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DEPARTMENT OF WATER AND NATURAL RESOURCES
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SOUTH DAKOTA GEOLOGICAL SURVEY
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Open-File Report No. 35-UR

GROUND-WATER STUDY FOR THE CITY OF FAIRVIEW, SOUTH DAKOTA

by

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INTRODUCTION

This report contains the results of a ground-water investigation conducted by the South Dakota Geological Survey for the City of Fairview, Lincoln County, South Dakota. Field work was conducted from June 2 to June 25, 1980, and on August 21 and August 22, 1980. The investigation included drilling 23 test holes (fig. 1, app. A), construction of 9 observation wells (fig. 1), and collecting and analyzing 47 water samples (fig. 2, table 1, app. B).

The investigation was financed by the South Dakota Geological Survey, the East Dakota Conservancy Sub-District, and the City of Fairview.

Fairview currently obtains its water from a 60-foot glacial outwash well located within the city limits. In past years, chemical analyses of the city water have shown a high concentration (17.5 parts per million) of nitrate in an otherwise chemically acceptable drinking water (samples 5 and 6, fig. 2, table 1, app. B). Inspection of the immediate vicinity of the city well found potential contamination sources in the form of septic tanks, cesspools, and fertilizer storage. Consequently, the South Dakota Geological Survey was asked to locate a new source of ground water in the vicinity of Fairview.

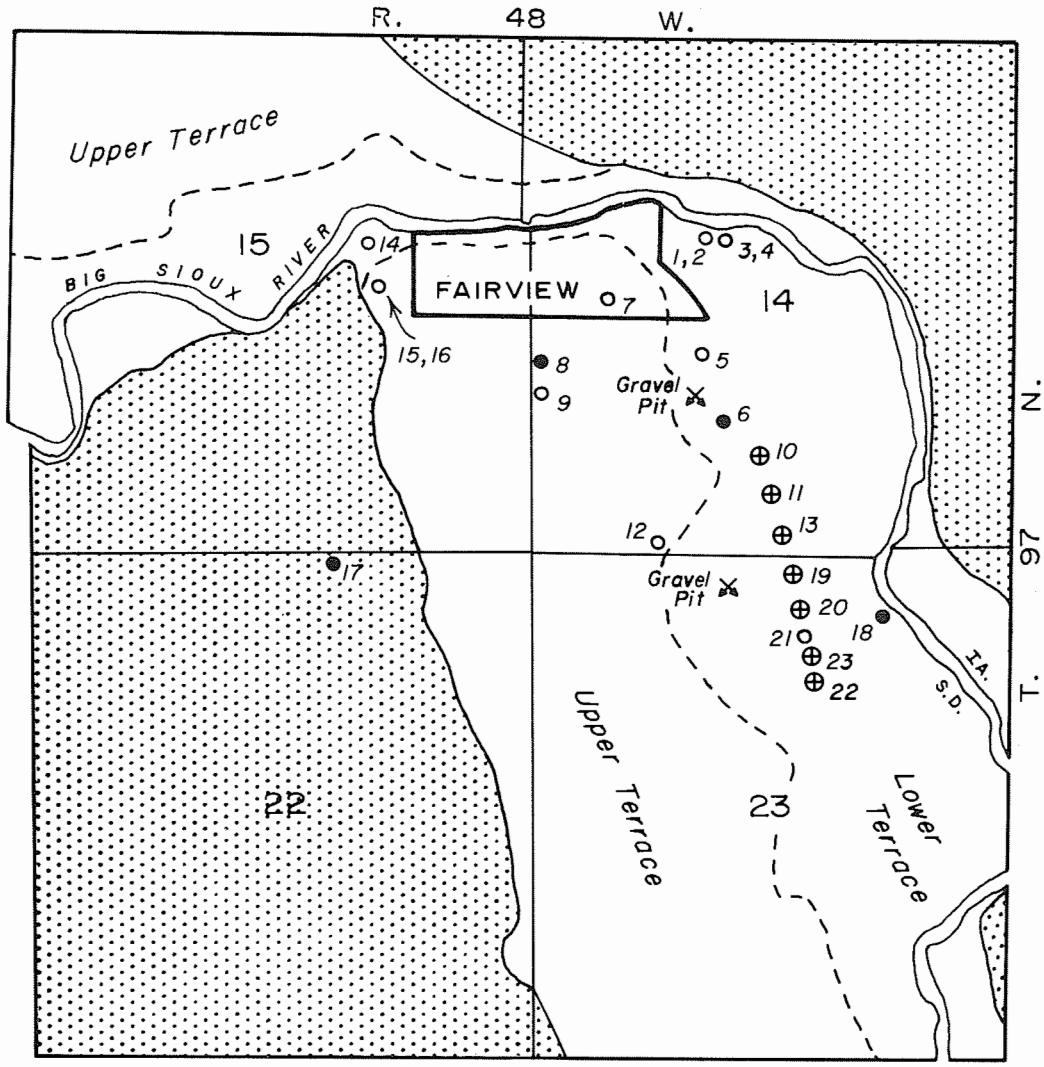
GROUND WATER IN SURFICIAL DEPOSITS

Glacial Deposits

Two types of glacial deposits occur in the Fairview area: till and outwash. Till, which consists of poorly sorted, nonstratified sand and gravel in a dense clay matrix, crops out along the bluffs of the Big Sioux River and forms the high undulating plain beyond the bluffs. Outwash consists of stratified, coarse sand and gravel with minor clay content, is more permeable than till, and is capable of yielding significant quantities of water.

Outwash follows and extends across the Big Sioux River valley to the base of the bluffs. In the Fairview area, the outwash is separated, topographically, into upper and lower terraces (fig. 1). The upper terrace is composed of dry, stratified, coarse sand and gravel with an average thickness of 29.5 feet (rotary test holes at Map Locations (ML) 7, 9, 12, and 16, fig. 1, app. A). The lower terrace has, on the average, 7 feet of saturated coarse sand and gravel to the north and east of Fairview and 22.6 feet of saturated sand and gravel south of town (fig. 3).

The first exploration site was east of Fairview at ML 1, 2, 3, and 4 (fig. 1, app. A). Test holes were located along a narrow access road near the northern rim of the lower outwash terrace. The test holes encountered a sequence of gravel and clay lenses approximately 18 feet thick, which was overlain by 20 feet of



Glacial Outwash-*chiefly sand and gravel except for a thin overlying veneer of alluvium along the Big Sioux River*

Glacial Till-*poorly sorted, non-stratified sediments consisting of sand and gravel in a dense clay matrix*

Rim of the upper outwash terrace

●6 Rotary test hole — *Map location no. corresponds to log in app. A.*

○5 Rotary test hole with observation well

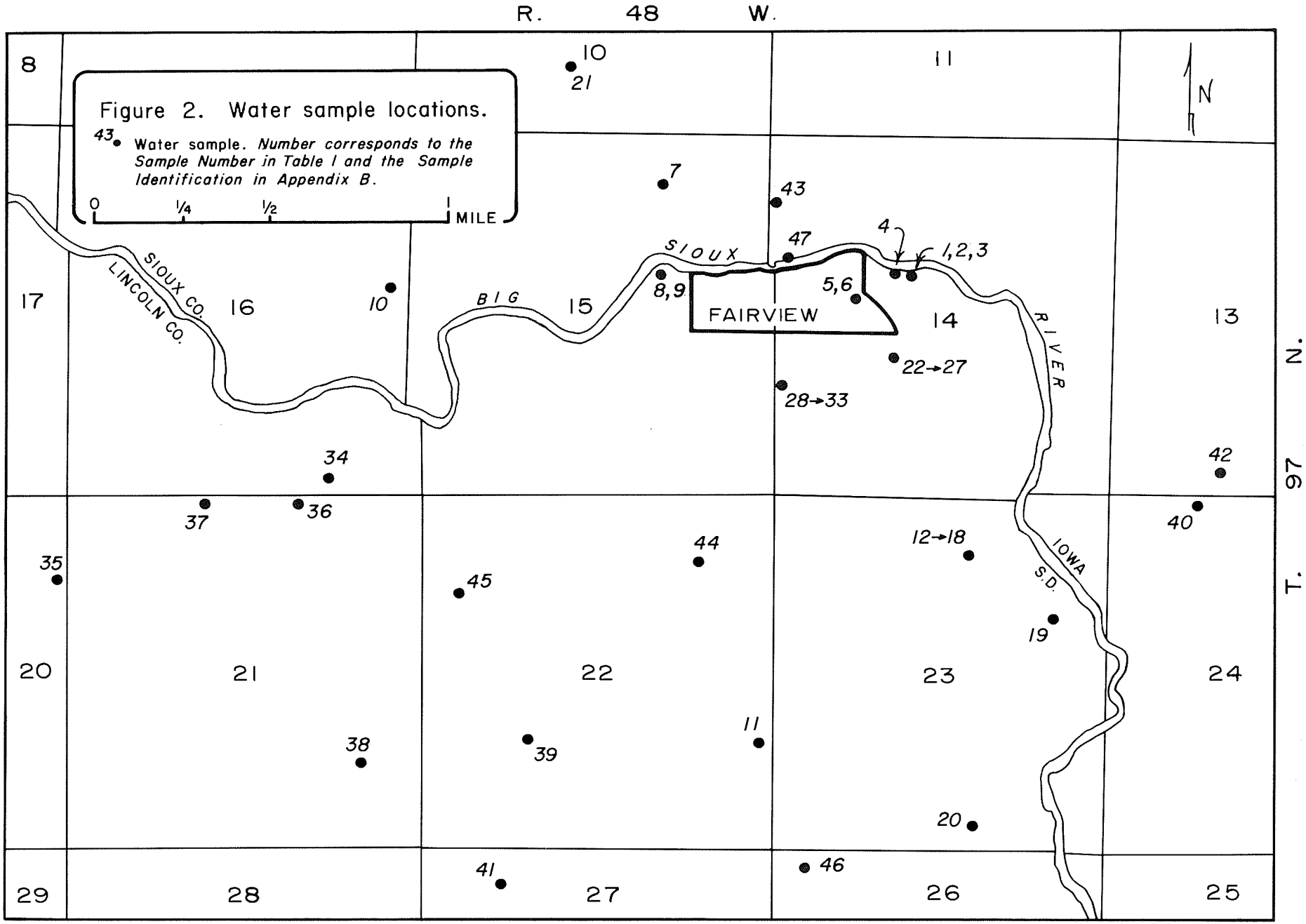
⊕10 Auger test hole-*map location no. corresponds to log in app. B.*

N

0 1/2 MILES

Sec. 14, 15, 22, 23 T. 97 N. R. 48 W.

