STATE OF SOUTH DAKOTA
George S. Mickelson, Governor

DEPARTMENT OF WATER AND NATURAL RESOURCES
John J. Smith, Secretary

GEOLOGICAL SURVEY
Merlin J. Tipton, State Geologist

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GROUND-WATER INVESTIGATION FOR BIG STONE CITY, SOUTH DAKOTA

by

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CONTENTS

ILLUSTRATIONS

Figures

TABLES

Contents -- continued. Page

APPENDICES

INTRODUCTION

This investigation was conducted by the South Dakota Geological Survey in an effort to identify alternative ground water supplies for Big Stone City, South Dakota. The City's current supply from the Fairmount Aquifer contains high levels of dissolved inorganic compounds, particularly iron and manganese. The City has three wells in this aquifer.

The study area was limited to within a few miles of the City limits because of the prohibitive cost of piping water. Funding for the project was provided by Big Stone City and the State of South Dakota through the South Dakota Geological Survey.

Methods of Investigation

Field work for this study was conducted in three phases. Initial test drilling and observation-well installation took place between June 9 and July 1, 1981. The next phase involved the installation of several observation wells later that same year (October 20, 1981). The final period of field work occurred between June 2 and June 12, 1986. A total of 30 test holes were drilled during the study and 18 observation wells were installed (fig. 1). Lithologic logs for all test holes and descriptions of the observation wells are in appendix A. Logs for the three municipal wells are in appendix B.

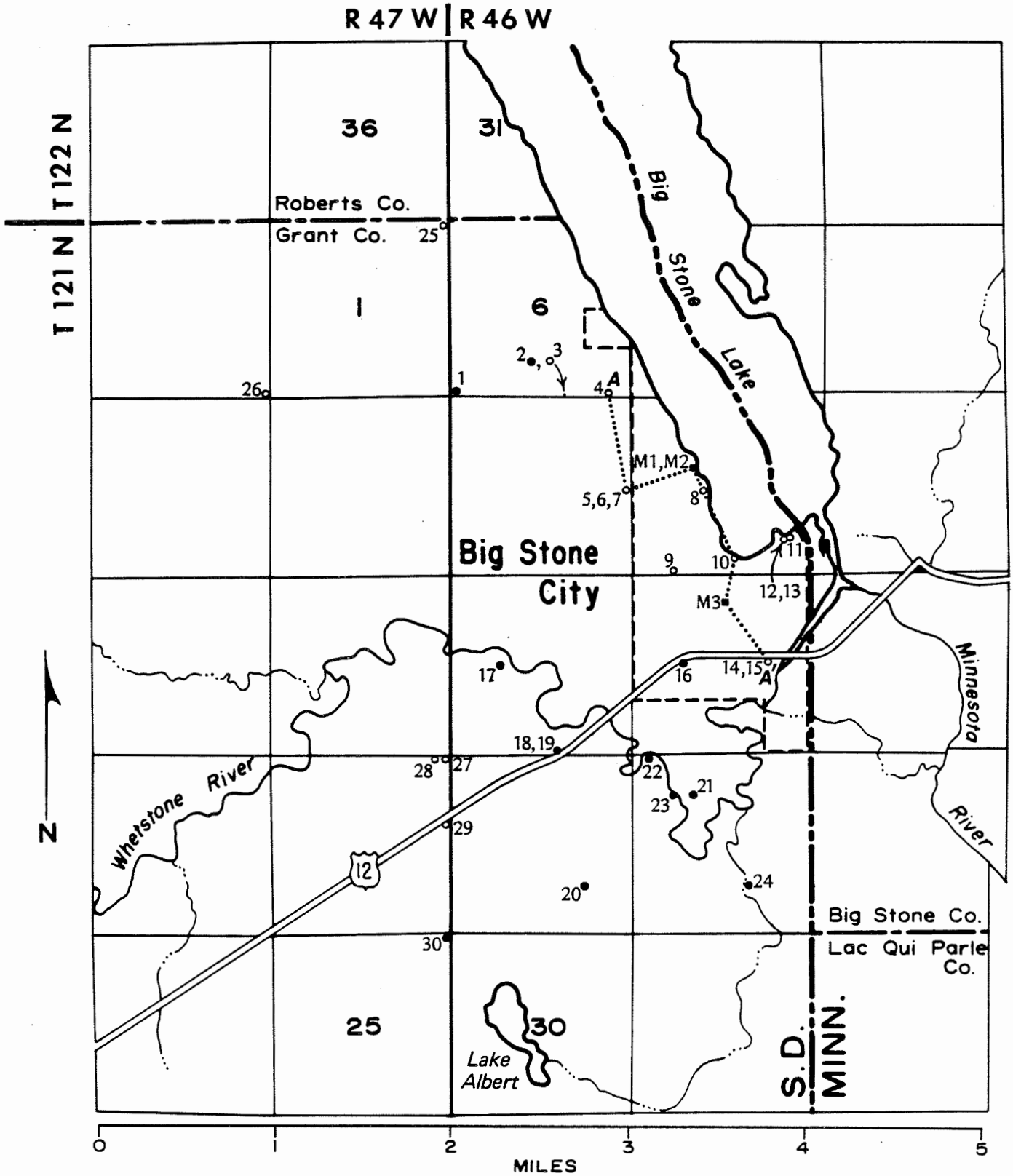
Water samples for chemical analyses were collected from the observation wells, the three municipal wells, and private wells in the area (fig. 2). Several wells were sampled more than once. The analyses determined the concentrations of a variety of dissolved inorganic compounds. Sampling took place in June and October, 1981, April, 1982, and June, 1986. A total of 50 samples were analyzed. A summary of the results is given in table 1 and the complete results are presented in appendix C. The significance of some chemical and physical parameters of drinking water are given in table 2.

Acknowledgements

The authors would like to acknowledge the help provided by David Hegge, William Voeltz, Mary Jane Lempka, Stan Adolphson, and the residents of Big Stone City during the course of this investigation.

GROUND WATER IN QUATERNARY DEPOSITS

Glacially-derived material comprises nearly all of the surficial deposits in the study area. These deposits can be divided into two basic categories: till and outwash. Till is an unsorted mixture of silt, sand, and gravel in a clay matrix. It

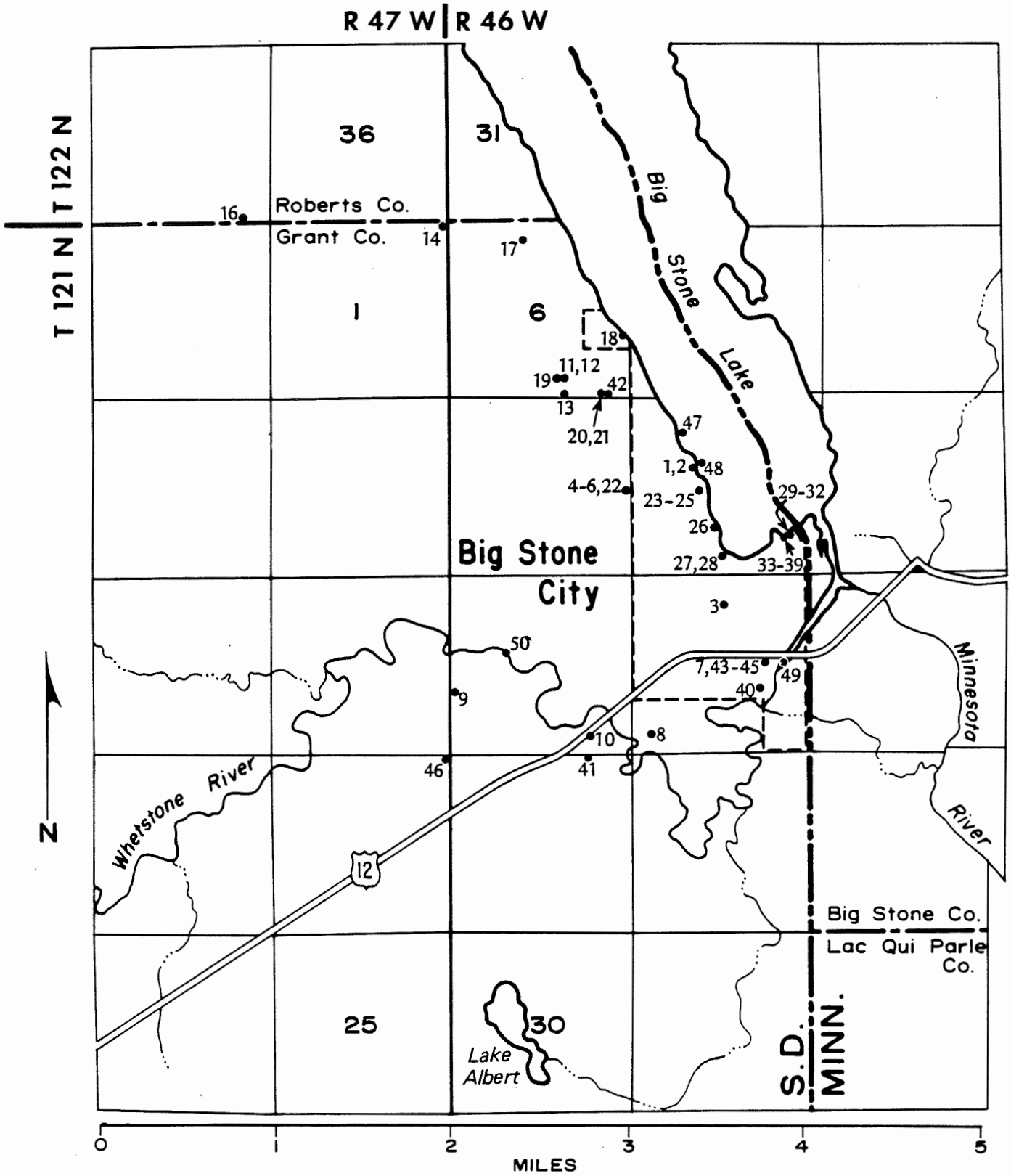


24● Test hole
7○ Observation well
} Numbers refer to map-location numbers (ML) listed on logs in Appendix A.

M3 Municipal well. Letter and number refer to map-location number in Appendix B.

····· Location of stratigraphic cross section (figure 4).

Figure 1. Test-hole and observation-well locations.



23● Water-sample location. Number refers to map-location number in Appendix C.

Note: Location of sample ML15 is west of this map, SE, NE, NE, SE, Sec. 33, T. 122 N., R. 47 W.

Figure 2. Water-sample locations.

Table 1. Summary of the chemical analyses of water samples
(Analytical results are shown in parts per million)

Water Source	Parameter	EPA Limits*	Number of Analyses	Range in Levels	Comments**
Municipal wells	Calcium	None	3	106 - 233	Average = 164
	Magnesium	None	3	66 - 95	Average = 80.2
	Sodium	None	3	16.3 - 70	Average = 44.6
	Sulfate	250	3	334 - 562	Average = 439.7
	Chloride	250	3	3.2 - 33.5	Average = 18.9
	Iron	0.30	3	0.82 - 4.8	Average = 3.14
	Manganese	0.05	3	0.51 - 1.01	Average = 0.75
	Nitrate-Nitrogen	10.0	3	<0.10 - 0.65	Detected in 2 samples
	Fluoride	2.4	3	0.23 - 1.08	Average = 0.77
	Total dissolved solids	500	3	767 - 1348	Average = 1025
Surface outwash	Calcium	None	6***	62 - 171	Average = 98.3
	Magnesium	None	6***	38 - 61.2	Average = 46.7
	Sodium	None	6***	9 - 81	Average = 24.2
	Sulfate	250	7	24 - 317	Average = 119.4
	Chloride	250	7	< 2.0 - 55.5	Detected in 6 samples
	Iron	0.30	7	< 0.05 - 0.19	Detected in 3 samples
	Manganese	0.05	7	< 0.05 - 0.66	Detected in 6 samples
	Nitrate-Nitrogen	10.0	7	< 0.10 - 1.25	Detected in 2 samples
	Fluoride	2.4	7	0.19 - 0.74	Average = 0.37
	Total dissolved solids	500	7	350 - 840	Average = 538

Table 1 -- continued.

Water Source	Parameter	EPA Limits*	Number of Analyses	Range in Levels	Comments**
Veblen Aquifer	Calcium	None	6	164 - 602	Average = 326
	Magnesium	None	6	59 - 172	Average = 106
	Sodium	None	6	21 - 134	Average = 45
	Sulfate	250	6	311 - 1540	Average = 718
	Chloride	250	6	$\leq$ 2 - 320	Detected in 5 samples
	Iron	0.30	6	< 0.05 - 1.75	Detected in 3 samples
	Manganese	0.05	6	< 0.05 - 1.19	Detected in 5 samples
	Nitrate-Nitrogen	10.0	6	< 0.10 - 85.0	Detected in 2 samples
	Fluoride	2.4	6	0.26 - 2.79	Average = 0.76
	Total dissolved solids	500	6	892 - 3120	Average = 1724
Fairmount Aquifer	Calcium	None	25	122 - 425	Average = 259
	Magnesium	None	25	51 - 329	Average = 141
	Sodium	None	25	23 - 161	Average = 83.8
	Sulfate	250	25	270 - 1270	Average = 547
	Chloride	250	25	< 2.0 - 54	Detected in 22 samples
	Iron	0.30	25	< 0.05 - 10.10	Detected in 22 samples
	Manganese	0.05	25	< 0.05 - 1.51	Detected in 24 samples
	Nitrate-Nitrogen	10.0	25	< 0.10 - 12.0	Detected in 4 samples
	Fluoride	2.4	25	< 0.10 - 0.87	Detected in 21 samples
	Total dissolved solids	500	25	818 - 3440	Average = 1629
Milbank Granite	Calcium	None	5	68 - 376	Average = 176
	Magnesium	None	5	20.0 - 115	Average = 78.4
	Sodium	None	5	41 - 146	Average = 84

Table 1 -- continued.

Water Source	Parameter	EPA Limits*	Number of Analyses	Range in Levels	Comments**
Milbank Granite -- continued.					
	Sulfate	250	5	370 - 750	Average = 549
	Chloride	250	5	< 2.0 - 51	Detected in 4 samples
	Iron	0.30	5	< 0.05 - 126	Detected in 1 sample
	Manganese	0.05	5	< 0.05 - 0.64	Detected in 3 samples
	Nitrate-Nitrogen	10.0	5	< 0.10 - 0.70	Detected in 2 samples
	Fluoride	2.4	5	0.31 - 2.85	Average = 1.01
	Total dissolved solids	500	5	760 - 1780	Average = 1170

* National Interim Primary Drinking Water Regulations (U.S. Environmental Protection Agency, 1985a) define maximum allowable levels of nitrate as nitrogen and fluoride. National Secondary Drinking Water Regulations (U.S. Environmental Protection Agency, 1985b) set suggested levels of sulfate, chloride, iron, manganese, and total dissolved solids.

** Average parameter level is presented only when it was detected in all of the samples.

*** One of the surface outwash water samples had gone through a commercial water softener before collection. As such, levels of calcium, magnesium, and sodium detected were not representative and were not used in compiling this table.

Table 2. Significance of some chemical and physical properties of drinking water.

CHEMICAL CONSTITUENTS	SIGNIFICANCE	RECOMMENDED LIMITS (ppm)*
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 - None
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 (SO4)	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.	250
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
Nitrate as N	In excess may be injurious when used in infant feeding. The U.S. Environmental Protection Agency regards 45 ppm as the safe limit of nitrate (NO3) or 10 ppm nitrogen (N).	10

Table 2 -- continued.

CHEMICAL CONSTITUENTS	SIGNIFICANCE	RECOMMENDED LIMITS (ppm)*
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 enamel.	2.4
pH	A measure of the hydrogen ion concentration; pH of 7.0 indicates a neutral solution, pH values lower than 7.0 indicate acidity, pH values higher than 7.0 indicate alkalinity. Alkalinity tends to aid encrustation and acidity tends to aid corrosion.	6.5 - 8.5
Hardness as $CaCO_3$	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. Good drinking water can be very hard.	None
Total Dissolved Solids	Total of all dissolved constituents. Water containing more than 1000 ppm dissolved solids may have a noticeable taste; it may also be unsuitable for irrigation and certain industrial uses.	500

Modified from Jorgensen (1966)
* (ppm) parts per million

is deposited directly from the ice, with little or no reworking by water. Although it can contain isolated pockets of sand and/or gravel, it is not typically a good source of water. Outwash is sorted and stratified sand and gravel that was deposited by glacial meltwater. Outwash deposits are usually good aquifers.

Analysis of the logs of the test holes drilled indicated that there are three outwash complexes in the study area that could be classified as aquifers: surficial outwash, the Veblen Aquifer, and the Fairmount Aquifer. Figure 3 shows their areal distribution and figure 4 shows their relative stratigraphic position.

