99 N., R. 52 W.	108	S	S
VanDiest, L.	NE¼NE¼SE¼SE¼ sec. 9, T. 99 N., R. 52 W.	35	G	S
Plucker, A.	NE¼NE¼NE¼SE¼ sec. 10, T. 99 N., R. 52 W.	70	G	S&D
Andernacht, H.	SW¼SW¼SE¼SE¼ sec. 11, T. 99 N., R. 52 W.	100	G	S
Plucker, Elmer	SE¼SE¼NE¼NE¼ sec. 12, T. 99 N., R. 52 W.	140	?	S
DeVries, E.	SE¼SE¼SE¼SE¼ sec. 12, T. 99 N., R. 52 W.	198	S	S&D

Name	Location	Depth of Well	Geologic Source	Use
Plucker, M.	SE¼SE¼SW¼SW¼ sec. 13, T. 99 N., R. 52 W.	161	S	S
Klock, H.	SW¼SE¼SE¼SE¼ sec. 16, T. 99 N., R. 52 W.	100	S	S
Weeldreyer, W.	SW¼SW¼SW¼SW¼ sec. 17, T. 99 N., R. 52 W.	18	G	S
Plucker, Enno	SE¼SE¼SE¼SW¼ sec. 20, T. 99 N., R. 52 W.	70	G	S&D
Haan, F.	NW¼NW¼NW¼NE¼ sec. 22, T. 99 N., R. 52 W.	128	SQ	S&D
Tippery, A.	SE¼SE¼SW¼SW¼ sec. 22, T. 99 N., R. 52 W.	600(?)	SQ	S
Rust, J.	SE¼SE¼SE¼NE¼ sec. 23, T. 99 N., R. 52 W.	26	G	S
Harms, D.	NW¼NW¼NW¼NW¼ sec. 23, T. 99 N., R. 52 W.	100(?)	S	S
Haan, F.	SE¼SW¼SW¼SW¼ sec. 23, T. 99 N., R. 52 W.	126	Gt	S
Plucker, S.	SE¼SE¼SW¼SW¼ sec. 25, T. 99 N., R. 52 W.	50	G	S
Smit, G.	SE¼SE¼SW¼SW¼ sec. 27, T. 99 N., R. 52 W.	100	S	S
City of Chancellor	SW¼SW¼NE¼NE¼ sec. 28, T. 99 N., R. 52 W.	560	SQ	S&D
Hammerstron, E.	NW¼NW¼NW¼NW¼ sec. 28, T. 99 N., R. 52 W.	180	S	S&D
Wilts, W.	SE¼SE¼SE¼SW¼ sec. 29, T. 99 N., R. 52 W.	200	SQ	S
VanHove, A.	SE¼SE¼SE¼SW¼ sec. 30, T. 99 N., R. 52 W.	52	G	S&D
Sigl, J.	SW¼SE¼SE¼NE¼ sec. 32, T. 99 N., R. 52 W.	187	SQ	S
Victor, H. C.	SE¼SE¼NE¼NE¼ sec. 34, T. 99 N., R. 52 W.	180	S	S
Meier, C.	NE¼SE¼SE¼SE¼ sec. 34, T. 99 N., R. 52 W.	187	G	S

Name	Location	Depth of Well	Geologic Source	Use
Anderson, E. P.	NE¼NW¼NW¼NW¼ sec. 35, T. 99 N., R. 52 W.	185	S	S&D
Bossman, E.	SW¼SW¼SW¼SE¼ sec. 36, T. 99 N., R. 52 W.	210	G	S
Rippentrop, F.	NW¼NW¼NE¼NE¼ sec. 31, T. 100 N., R. 51 W.	136	G	S
Weeldreyer, W.	SW¼SW¼SE¼SW¼ sec. 29, T. 100 N., R. 52 W.	90	N(?)	S&D
Weeldreyer, C.	SW¼SW¼SW¼NW¼ sec. 34, T. 100 N., R. 52 W.	236	SQ	S&D