Figure 1. General geologic map of the Fairview area including the locations of test holes and observation wells.


R. 48 W.
T. 97 N.
Figure 2. Water sample locations.
43 Water sample. Number corresponds to the Sample Number in Table I and the Sample Identification in Appendix B.
0 1/4 1/2 1 MILE
N
SIOUX CO.
LINCOLN CO.
BIG SIOUX RIVER
IOWA S.D.
FAIRVIEW
8
10
21
11
17
16
15
14
13
20
21
22
23
24
29
28
27
26
25
7
43
47
4
1,2,3
5,6
8,9
22→27
28→33
34
37
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42
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35
45
44
12→18
19
38
39
11
20
41
46

TABLE 1. Chemical analyses of water samples collected (Refer to app. B for location of water sample)

SAMPLE (1)	WATER SOURCE (2)	SAMPLING PROCEDURE (3)	PARTS PER MILLION				
			CALCIUM (4)	SODIUM (5)	MAGNESIUM (6)	IRON (7)	MANGANESE (8)
A	----	--	---	---	-----	0.30[1]	0.05[1]
1	BS-S	F1	105	39	33.0	<0.03	0.56
2	BS-S	F1	108	34	33.0	0.07	0.59
3	BS-S	NF	113	30	34.0	2.40	0.69
4	BS-S	F1	112	23	27.0	<0.03	0.04
5	BS-S	SA	100	20	38.0	<0.10	<0.02
6	BS-S	NF	113	22	36.0	<0.05	<0.05
7	BS-S	NF	175	12	46.0	0.32	0.34
8	BS-S	F1	88	12	28.0	0.05	<0.05
9	BS-S	F1	88	11	29.0	<0.05	<0.05
10	BS-S	NF	208	36	67.0	<0.05	<0.05
11	BS-S	NF	172	14	38.0	<0.05	<0.05
12	BS-S	F1	103	13	29.2	<0.05	0.30
13	BS-S	F1	83	12	26.0	0.06	0.28
14	BS-S	F1	82	11	26.0	0.06	0.30
15	BS-S	NF	112	10	30.0	0.60	0.33
16	BS-S	F1	78	10	25.0	0.05	0.27
17	BS-S	F2	90	10	25.6	0.05	0.38
18	BS-S	SA	71	10	22.8	2.30	0.43
19	BS-S	NF	108	6	27.4	<0.05	<0.05
20	BS-S	NF	105	8	32.7	<0.05	<0.05
21	Kd	NF	87	96	33.0	2.60	0.07
22	Kd	F1	82	135	32.0	0.09	<0.05

in the vicinity of Fairview.

PARTS PER MILLION						MICROMHOS
CHLORIDE (9)	FLUORIDE (10)	NITRATE NITROGEN (11)	SULFATE (12)	HARDNESS $CaCO_3$ (13)	TOTAL DISSOLVED SOLIDS (14)	CONDUCTIVITY (15)
250.0[1]	1.40-2.40[2]	10.00[2]	250[1]	----	500[1]	----
25.0	0.27	0.18	140	397	540	790
22.5	0.26	0.20	140	405	524	800
22.9	0.26	0.20	140	421	528	795
20.0	0.28	7.00	35	390	496	905
29.0	0.20	17.50	62	404	538	----
35.0	0.28	15.00	40	427	600	790
<5.0	0.42	2.20	280	625	680	920
5.0	0.42	3.20	105	334	400	660
4.8	0.41	3.60	103	338	392	650
92.5	0.30	47.50	25	793	1280	1510
<5.0	0.36	<0.50	280	585	820	880
20.0	0.34	<0.05	125	376	476	660
7.5	0.33	<0.05	50	314	396	620
2.6	0.31	<0.05	45	311	352	590
2.6	0.28	<0.05	41	402	348	590
2.3	0.33	<0.10	65	297	344	610
<2.0	0.24	<0.10	56	329	398	586
<0.2	0.23	<0.10	56	271	505	594
<6.0	0.29	8.80	23	382	400	720
10.0	0.40	17.50	40	396	504	720
16.0	1.10	<0.50	235	352	665	910
12.5	0.98	<0.10	355	336	712	1150

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
23	Kd	NF	125	145	34.0	<0.05	0.28
24	Kd	F1	70	139	29.0	<0.05	<0.05
25	Kd	F1	71	140	30.0	<0.05	<0.05
26	Kd	F2	87	147	31.0	0.02	0.04
27	Kd	SA	58	146	27.7	4.40	0.08
28	Kd	F1	87	47	33.0	0.16	<0.05
29	Kd	F1	83	56	32.0	0.06	<0.05
30	Kd	F1	84	60	32.0	0.07	<0.05
31	Kd	F1	87	61	31.0	<0.05	0.06
32	Kd	NF	88	68	32.0	2.70	0.22
33	Kd	F1	87	68	33.0	<0.05	0.08
34	Kd	NF	100	171	34.0	1.99	0.09
35	Kd	NF	82	180	25.5	2.74	0.15
36	kd	NF	93	170	31.0	1.10	0.10
37	Kd	NF	95	230	32.0	0.60	<0.05
38	Kd	NF	82	228	26.0	0.23	0.12
39	Kd	NF	92	216	29.0	0.56	0.15
40	Kd	NF	115	83	46.0	3.90	0.10
41	Kd	NF	80	200	30.0	2.40	0.07
42	UND	NF	210	21	58.0	0.06	<0.05
43	UND	NF	350	43	96.0	0.05	<0.05
44	UND	NF	360	24	74.0	2.00	0.08
45	UND	NF	575	62	120.0	0.06	0.10
46	UND	NF	205	18	49.0	1.63	0.70
47	BSR	NF	82	15	24.3	0.64	2.50

(9)	(10)	(11)	(12)	(13)	(14)	(15)
13.5	1.05	<0.10	360	451	788	1170
16.0	1.15	<0.10	338	293	684	1050
17.5	1.19	<0.10	325	300	700	1140
18.0	1.15	0.40	----	344	792	1180
14.1	1.08	<0.10	287	259	1040	1166
17.5	0.73	0.48	250	352	560	860
17.5	0.82	<0.10	250	338	544	900
17.5	0.84	<0.10	250	341	548	910
15.0	0.82	<0.10	265	344	552	890
17.5	0.88	<0.10	275	351	588	940
17.5	0.87	<0.10	285	352	592	920
18.0	1.28	<0.30	263	389	880	1390
20.0	1.48	<0.30	245	309	868	1320
18.0	1.22	<0.30	245	359	864	1330
18.0	1.25	2.10	413	368	1060	1565
25.0	1.58	<0.50	310	311	780	1470
23.5	1.49	0.30	562	348	1016	1520
12.0	1.06	<0.05	525	475	512	1060
25.0	1.40	<0.05	425	323	1024	1520
42.5	0.20	100.00	----	761	1332	1480
17.5	0.68	6.00	825	1266	1650	1750
24.0	0.41	11.00	700	1201	1330	1450
24.0	0.58	7.15	1295	1925	2240	2260
13.0	0.31	1.60	350	712	924	1200
20.5	0.36	1.80	60	304	272	410

SAMPLE A

1 United States Environmental Protection Agency "National Secondary Drinking Water Regulations" -- July 19, 1979 (recommended limits).

2 United States Environmental Protection Agency "National Interim Primary Drinking water Regulations" -- December 24, 1975 (enforceable limits).

WATER SOURCE

BS-S	Big Sioux Aquifer - South Management Unit
BSR	Big Sioux River
Kd	Dakota Formation
UND	Undifferentiated

SAMPLING PROCEDURE

NF The water sample was collected in two bottles; one bottle was preserved with nitric acid, the other with formaldehyde. The sample was not filtered at the time of collection or analysis.

F1 The water sample was collected in two bottles; one bottle was preserved with nitric acid, the other with formaldehyde. The sample was filtered at the time of collection.

F2 The water sample was collected in three bottles; the first bottle was preserved with nitric acid, the second bottle was preserved with sulfuric acid, and the third bottle remained untreated. The sample was filtered at the time of collection.

SA The water sample was collected in three bottles; two of the three bottles were treated with chemical preservatives. The sample was not filtered at the time of collection, but filtered at the time of analysis.

Samples designated NF, F1 and F2 were analyzed by the South Dakota Geological Survey, Vermillion, South Dakota.

Samples designated SA were analyzed by the State Health Laboratory and financed by the Office of Drinking water, Department of Water and Natural Resources, Pierre, South Dakota.

Expanded chemical analyses of samples 18 and 27 are located in tables 2 and 3, respectively.