Surface Outwash

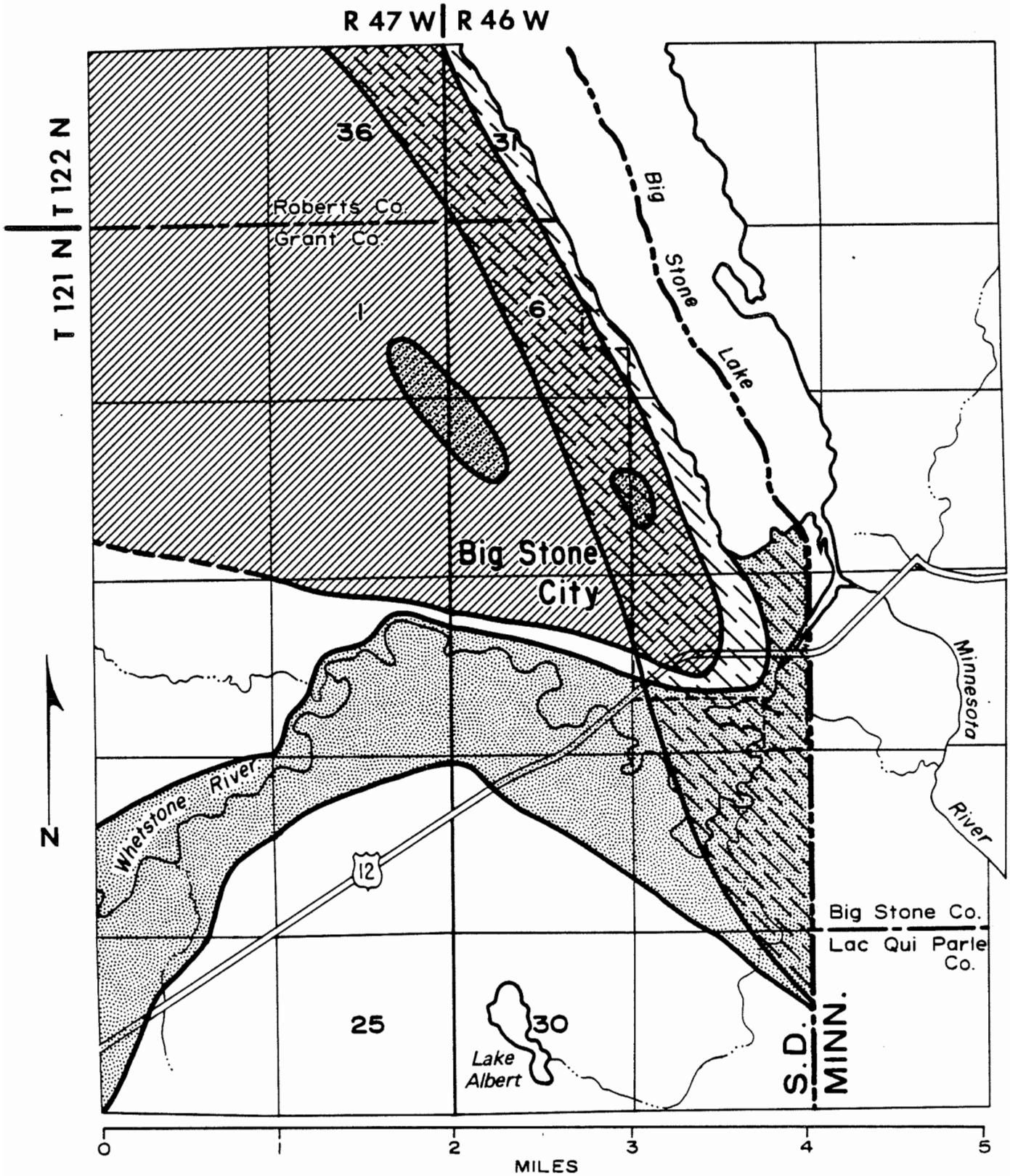
Isolated deposits of sand and gravel are found at the surface throughout the study area, but most of this material is concentrated in the valleys of the Minnesota and Whetstone Rivers and around Big Stone Lake (fig. 3). These deposits were formed during the last stage of glacial activity in this area when the two valleys served as meltwater drainageways. Sand and gravel in the Whetstone River valley is up to 35 feet thick, but is laterally discontinuous. Post-glacial erosion has removed much of the material from the Minnesota River valley and around Big Stone Lake, but some thin deposits still exist.

Surface outwash deposits are supplying water to a number of private users in the area. Although these deposits are found over most of the area, their discontinuous nature has prevented wider utilization of this aquifer. Water levels in the deposits appear to be about the same as adjacent surface water bodies, such as the Whetstone River, indicating a possible hydraulic connection between them.

Seven water samples were analyzed from surficial outwash deposits (app. C, water samples 4 through 10). Levels of dissolved inorganics are typically lower than those found in the City's current wells (table 1). Iron was detected in only one well (water samples 4, 5, and 6) and levels were below Environmental Protection Agency (EPA) recommended limits. Sulfate levels are also considerably lower and, with one exception, are all below EPA limits. Detectable levels of nitrate-nitrogen, 1.20 and 1.25 parts per million (ppm), were found in two wells adjacent to the Whetstone River (water samples 7 and 8). A water sample collected from the Whetstone River (water sample 49) near these wells had a similar amount of nitrate-nitrogen (0.9 ppm) and would seem to indicate a hydraulic connection between the surface outwash and the river in this area.

Veblen Aquifer

The Veblen Aquifer was defined by Hedges and others (1982) as an outwash deposit occupying an intermediate to basal position

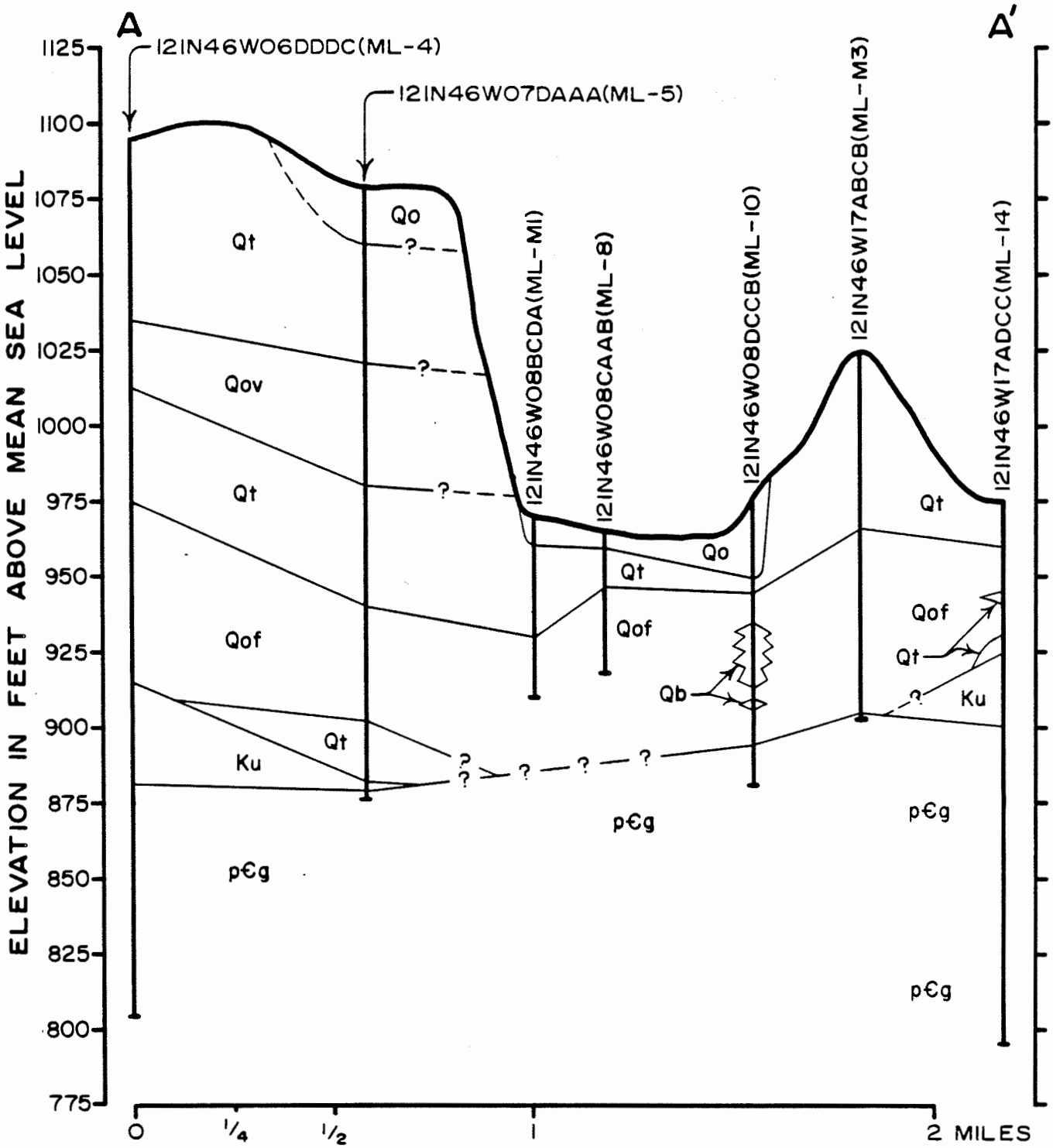


Surface outwash deposits (modified from Jarrett, 1986).

Veblen aquifer

Fairmount aquifer

Figure 3. Areal distribution of major Quaternary aquifers.



Vertical exaggeration = 40X

Figure 4. Stratigraphic cross section showing the position of major aquifers.

Qo = Outwash
Qov = Outwash, Veblen aquifer
Qof = Outwash, Fairmount aquifer
Qt = Till
Qb = Blocks of bedrock within outwash
Ku = Cretaceous units, undifferentiated
p€g = Milbank Granite
See figure 1 for location of section.

within the glacial deposits in northeastern South Dakota. During this investigation it was encountered northwest of Big Stone City (fig. 3) in an intermediate position (fig. 4). It is composed primarily of sand with some coarse gravel. The unit appears to be truncated to the east by the valley of the Minnesota River and Big Stone Lake and to the south by the valley of the Whetstone River.

Several farms northwest of Big Stone City are using the Veblen Aquifer for domestic wells and irrigation. The aquifer is completely saturated in this area and water in the wells will rise to within 30 feet of land surface. However, water levels in the aquifer are very low in the vicinity of Big Stone City. Several wells constructed within one-half mile of the bluff had less than 10 feet of water (fig. 1; ML 3, 7), and one well was dry (fig. 1; ML 6). The low water levels are apparently the result of discharge of water as a seep or spring(s) where the aquifer has been exposed by downcutting of the rivers.

Six water samples were analyzed from the Veblen Aquifer (app. C, water samples 11 through 16). Levels of dissolved chemicals are basically the same as those currently found in the City's wells, although the iron concentrations are a little lower (table 1). One of the private wells sampled (app. C, fig. 2, water samples 11 and 12) was found to have very high levels of several constituents. The high concentrations of nitrate-nitrogen and chloride suggest that this well has been contaminated locally, and does not accurately represent the aquifer. Water recovered from an observation well adjacent to this site (app. C, fig. 2, water sample 13) showed markedly lower dissolved chemicals.

Fairmount Aquifer

The Fairmount Aquifer was defined by Hedges and others (1982) as an outwash deposit occupying a basal position within the glacial deposits of northeastern South Dakota. In the study area it was encountered in and around the Minnesota River valley and Big Stone Lake (fig. 3). It was typically the basal glacial unit overlying either Cretaceous or Precambrian bedrock (fig. 4) and is composed of medium- to coarse-grained sand with minor clay or gravel lenses. Several blocks of Cretaceous shale were found within this unit.

All three of Big Stone City's municipal wells, as well as numerous private wells, are in the Fairmount Aquifer. The unit is under artesian conditions and water will rise to within 10 feet of land surface around Big Stone Lake. Wells drilled on higher ground in the area have correspondingly greater depths to water. It is the most widely utilized aquifer in the area because of its wide distribution and abundant water.

A total of 28 water samples were analyzed from the Fairmount Aquifer, including samples from the three municipal wells (app.

C, water samples 1 through 3 and 17 through 41). In general, the water quality was quite poor over the entire area (table 1). Iron was detected in 23 of the samples, at an average concentration of 3.27 ppm, which is more than 10 times the EPA recommended limit of 0.30 ppm. Levels of most other parameters, including manganese, sulfate, and total dissolved solids, were also high, relative to other aquifers and EPA standards.

Water samples were also collected from the municipal wells and the residence of Mary Ludwig and sent to the State Health Laboratory for iron bacteria analysis. Test results were positive for all samples. Iron bacteria produce a reddish organic mass or slime that accumulates in pipes and on well screens, reducing the overall productivity of the system.

GROUND WATER IN BEDROCK

The local bedrock units (from oldest to youngest) consist of the Precambrian Milbank Granite, which underlies the entire study area, and the Cretaceous age Greenhorn Limestone and Carlile Shale. The thickness and distribution of the Cretaceous rocks is quite variable due to post-depositional erosion. None of these units are typically good aquifers, but water has been produced from weathered portions of the granite. Weathered granite is composed of angular, medium to coarse quartz sand grains in a matrix of kaolinitic clays. The thickness of the weathered zone varies widely.

Five water samples from wells in the weathered Milbank Granite were analyzed (app. C, water samples 42 through 46). Levels of most chemical constituents were high, with the exception of iron which was detected in only one of the five samples analyzed. The exceptionally high potassium levels in this aquifer reflect the large amounts of that element in granitic rocks.

CONCLUSIONS AND RECOMMENDATIONS

Four aquifers were identified during the course of this investigation: surface outwash, the Veblen Aquifer, the Fairmount Aquifer, and the weathered Milbank Granite. Of these four, only the surface outwash contains water that is significantly better than the City's current supply. Unfortunately, the surface outwash is laterally discontinuous and therefore probably not capable of supplying large quantities of water.

The present data show that the most promising aquifer, near the City, for municipal use is the Fairmount Aquifer. The present City wells are drilled into this aquifer and it could sustain additional well development. However, water from this aquifer has generally high levels of dissolved chemicals, with many, particularly iron and manganese, in excess of EPA recommended limits. Iron bacteria have also been detected in water samples from the

City supply. Periodic treatment of the wells, and storage facilities if possible, are recommended to minimize these problems. Construction of a water treatment plant to remove undesirable chemicals is also an option. Finally, a hook-up to the Grant-Roberts Rural Water System to provide the City with better quality water should also be considered.

REFERENCES CITED

Hedges, L. A., Burch, S. L., Iles, D. L., Barari, R. A., and Schoon, R. A., 1982, Evaluation of groundwater resources, eastern South Dakota and upper Big Sioux River, South Dakota and Iowa; TASKS 1, 2, 3, and 4: Prepared by the South Dakota Geological Survey for the U.S. Army Corps of Engineers, Contract DACW45-80-C-0185.

Jarrett, M. J., 1986, Sand and gravel resources in Grant County, South Dakota: South Dakota Geological Survey, Information Pamphlet no. 36, 91 p.

Jorgensen, D., 1966, Ground water supply for the City of Lake Norden: South Dakota Geological Survey, Special Report no. 34, 37 p.

U.S. Environmental Protection Agency, 1985a, National interim primary drinking water standards - maximum contaminant levels for inorganic chemicals: Code of Federal Regulations, Title 40, Part 141, Section 141.11, p. 523-524.

U.S. Environmental Protection Agency, 1985b, National secondary drinking water regulations - secondary maximum contaminant levels: Code of Federal Regulations, Title 40, Part 143, Section 143.3, p. 584.

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.

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

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.

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

TOTAL DRILL HOLE DEPTH and SCREEN LENGTH: The numbers are presented in feet.

SCREEN TYPE and CASING TYPE: PVC = polyvinylchloride; MFG = manufactured.

CASING DIAMETER: The numbers are presented in inches.

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

COUNTY: GRANT LOCATION: 121N-46W-06CCCC
MAP LOCATION: 1
LEGAL LOCATION: SW SW SW SW SEC. 06, T. 121 N., R. 46 W.
LATITUDE: 45.1845 LONGITUDE: 96.2937
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: S. MITCHELL DRILLER'S LOG:
GEOLOGIST: J. GILBERTSON GEOLOGIST'S LOG: X
DATE DRILLED: 06-03-1986 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1115.00 T
TOTAL DRILL HOLE DEPTH: 112.0 TEST HOLE NUMBER: CO-86-04
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: X SINGLE POINT RESISTIVITY: X
NATURAL GAMMA: X EXTRA:
SAMPLES:

0	-	2.0	TOPSOIL, BLACK, SANDY
2.0	-	28.0	SAND, YELLOW-BROWN TO GRAY, MEDIUM TO COARSE
28.0	-	89.0	CLAY, GRAY, SILTY, SANDY, PEBBLY; SAND AND GRAVEL STRINGERS FROM 76 TO 79 AND 81 TO 83 FEET (TILL)
89.0	-	112.0	SAND AND GRAVEL, YELLOW-BROWN TO GRAY, MEDIUM SAND TO MEDIUM GRAVEL; MANY GRAY TILL STRINGERS(?)

DRILLING STOPPED BY ROCK AT 112 FEET.

* * * *

COUNTY: GRANT LOCATION: 121N-46W-06DCDC 1
MAP LOCATION: 2
LEGAL LOCATION: SW SE SW SE SEC. 06, T. 121 N., R. 46 W.
LATITUDE: 45.1845 LONGITUDE: 96.2846
LAND OWNER: N. VAN LITH
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: S. MITCHELL DRILLER'S LOG:
GEOLOGIST: J. GILBERTSON GEOLOGIST'S LOG: X
DATE DRILLED: 06-04-1986 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1100.00 T
TOTAL DRILL HOLE DEPTH: 186.0 TEST HOLE NUMBER: CO-86-06
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY: X
NATURAL GAMMA: X EXTRA:
SAMPLES:

0	-	2.0	TOPSOIL, BLACK
2.0	-	15.0	CLAY, TAN TO YELLOW-BROWN, VERY SILTY, SANDY, PEBBLY (TILL)
15.0	-	32.0	CLAY, TAN TO YELLOW-BROWN, SILTY, SANDY, PEBBLY (TILL)
32.0	-	69.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
69.0	-	74.0	CLAY, YELLOW-BROWN, VERY SANDY, SILTY, PEBBLY (TILL)
74.0	-	95.0	SAND AND GRAVEL, YELLOW-BROWN TO GRAY, MEDIUM SAND TO COARSE GRAVEL
95.0	-	116.0	CLAY, GRAY, SANDY, SILTY, PEBBLY; SOFT (TILL)
116.0	-	120.0	SAND AND GRAVEL
120.0	-	150.0	CLAY, GRAY, SILTY, SANDY, PEBBLY; MANY SAND AND GRAVEL STRINGERS (TILL)
150.0	-	163.0	CLAY, GRAY, VERY SILTY, SANDY, PEBBLY (TILL)
163.0	-	186.0	CLAY(?), GRAY, VERY SANDY, PEBBLY; MAY BE A VERY CLAYEY SAND

LOWEST INTERVAL MAY BE FAIRMOUNT AQUIFER ACCORDING TO ELECTRIC LOG. POOR, INDISTINCT CUTTINGS FROM THAT INTERVAL.

* * * *

COUNTY: GRANT LOCATION: 121N-46W-06DCDC 2
MAP LOCATION: 3
LEGAL LOCATION: SW SE SW SE SEC. 06, T. 121 N., R. 46 W.
LATITUDE: 45.1845 LONGITUDE: 96.2846
LAND OWNER: N. VAN LITH
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: S. MITCHELL DRILLER'S LOG:
GEOLOGIST: J. GILBERTSON GEOLOGIST'S LOG: X
DATE DRILLED: 06-10-1986 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1097.46 I
TOTAL DRILL HOLE DEPTH: 97.0 TEST HOLE NUMBER: CO-86-07
WATER RIGHTS WELL: SDGS WELL NAME: CO-86-07
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: VEBLEN
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. AND HM. SCREEN LENGTH: 13.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1100.46 I
CASING STICK-UP: 3.00 TOTAL CASING AND SCREEN: 100.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:

SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

SCREEN - 3 FEET SLOTTED (HACK-SAW) ABOVE 10 FEET MANUFACTURED SCREEN. DEPTH TO WATER: 82.82 FEET ON 06-18-1986.

0	-	2.0	TOPSOIL, BLACK
2.0	-	32.0	CLAY, TAN TO YELLOW-BROWN, SILTY, SANDY, PEBBLY (TILL)
32.0	-	69.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
69.0	-	74.0	CLAY, TAN TO YELLOW-BROWN, SANDY, SILTY, PEBBLY (TILL)
74.0	-	96.0	SAND AND GRAVEL, YELLOW-BROWN TO GRAY, MEDIUM SAND TO MEDIUM GRAVEL
96.0	-	97.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)

USED ELECTRIC LOG FROM CO-86-06 (121N-46W-06DCDC 1).

* * * *

COUNTY: GRANT LOCATION: 121N-46W-06DDDC
MAP LOCATION: 4
LEGAL LOCATION: SW SE SE SE SEC. 06, T. 121 N., R. 46 W.
LATITUDE: 45.1847 LONGITUDE: 96.2829
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: D. IVERSON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-23-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1095.00 T
TOTAL DRILL HOLE DEPTH: 291.0 TEST HOLE NUMBER: BSC-81-15
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-15
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: MILBANK GRANITE
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 6.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: 3.00 TOTAL CASING AND SCREEN: 286.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: X SINGLE POINT RESISTIVITY: X
NATURAL GAMMA: X EXTRA:
SAMPLES: X

SAMPLING INTERVAL: 10 FEET. DEPTH TO WATER: 119.48 FEET ON 07-01-1981, 116.25 FEET ON 05-20-1986.

0	-	1.0	TOPSOIL
1.0	-	20.0	CLAY, BROWN, SILTY, SANDY, PEBBLY (TILL)
20.0	-	38.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
38.0	-	53.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, GRAVELLY (TILL)
53.0	-	60.0	CLAY, BROWN-GRAY, SANDY
60.0	-	82.0	GRAVEL, FINE, SANDY; SOME CLAY
82.0	-	90.0	CLAY, RED-GRAY, SILTY, SANDY, PEBBLY (HAWK CREEK TILL)
90.0	-	120.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
120.0	-	180.0	SAND, MEDIUM; CLEAN
180.0	-	214.0	LIMESTONE, BROWN; SOME SHALE (GREENHORN LIMESTONE)
214.0	-	290.0	SAND, WHITE, FINE TO MEDIUM, ANGULAR; WEATHERED, SOME PINK ORTHOCLASE FELDSPAR GRAINS, KAOLINITIC (MILBANK GRANITE)
290.0	-	291.0	GRANITE, BLUE-GRAY; HARD (MILBANK GRANITE)

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COUNTY: GRANT LOCATION: 121N-46W-07DAAA 1
MAP LOCATION: 5
LEGAL LOCATION: NE NE NE SE SEC. 07, T. 121 N., R. 46 W.
LATITUDE: 45.1815 LONGITUDE: 96.2824
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: D. IVERSON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-22-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1078.07 I
TOTAL DRILL HOLE DEPTH: 200.0 TEST HOLE NUMBER: BSC-81-13
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-13
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: FAIRMOUNT
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 5.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1081.07 I
CASING STICK-UP: 3.00 TOTAL CASING AND SCREEN: 145.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:

SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

DRILLER DID NOT ATTEMPT TO DRILL THROUGH THE ZONE OF WEATHERED GRANITE. SOUTH WELL AT THIS SITE. DEPTH TO WATER: 102.35 FEET ON 05-20-1986, 102 FEET ON 06-11-1986.

0	-	1.0	TOPSOIL, BROWN
1.0	-	18.0	SAND, BROWN, COARSE
18.0	-	57.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
57.0	-	98.0	GRAVEL
98.0	-	127.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
127.0	-	138.0	CLAY, GRAY, SANDY (TILL)
138.0	-	176.0	SAND, FINE; SOME GRAVEL
176.0	-	187.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
187.0	-	196.0	CLAY, GRAY, PEBBLY (TILL)
196.0	-	199.0	SHALE(?), GRAY
199.0	-	200.0	SAND, WHITE, FINE TO MEDIUM, ANGULAR; WEATHERED, SOME PINK ORTHOCLASE FELDSPAR GRAINS, KAOLINITIC (MILBANK GRANITE)

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COUNTY: GRANT LOCATION: 121N-46W-07DAAA 2
MAP LOCATION: 6
LEGAL LOCATION: NE NE NE SE SEC. 07, T. 121 N., R. 46 W.
LATITUDE: 45.1816 LONGITUDE: 96.2824
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-22-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1081.00 T
TOTAL DRILL HOLE DEPTH: 110.0 TEST HOLE NUMBER: BSC-81-14
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-14
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: VEBLEN
MANAGEMENT UNIT:
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: 85.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:

SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

DRY HOLE; WELL DISMANTLED 07-01-1981.

0	-	1.0	TOPSOIL, BROWN
1.0	-	15.0	SAND, BROWN, COARSE
15.0	-	16.0	CLAY, BROWN, SANDY (TILL)
16.0	-	17.0	SAND, BROWN
17.0	-	24.0	CLAY, BROWN, SANDY (TILL)
24.0	-	55.0	CLAY, GRAY, PEBBLY (TILL)
55.0	-	96.0	SAND AND GRAVEL, MEDIUM SAND AND FINE TO COARSE GRAVEL
96.0	-	110.0	CLAY, GRAY, SANDY, PEBBLY (TILL)

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COUNTY: GRANT LOCATION: 121N-46W-07DAAA 3
MAP LOCATION: 7
LEGAL LOCATION: NE NE NE SE SEC. 07, T. 121 N., R. 46 W.
LATITUDE: 45.1817 LONGITUDE: 96.2824
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: S. MITCHELL DRILLER'S LOG:
GEOLOGIST: J. GILBERTSON GEOLOGIST'S LOG: X
DATE DRILLED: 06-11-1986 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1079.18 I
TOTAL DRILL HOLE DEPTH: 86.0 TEST HOLE NUMBER: CO-86-08
WATER RIGHTS WELL: SDGS WELL NAME: CO-86-08
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: VEBLEN
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1082.18 I
CASING STICK-UP: 3.00 TOTAL CASING AND SCREEN: 88.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

NORTH WELL AT THIS SITE.

0	-	2.0	TOPSOIL, BLACK

2.0 -	6.0	SILT, TAN, VERY SANDY; SOME PEBBLES
6.0 -	24.0	CLAY, YELLOW-BROWN, SILTY, SANDY, PEBBLY (TILL)
24.0 -	53.0	CLAY, GRAY, VERY SILTY, SANDY, PEBBLY (TILL)
53.0 -	83.0	SAND AND GRAVEL, YELLOW-BROWN TO GRAY, MEDIUM SAND TO MEDIUM GRAVEL; CLEAN; GRAY CLAY FROM 65 TO 67 FEET
83.0 -	86.0	CLAY, GRAY, SILTY, SANDY, PEBBLY

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COUNTY: GRANT LOCATION: 121N-46W-08CAAB
MAP LOCATION: 8
LEGAL LOCATION: NW NE NE SW SEC. 08, T. 121 N., R. 46 W.
LATITUDE: 45.1815 LONGITUDE: 96.2752
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: R. HAMMOND DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 10-20-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 965.41 I
TOTAL DRILL HOLE DEPTH: 47.0 TEST HOLE NUMBER: BSC-81-23
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-23
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: FAIRMOUNT
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 5.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 967.51 I
CASING STICK-UP: 2.10 TOTAL CASING AND SCREEN: 33.6
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

DEPTH TO WATER: 6.54 FEET ON 10-26-1981, 4.56 FEET ON 04-13-1982, 5.65 FEET ON 03-12-1986, 3.74 FEET ON 05-20-1986, 4.17 FEET ON 06-10-1986.

0 -	6.0	CLAY, DARK-BROWN, SILTY, PEBBLY
6.0 -	18.0	CLAY, YELLOW-BROWN, SANDY, PEBBLY; SOME GRAVEL STRINGERS (TILL)
18.0 -	34.0	SAND, GRAY-BROWN, FINE, SILTY
34.0 -	39.0	SAND, GRAY-BROWN, FINE, SILTY, GRAVELLY; SOME BOULDERS

39.0 -	41.0	CLAY, DARK-GRAY, SILTY
41.0 -	47.0	SAND, COARSE, PEBBLY

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COUNTY: GRANT LOCATION: 121N-46W-08CCCD
MAP LOCATION: 9
LEGAL LOCATION: SE SW SW SW SEC. 08, T. 121 N., R. 46 W.
LATITUDE: 45.1753 LONGITUDE: 96.2815
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT/L. HELSETH DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-19-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1094.00 T
TOTAL DRILL HOLE DEPTH: 194.0 TEST HOLE NUMBER: BSC-81-12
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-12
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: VEBLEN
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 5.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: 2.20 TOTAL CASING AND SCREEN: 65.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WELL DISMANTLED ON 07-01-1981; CASING WAS CLOGGED WITH FINE SAND AND GRAVEL. DEPTH TO WATER: 36.75 FEET.

0 -	1.0	TOPSOIL, BROWN
1.0 -	6.0	SAND, BROWN, FINE TO MEDIUM
6.0 -	33.0	CLAY, YELLOW-BROWN, SANDY, PEBBLY (TILL)
33.0 -	53.0	CLAY, GRAY, SANDY, PEBBLY (TILL)
53.0 -	67.0	SAND AND GRAVEL, COARSE SAND AND FINE GRAVEL
67.0 -	79.0	CLAY, GRAY, SANDY, PEBBLY (TILL)
79.0 -	81.0	ROCK, WHITE
81.0 -	83.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
83.0 -	96.0	SAND AND GRAVEL, COARSE SAND AND FINE GRAVEL
96.0 -	134.0	CLAY, GRAY, PEBBLY (TILL)
134.0 -	141.0	SILT, BROWN

141.0 -	156.0	SAND AND GRAVEL
156.0 -	168.0	CLAY, GRAY-BROWN, SANDY; SOME CONCRETIONS
168.0 -	178.0	SHALE, GRAY (CARLILE SHALE?)
178.0 -	193.0	SAND, WHITE, FINE TO MEDIUM; ANGULAR; WEATHERED, SOME PINK ORTHOCLASE FELDSPAR GRAINS, KAOLINITIC (MILBANK GRANITE)
193.0 -	194.0	GRANITE, BLUE-GRAY; HARD (MILBANK GRANITE)

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COUNTY: GRANT LOCATION: 121N-46W-08DCCB
MAP LOCATION: 10
LEGAL LOCATION: NW SW SW SE SEC. 08, T. 121 N., R. 46 W.
LATITUDE: 45.1756 LONGITUDE: 96.2745
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-24-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 974.77 I
TOTAL DRILL HOLE DEPTH: 94.0 TEST HOLE NUMBER: BSC-81-19
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-19
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: FAIRMOUNT
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 5.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 975.77 I
CASING STICK-UP: 1.00 TOTAL CASING AND SCREEN: 45.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

DEPTH TO WATER: 12.83 FEET ON 06-29-1981, 10.15 FEET ON 03-12-1986, 8.41 FEET ON 05-20-1986, 9.48 FEET ON 06-10-1986.

0 -	1.0	TOPSOIL, BROWN
1.0 -	9.0	SAND, GRAY, FINE TO MEDIUM
9.0 -	26.0	SAND AND GRAVEL, COARSE SAND AND BROWN FINE GRAVEL; CLAYEY
26.0 -	31.0	CLAY, GRAY
31.0 -	41.0	SAND, BLACK, FINE TO MEDIUM

41.0 -	62.0	SILTSTONE, BLACK
62.0 -	66.0	SAND
66.0 -	69.0	SILTSTONE, DARK-GRAY
69.0 -	81.0	SAND AND GRAVEL, COARSE SAND AND FINE GRAVEL
81.0 -	93.0	SAND, WHITE, FINE TO MEDIUM, ANGULAR; WEATHERED, SOME PINK ORTHOCLASE FELDSPAR GRAINS, KAOLINITIC (MILBANK GRANITE)
93.0 -	94.0	GRANITE, BLUE-GRAY; HARD, ONLY A FEW INCHES WERE PENETRATED IN THIS INTERVAL (MILBANK GRANITE)

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COUNTY: GRANT LOCATION: 121N-46W-08DDAB
MAP LOCATION: 11
LEGAL LOCATION: NW NE SE SE SEC. 08, T. 121 N., R. 46 W.
LATITUDE: 45.1806 LONGITUDE: 96.2719
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: D. IVERSON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 07-01-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 966.51 I
TOTAL DRILL HOLE DEPTH: 65.0 TEST HOLE NUMBER: BSC-81-21
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-21
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: FAIRMOUNT
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 10.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 970.11 I
CASING STICK-UP: 3.60 TOTAL CASING AND SCREEN: 59.8
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

EAST WELL AT THIS SITE. DEPTH TO WATER: 9.66 FEET ON 10-26-1981, 6.88 FEET ON 04-13-1982, 7.93 FEET ON 03-20-1986, 7.22 FEET ON 05-20-1986, 7.39 FEET ON 06-09-1986.

0 -	1.0	TOPSOIL, BLACK
1.0 -	10.0	CLAY, BROWN, SILTY, SANDY, PEBBLY

10.0 -	22.0	CLAY, GRAY, SILTY, SANDY, PEBBLY
22.0 -	38.0	SAND, TAN, FINE TO MEDIUM
38.0 -	45.0	CLAY, GRAY, SILTY, SANDY, PEBBLY
45.0 -	65.0	SAND AND GRAVEL, COARSE SAND AND FINE GRAVEL

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COUNTY: GRANT LOCATION: 121N-46W-08DDBA 1
MAP LOCATION: 12
LEGAL LOCATION: NE NW SE SE SEC. 08, T. 121 N., R. 46 W.
LATITUDE: 45.1806 LONGITUDE: 96.2720
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: D. IVERSON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 07-01-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 968.40 I
TOTAL DRILL HOLE DEPTH: 95.0 TEST HOLE NUMBER: BSC-81-20
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-20
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: FAIRMOUNT
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 11.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 970.40 I
CASING STICK-UP: 2.00 TOTAL CASING AND SCREEN: 71.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WEST WELL AT THIS SITE. DEPTH TO WATER: 9.96 FEET ON 10-26-1981, 7.17 FEET ON 04-13-1982, 8.22 FEET ON 03-20-1986, 7.47 FEET ON 05-20-1986, 7.67 FEET ON 06-11-1986.

0 -	1.0	TOPSOIL, BLACK
1.0 -	23.0	CLAY, GRAY, SILTY, SANDY, PEBBLY
23.0 -	40.0	SAND; SOME GRAY CLAY
40.0 -	45.0	CLAY, GRAY
45.0 -	74.0	SAND AND GRAVEL, COARSE SAND AND FINE GRAVEL
74.0 -	95.0	CLAY, GRAY, SILTY, SANDY, PEBBLY

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COUNTY: GRANT LOCATION: 121N-46W-08DDBA 2
MAP LOCATION: 13
LEGAL LOCATION: NE NW SE SE SEC. 08, T. 121 N., R. 46 W.
LATITUDE: 45.1806 LONGITUDE: 96.2720
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: R. HAMMOND DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 10-20-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 965.64 I
TOTAL DRILL HOLE DEPTH: 47.0 TEST HOLE NUMBER: BSC-81-22
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-22
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: FAIRMOUNT
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 5.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 969.74 I
CASING STICK-UP: 4.10 TOTAL CASING AND SCREEN: 33.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

CENTER WELL AT THIS SITE. DEPTH TO WATER: 8.95 FEET ON 10-26-1981, 6.28 FEET ON 04-13-1982, 7.32 FEET ON 03-20-1986, 6.93 FEET ON 05-20-1986, 7.07 FEET ON 06-09-1986.