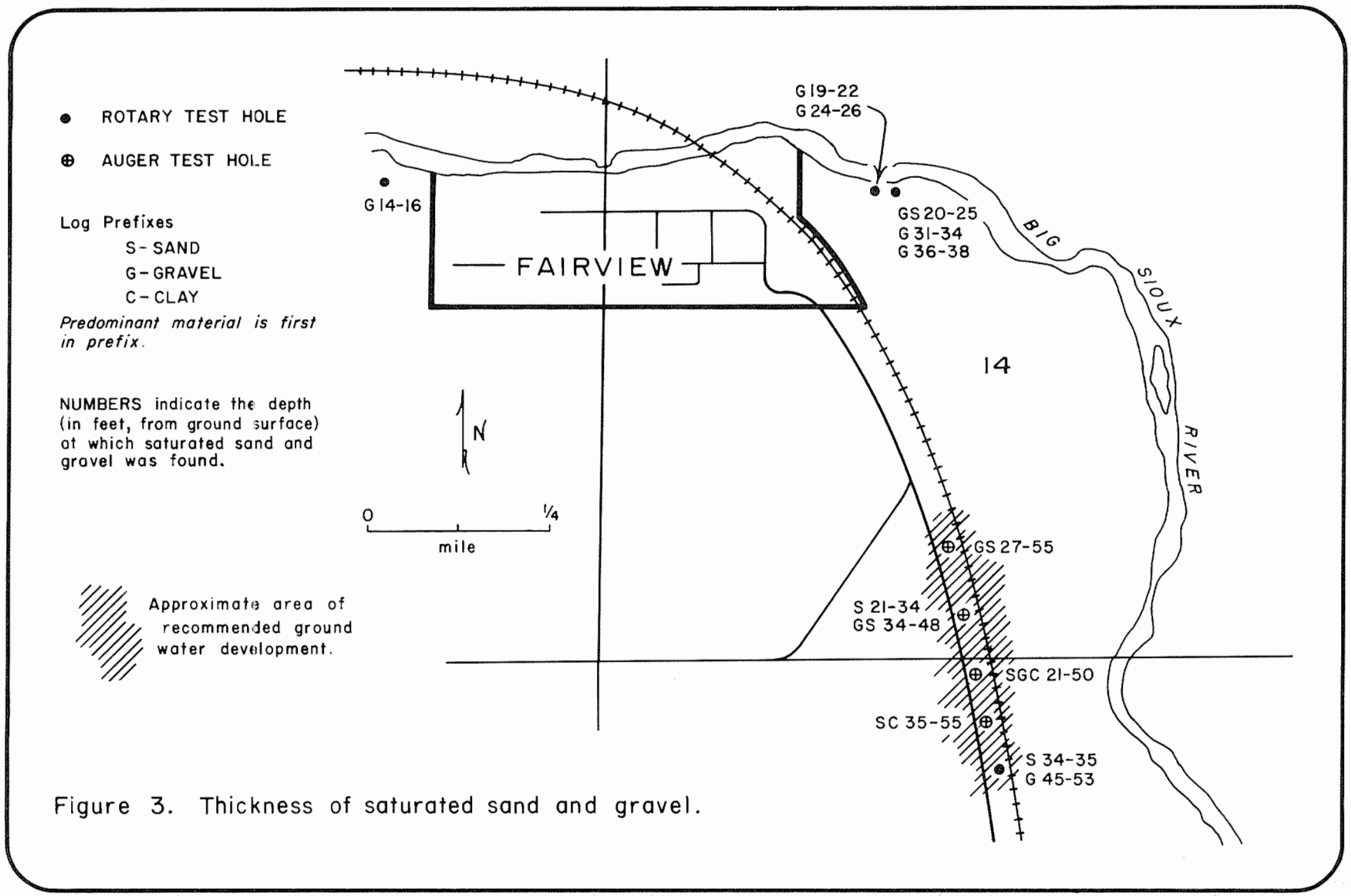

Figure 3. Thickness of saturated sand and gravel.

silty overbank deposits. Two observation wells were placed at two different depths within this gravel sequence. The observation well at ML 2 (fig. 1, app. A) was completed at a depth of 26 feet and the observation well at ML 4 (fig. 1, app. A) at 36 feet below the land surface. This allowed for the determination of possible variances in nitrate concentrations between two gravel strata separated by a clay layer within the aquifer.

Chemical analyses from the two observation wells showed a marked difference in nitrate concentrations. The shallow observation well at ML 2 had 7 parts per million (ppm) nitrate (sample 4, fig. 2, table 1, app. B) whereas the deeper observation well at ML 4 had only an average of 0.19 ppm nitrate (samples 1-3, fig. 2, table 1, app. B). The low nitrate concentrations in samples 1 through 3 can be attributed to a partial barrier to the ground water formed by the clay layer separating the gravel strata and thus preventing the mixing of water. Other chemical constituents in the lower gravel were comparable to the community's current supply except for higher concentrations of sulfate (140 ppm), iron (2.40 ppm), and manganese (0.69 ppm) from water sample 3 (table 1). Part of the concentration of iron in water sample 3 could, however, be attributed to an excess of sediments in the unfiltered water samples. These values indicate higher concentrations in comparison to traces of these constituents in the City's present water supply (samples 5 and 6, table 1).

A second exploration site was located west of Fairview along the northern rim of the lower terrace. Drilling showed that a 2-foot layer of gravel was present in an observation well at ML 14 (fig. 1, app. A). The water sample from this horizon contained 3.6 ppm nitrate (sample 9, fig. 2, table 1, app. B) which was less than the nitrate concentration of the present city water supply. Further exploration at this locale was discontinued due to the limited thickness of gravel and the inaccessibility of the land.

A third exploration site was located three-fourths of a mile southeast of town in the vicinity of the abandoned Chicago, Milwaukee, St. Paul and Pacific Railroad gravel pit. A test hole at ML 21 (fig. 1, app. A) encountered approximately 45 feet of white and brown silts underlain by 8 feet of gravel. This gravel was composed mainly of green quartz and plagioclase feldspar which suggests a non-glacial source for this material. An observation well was constructed in this test hole to a depth of 53 feet. Further test drilling conducted on August 21 and 22, 1980, yielded an average gravel thickness of 25.8 feet over an approximate longitudinal extent of three-eighths of a mile (fig. 3). The width of the gravel was not determined because of the inaccessibility to the surrounding properties.

The water level in this well was approximately 21 feet below the top of the casing. After extrapolation of the water level from observation well ML 21 to the other test holes and it was determined that the average saturated thickness of the gravel was

22.6 feet (fig. 3).

Water analyses (samples 12-18, fig. 2, table 1, app. B) from observation well ML 21 were comparable with the present city water except for a substantial reduction in nitrate concentration (less than 0.1 ppm). However, higher iron (0.60 ppm) and manganese (0.33 ppm; sample 15, table 1) concentrations were observed. Again, part of the iron concentration in water sample 15 could be attributed to an excess of sediments in the unfiltered water sample.

A separate water sample was collected from the observation well at ML 21 and sent to the State Health Laboratory for complete analysis (table 2). Results were comparable to sample 15 (table 1) except for an even higher iron concentration of 2.30 ppm. The higher iron concentration observed by the State Health Laboratory is believed to have been caused by suspended sediments in their unfiltered sample. It is thougnt that the acid used to preserve the water sample dissolved the available iron from the suspended sediments which caused the discrepancy in iron values. The "sampling procedure" column in table 1, further explains the various methods of water sampling used during this study.

Alluvial Deposits

Alluvial floodplain deposits lie topographically below the lower outwash terrace, along the Big Sioux River and consist of sand and silt with random pockets of clay. These sediments form a thin veneer overlying the lower outwash deposits. The alluvial deposits were not explored due to their limited thickness and the inaccessibility of the land.

GROUND WATER IN BEDROCK

Bedrock formations in the Fairview area consist of Cretaceous and Precambrian age strata. Cretaceous sediments underlying the glacial deposits are, in descending order: Carlile Shale, Greenhorn Limestone, Graneros Shale, and the Dakota Formation. The Carlile Shale and Graneros Shale consist of gray shales; whereas, the Greenhorn Limestone consists of thin layers of limestone and calcareous shales. The Greenhorn, however, was only present at ML 7 (fig. 1, app. A) and was not observed in the rotary test holes at ML 5 and ML 9 (fig. 1, app. A). This observed hiatus may be the result of an erosional remnant formed during the time spanning the deposition of the Cretaceous strata. More subsurface data are needed in order to reach an exact conclusion.

The Dakota Formation underlies the Graneros Shale and consists of fine-grained sands, lenticular sandstones, and interbedded shales that have an average thickness of 230 feet in the Fairview area. These strata unconformably overlie the Precambrian Sioux Quartzite.

TABLE 2

Chemical analysis of water from observation well ML 21
(Big Sioux Aquifer - South Management Unit; fig. 1)

Analyzed by the State Health Laboratory and financed by the Office of Drinking Water, South Dakota Department of Water and Natural Resources.

PARAMETER	MAXIMUM LIMIT [1]		RESULTS
Arsenic	50	ug/l	1.7
Barium	1000	ug/l	59
Cadmium	10	ug/l	<1.0
Chromium	50	ug/l	<1.0
Lead	50	ug/l	3.5
Mercury	2	ug/l	<0.20
Nitrate (as N)	10	mg/l	<0.1
Selenium	10	ug/l	4.0
Silver	50	ug/l	<1.0
Fluoride	2.4	mg/l	0.23
Gross alpha	15	pCi/l	2.2 ± 2.6

* * * * * * * * * * *

PARAMETER	SUGGESTED LIMIT [2]		RESULTS
Chloride (Cl)	250	mg/l	<0.2
Copper (Cu)	1	mg/l	<0.005
Iron (Fe)	0.3	mg/l	2.30
Manganese (Mn)	0.05	mg/l	0.43
Sulfate (SO4)	250	mg/l	56
Zinc (Zn)	5	mg/l	0.012
Total Dissolved Solids	500	mg/l	505
Conductivity	25 C	umhos/cm	594
Calcium (Ca)	---	mg/l	71.0
Magnesium (Mg)	---	mg/l	22.8
Hardness (CaCO3)	---	mg/l	271
Sodium (Na)	---	mg/l	10.5
Potassium (K)	---	mg/l	9.4

mg/l = milligrams/liter = parts/million (ppm)
ug/l = micrograms/liter = parts/billion (ppb)
pCi/l = picocuries/liter

1 United States Environmental Protection Agency "National Interim Primary Drinking Water Regulations" -- December 24, 1975 (enforceable limits).

2 United States Environmental Protection Agency "National Secondary Drinking Water Regulations" -- July 19, 1979 (recommended limits).

Of the above mentioned bedrock units only the Dakota Formation has aquifer potential in this area. Three test holes, two of which were completed as observation wells, were constructed in the fine-grained sands. An observation well at ML 9 was constructed at the contact of the Dakota Formation and the Sioux Quartzite at a depth of 453 feet. A similar observation well at ML 5 was constructed to a depth of 209 feet and finished in the upper 46 feet of the Dakota Formation.

Construction of observation wells at different levels provided a determination of possible variances in iron concentration and other chemical constituents within the aquifer. Chemical analyses showed a slightly higher concentration of iron in the unfiltered samples of the deep Dakota Formation observation well at ML 9 (2.70 ppm; sample 32, fig. 2 table 1, app. B) as compared with those of the shallow Dakota Formation observation well at ML 5 (less than 0.05 ppm; sample 23, fig. 2, table 1, app. B).

In general, the Dakota Formation has higher average sodium (88 ppm) and sulfate (290 ppm) concentrations than does the City's current water supply. Further analysis of the shallow Dakota Formation observation well (ML 5) by the Division of Water Quality (table 3) indicated a higher iron concentration (4.40 ppm) than observed in sample 23. The higher iron value is again attributed to suspended sediments in the sample analyzed by the State Health Laboratory.

CONCLUSIONS AND RECOMMENDATIONS

There are two potential sources of ground water for the city of Fairview. Most favorable for the development of a new water source is that portion of the Big Sioux Aquifer just north of and including the observation well at ML 21. The approximate known extent of the recommended area and saturated thicknesses in this area are shown in figure 3. Overall water quality in this area is better than the city's current supply, however, higher iron and manganese concentrations (sample 15, table 1) should be expected.

A complete chemical analysis of the water from the area around ML 21 was conducted by the State Health Laboratory and was financed by the Office of Drinking Water, Department of Water and Natural Resources. These analyses included an examination of trace elements as well as the general water quality parameters (table 2). Study of the analysis has shown that the dissolved chemical concentrations were less than the enforceable limits required by the United States Environmental Protection Agency (sample A, table 1), however the iron and manganese concentrations were higher than the recommended limits set by the same agency. If the iron and manganese concentrations are determined to be higher than the recommended limits (after an extended aquifer test), treament techniques should be employed to remove the excess iron and manganese.

TABLE 3

Chemical analysis of water from observation well ML 5
(Dakota Formation, fig. 1)

Analyzed by the State Health Laboratory and financed by the Office of Drinking Water, South Dakota Department of Water and Natural Resources.

PARAMETER	MAXIMUM LIMIT [1]		RESULTS
Arsenic	50	ug/l	2.3
Barium	1000	ug/l	<5
Cadmium	10	ug/l	<1.0
Chromium	50	ug/l	1.9
Lead	50	ug/l	8.8
Mercury	2	ug/l	<0.20
Nitrate (as N)	10	mg/l	<0.1
Selenium	10	ug/l	4.2
Silver	50	ug/l	<1.0
Fluoride	2.4	mg/l	1.08
Gross alpha	15	pCi/l	5.5 ± 3.0

* * * * * * * * * * *

PARAMETER	SUGGESTED LIMIT [2]		RESULTS
Chloride (Cl)	250	mg/l	14.1
Copper (Cu)	1	mg/l	0.006
Iron (Fe)	0.3	mg/l	4.40
Manganese (Mn)	0.05	mg/l	0.08
Sulfate (SO4)	250	mg/l	287
Zinc (Zn)	5	mg/l	0.028
Total Dissolved Solids	500	mg/l	1040
Conductivity	25 C	umhos/cm	1166
Calcium (Ca)	---	mg/l	58.2
Magnesium (Mg)	---	mg/l	27.7
Hardness (CaCO3)	---	mg/l	259
Sodium (Na)	---	mg/l	146
Potassium (K)	---	mg/l	19.4

mg/l = milligrams/liter = parts/million (ppm)
ug/l = micrograms/liter = parts/billion (ppb)
pCi/l = picocuries/liter

1 United States Environmental Protection Agency "National Interim Primary Drinking Water Regulations" -- December 24, 1975 (enforceable limits).

2 United States Environmental Protection Agency "National Secondary Drinking Water Regulations" -- July 19, 1979 (recommended limits).

In general, the ground water in this portion of the Big Sioux Aquifer is softer (271 ppm hardness, table 2) than either the upper Dakota Formation (451 ppm hardness; sample 23, table 1) or Fairview's present water supply (390 ppm hardness; samples 5 and 6, table 1). Also, the aquifer generally does not contain as much sodium, sulfate, and total dissolved solids concentrations as found in the Dakota Formation.

Prior to the construction of any permanent facilities, it is recommended that a few additional test holes be drilled to determine the most promising location for the production well and that an aquifer test be conducted to determine the rate at which water may be pumped from the aquifer. Water samples should also be collected and analyzed for chemical and biological suitability.

The Dakota Formation is a second alternative for Fairview's water supply. Water from the upper part of the aquifer (observation well at ML 5, fig. 1, app. A) was also analyzed by the State Health Laboratory and financed by the Office of Drinking water, Department of Water and Natural Resources, for trace elements and general water quality parameters (table 3). That chemical analysis suggests high iron (4.40 ppm), sodium (146 ppm), sulfate (287 ppm), and total dissolved solids (1040 ppm) in comparison with Fairview's present water supply (samples 5 and 6, table 1) although part of the iron concentration observed in table 3 is attributed to an excess of sediments in the water sample. If the City considers development of a Dakota Formation well, it should be constructed in the upper sands of the aquifer because of the possibility of an increase in iron in the ground water from the lower portions of the aquifer.

Before a permanent well is drilled, city officials should contact the Division of Water Rights, Department of Water and Natural Resources, to obtain a permit for a water right. Also the Division of Water Quality, Department of Water and Natural Resources, should be contacted for final determination of biological and chemical suitability of the water.

Upon request, the South Dakota Geological Survey will log the new well and supervise an aquifer test.

REFERENCES CITED

South Dakota Department of Environmental Protection, 1979, South Dakota Public Water Supply Data.

United States Environmental Protection Agency, "National Interim Primary Drinking Water Regulations," Federal Register, v. 40, no. 248, December 24, 1975.

United States Environmental Protection Agency, "National Secondary Drinking Water Regulations," Federal Register, v. 44, no. 140, July 19, 1979.

APPENDIX A

Logs of test holes and observation wells

MAP LOCATION (ML): A number arbitrarily assigned to the log according to the order in which it is listed (see LEGAL LOCATION and LOCATION). This number corresponds to the numbers shown on figure 1.

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). In several LOCATIONS, the smallest quarter section is followed by the number 1 or 2, which designates the first or second test hole or observation well drilled at that particular location.

LATITUDE AND LONGITUDE: The format is DDD.MMSS where D is degress, M is minutes, and S is seconds.

DRILLING COMPANY: SDGS is an abbreviation for South Dakota Geological Survey.

TOTAL DRILL HOLE DEPTH, SCREEN LENGTH, CASING STICK-UP, AND TOTAL CASING AND SCREEN: The numbers are presented in feet.

SCREEN TYPE AND CASING TYPE: PVC (polyvinylchloride); MFG (manufactured).

CASING DIAMETER: The numbers are presented in inches.

CASING TOP ELEVATION AND GROUND SURFACE ELEVATION: Numbers are presented in feet above mean sea level. I - elevation was determined by using a surveying instrument. T - elevation was estimated from a 7 1/2 minute series topographic map.

COUNTY: LINCOLN LOCATION: 097N-48W-14BDBC 1
MAP LOCATION: 1
LEGAL LOCATION: SW NW SE NW SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1322 LONGITUDE: 96.2858
LAND OWNER: L. SWENSON
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: B. GARRISON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-05-1980 DRILLING METHOD: ROTARY
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1201.00 T
TOTAL DRILL HOLE DEPTH: 76.0 TEST HOLE NUMBER: F-3

0 -	19	SILT, BROWN, SANDY (ALLUVIUM)
19 -	22	GRAVEL, REDDISH-BROWN, COARSE
22 -	24	CLAY
24 -	26	GRAVEL, REDDISH-BROWN, COARSE
26 -	34	CLAY, GRAY
34 -	36	GRAVEL, REDDISH-BROWN, COARSE
36 -	55	CLAY, GRAY, SANDY; SOFT
55 -	76	SHALE, GRAY (CARLILE SHALE)

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COUNTY: LINCOLN LOCATION: 097N-48W-14BDBC 2
MAP LOCATION: 2
LEGAL LOCATION: SW NW SE NW SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1322 LONGITUDE: 96.2858
LAND OWNER: L. SWENSON
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: B. GARRISON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-05-1980 DRILLING METHOD: ROTARY
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1201.00 T
TOTAL DRILL HOLE DEPTH: 26.0 TEST HOLE NUMBER: F-4
SDGS WELL NAME: F-4 WATER RIGHTS WELL NAME:
AQUIFER: BIG SIOUX BASIN: BIG SIOUX
MANAGEMENT UNIT: SOUTH
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 5.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: 0.8 TOTAL CASING AND SCREEN: 25.0
WELL MAINTENANCE DATE:

DEPTH TO WATER: 17.14 FEET ON 6-13-80.

0 -	19	SILT, BROWN, SANDY (ALLUVIUM)
19 -	22	GRAVEL, REDDISH-BROWN, COARSE
22 -	24	CLAY
24 -	26	GRAVEL, REDDISH-BROWN, COARSE

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COUNTY: LINCOLN LOCATION: 097N-48W-14BDDB 1
MAP LOCATION: 3
LEGAL LOCATION: NW SE SE NW SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1322 LONGITUDE: 96.2856
LAND OWNER: L. SWENSON
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: B. GARRISON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-09-1980 DRILLING METHOD: ROTARY
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1201.00 T
TOTAL DRILL HOLE DEPTH: 56.0 TEST HOLE NUMBER: F-5

0 -	20	CLAY, BROWN, SILTY, SANDY (ALLUVIUM)
20 -	25	GRAVEL, REDDISH-BROWN, COARSE TO FINE; SOME SAND
25 -	31	CLAY; SOFT
31 -	34	GRAVEL, REDDISH-BROWN, COARSE TO FINE
34 -	36	CLAY
36 -	38	GRAVEL, REDDISH-BROWN, COARSE TO FINE
38 -	45	CLAY, GRAY; SOFT
45 -	56	SHALE, GRAY (CARLILE SHALE)

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COUNTY: LINCOLN LOCATION: 097N-48W-14BDDB 2
MAP LOCATION: 4
LEGAL LOCATION: NW SE SE NW SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1322 LONGITUDE: 96.2856
LAND OWNER: L. SWENSON
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: B. GARRISON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-09-1980 DRILLING METHOD: ROTARY
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1201.00 T
TOTAL DRILL HOLE DEPTH: 38.0 TEST HOLE NUMBER: F-6
SDGS WELL NAME: F-6 WATER RIGHTS WELL NAME:
AQUIFER: BIG SIOUX BASIN: BIG SIOUX
MANAGEMENT UNIT: SOUTH
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 5.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: 2.6 TOTAL CASING AND SCREEN: 36.0
WELL MAINTENANCE DATE:

DEPTH TO WATER: 14.95 FEET ON 6-13-80.

0 -	20	CLAY, BROWN, SILTY, SANDY (ALLUVIUM)
20 -	25	GRAVEL, REDDISH-BROWN, COARSE TO FINE; SOME SAND
25 -	31	CLAY; SOFT
31 -	34	GRAVEL, REDDISH-BROWN, COARSE TO FINE
34 -	36	CLAY

36 -	38	GRAVEL, REDDISH-BROWN, COARSE TO FINE

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COUNTY: LINCOLN LOCATION: 097N-48W-14CACA
MAP LOCATION: 5
LEGAL LOCATION: NE SW NE SW SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1310 LONGITUDE: 96.2858
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: L. HELSETH/E. KOGLIN DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-23-1980 DRILLING METHOD: ROTARY
E-LOG: YES SAMPLES: NO GROUND SURFACE ELEVATION: 1215.00 T
TOTAL DRILL HOLE DEPTH: 209.0 TEST HOLE NUMBER: F-16
SDGS WELL NAME: F-16 WATER RIGHTS WELL NAME: LN-81Q
AQUIFER: DAKOTA BASIN: BIG SIOUX
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1214.12 I
CASING STICK-UP: 2.7 TOTAL CASING AND SCREEN: 209.0
WELL MAINTENANCE DATE:

DEPTH TO WATER: 54 FEET ON 6-25-80, 54.11 FEET ON 9-10-81. FINE SUBDIVISIONS OF THE DRILLER'S LOG WERE INTERPRETED BY USING AN ELECTRIC LOG. E-LOG: SINGLE POINT RESISTIVITY, SPONTANEOUS POTENTIAL.