0	-	7.0	CLAY, DARK-BROWN, SILTY (ROADFILL)
7.0	-	22.0	CLAY, BLACK AND DARK-GRAY-BROWN, SILTY (DELTAIC SEDIMENTS-WHETSTONE RIVER)
22.0	-	39.0	SAND, GRAY, FINE; SOME SMALL SHELLS
39.0	-	42.0	CLAY, DARK-GRAY-BROWN, SILTY
42.0	-	47.0	SAND, COARSE, PEBBLY

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COUNTY: GRANT LOCATION: 121N-46W-17ADCC 1
MAP LOCATION: 14
LEGAL LOCATION: SW SW SE NE SEC. 17, T. 121 N., R. 46 W.
LATITUDE: 45.1730 LONGITUDE: 96.2725
LAND OWNER:

PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: L. HELSETH DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-09-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 974.91 I
TOTAL DRILL HOLE DEPTH: 180.0 TEST HOLE NUMBER: BSC-81-1
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-1
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: MILBANK GRANITE
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 6.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 975.91 I
CASING STICK-UP: 1.00 TOTAL CASING AND SCREEN: 166.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY: X
NATURAL GAMMA: X EXTRA:
SAMPLES: X

SAMPLING INTERVAL: 10 FEET. EAST WELL AT THIS SITE. DEPTH TO WATER: 15.28 FEET ON 06-30-1981, 13.40 FEET ON 05-20-1986, 13.93 FEET ON 06-10-1986.

0	-	7.0	TOPSOIL, BLACK
7.0	-	15.0	CLAY, YELLOW, SILTY, PEBBLY (TILL)
15.0	-	28.0	SAND, MEDIUM TO COARSE, CLAYEY
28.0	-	30.0	SAND, MEDIUM TO COARSE
30.0	-	34.0	CLAY, YELLOW, SILTY, PEBBLY (TILL)
34.0	-	44.0	SAND, GRAY, MEDIUM TO COARSE
44.0	-	51.0	CLAY, DARK-GRAY, SILTY, PEBBLY (TILL)
51.0	-	64.0	CLAY, DARK-GRAY, WHITE-SPECKLED; CALCAREOUS, HARD (GREENHORN LIMESTONE)
64.0	-	75.0	SHALE, DARK-GRAY; NONCALCAREOUS, HARD
75.0	-	100.0	SAND, WHITE AND BROWN; NONCALCAREOUS, SLIGHTLY CEMENTED
100.0	-	179.0	SAND, WHITE, FINE TO MEDIUM, ANGULAR; WEATHERED, SOME PINK ORTHOCLASE FELDSPAR GRAINS, KAOLINITIC (MILBANK GRANITE)
179.0	-	180.0	GRANITE, BLUE-GRAY; HARD, ONLY A FEW INCHES WERE PENETRATED IN THIS INTERVAL (MILBANK GRANITE)

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COUNTY: GRANT LOCATION: 121N-46W-17ADCC 2
MAP LOCATION: 15
LEGAL LOCATION: SW SW SE NE SEC. 17, T. 121 N., R. 46 W.
LATITUDE: 45.1730 LONGITUDE: 96.2735
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: S. MITCHELL DRILLER'S LOG:
GEOLOGIST: J. GILBERTSON GEOLOGIST'S LOG: X
DATE DRILLED: 06-12-1986 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 972.93 I
TOTAL DRILL HOLE DEPTH: 26.0 TEST HOLE NUMBER: CO-86-10
WATER RIGHTS WELL: SDGS WELL NAME: CO-86-10
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER:
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 5.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 975.93 I
CASING STICK-UP: 3.00 TOTAL CASING AND SCREEN: 29.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

WEST WELL AT THIS SITE. DEPTH TO WATER: 12.12 FEET ON 06-17-1986.

0	-	4.0	TOPSOIL, BLACK, SANDY
4.0	-	15.0	SILT, DARK-BROWN TO BLACK, SANDY, NONCALCAREOUS
15.0	-	25.0	SAND, BROWNISH-GRAY, FINE, CLAYEY
25.0	-	26.0	SILT, GRAY TO ORANGISH-BROWN, MOTTLED; CALCAREOUS

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COUNTY: GRANT LOCATION: 121N-46W-17BDCC
MAP LOCATION: 16
LEGAL LOCATION: SW SW SE NW SEC. 17, T. 121 N., R. 46 W.
LATITUDE: 45.1730 LONGITUDE: 96.2803
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT/L. HELSETH DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-15-1981 DRILLING METHOD: ROTARY

GROUND SURFACE ELEVATION: 1050.00 T
TOTAL DRILL HOLE DEPTH: 151.0 TEST HOLE NUMBER: BSC-81-2
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: X SINGLE POINT RESISTIVITY: X
NATURAL GAMMA: X EXTRA:
SAMPLES:

0	-	2.0	TOPSOIL, BLACK
2.0	-	17.0	SAND, BROWN, COARSE
17.0	-	34.0	GRAVEL, MEDIUM
34.0	-	69.0	GRAVEL, MEDIUM TO COARSE
69.0	-	105.0	CLAY, GRAY, SILTY, SANDY, PEBBLY; SOME GRAVEL STRINGERS (TILL)
105.0	-	129.0	GRAVEL, MEDIUM TO COARSE
129.0	-	139.0	SHALE, GRAY (GREENHORN LIMESTONE?)
139.0	-	150.0	SAND, WHITE, FINE TO MEDIUM, ANGULAR; WEATHERED, SOME PINK ORTHOCLASE FELDSPAR GRAINS, KAOLINITIC (MILBANK GRANITE)
150.0	-	151.0	GRANITE, BLUE-GRAY; HARD, ONLY A FEW INCHES WERE PENETRATED IN THIS INTERVAL (MILBANK GRANITE)

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COUNTY: GRANT LOCATION: 121N-46W-18BDCC
MAP LOCATION: 17
LEGAL LOCATION: SW SW SE NW SEC. 18, T. 121 N., R. 46 W.
LATITUDE: 45.1730 LONGITUDE: 96.2913
LAND OWNER: OTTER TAIL POWER CO.
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT/L. HELSETH DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-18-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1020.00 T
TOTAL DRILL HOLE DEPTH: 90.0 TEST HOLE NUMBER: BSC-81-11
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

TEST HOLE WAS ABANDONED AFTER THE CLUTCH BROKE.

0	-	3.0	TOPSOIL, BLACK, SILTY

3.0 -	6.0	SAND, BROWN, SILTY
6.0 -	19.0	GRAVEL, COARSE
19.0 -	41.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
41.0 -	42.0	ROCK
42.0 -	50.0	CLAY, GRAY; HARD
50.0 -	53.0	SAND, COARSE
53.0 -	62.0	CLAY, GRAY, SANDY (TILL)
62.0 -	64.0	SAND, COARSE
64.0 -	79.0	CLAY, GRAY; SAND STRINGERS
79.0 -	90.0	LIMESTONE, BROWN; CALCAREOUS, HARD (GREENHORN LIMESTONE)

* * * *

COUNTY: GRANT LOCATION: 121N-46W-18DCCD 1
MAP LOCATION: 18
LEGAL LOCATION: SE SW SW SE SEC. 18, T. 121 N., R. 46 W.
LATITUDE: 45.1701 LONGITUDE: 96.2851
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: L. HELSETH DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-16-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1050.00 T
TOTAL DRILL HOLE DEPTH: 11.0 TEST HOLE NUMBER: BSC-81-6
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

DRILLER COULD NOT PENETRATE THE FORMATION
THEREFORE THE TEST HOLE WAS ABANDONED.

0 -	1.0	TOPSOIL, BLACK
1.0 -	10.0	GRAVEL, COARSE
10.0 -	11.0	ROCK (GRAVEL? GRANITE?)

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COUNTY: GRANT LOCATION: 121N-46W-18DCCD 2
MAP LOCATION: 19
LEGAL LOCATION: SE SW SW SE SEC. 18, T. 121 N., R. 46 W.
LATITUDE: 45.1701 LONGITUDE: 96.2851
LAND OWNER:
PROJECT: BIG STONE CITY STUDY

DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-17-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1050.00 T
TOTAL DRILL HOLE DEPTH: 10.0 TEST HOLE NUMBER: BSC-81-7
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

DRILLER COULD NOT PENETRATE THE FORMATION
THEREFORE THE TEST HOLE WAS ABANDONED.

0	-	1.0	TOPSOIL, DARK-BROWN
1.0	-	9.0	SAND AND GRAVEL, COARSE SAND AND BROWN, MEDIUM TO COARSE GRAVEL
9.0	-	10.0	ROCK; LOST WATER CONSISTENTLY WITH MAXIMUM BENTONITE CONTENT (WEATHERED GRANITE?)

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COUNTY: GRANT LOCATION: 121N-46W-19DBDD
MAP LOCATION: 20
LEGAL LOCATION: SE SE NW SE SEC. 19, T. 121 N., R. 46 W.
LATITUDE: 45.1623 LONGITUDE: 96.2845
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT/D. IVERSON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-24-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1070.00 T
TOTAL DRILL HOLE DEPTH: 148.0 TEST HOLE NUMBER: BSC-81-17
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

0	-	1.0	TOPSOIL, BLACK
1.0	-	18.0	CLAY, BROWN, SILTY, SANDY, PEBBLY (TILL)
18.0	-	25.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
25.0	-	38.0	SAND, FINE
38.0	-	40.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)

40.0 -	56.0	CLAY, RED-GRAY, SILTY, SANDY, PEBBLY (HAWK CREEK TILL)
56.0 -	67.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
67.0 -	75.0	CLAY, GRAY; SOME SAND STRINGERS (TILL)
75.0 -	80.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
80.0 -	93.0	CLAY, GRAY, SANDY
93.0 -	116.0	SHALE, GRAY (CARLILE SHALE)
116.0 -	122.0	SHALE, DARK-BROWN, WHITE SPECKLED (FAIRPORT SHALE MEMBER? - CARLILE SHALE)
122.0 -	144.0	SAND, WHITE, FINE TO MEDIUM, ANGULAR; WEATHERED, SOME PINK ORTHOCLASE FELDSPAR GRAINS, KAOLINITIC (MILBANK GRANITE)
144.0 -	148.0	GRANITE, BLUE-GRAY; HARD (MILBANK GRANITE)

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COUNTY: GRANT LOCATION: 121N-46W-20BACD
MAP LOCATION: 21
LEGAL LOCATION: SE SW NE NW SEC. 20, T. 121 N., R. 46 W.
LATITUDE: 45.1649 LONGITUDE: 96.2756
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT/L. HELSETH DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-16-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1000.00 T
TOTAL DRILL HOLE DEPTH: 56.0 TEST HOLE NUMBER: BSC-81-3
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

0 -	1.0	SILT, BROWN
1.0 -	21.0	SAND AND GRAVEL, COARSE SAND AND FINE TO MEDIUM GRAVEL
21.0 -	22.0	ROCK
22.0 -	36.0	SAND, GRAY-BROWN, FINE TO COARSE
36.0 -	40.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
40.0 -	44.0	SAND, GRAY-BROWN, MEDIUM
44.0 -	46.0	SAND AND GRAVEL
46.0 -	55.0	CLAY, DARK-BROWN; GREASY (FAIRPORT SHALE MEMBER - CARLILE SHALE?)
55.0 -	56.0	GRANITE, BLUE-GRAY; HARD, ONLY A

FEW INCHES WERE PENETRATED IN THIS INTERVAL (MILBANK GRANITE)

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COUNTY: GRANT LOCATION: 121N-46W-20BBBA
MAP LOCATION: 22
LEGAL LOCATION: NE NW NW NW SEC. 20, T. 121 N., R. 46 W.
LATITUDE: 45.1659 LONGITUDE: 96.2815
LAND OWNER: D. SCHMEIG
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: L. HELSETH DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-16-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 990.00 T
TOTAL DRILL HOLE DEPTH: 51.0 TEST HOLE NUMBER: BSC-81-4
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: X SINGLE POINT RESISTIVITY: X
NATURAL GAMMA: X EXTRA:
SAMPLES:

0	-	2.0	TOPSOIL, BLACK
2.0	-	22.0	SAND AND GRAVEL, COARSE SAND AND MEDIUM TO COARSE GRAVEL
22.0	-	26.0	CLAY, GRAY, SILTY, PEBBLY (TILL)
26.0	-	33.0	SAND AND GRAVEL, COARSE SAND AND MEDIUM TO COARSE GRAVEL
33.0	-	48.0	SHALE, DARK-BROWN, WHITE SPECKLED; CALCAREOUS (FAIRPORT SHALE MEMBER? - CARLILE SHALE)
48.0	-	51.0	GRANITE, BLUE-GRAY; HARD (MILBANK GRANITE)

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COUNTY: GRANT LOCATION: 121N-46W-20BBDD
MAP LOCATION: 23
LEGAL LOCATION: SE SE NW NW SEC. 20, T. 121 N., R. 46 W.
LATITUDE: 45.1648 LONGITUDE: 96.2809
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: L. HELSETH DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X

DATE DRILLED: 06-16-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 990.00 T
TOTAL DRILL HOLE DEPTH: 55.0 TEST HOLE NUMBER: BSC-81-5
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

0	-	9.0	CLAY, GRAY, SILTY, PEBBLY (TILL)
9.0	-	27.0	SAND AND GRAVEL, COARSE SAND AND MEDIUM TO COARSE GRAVEL
27.0	-	34.0	SHALE, GRAY; HARD (CARLILE SHALE)
34.0	-	51.0	SHALE, DARK-BROWN, WHITE SPECKLED; CALCAREOUS, HARD (FAIRPORT SHALE MEMBER? - CARLILE SHALE)
51.0	-	55.0	GRANITE, BLUE-GRAY; HARD (MILBANK GRANITE)

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COUNTY: GRANT LOCATION: 121N-46W-20DBDC
MAP LOCATION: 24
LEGAL LOCATION: SW SE NW SE SEC. 20, T. 121 N., R. 46 W.
LATITUDE: 45.1623 LONGITUDE: 96.2734
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT/D. IVERSON DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-24-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1035.00 T
TOTAL DRILL HOLE DEPTH: 145.0 TEST HOLE NUMBER: BSC-81-18
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

0	-	1.0	TOPSOIL, BLACK
1.0	-	24.0	GRAVEL, FINE; SOME SAND
24.0	-	81.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
81.0	-	86.0	SAND, COARSE
86.0	-	95.0	LIMESTONE, BROWN; CALCAREOUS (GREENHORN LIMESTONE)
95.0	-	100.0	SAND, BLUE, COARSE (MILBANK GRANITE

WASH)

100.0 -	143.0	SAND, WHITE, MEDIUM, ANGULAR; WEATHERED, SOME PINK ORTHOCLASE FELDSPAR GRAINS, KAOLINITIC (MILBANK GRANITE)
143.0 -	145.0	GRANITE, BLUE-GRAY; HARD (MILBANK GRANITE)

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COUNTY: GRANT LOCATION: 121N-47W-01AAAA
MAP LOCATION: 25
LEGAL LOCATION: NE NE NE NE SEC. 01, T. 121 N., R. 47 W.
LATITUDE: 45.1936 LONGITUDE: 96.2940
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: S. MITCHELL DRILLER'S LOG:
GEOLOGIST: J. GILBERTSON GEOLOGIST'S LOG: X
DATE DRILLED: 06-02-1986 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1092.05 I
TOTAL DRILL HOLE DEPTH: 106.0 TEST HOLE NUMBER: CO-86-03
WATER RIGHTS WELL: SDGS WELL NAME: CO-86-03
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: VEBLEN
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. AND HM. SCREEN LENGTH: 13.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION: 1095.05 I
CASING STICK-UP: 3.00 TOTAL CASING AND SCREEN: 109.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

SCREEN - LOWER 5 FEET MANUFACTURED, UPPER 8 FEET SLOTTED WITH HACK-SAW. DEPTH TO WATER: 57.44 FEET ON 06-17-1986.