0 -	7	CLAY, YELLOW
7 -	11	GRAVEL, REDDISH-BROWN, COARSE
11 -	18	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
18 -	32	SAND, GRAY, SILTY; SOME CLAY STRINGERS
32 -	40	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
40 -	142	SHALE, GRAY (CARLILE SHALE)
142 -	164	SHALE, GRAY (CARLILE SHALE? GRANEROS SHALE?)
164 -	175	SAND, WHITE, FINE; CEMENTED STRINGER AT 170 FEET (DAKOTA FORMATION)
175 -	188	SHALE, GRAY; SOME INTERBEDDED SAND (DAKOTA FORMATION)
188 -	194	SAND, WHITE, FINE; CEMENTED STRINGER AT 190 FEET (DAKOTA FORMATION)
194 -	196	SAND, WHITE, FINE; CEMENTED (DAKOTA FORMATION)
196 -	206	SAND, WHITE, FINE; CEMENTED STRINGER AT 200 FEET (DAKOTA FORMATION)
206 -	209	SHALE, GRAY; SOME INTERBEDDED SAND (DAKOTA FORMATION)

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COUNTY: LINCOLN LOCATION: 097N-48W-14CADC 1
MAP LOCATION: 6
LEGAL LOCATION: SW SE NE SW SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1306 LONGITUDE: 96.2856
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: B. GARRISON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-05-1980 DRILLING METHOD: ROTARY
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1210.00 T
TOTAL DRILL HOLE DEPTH: 76.0 TEST HOLE NUMBER: F-2

0 -	6	GRAVEL, RED-BROWN, COARSE, GRADING TO SAND
6 -	9	CLAY, BROWN
9 -	13	GRAVEL, RED-BROWN, COARSE, GRADING TO SAND
13 -	57	CLAY, GRAY, SANDY, SILTY; CALCAREOUS
57 -	76	SHALE, GRAY; NONCALCAREOUS (CARLILE SHALE)

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COUNTY: LINCOLN LOCATION: 097N-48W-14CBAB
MAP LOCATION: 7
LEGAL LOCATION: NW NE NW SW SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1316 LONGITUDE: 96.2914
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: L. HELSETH DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-11-1980 DRILLING METHOD: ROTARY
E-LOG: YES SAMPLES: NO GROUND SURFACE ELEVATION: 1225.00 T
TOTAL DRILL HOLE DEPTH: 448.0 TEST HOLE NUMBER: F-14
SDGS WELL NAME: F-14 WATER RIGHTS WELL NAME:
AQUIFER: DAKOTA BASIN: BIG SIOUX
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: TOTAL CASING AND SCREEN: 447.0
WELL MAINTENANCE DATE:

THE WELL WAS REMOVED BECAUSE IT DID NOT PUMP. FINE SUBDIVISIONS OF THE DRILLER'S LOG WERE INTERPRETED BY USING AN ELECTRIC LOG.
E-LOG: SINGLE POINT RESISTIVITY, SPONTANEOUS POTENTIAL, NATURAL GAMMA.

0 -	7	CLAY, YELLOW, SILTY, SANDY, PEBBLY (TILL)
7 -	39	GRAVEL, REDDISH-BROWN, MEDIUM TO COARSE; SOME COBBLES

39 -	68	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
68 -	109	SHALE, GRAY (CARLILE SHALE)
109 -	138	LIMESTONE, BROWN; SOME INTERBEDDED SHALE, WHITE FLECKS (GREENHORN LIMESTONE)
138 -	193	SHALE, DARK-GRAY (GRANEROS SHALE)
193 -	202	SAND, WHITE, FINE (DAKOTA FORMATION)
202 -	204	SHALE, GRAY (DAKOTA FORMATION)
204 -	207	SAND, WHITE, FINE (DAKOTA FORMATION)
207 -	215	SHALE, LIGHT-GRAY (DAKOTA FORMATION)
215 -	218	SAND, WHITE, FINE; CEMENTED (DAKOTA FORMATION)
218 -	223	SHALE, LIGHT-GRAY (DAKOTA FORMATION)
223 -	224	SAND, WHITE, FINE; CEMENTED (DAKOTA FORMATION)
224 -	234	SAND, WHITE, FINE (DAKOTA FORMATION)
234 -	239	SHALE, LIGHT-GRAY (DAKOTA FORMATION)
239 -	246	SAND, WHITE, FINE; SOME CLAY (DAKOTA FORMATION)
246 -	258	CLAY, TAN, SILTY, SANDY (DAKOTA FORMATION)
258 -	274	SAND, WHITE, FINE, CLAYEY; SOME COAL STRINGERS (DAKOTA FORMATION)
274 -	285	CLAY, REDDISH-BROWN, SILTY, SANDY; SOME BLACK CLAY (DAKOTA FORMATION)
285 -	294	CLAY, LIGHT-GRAY, SANDY (DAKOTA FORMATION)
294 -	303	CLAY, LIGHT-GRAY, SILTY; SCATTERED CEMENTED LAYERS (DAKOTA FORMATION)
303 -	306	SHALE, GRAY (DAKOTA FORMATION)
306 -	318	SHALE, GRAY; SOME INTERBEDDED SAND (DAKOTA FORMATION)
318 -	383	SAND, WHITE, FINE; SOME SHALE STRINGERS (DAKOTA FORMATION)
383 -	386	SAND, WHITE, FINE; CEMENTED (DAKOTA FORMATION)
386 -	400	SAND, WHITE, FINE; SOME TAN CLAY (DAKOTA FORMATION)
400 -	403	SHALE, LIGHT-GRAY (DAKOTA FORMATION)
403 -	407	SAND, WHITE, FINE; SOME CLAY (DAKOTA FORMATION)
407 -	410	SHALE, LIGHT-GRAY (DAKOTA FORMATION)
410 -	425	SAND, WHITE, FINE; SOME CLAY (DAKOTA FORMATION)
425 -	429	CLAY, BLACK (DAKOTA FORMATION)
429 -	441	SAND, WHITE, FINE (DAKOTA FORMATION)
441 -	447	SAND, WHITE, PINK, MEDIUM TO COARSE (WEATHERED QUARTZITE)
447 -	448	SIOUX QUARTZITE, PINK, HARD; THERE WERE ONLY A FEW INCHES PENETRATED IN THIS INTERVAL AND A SAMPLE WAS NOT OBTAINED

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COUNTY: LINCOLN LOCATION: 097N-48W-14CBBC
MAP LOCATION: 8
LEGAL LOCATION: SW NW NW SW SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1312 LONGITUDE: 96.2923
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: B. GARRISON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-11-1980 DRILLING METHOD: ROTARY
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1225.00 T
TOTAL DRILL HOLE DEPTH: 186.0 TEST HOLE NUMBER: F-12

0 -	5	TOPSOIL, BROWN
5 -	25	GRAVEL, REDDISH-BROWN, COARSE TO FINE; SOME SAND
25 -	33	CLAY, BROWN
33 -	36	GRAVEL, REDDISH-BROWN, COARSE TO FINE
36 -	92	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
92 -	186	SHALE, OLIVE-GRAY (CARLILE SHALE)

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COUNTY: LINCOLN LOCATION: 097N-48W-14CBCB
MAP LOCATION: 9
LEGAL LOCATION: NW SW NW SW SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1305 LONGITUDE: 96.2923
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: L. HELSETH/M. KOFFLER DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-13-1980 DRILLING METHOD: ROTARY
E-LOG: YES SAMPLES: NO GROUND SURFACE ELEVATION: 1230.00 T
TOTAL DRILL HOLE DEPTH: 454.0 TEST HOLE NUMBER: F-15
SDGS WELL NAME: F-15 WATER RIGHTS WELL NAME: LN-81P
AQUIFER: DAKOTA BASIN: BIG SIOUX
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1239.62 I
CASING STICK-UP: TOTAL CASING AND SCREEN: 453.0
WELL MAINTENANCE DATE:

THIRD DRILLER - E. KOGLIN. DEPTH TO WATER: 74 FEET ON 6-24-80. FINE SUBDIVISIONS OF THE DRILLER'S LOG WERE INTERPRETED BY USING AN ELECTRIC LOG. E-LOG: SINGLE POINT RESISTIVITY, SPONTANEOUS POTENTIAL, NATURAL GAMMA.

0 -	4	CLAY, YELLOWISH-BROWN, SILTY, SANDY, PEBBLY (TILL)
4 -	40	GRAVEL, REDDISH-BROWN, COARSE
40 -	60	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)

60 -	190	SHALE, GRAY (CARLILE SHALE)
190 -	229	SHALE, GRAY (CARLILE SHALE? GRANEROS SHALE?)
229 -	232	SAND, WHITE, FINE; CEMENTED (DAKOTA FORMATION)
232 -	234	SHALE, GRAY (DAKOTA FORMATION)
234 -	237	SAND, WHITE, FINE (DAKOTA FORMATION)
237 -	244	SHALE, GRAY (DAKOTA FORMATION)
244 -	248	SAND, WHITE, FINE; CEMENTED (DAKOTA FORMATION)
248 -	254	SHALE, GRAY (DAKOTA FORMATION)
254 -	259	SAND, WHITE, FINE; CEMENTED (DAKOTA FORMATION)
259 -	268	SHALE, GRAY (DAKOTA FORMATION)
268 -	273	SAND, WHITE, FINE; CEMENTED (DAKOTA FORMATION)
273 -	288	SHALE, GRAY (DAKOTA FORMATION)
288 -	298	SAND, WHITE, FINE; CEMENTED STRINGER AT 292 FEET (DAKOTA FORMATION)
298 -	304	SHALE, GRAY (DAKOTA FORMATION)
304 -	306	SAND, WHITE, FINE; CEMENTED (DAKOTA FORMATION)
306 -	308	SHALE, GRAY (DAKOTA FORMATION)
308 -	310	SAND, WHITE, FINE (DAKOTA FORMATION)
310 -	312	SAND, WHITE, FINE; CEMENTED (DAKOTA FORMATION)
312 -	318	SHALE, GRAY (DAKOTA FORMATION)
318 -	321	SAND, WHITE, FINE (DAKOTA FORMATION)
321 -	386	SHALE, GRAY; INTERBEDDED SAND STRINGERS (DAKOTA FORMATION)
386 -	402	SAND, WHITE, FINE; INTERBEDDED SHALE (DAKOTA FORMATION)
402 -	403	SHALE, GRAY (DAKOTA FORMATION)
403 -	405	SAND, WHITE, FINE (DAKOTA FORMATION)
405 -	407	SHALE, GRAY (DAKOTA FORMATION)
407 -	408	SAND, WHITE, FINE (DAKOTA FORMATION)
408 -	409	SHALE, GRAY (DAKOTA FORMATION)
409 -	419	SAND, WHITE, FINE; SHALE STRINGERS (DAKOTA FORMATION)
419 -	423	SHALE, GRAY (DAKOTA FORMATION)
423 -	444	SAND, WHITE, MEDIUM (DAKOTA FORMATION)
444 -	453	SAND, WHITE, PINK, MEDIUM (WEATHERED QUARTZITE)
453 -	454	SIOUX QUARTZITE, PINK, HARD, THERE WERE ONLY A FEW INCHES OF PENETRATION IN THIS INTERVAL AND A SAMPLE WAS NOT OBTAINED

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COUNTY: LINCOLN LOCATION: 097N-48W-14CDAA
MAP LOCATION: 10
LEGAL LOCATION: NE NE SE SW SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1301 LONGITUDE: 96.2853

LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: D. TOMHAVE — DRILLER'S LOG:
GEOLOGIST: S. GREEN — GEOLOGIST'S LOG: X
DATE DRILLED: 08-22-1980 — DRILLING METHOD: AUGER
E-LOG: NO SAMPLES: NO — GROUND SURFACE ELEVATION: 1209.00 T
TOTAL DRILL HOLE DEPTH: 58.0 — TEST HOLE NUMBER: A-4

0 -	5	CLAY, BROWN, SILTY, SANDY, PEBBLY
5 -	10	SAND, BROWN, MEDIUM; SATURATED
10 -	50	GRAVEL, REDDISH-BROWN, FINE TO COARSE, SANDY
50 -	58	CLAY, GRAY, SILTY

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COUNTY: LINCOLN — LOCATION: 097N-48W-14CDAD
MAP LOCATION: 11
LEGAL LOCATION: SE NE SE SW SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1259 — LONGITUDE: 96.2852
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: D. TOMHAVE — DRILLER'S LOG:
GEOLOGIST: S. GREEN — GEOLOGIST'S LOG: X
DATE DRILLED: 08-22-1980 — DRILLING METHOD: AUGER
E-LOG: NO SAMPLES: NO — GROUND SURFACE ELEVATION: 1209.00 T
TOTAL DRILL HOLE DEPTH: 63.0 — TEST HOLE NUMBER: A-7

0 -	1	WOOD, RAILROAD TIE FROM OLD SIDING
1 -	4	CLAY, BLACK, SILTY, SANDY, PEBBLY
4 -	10	CLAY, REDDISH-BROWN, SILTY, SANDY, PEBBLY
10 -	15	SAND, LIGHT-BROWN, SILTY; SOME GRAVEL
15 -	20	SILT, GREENISH-BROWN, SANDY; MOIST
20 -	21	SILT, BLACK, SANDY, CLAYEY; MOIST
21 -	27	SILT, GREENISH-GRAY, SANDY, CLAYEY; MOIST
27 -	38	SAND, GREENISH-BROWN, FINE, SILTY, CLAYEY; SATURATED
38 -	45	SAND, GREENISH-BROWN, COARSE
45 -	55	SAND, GREENISH-BROWN, COARSE, GRADING TO FINE GRAVEL
55 -	63	CLAY, GRAY, SILTY, PEBBLY

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COUNTY: LINCOLN — LOCATION: 097N-48W-14CDCC
MAP LOCATION: 12
LEGAL LOCATION: SW SW SE SW SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1456 — LONGITUDE: 96.2905
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: B. GARRISON — DRILLER'S LOG:

GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-04-1980 DRILLING METHOD: ROTARY
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1235.00 T
TOTAL DRILL HOLE DEPTH: 66.0 TEST HOLE NUMBER: F-1
SDGS WELL NAME: F-1 WATER RIGHTS WELL NAME:
AQUIFER: BIG SIOUX BASIN: BIG SIOUX
MANAGEMENT UNIT: SOUTH
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 5.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: TOTAL CASING AND SCREEN: 36.0
WELL MAINTENANCE DATE:

DRY HOLE

0 -	4	TOPSOIL, BLACK
4 -	37	GRAVEL, REDDISH-BROWN, COARSE, GRADING TO SAND
37 -	42	CLAY, BROWN
42 -	66	CLAY, GRAY

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COUNTY: LINCOLN LOCATION: 097N-48W-14DCCB
MAP LOCATION: 13
LEGAL LOCATION: NW SW SW SE SEC. 14, T. 097 N., R. 48 W.
LATITUDE: 43.1253 LONGITUDE: 96.2849
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: D. TOMHAVE DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 08-22-1980 DRILLING METHOD: AUGER
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1210.00 T
TOTAL DRILL HOLE DEPTH: 58.0 TEST HOLE NUMBER: A-3

0 -	3	CLAY, BLACK, SILTY (TOPSOIL)
3 -	5	CLAY, BROWN, SILTY, SANDY, PEBBLY
5 -	10	GRAVEL, REDDISH-BROWN, COARSE; SOME SAND
10 -	16	SAND, GREENISH-BROWN, MEDIUM; DRY
16 -	34	SAND, GREENISH-BROWN, MEDIUM GRADING TO COARSE; SATURATED
34 -	48	GRAVEL, BROWN, FINE, SANDY; SATURATED
48 -	58	CLAY, GRAY, SILTY

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COUNTY: LINCOLN LOCATION: 097N-48W-15ACDB
MAP LOCATION: 14
LEGAL LOCATION: NW SE SW NE SEC. 15, T. 097 N., R. 48 W.
LATITUDE: 43.1321 LONGITUDE: 96.2947
LAND OWNER: FAIRVIEW
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS

DRILLER: B. GARRISON — DRILLER'S LOG:
GEOLOGIST: S. GREEN — GEOLOGIST'S LOG: X
DATE DRILLED: 06-10-1980 — DRILLING METHOD: ROTARY
E-LOG: NO SAMPLES: NO — GROUND SURFACE ELEVATION: 1190.00 T
TOTAL DRILL HOLE DEPTH: 46.0 — TEST HOLE NUMBER: F-10
SDGS WELL NAME: F-10 — WATER RIGHTS WELL NAME:
AQUIFER: BIG SIOUX — BASIN: BIG SIOUX
MANAGEMENT UNIT: SOUTH
SCREEN TYPE: PVC, MFG. — SCREEN LENGTH: 5.0
CASING TYPE: PVC — CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: 1.5 — TOTAL CASING AND SCREEN: 18.5
WELL MAINTENANCE DATE:

DEPTH TO WATER: 11 FEET ON 6-18-80.

0 -	5	SILT, BROWN
5 -	7	GRAVEL, REDDISH-BROWN, COARSE TO FINE
7 -	14	CLAY
14 -	16	GRAVEL, REDDISH-BROWN, COARSE TO FINE
16 -	42	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
42 -	46	SHALE, GRAY (CARLILE SHALE)

* * * *

COUNTY: LINCOLN — LOCATION: 097N-48W-15ACDD 1
MAP LOCATION: 15
LEGAL LOCATION: SE SE SW NE SEC. 15, T. 097 N., R. 48 W.
LATITUDE: 43.1317 — LONGITUDE: 96.2943
LAND OWNER: GAME, FISH, & PARKS
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: B. GARRISON — DRILLER'S LOG:
GEOLOGIST: S. GREEN — GEOLOGIST'S LOG: X
DATE DRILLED: 06-10-1980 — DRILLING METHOD: ROTARY
E-LOG: NO SAMPLES: NO — GROUND SURFACE ELEVATION: 1232.00 T
TOTAL DRILL HOLE DEPTH: 66.0 — TEST HOLE NUMBER: F-8

0 -	1	SILT, BLACK (TOPSOIL)
1 -	18	SAND, MEDIUM TO FINE, SILTY
18 -	23	GRAVEL, REDDISH-BROWN, COARSE TO FINE
23 -	24	CLAY
24 -	36	GRAVEL, REDDISH-BROWN, VERY COARSE, GRADING TO SAND
36 -	45	CLAY, GRAY
45 -	61	CLAY, GRAY; GRAVELLY
61 -	62	ROCK
62 -	66	SHALE, GRAY (CARLILE SHALE)

* * * *

COUNTY: LINCOLN — LOCATION: 097N-48W-15ACDD 2
MAP LOCATION: 16
LEGAL LOCATION: SE SE SW NE SEC. 15, T. 097 N., R. 48 W.

LATITUDE: 43.1317 LONGITUDE: 96.2943
LAND OWNER: GAME, FISH, & PARKS
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: B. GARRISON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-10-1980 DRILLING METHOD: ROTARY
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1232.00 T
TOTAL DRILL HOLE DEPTH: 36.0 TEST HOLE NUMBER: F-9
SDGS WELL NAME: F-9 WATER RIGHTS WELL NAME:
AQUIFER: BIG SIOUX BASIN: BIG SIOUX
MANAGEMENT UNIT: SOUTH
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 5.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: TOTAL CASING AND SCREEN: 36.0
WELL MAINTENANCE DATE:

DRY HOLE

0 -	1	SILT, BLACK (TOPSOIL)
1 -	18	SAND, MEDIUM TO FINE, SILTY
18 -	23	GRAVEL, REDDISH-BROWN, COARSE TO FINE
23 -	24	CLAY
24 -	36	GRAVEL, REDDISH-BROWN, VERY COARSE, GRADING TO SAND

* * * *

COUNTY: LINCOLN LOCATION: 097N-48W-22ABBA
MAP LOCATION: 17
LEGAL LOCATION: NE NW NW NE SEC. 22, T. 097 N., R. 48 W.
LATITUDE: 43.1259 LONGITUDE: 96.2951
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: B. GARRISON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-11-1980 DRILLING METHOD: ROTARY
E-LOG: YES SAMPLES: NO GROUND SURFACE ELEVATION: 1350.00 T
TOTAL DRILL HOLE DEPTH: 126.0 TEST HOLE NUMBER: F-11

E-LOG: SINGLE POINT RESISTIVITY, SPONTANEOUS POTENTIAL, NATURAL GAMMA.