0 -	2.0	TOPSOIL, BLACK
2.0 -	18.0	CLAY, YELLOW-BROWN TO TAN, SILTY, SANDY, PEBBLY (TILL)
18.0 -	86.0	CLAY, GRAY, SILTY, SANDY, PEBBLY; SAND STRINGERS BELOW 70 FEET (TILL)
86.0 -	103.0	SAND AND GRAVEL, YELLOW-BROWN AND GRAY, MEDIUM SAND TO MEDIUM GRAVEL
103.0 -	106.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)

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COUNTY: GRANT LOCATION: 121N-47W-02DDDD
MAP LOCATION: 26
LEGAL LOCATION: SE SE SE SE SEC. 02, T. 121 N., R. 47 W.
LATITUDE: 45.1844 LONGITUDE: 96.3054
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: S. MITCHELL DRILLER'S LOG:
GEOLOGIST: J. GILBERTSON GEOLOGIST'S LOG: X
DATE DRILLED: 06-03-1986 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1115.00 T
TOTAL DRILL HOLE DEPTH: 126.0 TEST HOLE NUMBER: CO-86-05
WATER RIGHTS WELL: SDGS WELL NAME: CO-86-05
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: VEBLEN(?)
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 5.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: 3.00 TOTAL CASING AND SCREEN: 129.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: X SINGLE POINT RESISTIVITY: X
NATURAL GAMMA: X EXTRA: X
SAMPLES:

8 FEET OF BLANK CASING BELOW SCREEN. E-LOG TO 112 FEET.

0	-	1.0	TOPSOIL, BLACK
1.0	-	6.0	CLAY, YELLOW-BROWN TO TAN, VERY SANDY
6.0	-	12.0	SAND AND GRAVEL, YELLOW-BROWN, MEDIUM SAND TO FINE GRAVEL
12.0	-	18.0	CLAY, YELLOW-BROWN TO TAN, SILTY, SANDY, PEBBLY (TILL)
18.0	-	76.0	CLAY, GRAY, SILTY, SANDY, PEBBLY; SAND STRINGERS FROM 30 TO 40 FEET AND 55 TO 64 FEET (TILL)
76.0	-	101.0	CLAY, GRAY, VERY SANDY, SILTY, PEBBLY (TILL)
101.0	-	109.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
109.0	-	118.0	SAND AND GRAVEL, YELLOW-BROWN TO GRAY, COARSE SAND TO MEDIUM GRAVEL
118.0	-	126.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)

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COUNTY: GRANT LOCATION: 121N-47W-24AAAA
MAP LOCATION: 27
LEGAL LOCATION: NE NE NE NE SEC. 24, T. 121 N., R. 47 W.
LATITUDE: 45.1659 LONGITUDE: 96.2938
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: L. HELSETH DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-17-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1049.00 T
TOTAL DRILL HOLE DEPTH: 127.0 TEST HOLE NUMBER: BSC-81-9
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-9
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: MILBANK GRANITE
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 6.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: TOTAL CASING AND SCREEN: 126.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

0	-	6.0	CLAY, YELLOW, SILTY, PEBBLY (TILL)
6.0	-	22.0	SAND AND GRAVEL, MEDIUM SAND AND MEDIUM TO COARSE GRAVEL
22.0	-	68.0	CLAY, GRAY, SILTY, SANDY, GRAVELLY (TILL)
68.0	-	70.0	SAND
70.0	-	86.0	CLAY, GRAY, SILTY, PEBBLY (TILL)
86.0	-	90.0	SAND
90.0	-	98.0	SHALE, GRAY (CARLILE SHALE)
98.0	-	112.0	SAND, BLUE, MEDIUM TO COARSE (MILBANK GRANITE WASH)
112.0	-	126.0	SAND, WHITE, FINE TO MEDIUM, ANGULAR; WEATHERED, SOME PINK ORTHOCLASE FELDSPAR GRAINS, KAOLINITIC (MILBANK GRANITE)
126.0	-	127.0	GRANITE, BLUE-GRAY; HARD, ONLY A FEW INCHES WERE PENETRATED IN THIS INTERVAL (MILBANK GRANITE)

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COUNTY: GRANT LOCATION: 121N-47W-24AAAB

MAP LOCATION: 28
LEGAL LOCATION: NW NE NE NE SEC. 24, T. 121 N., R. 47 W.
LATITUDE: 45.1659 LONGITUDE: 96.2940
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-18-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1049.00 T
TOTAL DRILL HOLE DEPTH: 30.0 TEST HOLE NUMBER: BSC-81-10
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-10
OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER:
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH:
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: 3.00 TOTAL CASING AND SCREEN: 25.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

DRY HOLE; WELL DISMANTLED ON 07-01-1981.

0	-	1.0	TOPSOIL, LIGHT-BROWN, SANDY
1.0	-	6.0	CLAY, YELLOW-BROWN, SILTY (TILL)
6.0	-	22.0	SAND AND GRAVEL, MEDIUM SAND AND MEDIUM TO COARSE GRAVEL
22.0	-	30.0	CLAY, GRAY, SANDY, PEBBLY (TILL)

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COUNTY: GRANT LOCATION: 121N-47W-24ADAD
MAP LOCATION: 29
LEGAL LOCATION: SE NE SE NE SEC. 24, T. 121 N., R. 47 W.
LATITUDE: 45.1643 LONGITUDE: 96.2938
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT/L. HELSETH DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-17-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1070.00 T
TOTAL DRILL HOLE DEPTH: 194.0 TEST HOLE NUMBER: BSC-81-8
WATER RIGHTS WELL: SDGS WELL NAME: BSC-81-8

OTHER WELL NAME:
BASIN: MINNESOTA/WHETSTONE AQUIFER: MILBANK GRANITE
MANAGEMENT UNIT:
SCREEN TYPE: PVC, MFG. SCREEN LENGTH: 11.0
CASING TYPE: PVC CASING DIAMETER: 2.0
CASING TOP ELEVATION:
CASING STICK-UP: 2.50 TOTAL CASING AND SCREEN: 171.0
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

OBSERVATION WELL WAS REMOVED ON 07-01-1981 BECAUSE OF PUMPING DIFFICULTIES.

0	-	3.0	TOPSOIL, BLACK
3.0	-	16.0	CLAY, YELLOW-BROWN, SILTY, SANDY, PEBBLY (TILL)
16.0	-	17.0	ROCK
17.0	-	19.0	CLAY, BROWN, SILTY, SANDY, PEBBLY (TILL)
19.0	-	20.0	ROCK
20.0	-	21.0	CLAY, GRAY
21.0	-	22.0	ROCK
22.0	-	38.0	CLAY, GRAY; SOFT
38.0	-	39.0	ROCK
39.0	-	46.0	CLAY, GRAY; SOFT
46.0	-	57.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
57.0	-	67.0	GRAVEL
67.0	-	75.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
75.0	-	78.0	GRAVEL
78.0	-	82.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
82.0	-	85.0	GRAVEL
85.0	-	87.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
87.0	-	88.0	ROCK
88.0	-	105.0	CLAY, DARK-GRAY; HARD (CARLILE SHALE?)
105.0	-	134.0	SHALE, GRAY (CARLILE SHALE)
134.0	-	135.0	LIMESTONE, WHITE; CALCAREOUS (GREENHORN LIMESTONE?)
135.0	-	191.0	SAND, WHITE, FINE TO MEDIUM, ANGULAR; WEATHERED, SOME PINK ORTHOCLASE FELDSPAR GRAINS, KAOLINITIC (MILBANK GRANITE)
191.0	-	194.0	GRANITE, BLUE-GRAY; HARD (MILBANK GRANITE)

* * * *

COUNTY: GRANT LOCATION: 121N-47W-25AAAA
MAP LOCATION: 30
LEGAL LOCATION: NE NE NE NE SEC. 25, T. 121 N., R. 47 W.
LATITUDE: 45.1606 LONGITUDE: 96.2938
LAND OWNER:
PROJECT: BIG STONE CITY STUDY
DRILLING COMPANY: SDGS
DRILLER: M. JARRETT DRILLER'S LOG:
GEOLOGIST: S. GREEN GEOLOGIST'S LOG: X
DATE DRILLED: 06-23-1981 DRILLING METHOD: ROTARY
GROUND SURFACE ELEVATION: 1073.00 T
TOTAL DRILL HOLE DEPTH: 52.0 TEST HOLE NUMBER: BSC-81-16
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

0	-	1.0	TOPSOIL, BLACK
1.0	-	16.0	CLAY, YELLOW-BROWN, SANDY (TILL)
16.0	-	18.0	CLAY, RED, SANDY (TILL)
18.0	-	23.0	CLAY, GRAY, SANDY (TILL)
23.0	-	30.0	CLAY, RED-GRAY, SILTY, SANDY, PEBBLY (HAWK CREEK TILL)
30.0	-	35.0	CLAY, GRAY, SILTY, SANDY (TILL)
35.0	-	42.0	SAND, GRAY, FINE TO COARSE
42.0	-	47.0	CLAY, GRAY, SANDY (TILL)
47.0	-	48.0	SAND
48.0	-	51.0	CLAY, GRAY, SANDY (TILL)
51.0	-	52.0	GRANITE, BLUE-GRAY; HARD (MILBANK GRANITE)

* * * *

APPENDIX B

Logs of Big Stone City Municipal 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.

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

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). The smallest quarter section may be followed by the number 1 or 2, which designates the first or second well drilled at that particular location.

TOTAL DRILL HOLE DEPTH and SCREEN LENGTH: The numbers are presented in feet.

SCREEN TYPE and CASING TYPE: PVC = polyvinylchloride; MFG = manufactured.

CASING DIAMETER: The numbers are presented in inches.

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

COUNTY: GRANT LOCATION: 121N-46W-08BDCA 1
MAP LOCATION: M 1
LEGAL LOCATION: NE SW SE NW SEC. 08, T. 121 N., R. 46 W.
LATITUDE: 45.1823 LONGITUDE: 96.2757
LAND OWNER: BIG STONE CITY
PROJECT: MUNICIPAL WELL #1
DRILLING COMPANY:
DRILLER: DRILLER'S LOG: X
GEOLOGIST: GEOLOGIST'S LOG:
DATE DRILLED: 00-00-0000 DRILLING METHOD:
GROUND SURFACE ELEVATION: 970.00 T
TOTAL DRILL HOLE DEPTH: 60.0 TEST HOLE NUMBER:
WATER RIGHTS WELL: SDGS WELL NAME:
OTHER WELL NAME: MUNICIPAL
BASIN: MINNESOTA/WHETSTONE AQUIFER: FAIRMOUNT
MANAGEMENT UNIT:
SCREEN TYPE: SCREEN LENGTH:
CASING TYPE: UNKNOWN CASING DIAMETER: 12.0
CASING TOP ELEVATION:
CASING STICK-UP: TOTAL CASING AND SCREEN:
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

NO OTHER INFORMATION AVAILABLE FOR WELL.

0	-	2.0	DIRT, BLACK
2.0	-	10.0	CLAY, YELLOW; GRAVEL
10.0	-	20.0	ROCK AND CLAY
20.0	-	30.0	CLAY, BLUE; MIXED WITH SAND
30.0	-	40.0	CLAY
40.0	-	50.0	SAND, FINE; WATER BEARING
50.0	-	60.0	SAND; WATER BEARING

* * * *

COUNTY: GRANT LOCATION: 121N-46W-08BDCA 2
MAP LOCATION: M 2
LEGAL LOCATION: NE SW SE NW SEC. 08, T. 121 N., R. 46 W.
LATITUDE: 45.1823 LONGITUDE: 96.2757
LAND OWNER: BIG STONE CITY
PROJECT: MUNICIPAL WELL #2
DRILLING COMPANY:
DRILLER: DRILLER'S LOG: X
GEOLOGIST: GEOLOGIST'S LOG:
DATE DRILLED: 00-00-1967 DRILLING METHOD:

GROUND SURFACE ELEVATION: 970.00 T
TOTAL DRILL HOLE DEPTH: 60.0 TEST HOLE NUMBER:
WATER RIGHTS WELL: SDGS WELL NAME:
OTHER WELL NAME: MUNICIPAL
BASIN: MINNESOTA/WHETSTONE AQUIFER:
MANAGEMENT UNIT:
SCREEN TYPE: SCREEN LENGTH:
CASING TYPE: UNKNOWN CASING DIAMETER: 12.0
CASING TOP ELEVATION:
CASING STICK-UP: TOTAL CASING AND SCREEN:
WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

NO OTHER INFORMATION AVAILABLE FOR WELL.

0	-	2.0	DIRT, BLACK
2.0	-	10.0	CLAY, YELLOW; GRAVEL
10.0	-	20.0	ROCK AND CLAY
20.0	-	30.0	CLAY, BLUE; MIXED WITH SAND
30.0	-	40.0	CLAY
40.0	-	50.0	SAND, FINE; WATER BEARING
50.0	-	60.0	SAND; WATER BEARING

* * * *

COUNTY: GRANT LOCATION: 121N-46W-17ABCB
MAP LOCATION: M 3
LEGAL LOCATION: NW SW NW NE SEC. 17, T. 121 N., R. 46 W.
LATITUDE: 45.1743 LONGITUDE: 96.2743
LAND OWNER: BIG STONE CITY
PROJECT: MUNICIPAL WELL #3
DRILLING COMPANY: FREDERICKSON'S INC.
DRILLER: DRILLER'S LOG: X
GEOLOGIST: GEOLOGIST'S LOG:
DATE DRILLED: 08-25-1977 DRILLING METHOD:
GROUND SURFACE ELEVATION: 1025.00 T
TOTAL DRILL HOLE DEPTH: 121.0 TEST HOLE NUMBER:
WATER RIGHTS WELL: SDGS WELL NAME:
OTHER WELL NAME: MUNICIPAL
BASIN: MINNESOTA/WHETSTONE AQUIFER: FAIRMOUNT
MANAGEMENT UNIT:
SCREEN TYPE: STAINLESS STEEL SCREEN LENGTH: 25.0
CASING TYPE: BLACK CASING DIAMETER: 12.0
CASING TOP ELEVATION:
CASING STICK-UP: TOTAL CASING AND SCREEN:

WELL MAINTENANCE DATE:
USGS HYDROLOGICAL UNIT CODE: 07020001
ELECTRIC LOG INFORMATION:
SPONTANEOUS POTENTIAL: SINGLE POINT RESISTIVITY:
NATURAL GAMMA: EXTRA:
SAMPLES:

STICK-UP NOT GIVEN ON REPORT, SO UNABLE TO DETERMINE TOTAL CASING AND SCREEN. BOTTOM OF THE CASING IS AT 95 FEET. CASING WEIGHT IS 49.56 LBS. PER FOOT. SCREEN MADE UP OF 10 FEET OF 25 SLOT, 10 FEET OF 20 SLOT, AND 5 FEET OF TIGHTWIND.

0	-	2.0	TOPSOIL
2.0	-	12.0	CLAY, YELLOW
12.0	-	36.0	CLAY, GRAY
36.0	-	37.0	SAND
37.0	-	48.0	CLAY, GRAY
48.0	-	50.0	SAND
50.0	-	60.0	CLAY, GRAY
60.0	-	74.0	SAND, RED; SANDY CLAY LAYERS
74.0	-	120.0	SAND, GRAY
120.0	-	121.0	GRANITE, WHITE; DECOMPOSED; PSEUDO END DEPTH

* * * *

APPENDIX C

Chemical Analyses of Water Samples

MAP LOCATION NUMBER: A number arbitrarily assigned to the water sample according to the source aquifer and the order it is listed (see **LEGAL LOCATION and LOCATION**). The three municipal well samples are listed first. All numbers correspond to the numbers shown on figure 2.

LEGAL LOCATION and LOCATION: The locations are listed by the smallest township number, then the smallest range number, the smallest section number, and then by quarter section: A (NE), B (NW), C (SW), and D (SE). 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 at that particular location.

WELL CONTROLLER: Designates party responsible for the well from which water sample was recovered. **South Dakota Geological Survey (SDGS)** wells are observation wells installed for this study. **Big Stone City or Private** wells are (or were) being used as actual water supply wells.

LAB: Indicates where water analyses were conducted. SDGS is an abbreviation for South Dakota Geological Survey.

GROUND SURFACE ELEVATION and CASING TOP ELEVATION: Numbers are presented in feet above mean sea level. An **I** indicates elevation was determined by surveying. A **T** indicates the elevation was determined from topographic maps.

WELL DEPTH: Numbers are presented in feet.

CASING TOP: PVC = polyvinylchloride.

AQUIFER: Name assigned to the unit from which the samples were collected.

MAP LOCATION: 1
SAMPLE: BC-81-01 LOCATION: 121N-46W-08BDCA
LEGAL LOCATION: NE SW SE NW SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1823 LONG.: 96.2757 COUNTY: GRANT
OWNER-CONTROLLER: BIG STONE CITY
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-04-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): MUNICIPAL
GROUND SURFACE ELEV.: 970.00 WELL DEPTH: 60 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: MUNICIPAL WELL #1
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	152 PPM	%NA:	
MG:	80 PPM	SAR:	
NA:	70 PPM	ADJ SAR:	
K:		RSC:	
SO4:	423 PPM	CATIONS:	
CL:	34 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	0.82 PPM	LI:	
MN:	1.01 PPM	SB:	
NO3-N:	0.35 PPM	AL:	
F:	108 PPM	MO:	
TDS:	960 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	1210 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	706 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 2
SAMPLE: BC-81-19 LOCATION: 121N-46W-08BDCA
LEGAL LOCATION: NE SW SE NW SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1823 LONG.: 96.2757 COUNTY: GRANT
OWNER-CONTROLLER: BIG STONE CITY
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 10-26-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): MUNICIPAL
GROUND SURFACE ELEV.: 970.00 T WELL DEPTH: 50 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: MUNICIPAL WELL #2
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	106 PPM	%NA:	
MG:	66 PPM	SAR:	
NA:	48 PPM	ADJ SAR:	
K:		RSC:	
SO4:	334 PPM	CATIONS:	
CL:	20 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	4.80 PPM	LI:	
MN:	0.73 PPM	SB:	
NO3-N:	0.65 PPM	AL:	
F:	101 PPM	MO:	
TDS:	767 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	1050 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	535 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 3
SAMPLE: BSC3-1 LOCATION: 121N-46W-17ABCB
LEGAL LOCATION: NW SW NW NE SEC. 17, T. 121 N., R. 46 W.
LAT.: 45.1743 LONG.: 96.2743 COUNTY: GRANT
OWNER-CONTROLLER: MUNICIPAL WELL #3
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 03-00-1981
LAB: DEPARTMENT OF PUBLIC HEALTH
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): MUNICIPAL
GROUND SURFACE ELEV.: 1025.00 T WELL DEPTH: 120 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT: BIG STONE CITY
USAGE:
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: FILTERED: HNO3: SCREENED:
H2SO4 OR FORMALIN TREATED:
OTHER:

CA:	233 PPM	%NA:	
MG:	95 PPM	SAR:	
NA:	16 PPM	ADJ SAR:	
K:		RSC:	
SO4:	562 PPM	CATIONS:	
CL:	3 PPM	ANIONS:	
HCO3:	515 PPM	ALK-MO:	
CO3:		ALK-P:	
FE:	3.80 PPM	LI:	
MN:	0.51 PPM	SB:	
NO3-N: <	0.10 PPM	AL:	
F:	23 PPM	MO:	
TDS:	1348 PPM @ 180 C	FIELD TDS:	
PH:	7.20	FIELD PH:	
COND:	1716 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	973 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES: NO2 AS N = < 0.01 MG/L.