0 -	18	CLAY, YELLOW, SILTY, SANDY, PEBBLY (TILL)
18 -	104	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
104 -	126	SHALE, OLIVE-GRAY (CARLILE SHALE)

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COUNTY: LINCOLN LOCATION: 097N-48W-23ABAD
MAP LOCATION: 18
LEGAL LOCATION: SE NE NW NE SEC. 23, T. 097 N., R. 48 W.

LATITUDE: 43.1246 LONGITUDE: 96.2834
LAND OWNER: L. SWENSON
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: B. GARRISON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-10-1980 DRILLING METHOD: ROTARY
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1190.00 T
TOTAL DRILL HOLE DEPTH: 48.0 TEST HOLE NUMBER: F-7

0 -	12	SILT, BROWN, SANDY
12 -	15	CLAY, YELLOW, SILTY; SOFT
15 -	17	GRAVEL, REDDISH-BROWN, MEDIUM
17 -	18	CLAY
18 -	19	ROCK
19 -	26	CLAY
26 -	27	ROCK
27 -	45	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
45 -	48	SHALE, GRAY (CARLILE SHALE)

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COUNTY: LINCOLN LOCATION: 097N-48W-23ABBB
MAP LOCATION: 19
LEGAL LOCATION: NW NW NW NE SEC. 23, T. 097 N., R. 48 W.
LATITUDE: 43.1248 LONGITUDE: 96.2848
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: D. TICHY DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 08-21-1980 DRILLING METHOD: AUGER
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1208.00 T
TOTAL DRILL HOLE DEPTH: 58.0 TEST HOLE NUMBER: A-2

0 -	1	SILT, YELLOW-BROWN; DRY
1 -	5	GRAVEL, REDDISH-BROWN, COARSE, GRADING TO SAND; DRY
5 -	10	SILT, LIGHT-BROWN; MOIST, SOME CLAY
10 -	16	SAND, LIGHT-BROWN, FINE GRADING TO MEDIUM; MOIST
16 -	18	CLAY, BROWN, SILTY, SANDY
18 -	50	SAND, LIGHT-BROWN, FINE, GRADING TO FINE GRAVEL, CLAYEY; SATURATED
50 -	58	SHALE, GRAY (CARLILE SHALE)

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COUNTY: LINCOLN LOCATION: 097N-48W-23ABBC
MAP LOCATION: 20
LEGAL LOCATION: SW NW NW NE SEC. 23, T. 097 N., R. 48 W.
LATITUDE: 43.1244 LONGITUDE: 96.2846
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY

DRILLING COMPANY: SDGS
DRILLER: D. TICHY DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 08-21-1980 DRILLING METHOD: AUGER
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1208.00 T
TOTAL DRILL HOLE DEPTH: 83.0 TEST HOLE NUMBER: A-1

0 -	8	GRAVEL, REDDISH-BROWN, COARSE, GRADING TO SAND
8 -	10	SILT, GREENISH-BROWN, SANDY, CLAYEY; MOIST
10 -	11	SILT, BROWN, SANDY; MOIST
11 -	21	CLAY, BROWN, SILTY, SANDY, PEBBLY; MOIST
21 -	35	SILT, GRAY, SANDY; MOIST, SOME PEBBLES
35 -	55	SAND, GRAY, FINE GRADING TO COARSE, SILTY, SOME CLAY; SATURATED
55 -	83	SHALE, GRAY (CARLILE SHALE)

* * * *

COUNTY: LINCOLN LOCATION: 097N-48W-23ABCA
MAP LOCATION: 21
LEGAL LOCATION: NE SW NW NE SEC. 23, T. 097 N., R. 48 W.
LATITUDE: 43.1242 LONGITUDE: 96.2846
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: B. GARRISON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-13-1980 DRILLING METHOD: ROTARY
E-LOG: NO SAMPLES: YES GROUND SURFACE ELEVATION: 1210.00 T
TOTAL DRILL HOLE DEPTH: 66.0 TEST HOLE NUMBER: F-13
SDGS WELL NAME: F-13 WATER RIGHTS WELL NAME:
AQUIFER: BIG SIOUX BASIN: BIG SIOUX
MANAGEMENT UNIT: SOUTH
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 5.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: 1.2 TOTAL CASING AND SCREEN: 53.0
WELL MAINTENANCE DATE:

DEPTH TO WATER: 20.83 FEET ON 6-16-80, 20.00 FEET ON 6-25-80, 23.38 FEET ON 9-10-81. SAMPLING INTERVAL: 10 FEET.

0 -	4	TOPSOIL, BROWN
4 -	19	CLAY, GREENISH-WHITE, SILTY, SANDY
19 -	20	SAND, WHITE, MEDIUM; CLEAN, NONCALCAREOUS
20 -	31	SILT, WHITE; HARD, NONCALCAREOUS
31 -	34	SILT, BLUE-GRAY
34 -	35	SAND, WHITE; SOFT, NONCALCAREOUS
35 -	37	SILT, BLUE-GRAY
37 -	43	SILT, BROWN
43 -	45	SILT, GRAY; NONCALCAREOUS

45 -	53	GRAVEL, GREEN, FINE TO MEDIUM
53 -	66	SHALE, GRAY; CALCAREOUS (CARLILE SHALE)

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COUNTY: LINCOLN LOCATION: 097N-48W-23ABCD 1
MAP LOCATION: 22
LEGAL LOCATION: SE SW NW NE SEC. 23, T. 097 N., R. 48 W.
LATITUDE: 43.1237 LONGITUDE: 96.2845
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: D. TOMHAVE DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 08-22-1980 DRILLING METHOD: AUGER
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1206.00 T
TOTAL DRILL HOLE DEPTH: 18.0 TEST HOLE NUMBER: A-5

0 -	1	CLAY, BLACK (TOPSOIL)
1 -	3	CLAY, BROWN, SILTY, SANDY, PEBBLY (TILL)
3 -	7	CLAY, DARK-BROWN, SILTY, SANDY, PEBBLY (TILL)
7 -	15	CLAY, REDDISH-BROWN, SILTY, SANDY, PEBBLY (TILL)
15 -	18	CLAY, GRAY, SILTY, SANDY, PEBBLY

* * * *

COUNTY: LINCOLN LOCATION: 097N-48W-23ABCD 2
MAP LOCATION: 23
LEGAL LOCATION: SE SW NW NE SEC. 23, T. 097 N., R. 48 W.
LATITUDE: 43.1239 LONGITUDE: 96.2845
LAND OWNER:
PROJECT: FAIRVIEW CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: D. TOMHAVE DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 08-22-1980 DRILLING METHOD: AUGER
E-LOG: NO SAMPLES: NO GROUND SURFACE ELEVATION: 1206.00 T
TOTAL DRILL HOLE DEPTH: 33.0 TEST HOLE NUMBER: A-6

0 -	1	CLAY, BLACK, SILTY (TOPSOIL)
1 -	15	CLAY, BROWN, SILTY, SANDY, PEBBLY (TILL)
15 -	29	CLAY, GRAY, SILTY, SANDY, PEBBLY
29 -	33	SHALE, GRAY; SHELL FRAGMENTS, CALCAREOUS (CARLILE SHALE)

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APPENDIX B

Well Information and Locations of the Water Samples

For logs of the observation wells constructed by the South Dakota Geological Survey, see logs in Appendix A with the same location as the water sample.

SAMPLE IDENTIFICATION

* For water analyses, see table 1.
* For map location, see figure 2.

LOCATION

All descriptors for the location within a section (i.e., NE NW SW SE) refer to quarter sections.

WATER SOURCE

BS-S	Big Sioux Aquifer - South Management Unit
BSR	Big Sioux River
Kd	Dakota Formation
UNK	Unknown

WELL DEPTH

The depths to water for wells and depth of the wells not controlled by the South Dakota Geological Survey were obtained from the well controller.

WELL CONTROLLER

SDGS - South Dakota Geological Survey

USAGE

D	- Domestic
M	- Municipal
OB	- Observation
S	- Stock

Sample Identification: 1
Location: NW SE SE NW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-13-80
Water Source: BS-S
Well Depth (ft): 36
Depth to Water from Casing Top (ft): 14.95
Well Controller: SDGS
Usage: OB

Sample Identification: 2
Location: NW SE SE NW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-13-80
Water Source: BS-S
Well Depth (ft): 36
Depth to Water from Casing Top (ft): 14.95
Well Controller: SDGS
Usage: OB

Sample Identification: 3
Location: NW SE SE NW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-13-80
Water Source: BS-S
Well Depth (ft): 36
Depth to water from Casing Top (ft): 14.95
Well Controller: SDGS
Usage: OB

Sample Identification: 4
Location: SW NW SE NW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-13-80
Water Source: BS-S
Well Depth (ft): 25
Depth to Water from Casing Top (ft): 17.14
Well Controller: SDGS
Usage: OB

Sample Identification: 5
Location: NW SW SE NW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 11-76
Water Source: BS-S
Well Depth (ft): 60
Depth to Water from Casing Top (ft): ----
Well Controller: City of Fairview
Usage: M
Comment: This sample was analyzed by the Division of Water Quality, Department of Water and Natural Resources.

Sample Identification: 6
Location: NW SW SE NW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-3-80
Water Source: BS-S
Well Depth (ft): 60
Depth to Water from Casing Top (ft): ----

Sample Identification 6 -- continued.

Well Controller: City of Fairview
Usage: M
Comment: This sample was collected from the outside tap of the City elevator.

Sample Identification: 7
Location: SE NE NW NE sec. 15, T. 97 N., R. 48 W.
Date Sampled: 6-3-80
Water Source: BS-S
Well Depth (ft): 35
Depth to Water from Casing Top (ft): ----
Well Controller: J. Van Woudenberg
Usage: D, S

Sample Identification: 8
Location: NW SE SW NE sec. 15, T. 97 N., R. 48 W.
Date Sampled: 6-18-80
Water Source: BS-S
Well Depth (ft): 18
Depth to Water from Casing Top (ft): 11.00
Well Controller: SDGS
Usage: OB

Sample Identification: 9
Location: NW SE SW NE sec. 15, T. 97 N., R. 48 W.
Date Sampled: 6-18-80
Water Source: BS-S
Well Depth (ft): 18
Depth to Water from Casing Top (ft): 11.00
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 0.5 hours after sample 8.