MAP LOCATION: 4
SAMPLE: BC-81-06 LOCATION: 121N-46W-07DAAA
LEGAL LOCATION: NE NE NE SE SEC. 07, T. 121 N., R. 46 W.
LAT.: 45.1815 LONG.: 96.2824 COUNTY: GRANT
OWNER-CONTROLLER: GREENWOOD CEMETARY
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-10-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1100.00 T WELL DEPTH:
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP: PITCHER
AQUIFER: SURFACE OUTWASH BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE:
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	67 PPM	%NA:	
MG:	43 PPM	SAR:	
NA:	12 PPM	ADJ SAR:	
K:		RSC:	
SO4:	25 PPM	CATIONS:	
CL:	3 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	0.08 PPM	LI:	
MN:	0.19 PPM	SB:	
NO3-N: <	0.10 PPM	AL:	
F:	19 PPM	MO:	
TDS:	380 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	749 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	342 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 5
SAMPLE: BC-81-20 LOCATION: 121N-46W-07DAAA
LEGAL LOCATION: NE NE NE SE SEC. 07, T. 121 N., R. 46 W.
LAT.: 45.1815 LONG.: 96.2824 COUNTY: GRANT
OWNER-CONTROLLER: GREENWOOD CEMETARY
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 07-01-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1100.00 T WELL DEPTH:
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: SURFACE OUTWASH BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE:
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	62 PPM	%NA:	
MG:	45 PPM	SAR:	
NA:	12 PPM	ADJ SAR:	
K:		RSC:	
SO4:	24 PPM	CATIONS:	
CL:	2 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	0.19 PPM	LI:	
MN:	0.18 PPM	SB:	
NO3-N: <	0.10 PPM	AL:	
F:	24 PPM	MO:	
TDS:	350 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	644 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	338 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 6
SAMPLE: BSC-86-008 LOCATION: 121N-46W-07DAAA
LEGAL LOCATION: NE NE NE SE SEC. 07, T. 121 N., R. 46 W.
LAT.: 45.1815 LONG.: 96.2824 COUNTY: GRANT
OWNER-CONTROLLER: GREENWOOD CEMETARY
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-11-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1100.00 T WELL DEPTH: 29.6 FEET
CASING TOP ELEVATION: DEPTH TO WATER: 11.4 FEET
CASING TYPE: STEEL
PUMP: HAND PUMP
AQUIFER: SURFACE OUTWASH BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE:
LAKE: STREAM:
OTHER:
WHERE COLLECTED: GREENWOOD CEMETARY WELL
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:	75 PPM	%NA:	
MG:	51 PPM	SAR:	
NA:	9 PPM	ADJ SAR:	
K:		RSC:	
SO4:	109 PPM	CATIONS:	
CL:	7 PPM	ANIONS:	
HCO3:	385 PPM	ALK-MO:	
CO3:		ALK-P:	
FE:	0.06 PPM	LI:	
MN:	0.09 PPM	SB:	
NO3-N: <=	0.20 PPM	AL:	
F:	30 PPM	MO:	
TDS:	488 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	7.78
COND:	763 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		FIELD TEMP:	9 C
AG:		SI:	
AS: <	0.300 PPB	BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:	0.8000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 7
SAMPLE: BSC-86-010 LOCATION: 121N-46W-17ADCC 2
LEGAL LOCATION: SW SW SE NE SEC. 17, T. 121 N., R. 46 W.
LAT.: 45.1730 LONG.: 96.2725 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-17-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 963.81 FEET SDGS WELL (OR OTHER): CO-86-10
GROUND SURFACE ELEV.: WELL DEPTH: 29.15
CASING TOP ELEVATION: 975.93 I DEPTH TO WATER: 12.12 FEET
CASING TYPE: PVC
PUMP: BLADDER
AQUIFER: SURFACE OUTWASH BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:		171 PPM	%NA:	
MG:		43 PPM	SAR:	
NA:		19 PPM	ADJ SAR:	
K:			RSC:	
SO4:		141 PPM	CATIONS:	
CL:		39 PPM	ANIONS:	
HCO3:		546 PPM	ALK-MO:	
CO3:			ALK-P:	ND
FE:	<	0.05 PPM	LI:	
MN:		0.66 PPM	SB:	
NO3-N:		1.20 PPM	AL:	
F:		43 PPM	MO:	
TDS:		772 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	7.21
COND:		1166 UMHOS @ 25 C	FIELD COND:	
HARDNESS:			FIELD TEMP:	12 C
AG:			SI:	
AS:		0.600 PPB	BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:		3.5000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 8
SAMPLE: BC-81-02 LOCATION: 121N-46W-17CCCA
LEGAL LOCATION: NE SW SW SW SEC. 17, T. 121 N., R. 46 W.
LAT.: 45.1702 LONG.: 96.2817 COUNTY: GRANT
OWNER-CONTROLLER: D. SCHMIEG
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-04-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1000.00 T WELL DEPTH:
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: SURFACE OUTWASH BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: DOMESTIC
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		137 PPM	%NA:
MG:		61 PPM	SAR:
NA:		81 PPM	ADJ SAR:
K:			RSC:
SO4:		317 PPM	CATIONS:
CL:		56 PPM	ANIONS:
HCO3:			ALK-MO:
CO3:			ALK-P:
FE:	<	0.05 PPM	LI:
MN:		0.44 PPM	SB:
NO3-N:		1.25 PPM	AL:
F:		27 PPM	MO:
TDS:		840 PPM @ 180 C	FIELD TDS:
PH:			FIELD PH:
COND:		1240 UMHOS @ 25 C	FIELD COND:
HARDNESS:		593 PPM	FIELD TEMP:
AG:			SI:
AS:			BE:
B:			RB:
BA:			CU:
CD:			SR:
CR:			NI:
HG:			ZN:
PB:			CS:
SE:			

NOTES:

MAP LOCATION: 9
SAMPLE: BC-81-12 LOCATION: 121N-46W-18CBCB
LEGAL LOCATION: NW SW NW SW SEC. 18, T. 121 N., R. 46 W.
LAT.: 45.1718 LONG.: 96.2935 COUNTY: GRANT
OWNER-CONTROLLER: R. ROSS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-17-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1050.00 T WELL DEPTH: 30 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: SURFACE OUTWASH BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE:
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	<	5 PPM	%NA:	
MG:		2 PPM	SAR:	
NA:		220 PPM	ADJ SAR:	
K:			RSC:	
SO4:		135 PPM	CATIONS:	
CL:		3 PPM	ANIONS:	
HCO3:			ALK-MO:	
CO3:			ALK-P:	
FE:	<	0.05 PPM	LI:	
MN:	<	0.05 PPM	SB:	
NO3-N:	<	0.10 PPM	AL:	
F:		74 PPM	MO:	
TDS:		595 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	
COND:		869 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		19 PPM	FIELD TEMP:	
AG:			SI:	
AS:			BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:				

NOTES: WATER WAS RUN THROUGH A WATER SOFTENER.

MAP LOCATION: 10
SAMPLE: BC-81-15 LOCATION: 121N-46W-18DDCB
LEGAL LOCATION: NW SW SE SE SEC. 18, T. 121 N., R. 46 W.
LAT.: 45.1705 LONG.: 96.2841 COUNTY: GRANT
OWNER-CONTROLLER: E. BINSFELD
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-18-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1050.00 T WELL DEPTH: 50 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: SURFACE OUTWASH BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE:
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		78 PPM	%NA:
MG:		380 PPM	SAR:
NA:		12 PPM	ADJ SAR:
K:			RSC:
SO4:		85 PPM	CATIONS:
CL:	<	2 PPM	ANIONS:
HCO3:			ALK-MO:
CO3:			ALK-P:
FE:	<	0.05 PPM	LI:
MN:		0.30 PPM	SB:
NO3-N:	<	0.10 PPM	AL:
F:		44 PPM	MO:
TDS:		380 PPM @ 180 C	FIELD TDS:
PH:			FIELD PH:
COND:		647 UMHOS @ 25 C	FIELD COND:
HARDNESS:		350 PPM	FIELD TEMP:
AG:			SI:
AS:			BE:
B:			RB:
BA:			CU:
CD:			SR:
CR:			NI:
HG:			ZN:
PB:			CS:
SE:			

NOTES:

MAP LOCATION: 11
SAMPLE: BC-81-08 LOCATION: 121N-46W-06DCDB
LEGAL LOCATION: NW SE SW SE SEC. 06, T. 121 N., R. 46 W.
LAT.: 45.1850 LONG.: 96.2846 COUNTY: GRANT
OWNER-CONTROLLER: N. VANLITH
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-10-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1110.00 T WELL DEPTH: 60 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: VEBLEN BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: DOMESTIC
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		590 PPM	%NA:	
MG:		172 PPM	SAR:	
NA:		134 PPM	ADJ SAR:	
K:			RSC:	
SO4:		1100 PPM	CATIONS:	
CL:		320 PPM	ANIONS:	
HCO3:			ALK-MO:	
CO3:			ALK-P:	
FE:	<	0.05 PPM	LI:	
MN:	<	0.05 PPM	SB:	
NO3-N:		85.00 PPM	AL:	
F:		279 PPM	MO:	
TDS:		3120 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	
COND:		4214 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		2176 PPM	FIELD TEMP:	
AG:			SI:	
AS:			BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:				

NOTES:

MAP LOCATION: 12
SAMPLE: BSC-86-015 LOCATION: 121N-46W-06DCDB
LEGAL LOCATION: NW SE SW SE SEC. 06, T. 121 N., R. 46 W.
LAT.: 45.1850 LONG.: 96.2846 COUNTY: GRANT
OWNER-CONTROLLER: N. VANLITH
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-18-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1110.00 T WELL DEPTH: 54.30 FEET
CASING TOP ELEVATION: DEPTH TO WATER: 26.08 FEET
CASING TYPE:
PUMP: SUBMERSIBLE
AQUIFER: VEBLEN BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: DOMESTIC (UNUSED)
LAKE: STREAM:
OTHER:
WHERE COLLECTED: FROM NICK VANLITH OLD WELL
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:		602 PPM	%NA:	
MG:		162 PPM	SAR:	
NA:		35 PPM	ADJ SAR:	
K:			RSC:	
SO4:		1540 PPM	CATIONS:	
CL:		66 PPM	ANIONS:	
HCO3:		473 PPM	ALK-MO:	
CO3:			ALK-P:	ND
FE:	<	0.05 PPM	LI:	
MN:		0.10 PPM	SB:	
NO3-N:		28.70 PPM	AL:	
F:		44 PPM	MO:	
TDS:		2995 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	7.18
COND:		2887 UMHOS @ 25 C	FIELD COND:	
HARDNESS:			FIELD TEMP:	11 C
AG:			SI:	
AS:	<=	0.300 PPB	BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:		3.6000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 13
SAMPLE: BSC-86-014 LOCATION: 121N-46W-06DCDC 2
LEGAL LOCATION: SW SE SW SE SEC. 06, T. 121 N., R. 46 W.
LAT.: 45.1845 LONG.: 96.2846 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-18-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): CO-86-07
GROUND SURFACE ELEV.: WELL DEPTH: 98.80
CASING TOP ELEVATION: 1100.46 I DEPTH TO WATER: 82.82 FEET
CASING TYPE: PVC
PUMP:
AQUIFER: VEBLEN BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:	170 PPM	%NA:	
MG:	70 PPM	SAR:	
NA:	26 PPM	ADJ SAR:	
K:		RSC:	
SO4:	349 PPM	CATIONS:	
CL:	6 PPM	ANIONS:	
HCO3:	519 PPM	ALK-MO:	
CO3:		ALK-P:	ND
FE:	0.16 PPM	LI:	
MN:	0.63 PPM	SB:	
NO3-N: <	0.20 PPM	AL:	
F:	30 PPM	MO:	
TDS:	950 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	7.12
COND:	1158 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		FIELD TEMP:	14 C
AG:		SI:	
AS:	20.000 PPB	BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE: <=	0.2000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 14
SAMPLE: BSC-86-012 LOCATION: 121N-47W-01AAAA
LEGAL LOCATION: NE NE NE NE SEC. 01, T. 121 N., R. 47 W.
LAT.: 45.1936 LONG.: 96.2940 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-17-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 1037.61 FEET SDGS WELL (OR OTHER): CO-86-03
GROUND SURFACE ELEV.: WELL DEPTH: 107.22
CASING TOP ELEVATION: 1095.05 I DEPTH TO WATER: 57.44 FEET
CASING TYPE: PVC
PUMP: BLADDER
AQUIFER: VEBLEN BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:	164 PPM	%NA:	
MG:	59 PPM	SAR:	
NA:	30 PPM	ADJ SAR:	
K:		RSC:	
SO4:	311 PPM	CATIONS:	
CL:	10 PPM	ANIONS:	
HCO3:	502 PPM	ALK-MO:	
CO3:		ALK-P:	ND
FE:	1.75 PPM	LI:	
MN:	0.46 PPM	SB:	
NO3-N: <	0.20 PPM	AL:	
F:	40 PPM	MO:	
TDS:	892 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	7.21
COND:	1262 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		FIELD TEMP:	14 C
AG:		SI:	
AS:	25.000 PPB	BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:	0.9000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 15
SAMPLE: BC-82-05 LOCATION: 122N-47W-33DAAD
LEGAL LOCATION: SE NE NE SE SEC. 33, T. 122 N., R. 47 W.
LAT.: 45.1957 LONG.: 96.3321 COUNTY: ROBERTS
OWNER-CONTROLLER: L. VOELTZ
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 04-13-1982
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1100.00 T WELL DEPTH: 55 FEET
CASING TOP ELEVATION: DEPTH TO WATER: 30 FEET
CASING TYPE:
PUMP:
AQUIFER: VEBLEN BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: STOCK
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	200 PPM	%NA:	
MG:	79 PPM	SAR:	
NA:	21 PPM	ADJ SAR:	
K:		RSC:	
SO4:	402 PPM	CATIONS:	
CL:	4 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	0.02 PPM	LI:	
MN:	0.46 PPM	SB:	
NO3-N:	< 0.10 PPM	AL:	
F:	26 PPM	MO:	
TDS:	1102 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	1409 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	824 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 16
SAMPLE: BSC-86-013 LOCATION: 122N-47W-35DDCD
LEGAL LOCATION: SE SW SE SE SEC. 35, T. 122 N., R. 47 W.
LAT.: 45.1935 LONG.: 96.3100 COUNTY: ROBERTS
OWNER-CONTROLLER: USGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-17-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): R2-85-28
GROUND SURFACE ELEV.: WELL DEPTH: 75.05
CASING TOP ELEVATION: DEPTH TO WATER: 30.48 FEET
CASING TYPE: PVC
PUMP: BLADDER
AQUIFER: VEBLEN BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:		232 PPM	%NA:	
MG:		95 PPM	SAR:	
NA:		21 PPM	ADJ SAR:	
K:			RSC:	
SO4:		604 PPM	CATIONS:	
CL:	<=	2 PPM	ANIONS:	
HCO3:		531 PPM	ALK-MO:	
CO3:			ALK-P:	ND
FE:		1.08 PPM	LI:	
MN:		1.19 PPM	SB:	
NO3-N:	<	0.20 PPM	AL:	
F:		35 PPM	MO:	
TDS:		1286 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	7.02
COND:		1668 UMHOS @ 25 C	FIELD COND:	
HARDNESS:			FIELD TEMP:	13 C
AG:			SI:	
AS:		3.900 PPB	BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:	<	0.2000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 17
SAMPLE: BC-81-22 LOCATION: 121N-46W-06BAAC
LEGAL LOCATION: SW NE NE NW SEC. 06, T. 121 N., R. 46 W.
LAT.: 45.1932 LONG.: 96.2907 COUNTY: GRANT
OWNER-CONTROLLER: D. HEGGE
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-29-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1090.00 T WELL DEPTH: 190 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: DOMESTIC
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		163 PPM	%NA:	
MG:		71 PPM	SAR:	
NA:		27 PPM	ADJ SAR:	
K:			RSC:	
SO4:		280 PPM	CATIONS:	
CL:	<	2 PPM	ANIONS:	
HCO3:			ALK-MO:	
CO3:			ALK-P:	
FE:		2.70 PPM	LI:	
MN:		0.47 PPM	SB:	
NO3-N:	<	0.10 PPM	AL:	
F:		19 PPM	MO:	
TDS:		864 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	
COND:		1340 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		699 PPM	FIELD TEMP:	
AG:			SI:	
AS:			BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:				

NOTES:

MAP LOCATION: 18
SAMPLE: BC-81-05 LOCATION: 121N-46W-06DADA
LEGAL LOCATION: NE SE NE SE SEC. 06, T. 121 N., R. 46 W.
LAT.: 45.1913 LONG.: 96.2826 COUNTY: GRANT
OWNER-CONTROLLER: F. ANDERSON
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-10-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 990.00 T WELL DEPTH: 60 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: DOMESTIC
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		192 PPM	%NA:	
MG:		86 PPM	SAR:	
NA:		45 PPM	ADJ SAR:	
K:			RSC:	
SO4:		325 PPM	CATIONS:	
CL:	<=	2 PPM	ANIONS:	
HCO3:			ALK-MO:	
CO3:			ALK-P:	
FE:	<	0.05 PPM	LI:	
MN:	<	0.05 PPM	SB:	
NO3-N:		12.00 PPM	AL:	
F:		27 PPM	MO:	
TDS:		1060 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	
COND:		1694 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		832 PPM	FIELD TEMP:	
AG:			SI:	
AS:			BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:				

NOTES:

MAP LOCATION: 19
SAMPLE: BC-81-09 LOCATION: 121N-46W-06DCAC
LEGAL LOCATION: SW NE SW SE SEC. 06, T. 121 N., R. 46 W.
LAT.: 45.1852 LONG.: 96.2850 COUNTY: GRANT
OWNER-CONTROLLER: N. VANLITH
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-10-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1110.00 T WELL DEPTH: 110 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: STOCK
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	197 PPM	%NA:	
MG:	84 PPM	SAR:	
NA:	44 PPM	ADJ SAR:	
K:		RSC:	
SO4:	350 PPM	CATIONS:	
CL:	3 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	2.80 PPM	LI:	
MN:	0.61 PPM	SB:	
NO3-N:	< 0.10 PPM	AL:	
F:	24 PPM	MO:	
TDS:	1040 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	1718 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	837 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 20
SAMPLE: BC-81-07 LOCATION: 121N-46W-06DDCD
LEGAL LOCATION: SE SW SE SE SEC. 06, T. 121 N., R. 46 W.
LAT.: 45.1846 LONG.: 96.2834 COUNTY: GRANT
OWNER-CONTROLLER: D. RICHARDSON
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-10-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1105.00 T WELL DEPTH: 150 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: DOMESTIC
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	178 PPM	%NA:	
MG:	85 PPM	SAR:	
NA:	49 PPM	ADJ SAR:	
K:		RSC:	
SO4:	300 PPM	CATIONS:	
CL:	40 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	0.47 PPM	LI:	
MN:	0.18 PPM	SB:	
NO3-N:	8.00 PPM	AL:	
F:	30 PPM	MO:	
TDS:	1070 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	1820 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	791 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 21
SAMPLE: BC-81-21 LOCATION: 121N-46W-06DDCD
LEGAL LOCATION: SE SW SE SE SEC. 06, T. 121 N., R. 46 W.
LAT.: 45.1846 LONG.: 96.2834 COUNTY: GRANT
OWNER-CONTROLLER: D. RICHARDSON
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 07-01-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1105.00 T WELL DEPTH: 150 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: DOMESTIC
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	176 PPM	%NA:	
MG:	90 PPM	SAR:	
NA:	36 PPM	ADJ SAR:	
K:		RSC:	
SO4:	300 PPM	CATIONS:	
CL:	36 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	0.48 PPM	LI:	
MN:	0.15 PPM	SB:	
NO3-N:	5.70 PPM	AL:	
F:	26 PPM	MO:	
TDS:	1030 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	1280 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	808 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 22
SAMPLE: BSC-86-007 LOCATION: 121N-46W-07DAAA 1
LEGAL LOCATION: NE NE NE SE SEC. 07, T. 121 N., R. 46 W.
LAT.: 45.1815 LONG.: 96.2824 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-11-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): BSC-81-13
GROUND SURFACE ELEV.: WELL DEPTH: 145
CASING TOP ELEVATION: 1081.07 I DEPTH TO WATER: 102 FEET
CASING TYPE: PVC
PUMP: BLADDER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:		417 PPM	%NA:	
MG:		106 PPM	SAR:	
NA:		23 PPM	ADJ SAR:	
K:			RSC:	
SO4:		1103 PPM	CATIONS:	
CL:		24 PPM	ANIONS:	
HCO3:		458 PPM	ALK-MO:	
CO3:			ALK-P:	ND
FE:	<	0.05 PPM	LI:	
MN:		0.91 PPM	SB:	
NO3-N:	<	0.20 PPM	AL:	
F:		40 PPM	MO:	
TDS:		2028 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	7.31
COND:		2320 UMHOS @ 25 C	FIELD COND:	
HARDNESS:			FIELD TEMP:	11 C
AG:			SI:	
AS:		0.700 PPB	BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:		0.6000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 23
SAMPLE: BC-81-33 LOCATION: 121N-46W-08CAAB
LEGAL LOCATION: NW NE NE SW SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1815 LONG.: 96.2752 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 10-26-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 960.97 FEET SDGS WELL (OR OTHER): BSC-81-23
GROUND SURFACE ELEV.: WELL DEPTH: 33.62
CASING TOP ELEVATION: 967.51 I DEPTH TO WATER: 6.54 FEET
CASING TYPE: PVC
PUMP: PITCHER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	122 PPM	%NA:	
MG:	51 PPM	SAR:	
NA:	92 PPM	ADJ SAR:	
K:		RSC:	
SO4:	346 PPM	CATIONS:	
CL:	25 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	0.26 PPM	LI:	
MN:	0.31 PPM	SB:	
NO3-N:	0.54 PPM	AL:	
F:	33 PPM	MO:	
TDS:	860 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	1260 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	513 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 24
SAMPLE: BC-82-04 LOCATION: 121N-46W-08CAAB
LEGAL LOCATION: NW NE NE SW SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1815 LONG.: 96.2752 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 04-13-1982
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 962.95 FEET SDGS WELL (OR OTHER): BSC-81-23
GROUND SURFACE ELEV.: WELL DEPTH: 33.62
CASING TOP ELEVATION: 967.51 I DEPTH TO WATER: 4.56 FEET
CASING TYPE: PVC
PUMP: PITCHER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	152 PPM	%NA:	
MG:	53 PPM	SAR:	
NA:	51 PPM	ADJ SAR:	
K:		RSC:	
SO4:	368 PPM	CATIONS:	
CL:	24 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	0.65 PPM	LI:	
MN:	0.38 PPM	SB:	
NO3-N: <	0.10 PPM	AL:	
F:	35 PPM	MO:	
TDS:	935 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	1203 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	598 PPM	FIELD TEMP:	9 C
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 25
SAMPLE: BSC-86-004 LOCATION: 121N-46W-08CAAB
LEGAL LOCATION: NW NE NE SW SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1815 LONG.: 96.2752 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-10-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 963.34 FEET SDGS WELL (OR OTHER): BSC-81-23
GROUND SURFACE ELEV.: WELL DEPTH: 34.02
CASING TOP ELEVATION: 967.51 I DEPTH TO WATER: 4.17 FEET
CASING TYPE: PVC
PUMP: BLADDER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:	163 PPM	%NA:	
MG:	57 PPM	SAR:	
NA:	54 PPM	ADJ SAR:	
K:		RSC:	
SO4:	438 PPM	CATIONS:	
CL:	22 PPM	ANIONS:	
HCO3:	386 PPM	ALK-MO:	
CO3:		ALK-P:	ND
FE:	0.76 PPM	LI:	
MN:	1.42 PPM	SB:	
NO3-N: <	0.20 PPM	AL:	
F:	36 PPM	MO:	
TDS:	1006 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	7.16
COND:	1383 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		FIELD TEMP:	11 C
AG:		SI:	
AS:	2.500 PPB	BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE: <	0.2000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 26
SAMPLE: BC-81-10 LOCATION: 121N-46W-08CADD
LEGAL LOCATION: SE SE NE SW SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1803 LONG.: 96.2750 COUNTY: GRANT
OWNER-CONTROLLER: T. THOMPSON
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-10-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 980.00 T WELL DEPTH: 67 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE: PVC
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: BACK UP WELL
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	195 PPM	%NA:	
MG:	76 PPM	SAR:	
NA:	38 PPM	ADJ SAR:	
K:		RSC:	
SO4:	362 PPM	CATIONS:	
CL:	12 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	0.12 PPM	LI:	
MN:	0.58 PPM	SB:	
NO3-N: <	0.10 PPM	AL:	
F:	26 PPM	MO:	
TDS:	1060 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	1747 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	799 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 27
SAMPLE: BC-81-23 LOCATION: 121N-46W-08DCCB
LEGAL LOCATION: NW SW SW SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1756 LONG.: 96.2745 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-29-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): BSC-81-19
GROUND SURFACE ELEV.: WELL DEPTH:
CASING TOP ELEVATION: 975.77 I DEPTH TO WATER:
CASING TYPE: PVC
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		167 PPM	%NA:	
MG:		75 PPM	SAR:	
NA:		88 PPM	ADJ SAR:	
K:			RSC:	
SO4:		510 PPM	CATIONS:	
CL:		17 PPM	ANIONS:	
HCO3:			ALK-MO:	
CO3:			ALK-P:	
FE:	<	0.05 PPM	LI:	
MN:		0.47 PPM	SB:	
NO3-N:	<	0.10 PPM	AL:	
F:		23 PPM	MO:	
TDS:		1090 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	
COND:		1380 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		724 PPM	FIELD TEMP:	
AG:			SI:	
AS:			BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:				

NOTES:

MAP LOCATION: 28
SAMPLE: BSC-86-003 LOCATION: 121N-46W-08DCCB
LEGAL LOCATION: NW SW SW SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1756 LONG.: 96.2745 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-10-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 966.29 FEET SDGS WELL (OR OTHER): BSC-81-19
GROUND SURFACE ELEV.: WELL DEPTH: 45.04
CASING TOP ELEVATION: 975.77 I DEPTH TO WATER: 9.48 FEET
CASING TYPE: PVC
PUMP: BLADDER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:	242 PPM	%NA:	
MG:	87 PPM	SAR:	
NA:	23 PPM	ADJ SAR:	
K:		RSC:	
SO4:	622 PPM	CATIONS:	
CL:	14 PPM	ANIONS:	
HCO3:	497 PPM	ALK-MO:	
CO3:		ALK-P:	ND
FE:	4.06 PPM	LI:	
MN:	0.85 PPM	SB:	
NO3-N: <	0.20 PPM	AL:	
F:	21 PPM	MO:	
TDS:	1308 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	6.94
COND:	1674 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		FIELD TEMP:	11 C
AG:		SI:	
AS:	3.000 PPB	BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE: <	0.2000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 29
SAMPLE: BC-81-29 LOCATION: 121N-46W-08DDAB
LEGAL LOCATION: NW NE SE SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1806 LONG.: 96.2719 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 07-01-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): BSC-81-21
GROUND SURFACE ELEV.: WELL DEPTH:
CASING TOP ELEVATION: 970.11 I DEPTH TO WATER:
CASING TYPE: PVC
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	336 PPM	%NA:	
MG:	183 PPM	SAR:	
NA:	149 PPM	ADJ SAR:	
K:		RSC:	
SO4:	405 PPM	CATIONS:	
CL:	6 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	0.30 PPM	LI:	
MN:	0.18 PPM	SB:	
NO3-N: <	0.10 PPM	AL:	
F:	87 PPM	MO:	
TDS:	1860 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	2740 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	1589 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 30
SAMPLE: BC-81-32 LOCATION: 121N-46W-08DDAB
LEGAL LOCATION: NW NE SE SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1806 LONG.: 96.2719 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 10-26-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 959.17 FEET SDGS WELL (OR OTHER): BSC-81-21
GROUND SURFACE ELEV.: WELL DEPTH: 59.88
CASING TOP ELEVATION: 970.11 I DEPTH TO WATER: 10.94 FEET
CASING TYPE: PVC
PUMP: PITCHER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	346 PPM	%NA:	
MG:	177 PPM	SAR:	
NA:	128 PPM	ADJ SAR:	
K:		RSC:	
SO4:	531 PPM	CATIONS:	
CL:	9 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	4.60 PPM	LI:	
MN:	0.66 PPM	SB:	
NO3-N:	< 0.10 PPM	AL:	
F:	6 PPM	MO:	
TDS:	2190 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	2860 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	1587 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 31
SAMPLE: BC-82-02 LOCATION: 121N-46W-08DDAB
LEGAL LOCATION: NW NE SE SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1806 LONG.: 96.2719 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 04-13-1982
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 963.23 FEET SDGS WELL (OR OTHER): BSC-81-21
GROUND SURFACE ELEV.: WELL DEPTH: 59.88
CASING TOP ELEVATION: 970.11 I DEPTH TO WATER: 6.88 FEET
CASING TYPE: PVC
PUMP: PITCHER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		363 PPM	%NA:	
MG:		221 PPM	SAR:	
NA:		128 PPM	ADJ SAR:	
K:			RSC:	
SO4:		770 PPM	CATIONS:	
CL:		12 PPM	ANIONS:	
HCO3:			ALK-MO:	
CO3:			ALK-P:	
FE:		2.77 PPM	LI:	
MN:		0.63 PPM	SB:	
NO3-N:	<	0.10 PPM	AL:	
F:	<	10 PPM	MO:	
TDS:		2480 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	
COND:		3091 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		1812 PPM	FIELD TEMP:	9 C
AG:			SI:	
AS:			BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:				

NOTES:

MAP LOCATION: 32
SAMPLE: BSC-86-001 LOCATION: 121N-46W-08DDAB
LEGAL LOCATION: NW NE SE SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1806 LONG.: 96.2719 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-09-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 962.72 FEET SDGS WELL (OR OTHER): BSC-81-21
GROUND SURFACE ELEV.: WELL DEPTH: 58.33
CASING TOP ELEVATION: 970.11 I DEPTH TO WATER: 7.39 FEET
CASING TYPE: PVC
PUMP: BLADDER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:		386 PPM	%NA:	
MG:		223 PPM	SAR:	
NA:		124 PPM	ADJ SAR:	
K:			RSC:	
SO4:		885 PPM	CATIONS:	
CL:		12 PPM	ANIONS:	
HCO3:		1568 PPM	ALK-MO:	
CO3:			ALK-P:	ND
FE:		4.39 PPM	LI:	
MN:		0.70 PPM	SB:	
NO3-N:	<	0.20 PPM	AL:	
F:	<	10 PPM	MO:	
TDS:		2465 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	7.35
COND:		3350 UMHOS @ 25 C	FIELD COND:	
HARDNESS:			FIELD TEMP:	11 C
AG:			SI:	
AS:		0.800 PPB	BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:	<	0.2000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 33
SAMPLE: BC-81-28 LOCATION: 121N-46W-08DDBA 1
LEGAL LOCATION: NE NW SE SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1806 LONG.: 96.2720 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 07-01-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 959.80 FEET SDGS WELL (OR OTHER): BSC-81-20
GROUND SURFACE ELEV.: WELL DEPTH:
CASING TOP ELEVATION: 970.40 I DEPTH TO WATER: 10.6 FEET
CASING TYPE: PVC
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	281 PPM	%NA:	
MG:	219 PPM	SAR:	
NA:	127 PPM	ADJ SAR:	
K:		RSC:	
SO4:	470 PPM	CATIONS:	
CL:	4 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	0.18 PPM	LI:	
MN:	0.20 PPM	SB:	
NO3-N:	< 0.10 PPM	AL:	
F:	3 PPM	MO:	
TDS:	1810 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	2960 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	1124 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 34
SAMPLE: BC-81-31 LOCATION: 121N-46W-08DDBA 1
LEGAL LOCATION: NE NW SE SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1806 LONG.: 96.2720 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 10-26-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 960.44 FEET SDGS WELL (OR OTHER): BSC-81-20
GROUND SURFACE ELEV.: WELL DEPTH: 71
CASING TOP ELEVATION: 970.40 I DEPTH TO WATER: 9.96 FEET
CASING TYPE: PVC
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	272 PPM	%NA:	
MG:	185 PPM	SAR:	
NA:	117 PPM	ADJ SAR:	
K:		RSC:	
SO4:	504 PPM	CATIONS:	
CL:	12 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	6.10 PPM	LI:	
MN:	0.33 PPM	SB:	
NO3-N:	< 0.10 PPM	AL:	
F:	11 PPM	MO:	
TDS:	1970 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	2820 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	1438 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 35
SAMPLE: BC-82-03 LOCATION: 121N-46W-08DDBA 1
LEGAL LOCATION: NE NW SE SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1806 LONG.: 96.2720 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 04-13-1982
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 960.44 FEET SDGS WELL (OR OTHER): BSC-81-20
GROUND SURFACE ELEV.: WELL DEPTH: 71.00
CASING TOP ELEVATION: 970.40 I DEPTH TO WATER: 9.96 FEET
CASING TYPE: PVC
PUMP: PITCHER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	363 PPM	%NA:	
MG:	256 PPM	SAR:	
NA:	116 PPM	ADJ SAR:	
K:		RSC:	
SO4:	675 PPM	CATIONS:	
CL:	14 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	4.70 PPM	LI:	
MN:	0.29 PPM	SB:	
NO3-N:	< 0.10 PPM	AL:	
F:	6 PPM	MO:	
TDS:	2180 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	2818 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	1956 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 36
SAMPLE: BSC-86-006 LOCATION: 121N-46W-08DDBA 1
LEGAL LOCATION: NE NW SE SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1806 LONG.: 96.2720 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-11-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 962.73 FEET SDGS WELL (OR OTHER): BSC-81-20
GROUND SURFACE ELEV.: WELL DEPTH: 68.79
CASING TOP ELEVATION: 970.40 I DEPTH TO WATER: 7.67 FEET
CASING TYPE: PVC
PUMP: BLADDER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:		293 PPM	%NA:	
MG:		214 PPM	SAR:	
NA:		107 PPM	ADJ SAR:	
K:			RSC:	
SO4:		553 PPM	CATIONS:	
CL:		11 PPM	ANIONS:	
HCO3:		1551 PPM	ALK-MO:	
CO3:			ALK-P:	ND
FE:		4.32 PPM	LI:	
MN:		0.32 PPM	SB:	
NO3-N:	<	0.20 PPM	AL:	
F:	<	10 PPM	MO:	
TDS:		1920 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	7.50
COND:		2874 UMHOS @ 25 C	FIELD COND:	
HARDNESS:			FIELD TEMP:	11 C
AG:			SI:	
AS:		1.500 PPB	BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:		0.2000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 37
SAMPLE: BC-81-30 LOCATION: 121N-46W-08DDBA 2
LEGAL LOCATION: NE NW SE SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1806 LONG.: 96.2720 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 10-26-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): BSC-81-22
GROUND SURFACE ELEV.: WELL DEPTH: 27
CASING TOP ELEVATION: 969.74 I DEPTH TO WATER: 8.95 FEET
CASING TYPE: PVC
PUMP: PITCHER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	314 PPM	%NA:	
MG:	202 PPM	SAR:	
NA:	146 PPM	ADJ SAR:	
K:		RSC:	
SO4:	1270 PPM	CATIONS:	
CL:	31 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	4.90 PPM	LI:	
MN:	1.31 PPM	SB:	
NO3-N: <	0.10 PPM	AL:	
F:	5 PPM	MO:	
TDS:	2045 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	2900 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	1612 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 38
SAMPLE: BC-82-01 LOCATION: 121N-46W-08DDBA 2
LEGAL LOCATION: NE NW SE SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1806 LONG.: 96.2720 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 04-13-1982
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 963.46 FEET SDGS WELL (OR OTHER): BSC-81-22
GROUND SURFACE ELEV.: WELL DEPTH:
CASING TOP ELEVATION: 969.74 I DEPTH TO WATER: 6.28 FEET
CASING TYPE: PVC
PUMP: PITCHER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	425 PPM	%NA:	
MG:	329 PPM	SAR:	
NA:	161 PPM	ADJ SAR:	
K:		RSC:	
SO4:	173 PPM	CATIONS:	
CL:	34 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	5.51 PPM	LI:	
MN:	1.15 PPM	SB:	
NO3-N: <	0.10 PPM	AL:	
F:	2 PPM	MO:	
TDS:	3440 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	3585 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	2410 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 39
SAMPLE: BSC-86-002 LOCATION: 121N-46W-08DDBA 2
LEGAL LOCATION: NE NW SE SE SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1806 LONG.: 96.2720 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-09-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 962.67 FEET SDGS WELL (OR OTHER): BSC-81-22
GROUND SURFACE ELEV.: WELL DEPTH: 30.60
CASING TOP ELEVATION: 969.74 I DEPTH TO WATER: 7.07 FEET
CASING TYPE: PVC
PUMP: BLADDER
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:	331 PPM	%NA:	
MG:	250 PPM	SAR:	
NA:	142 PPM	ADJ SAR:	
K:		RSC:	
SO4:	1232 PPM	CATIONS:	
CL:	21 PPM	ANIONS:	
HCO3:	1201 PPM	ALK-MO:	
CO3:		ALK-P:	ND
FE:	10.10 PPM	LI:	
MN:	1.51 PPM	SB:	
NO3-N: <	0.20 PPM	AL:	
F: <	10 PPM	MO:	
TDS:	2695 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	7.28
COND:	3350 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		FIELD TEMP:	10 C
AG:		SI:	
AS:	45.000 PPB	BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:	0.2000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 40
SAMPLE: BC-81-26 LOCATION: 121N-46W-17DBDA
LEGAL LOCATION: NE SE NW SE SEC. 17, T. 121 N., R. 46 W.
LAT.: 45.1719 LONG.: 96.2730 COUNTY: GRANT
OWNER-CONTROLLER:
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-30-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 980.00 T WELL DEPTH: 40 FEET
CASING TOP ELEVATION: DEPTH TO WATER: 12.69 FEET
CASING TYPE:
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE:
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	263 PPM	%NA:	
MG:	92 PPM	SAR:	
NA:	50 PPM	ADJ SAR:	
K:		RSC:	
SO4:	625 PPM	CATIONS:	
CL:	54 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	8.30 PPM	LI:	
MN:	1.43 PPM	SB:	
NO3-N: <	0.10 PPM	AL:	
F:	26 PPM	MO:	
TDS:	1500 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	1780 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	1033 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 41
SAMPLE: BC-81-17 LOCATION: 121N-46W-19AABB
LEGAL LOCATION: NW NW NE NE SEC. 19, T. 121 N., R. 46 W.
LAT.: 45.1700 LONG.: 96.2840 COUNTY: GRANT
OWNER-CONTROLLER: L. SCHMIEG
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-18-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 1050.00 T WELL DEPTH: 100 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: FAIRMOUNT BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE:
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		149 PPM	%NA:
MG:		61 PPM	SAR:
NA:		29 PPM	ADJ SAR:
K:			RSC:
SO4:		270 PPM	CATIONS:
CL:	<	2 PPM	ANIONS:
HCO3:			ALK-MO:
CO3:			ALK-P:
FE:		3.80 PPM	LI:
MN:		0.18 PPM	SB:
NO3-N:	<	0.10 PPM	AL:
F:		27 PPM	MO:
TDS:		818 PPM @ 180 C	FIELD TDS:
PH:			FIELD PH:
COND:		1063 UMHOS @ 25 C	FIELD COND:
HARDNESS:		622 PPM	FIELD TEMP:
AG:			SI:
AS:			BE:
B:			RB:
BA:			CU:
CD:			SR:
CR:			NI:
HG:			ZN:
PB:			CS:
SE:			