Sample Identification: 10
Location: NE SE SE NE sec. 15, T. 97 N., R. 48 W.
Date Sampled: 6-6-80
Water Source: BS-S
Well Depth (ft): 40
Depth to Water from Casing Top (ft): ----
Well Controller: H. Van De Stroet
Usage: D, S

Sample Identification: 11
Location: NE SE NE SE sec. 22, T. 97 N., R. 48 W.
Date Sampled: 6-3-80
Water Source: BS-S
Well Depth (ft): ----
Depth to Water from Casing Top (ft): ----
Well Controller: C. Van De Stoet
Usage: D, S

Sample Identification: 12
Location: NE SW NW NE sec. 23, T. 97 N., R. 48 W.
Date Sampled: 6-16-80
Water Source: BS-S
Well Depth (ft): 53
Depth to Water from Casing Top (ft): 20.83
Well Controller: SDGS
Usage: OB

Sample Identification: 13
Location: NE SW NW NE sec. 23, T. 97 N., R. 48 W.
Date Sampled: 6-17-80
Water Source: BS-S
Well Depth (ft): 53
Depth to Water from Casing Top (ft): 20.83
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 0.75 hours after pumping was initiated.

Sample Identification: 14
Location: NE SW NW NE sec. 23, T. 97 N., R. 48 W.
Date Sampled: 6-17-80
Water Source: BS-S
Well Depth (ft): 53
Depth to Water from Casing Top (ft): 20.83
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 1.50 hours after pumping was initiated.

Sample Identification: 15
Location: NE SW NW NE sec. 23, T. 97 N., R. 48 W.
Date Sampled: 6-17-80
Water Source: BS-S
Well Depth (ft): 53
Depth to Water from Casing Top (ft): 20.83
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 2.25 hours after pumping was initiated.

Sample Identification: 16
Location: NE SW NW NE sec. 23, T. 97 N., R. 48 W.
Date Sampled: 6-25-80
Water Source: BS-S
Well Depth (ft): 53
Depth to Water from Casing Top (ft): 20.00
Well Controller: SDGS
Usage: OB

Sample Identification: 17
Location: NE SW NW NE sec. 23, T. 97 N., R. 48 W.
Date Sampled: 9-10-81

Sample Identification 17 -- continued.

Water Source: BS-S
Well Depth (ft): 53
Depth to Water from Casing Top (ft): 23.38
Well Controller: SDGS
Usage: OB

Sample Identification: 18
Location: NE SW NW NE sec. 23, T. 97 N., R. 48 W.
Date Sampled: 9-10-81
Water Source: BS-S
Well Depth (ft): 53
Depth to Water from Casing Top (ft): 23.38
Well Controller: SDGS
Usage: OB
Comment: This sample was analyzed by the Division of Water Quality, Department of Water and Natural Resources.

Sample Identification: 19
Location: SE NW SE NE sec. 23, T. 97 N., R. 48 W.
Date Sampled: 6-6-80
Water Source: BS-S
Well Depth (ft): 32
Depth to Water from Casing Top (ft): ----
Well Controller: Van Meeteren
Usage: D, S

Sample Identification: 20
Location: NE SW SW SE sec. 23, T. 97 N., R. 48 W.
Date Sampled: 6-6-80
Water Source: BS-S
Well Depth (ft): 36
Depth to Water from Casing Top (ft): ----
Well Controller: M. Peterson
Usage: D, S

Sample Identification: 21
Location: NE NW SE Sw sec. 10, T. 97 N., R. 48 W.
Date Sampled: 6-3-81
Water Source: Kd
Well Depth (ft): 475
Depth to Water from Casing Top (ft): ----
Well Controller: G. Bendester
Usage: D, S

Sample Identification: 22
Location: NE SW NE SW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-23-80
Water Source: Kd
Well Depth (ft): 209
Depth to Water from Casing Top (ft): ----
Well Controller: SDGS
Usage: OB

Sample Identification: 23
Location: NE SW NE SW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-23-80
Water Source: Kd
Well Depth (ft): 209
Depth to Water from Casing Top (ft): ----
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 0.50 hours after sample 22.

Sample Identification: 24
Location: NE SW NE SW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-25-80
Water Source: Kd
Well Depth (ft): 209
Depth to Water from Casing Top (ft): 54.00
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 0.75 hours after pumping was initiated.

Sample Identification: 25
Location: NE SW NE SW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-25-80
Water Source: Kd
Well Depth (ft): 209
Depth to Water from Casing Top (ft): 54.00
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 1.50 hours after pumping was initiated.

Sample Identification: 26
Location: NE SW NE SW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 9-10-81
Water Source: Kd
Well Depth (ft): 209
Depth to Water from Casing Top (ft): 54.11
Well Controller: SDGS
Usage: OB

Sample Identification: 27
Location: NE SW NE SW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 9-10-81
Water Source: Kd
Well Depth (ft): 209
Depth to Water from Casing Top (ft): 54.11
Well Controller: SDGS
Usage: OB
Comment: This sample was analyzed by the Division of Water Quality, Department of Water and Natural Resources.

Sample Identification: 28
Location: NW SW NW SW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-24-80
Water Source: Kd
Well Depth (ft): 453
Depth to Water from Casing Top (ft): 74.00
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 0.83 hours after pumping was initiated.

Sample Identification: 29
Location: NW SW NW SW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-24-80
Water Source: Kd
Well Depth (ft): 453
Depth to Water from Casing Top (ft): 74.00
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 1.58 hours after pumping was initiated.

Sample Identification: 30
Location: NW SW NW SW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-24-80
Water Source: Kd
Well Depth (ft): 453
Deptn to Water from Casing Top (ft): 74.00
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 2.25 hours after pumping was initiated.

Sample Identification: 31
Location: NW SW NW SW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-24-80
Water Source: Kd
Well Depth (ft): 453
Depth to Water from Casing Top (ft): 74.00
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 3.00 hours after pumping was initiated.

Sample Identification: 32
Location: NW SW NW SW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-24-80
Water Source: Kd
Well Depth (ft): 453
Deptn to Water from Casing Top (ft): 74.00
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 3.75 hours after pumping was initiated.

Sample Identification: 33
Location: NW SW NW SW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-24-80
Water Source: Kd
Well Depth (ft): 453
Depth to Water from Casing Top (ft): 74.00
Well Controller: SDGS
Usage: OB
Comment: This sample was taken 3.75 hours after pumping was initiated.

Sample Identification: 34
Location: SW SW SE SE sec. 16, T. 97 N., R. 48 W.
Date Sampled: 6-12-80
Water Source: Kd
Well Depth (ft): 500
Depth to Water from Casing Top (ft): ----
Well Controller: J. Strasser
Usage: D

Sample Identification: 35
Location: SE SE NE NE sec. 20, T. 97 N., R. 48 W.
Date Sampled: 6-12-80
Water Source: Kd
Well Depth (ft): 500
Depth to Water from Casing Top (ft): ----
Well Controller: A. Maasen
Usage: D, S

Sample Identification: 36
Location: NW NE NW NE sec. 21, T. 97 N., R. 48 W.
Date Sampled: 6-12-80
Water Source: Kd
Well Depth (ft): 500
Depth to Water from Casing Top (ft): ----
Well Controller: R. Van Noort
Usage: D, S

Sample Identification: 37
Location: NW NE NE Nw sec. 21, T. 97 N., R. 48 W.
Date Sampled: 6-11-80
Water Source: Kd
Well Depth (ft): 400
Depth to Water from Casing Top (ft): ----
Well Controller: C. Fossum
Usage: D, S

Sample Identification: 38
Location: NE NW SE SE sec. 21, T. 97 N., R. 48 W.
Date Sampled: 6-12-80
Water Source: Kd
Well Depth (ft): 428

Sample Identification 38 -- continued.

Depth to Water from Casing Top (ft): ----
Well Controller: J. Sorum
Usage: D, S

Sample Identification: 39
Location: NW SW NE SW sec. 22, T. 97 N., R. 48 W.
Date Sampled: 6-13-80
Water Source: Kd
Well Depth (ft): 450
Depth to Water from Casing Top (ft): ----
Well Controller: M. Loken
Usage: D, S

Sample Identification: 40
Location: NE NE NW NW sec. 24, T. 97 N., R. 48 W.
Date Sampled: 6-17-80
Water Source: Kd
Well Depth (ft): 520
Depth to Water from Casing Top (ft): ----
Well Controller: R. Rosgaard
Usage: D, S

Sample Identification: 41
Location: SE NE NW NW sec. 27, T. 97 N., R. 48 W.
Date Sampled: 6-17-80
Water Source: Kd
Well Depth (ft): 428
Depth to Water from Casing Top (ft): ----
Well Controller: A. Olsen
Usage: D, S

Sample Identification: 42
Location: SE NW SE SW sec. 13, T. 97 N., R. 48 W.
Date Sampled: 6-17-80
Water Source: UND
Well Depth (ft): ----
Depth to Water from Casing Top (ft): ----
Well Controller: J. De Young
Usage: D, S

Sample Identification: 43
Location: NW SW NW NW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-2-80
Water Source: UND
Well Depth (ft): 100
Depth to Water from Casing Top (ft): ----
Well Controller: A. Harmelink
Usage: D, S

Sample Identification: 44
Location: NW SW NE NE sec. 22, T. 97 N., R. 48 W.
Date Sampled: 6-3-80

Sample Identification 44 -- continued.

Water Source: UND
Well Depth (ft): 165
Depth to Water from Casing Top (ft): ----
Well Controller: B. Fish
Usage: D, S

Sample Identification: 45
Location: NE NW SW NW sec. 22, T. 97 N., R. 48 W.
Date Sampled: 6-13-80
Water Source: UND
well Depth (ft): 48
Depth to Water from Casing Top (ft): ----
Well Controller: L. Loken
Usage: D

Sample Identification: 46
Location: NW NE NW NW sec. 26, T. 97 N., R. 48 W.
Date Sampled: 6-6-80
Water Source: UND
Well Depth (ft): 130
Depth to Water from Casing Top (ft): ----
Well Controller: D. Sohl
Usage: D, S

Sample Identification: 47
Location: SE NW SW NW sec. 14, T. 97 N., R. 48 W.
Date Sampled: 6-6-80
Water Source: BSR
Well Depth (ft): ----
Depth to Water from Casing Top (ft): ----
Well Controller: ----
Usage: ----
Comment: This sample was collected along the north bank of the Big Sioux River.