NOTES:

MAP LOCATION: 42
SAMPLE: BC-81-27 LOCATION: 121N-46W-06DDDC
LEGAL LOCATION: SW SE SE SE SEC. 06, T. 121 N., R. 46 W.
LAT.: 45.1847 LONG.: 96.2829 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 07-01-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): BSC-81-15
GROUND SURFACE ELEV.: 1095.00 T WELL DEPTH:
CASING TOP ELEVATION: DEPTH TO WATER: 120 FEET
CASING TYPE: PVC
PUMP:
AQUIFER: MILBANK GRANITE BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		68 PPM	%NA:	
MG:		20 PPM	SAR:	
NA:		146 PPM	ADJ SAR:	
K:			RSC:	
SO4:		370 PPM	CATIONS:	
CL:		27 PPM	ANIONS:	
HCO3:			ALK-MO:	
CO3:			ALK-P:	
FE:	<	0.05 PPM	LI:	
MN:	<	0.05 PPM	SB:	
NO3-N:		0.10 PPM	AL:	
F:		285 PPM	MO:	
TDS:		760 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	
COND:		1120 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		252 PPM	FIELD TEMP:	
AG:			SI:	
AS:			BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:				

NOTES:

MAP LOCATION: 43
SAMPLE: BC-81-24 LOCATION: 121N-46W-17ADCC 1
LEGAL LOCATION: SW SW SE NE SEC. 17, T. 121 N., R. 46 W.
LAT.: 45.1730 LONG.: 96.2725 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-30-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 960.63 FEET SDGS WELL (OR OTHER): BSC-81-01
GROUND SURFACE ELEV.: WELL DEPTH:
CASING TOP ELEVATION: 975.91 I DEPTH TO WATER: 15.28 FEET
CASING TYPE: PVC
PUMP: AIR LIFT
AQUIFER: MILBANK GRANITE BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		188 PPM	%NA:
MG:		95 PPM	SAR:
NA:		96 PPM	ADJ SAR:
K:			RSC:
SO4:		625 PPM	CATIONS:
CL:		9 PPM	ANIONS:
HCO3:			ALK-MO:
CO3:			ALK-P:
FE:	<	0.05 PPM	LI:
MN:		0.40 PPM	SB:
NO3-N:	<	0.10 PPM	AL:
F:		92 PPM	MO:
TDS:		1240 PPM @ 180 C	FIELD TDS:
PH:			FIELD PH:
COND:		1670 UMHOS @ 25 C	FIELD COND:
HARDNESS:		858 PPM	FIELD TEMP:
AG:			SI:
AS:			BE:
B:			RB:
BA:			CU:
CD:			SR:
CR:			NI:
HG:			ZN:
PB:			CS:
SE:			

NOTES:

MAP LOCATION: 44
SAMPLE: BSC-86-005 LOCATION: 121N-46W-17ADCC 1
LEGAL LOCATION: SW SW SE NE SEC. 17, T. 121 N., R. 46 W.
LAT.: 45.1730 LONG.: 96.2725 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-10-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: 961.98 FEET SDGS WELL (OR OTHER): BSC-81-01
GROUND SURFACE ELEV.: WELL DEPTH: 163
CASING TOP ELEVATION: 975.91 I DEPTH TO WATER: 13.93 FEET
CASING TYPE: PVC
PUMP: BLADDER
AQUIFER: MILBANK GRANITE BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:		80 PPM	%NA:	
MG:		82 PPM	SAR:	
NA:		99 PPM	ADJ SAR:	
K:			RSC:	
SO4:		565 PPM	CATIONS:	
CL:		17 PPM	ANIONS:	
HCO3:		258 PPM	ALK-MO:	
CO3:			ALK-P:	ND
FE:	<=	0.05 PPM	LI:	
MN:	<	0.05 PPM	SB:	
NO3-N:	<	0.20 PPM	AL:	
F:		46 PPM	MO:	
TDS:		1040 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	7.67
COND:		1436 UMHOS @ 25 C	FIELD COND:	
HARDNESS:			FIELD TEMP:	11 C
AG:			SI:	
AS:	<	0.300 PPB	BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:	<	0.2000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 45
SAMPLE: BC-81-25 LOCATION: 121N-46W-17DABB
LEGAL LOCATION: NW NW NE SE SEC. 17, T. 121 N., R. 46 W.
LAT.: 45.1726 LONG.: 96.2726 COUNTY: GRANT
OWNER-CONTROLLER: BIG STONE CITY
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-30-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): PRIVATE
GROUND SURFACE ELEV.: 980.00 T WELL DEPTH: 138 FEET
CASING TOP ELEVATION: DEPTH TO WATER: 13.20 FEET
CASING TYPE:
PUMP:
AQUIFER: MILBANK GRANITE BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED: WELL NORTH OF WHETSTONE RIVER
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:	376 PPM	%NA:	
MG:	115 PPM	SAR:	
NA:	41 PPM	ADJ SAR:	
K:		RSC:	
SO4:	750 PPM	CATIONS:	
CL:	51 PPM	ANIONS:	
HCO3:		ALK-MO:	
CO3:		ALK-P:	
FE:	< 0.05 PPM	LI:	
MN:	0.64 PPM	SB:	
NO3-N:	0.70 PPM	AL:	
F:	31 PPM	MO:	
TDS:	1780 PPM @ 180 C	FIELD TDS:	
PH:		FIELD PH:	
COND:	2110 UMHOS @ 25 C	FIELD COND:	
HARDNESS:	1409 PPM	FIELD TEMP:	
AG:		SI:	
AS:		BE:	
B:		RB:	
BA:		CU:	
CD:		SR:	
CR:		NI:	
HG:		ZN:	
PB:		CS:	
SE:			

NOTES:

MAP LOCATION: 46
SAMPLE: BC-81-14 LOCATION: 121N-47W-24AAAA
LEGAL LOCATION: NE NE NE NE SEC. 24, T. 121 N., R. 47 W.
LAT.: 45.1659 LONG.: 96.2938 COUNTY: GRANT
OWNER-CONTROLLER: SDGS
SAMPLE TYPE: GROUND WATER COLLECTION DATE: 06-18-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER): BSC-81-09
GROUND SURFACE ELEV.: 1049.00 T WELL DEPTH: 123 FEET
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE: PVC
PUMP: AIR LIFT
AQUIFER: MILBANK GRANITE BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE: OBSERVATION
LAKE: STREAM:
OTHER:
WHERE COLLECTED:
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED: X
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		170 PPM	%NA:	
MG:		80 PPM	SAR:	
NA:		43 PPM	ADJ SAR:	
K:			RSC:	
SO4:		434 PPM	CATIONS:	
CL:	<	2 PPM	ANIONS:	
HCO3:			ALK-MO:	
CO3:			ALK-P:	
FE:		1.26 PPM	LI:	
MN:		0.14 PPM	SB:	
NO3-N:	<	0.10 PPM	AL:	
F:		49 PPM	MO:	
TDS:		1026 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	
COND:		1282 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		752 PPM	FIELD TEMP:	
AG:			SI:	
AS:			BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:				

NOTES:

MAP LOCATION: 47
SAMPLE: BSC-86-009 LOCATION: 121N-46W-08BACC
LEGAL LOCATION: SW SW NE NW SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1832 LONG.: 96.2802 COUNTY: GRANT
OWNER-CONTROLLER:
SAMPLE TYPE: SURFACE WATER COLLECTION DATE: 06-12-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER):
GROUND SURFACE ELEV.: WELL DEPTH:
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE:
LAKE: BIG STONE LAKE STREAM:
OTHER:
WHERE COLLECTED: POWER PLANT WATER INTAKE
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:		83 PPM	%NA:	
MG:		43 PPM	SAR:	
NA:		33 PPM	ADJ SAR:	
K:			RSC:	
SO4:		261 PPM	CATIONS:	
CL:		13 PPM	ANIONS:	
HCO3:		211 PPM	ALK-MO:	
CO3:			ALK-P:	
FE:		0.08 PPM	LI:	
MN:	<=	0.05 PPM	SB:	
NO3-N:		0.30 PPM	AL:	
F:		16 PPM	MO:	
TDS:		580 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	8.46
COND:		861 UMHOS @ 25 C	FIELD COND:	
HARDNESS:			FIELD TEMP:	21 C
AG:			SI:	
AS:		3.400 PPB	BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:		0.6000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 48
SAMPLE: BC-81-03 LOCATION: 121N-46W-08BDCA
LEGAL LOCATION: NE SW SE NW SEC. 08, T. 121 N., R. 46 W.
LAT.: 45.1824 LONG.: 96.2754 COUNTY: GRANT
OWNER-CONTROLLER:
SAMPLE TYPE: SURFACE WATER COLLECTION DATE: 06-09-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER):
GROUND SURFACE ELEV.: WELL DEPTH:
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE:
LAKE: BIG STONE LAKE STREAM:
OTHER:
WHERE COLLECTED: EAST OF MUNICIPAL WELL #1
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		99 PPM	%NA:	
MG:		61 PPM	SAR:	
NA:		66 PPM	ADJ SAR:	
K:			RSC:	
SO4:		340 PPM	CATIONS:	
CL:		19 PPM	ANIONS:	
HCO3:			ALK-MO:	
CO3:			ALK-P:	
FE:	<	0.05 PPM	LI:	
MN:		0.06 PPM	SB:	
NO3-N:	<	0.10 PPM	AL:	
F:		12 PPM	MO:	
TDS:		752 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	
COND:		931 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		498 PPM	FIELD TEMP:	
AG:			SI:	
AS:			BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:				

NOTES:

MAP LOCATION: 49
SAMPLE: BSC-86-011 LOCATION: 121N-46W-17ADCC
LEGAL LOCATION: SW SW SE NE SEC. 17, T. 121 N., R. 46 W.
LAT.: 45.1730 LONG.: 96.2720 COUNTY: GRANT
OWNER-CONTROLLER:
SAMPLE TYPE: SURFACE WATER COLLECTION DATE: 06-17-1986
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER):
GROUND SURFACE ELEV.: WELL DEPTH:
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE:
LAKE: STREAM: WHETSTONE RIVER
OTHER:
WHERE COLLECTED: OFF BRIDGE ON HIGHWAY 12
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER: UNTREATED

CA:		124 PPM	%NA:	
MG:		54 PPM	SAR:	
NA:		33 PPM	ADJ SAR:	
K:			RSC:	
SO4:		312 PPM	CATIONS:	
CL:		10 PPM	ANIONS:	
HCO3:		336 PPM	ALK-MO:	
CO3:			ALK-P:	ND
FE:	<	0.05 PPM	LI:	
MN:		0.09 PPM	SB:	
NO3-N:		0.90 PPM	AL:	
F:		46 PPM	MO:	
TDS:		770 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	8.14
COND:		1081 UMHOS @ 25 C	FIELD COND:	
HARDNESS:			FIELD TEMP:	20 C
AG:			SI:	
AS:		3.700 PPB	BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:		0.9000 PPB		

NOTES: ALL INSITU ANALYSIS CONDUCTED ON UNFILTERED WATER.

MAP LOCATION: 50
SAMPLE: BC-81-04 LOCATION: 121N-46W-18BDCB
LEGAL LOCATION: NW SW SE NW SEC. 18, T. 121 N., R. 46 W.
LAT.: 45.1730 LONG.: 96.2913 COUNTY: GRANT
OWNER-CONTROLLER:
SAMPLE TYPE: SURFACE WATER COLLECTION DATE: 06-09-1981
LAB: SDGS
PROJECT: BIG STONE CITY STUDY WATER RIGHTS WELL:
WATER ELEVATION: SDGS WELL (OR OTHER):
GROUND SURFACE ELEV.: 970.00 T WELL DEPTH:
CASING TOP ELEVATION: DEPTH TO WATER:
CASING TYPE:
PUMP:
AQUIFER: BASIN: MINNESOTA/WHETSTONE
MANAGEMENT UNIT:
USAGE:
LAKE: STREAM: WHETSTONE RIVER
OTHER:
WHERE COLLECTED: ON EDGE OF SHORE
CLEAN CONTAINER: X FILTERED: X HNO3: X SCREENED:
H2SO4 OR FORMALIN TREATED: H
OTHER:

CA:		127 PPM	%NA:	
MG:		58 PPM	SAR:	
NA:		91 PPM	ADJ SAR:	
K:			RSC:	
SO4:		388 PPM	CATIONS:	
CL:	<	10 PPM	ANIONS:	
HCO3:			ALK-MO:	
CO3:			ALK-P:	
FE:	<	0.05 PPM	LI:	
MN:		0.43 PPM	SB:	
NO3-N:	<	0.10 PPM	AL:	
F:		27 PPM	MO:	
TDS:		878 PPM @ 180 C	FIELD TDS:	
PH:			FIELD PH:	
COND:		1540 UMHOS @ 25 C	FIELD COND:	
HARDNESS:		553 PPM	FIELD TEMP:	
AG:			SI:	
AS:			BE:	
B:			RB:	
BA:			CU:	
CD:			SR:	
CR:			NI:	
HG:			ZN:	
PB:			CS:	
SE:				

NOTES: