STATE OF SOUTH DAKOTA
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DEPARTMENT OF NATURAL RESOURCE DEVELOPMENT
Vern W. Butler, Secretary

GEOLOGICAL SURVEY
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Special Report 62

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

by

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CONTENTS

FIGURES

TABLE

APPENDICES

INTRODUCTION

This report contains the results of a special investigation conducted by the South Dakota Geological Survey from May 13 to May 16, 1975, in and around the city of Harrold, Hughes County, South Dakota. It is the 62nd in a continuing series of investigations to assist the cities in South Dakota in locating future water supplies.

Harrold now obtains water from a single well one-half mile south of the city. This well yields water from the alluvium and outwash in the floodplain of the South Fork of Medicine Knoll Creek.

Included in the survey of the Harrold area were: (1) geologic mapping of the area, (2) drilling of 10 auger test holes, (3) a well inventory, and (4) collection and analyses of 8 water samples.

ACKNOWLEDGMENTS

The cooperation of the residents of Harrold and the surrounding area is appreciated. The project was funded by the city of Harrold, the Oahe Conservancy Sub-District, and the South Dakota Geological Survey.

LOCATION AND EXTENT OF STUDY AREA

Harrold is located in central South Dakota in Hughes County in the Missouri du Coteau division of the Great Plains physiographic province (fig. 1). The Harrold study area as used in this report includes a region that measures 2 miles north-south by 2 miles east-west.

GENERAL GEOLOGY

Surficial Deposits

Surficial deposits of the Harrold area include recent alluvium, glacial outwash, and glacial till (fig. 2). The glacial deposits in this area were formed during the last part of the Pleistocene Epoch of geologic time. These deposits can be divided into two basic groups, till and outwash. Till is deposited directly from the glacial ice and consists of sand, pebbles, and boulders randomly distributed in a matrix of clay. Outwash is a more homogenous deposit consisting primarily of sand and gravel with minor amounts of silt and clay that is deposited by streams flowing out from the melting glacial ice. Till and outwash are collectively known as glacial drift.

Recent alluvium is the material which has been deposited since the end of the Pleistocene Epoch. It consists of a thin veneer of sand, silt, and clay deposited on the floodplains of streams. The combined thickness of drift and alluvium ranges from approximately 40 to 100 feet. Drillers' logs of the auger test holes which were drilled are listed in appendix A.

Subsurface Bedrock

No bedrock is exposed in the study area but available data from drill holes indicate an approximate thickness of 2,500 feet of Cretaceous and older rocks overlying the Precambrian basement rocks. The Cretaceous Dakota and Fall River Formations are the two major bedrock aquifers in the area and several wells are developed in these formations. The Dakota is encountered at a depth of approximately 1,400 to 1,500 feet and the Fall Fiver from approximately 1,800 to 2,000 feet.

The bedrock which lies directly under the glacial drift is the Pierre Shale. It consists of a dark-gray silty clay and is a very poor aquifer.

QUALITY OF GROUND WATER

Table 1 is a compilation of the chemical analyses of water samples collected in the Harrold area (for map location, see fig. 3). Samples 1 through 5 were collected from alluvium and glacial outwash in the South Fork of Medicine Knoll Creek. This included a sample of the present Harrold city well. All of these samples contain more than the recommended amount of manganese; samples 2 (Harrold city well) and 5 contain more than the recommended amount of iron; and sample 5 also contains more chlorides, sulfates, sodium, and total dissolved solids than recommended. The present city well is one of the best quality samples taken in the South Fork of Medicine Knoll Creek aquifer having the lowest total dissolved solids content (615 ppm).

Sample 6 was obtained from a Fall River Formation well which is 1,985 feet deep. This sample was over the recommended limit of iron and contained over twice the recommended limit of total dissolved solids (2,100 ppm).

Samples 7 and 8 were taken from Dakota Formation wells which were 1,470 and 1,520 feet deep. Both of these wells were over the recommended limits of chlorides, iron, manganese, sodium, and total dissolved solids.

In conjunction with the sampling program, a well interview was conducted in the Harrold area, the results of which are compiled in appendix B.

CONCLUSIONS AND RECOMMENDATIONS

As was stated earlier the alluvium and outwash in

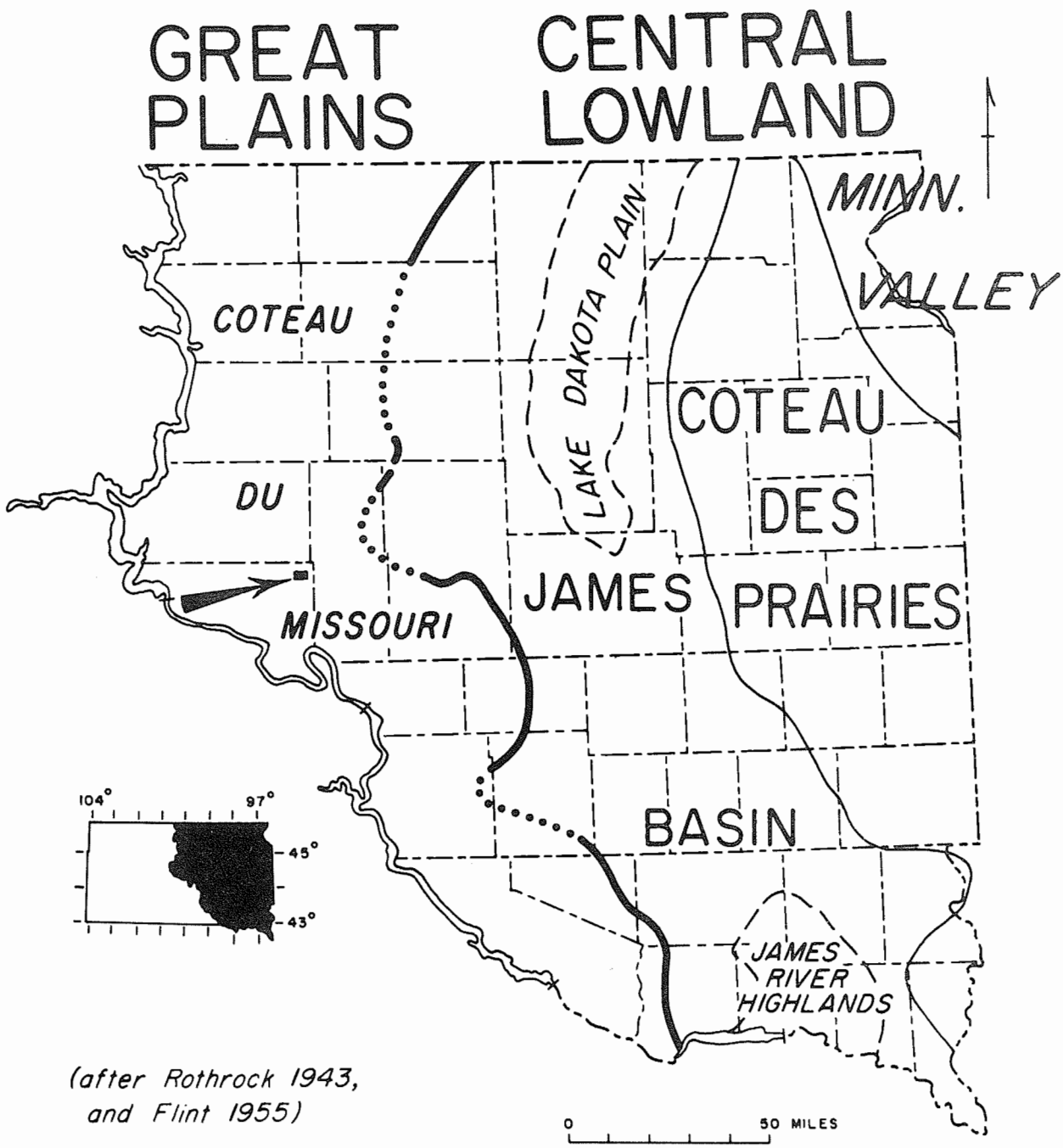


Figure 1. Map of eastern South Dakota showing the major physiographic divisions and location of the Harrold area.

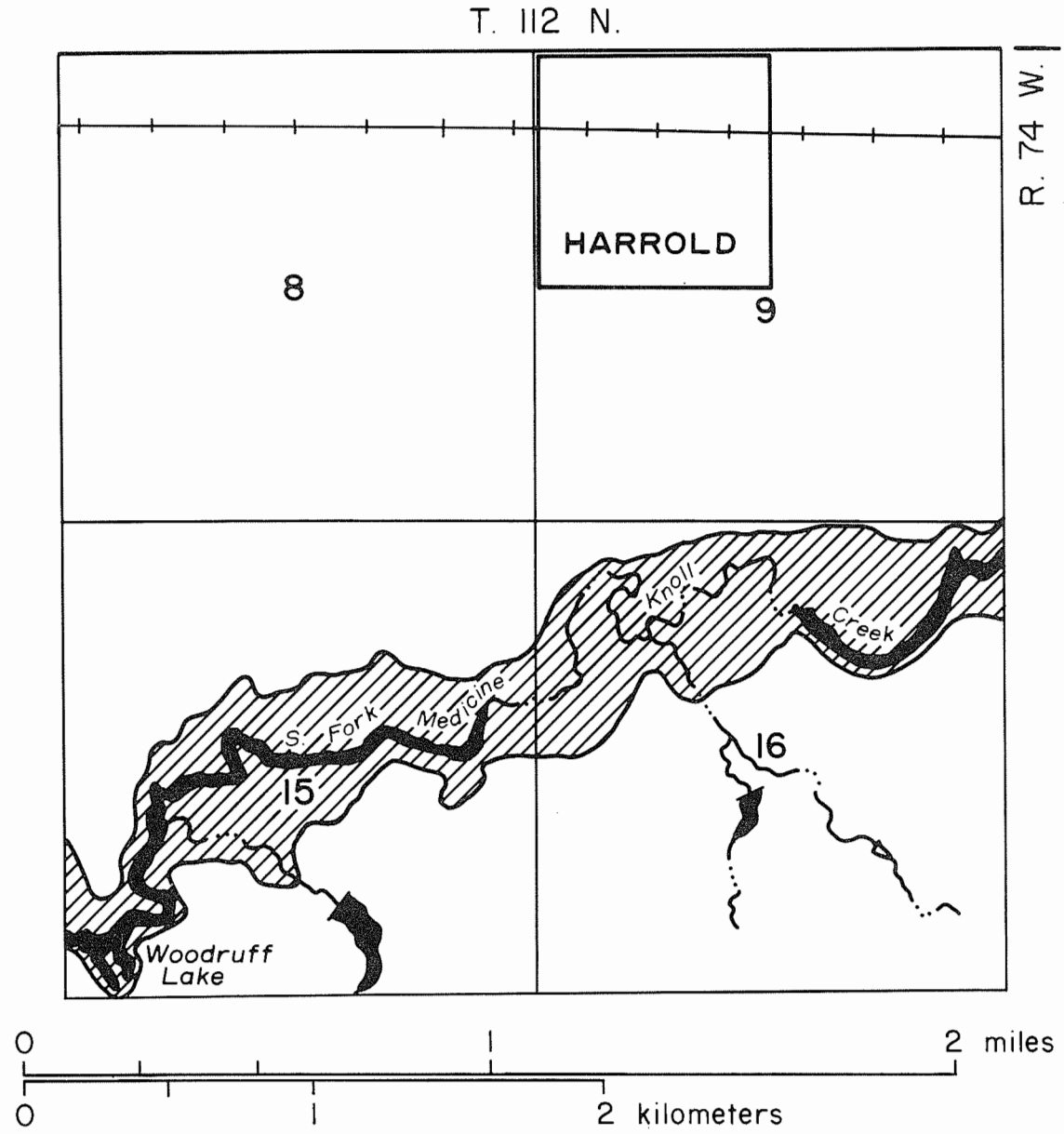


Figure 2. Generalized geologic map of the Harrold area. dj

TABLE 1. Chemical analyses of water samples from the Harrold area

Sample	Depth of well in feet	Parts Per Million									
		Calcium	Sodium	Magnesium	Chlorides	Sulfate	Iron	Manganese	Nitrate Nitrogen	Total Solids	Location
A		------	270[1]	------	250	500[2]	0.3	0.05	10.0	1000[2]	
1	18	250	60	40	55	<20 ?	<0.05	1.70	9	692	SE¼SE¼SE¼SE¼ sec. 11, T. 112 N., R. 74 W.
2	40	150	60	20	10	<20	2.0	0.50	<0.5	615	NE¼SE¼NE¼NW¼ sec. 16, T. 112 N., R. 74 W.
3	60	40	350	<10	170	<20	0.30	0.40	<0.5	760	SW¼NE¼SW¼NE¼ sec. 17, T. 112 N., R. 74 W.
4	40	200	80	30.3	40	250	<0.05	0.25	6	764	SE¼NE¼SW¼NE¼ sec. 17, T. 112 N., R. 74 W.
5	30	470	660	140	287	1080	0.50	0.75	2.5	3650	SE¼SW¼NW¼NE¼ sec. 13, T. 112 N., R. 75 W.
6	1985	560	60	90	65	320	1.0	<0.05	<0.5	2100	NE¼NE¼NE¼SE¼ sec. 1, T. 112 N., R. 75 W.
7	1470	130	460	15	360	300	2.6	0.50	<0.5	1265	NE¼NE¼NE¼SE¼ sec. 8, T. 112 N., R. 74 W.
8	1520	20	750	15	660	270	1.0	0.10	2.0	1760	NW¼NW¼NW¼SW¼ sec. 21, T. 112 N., R. 74 W.

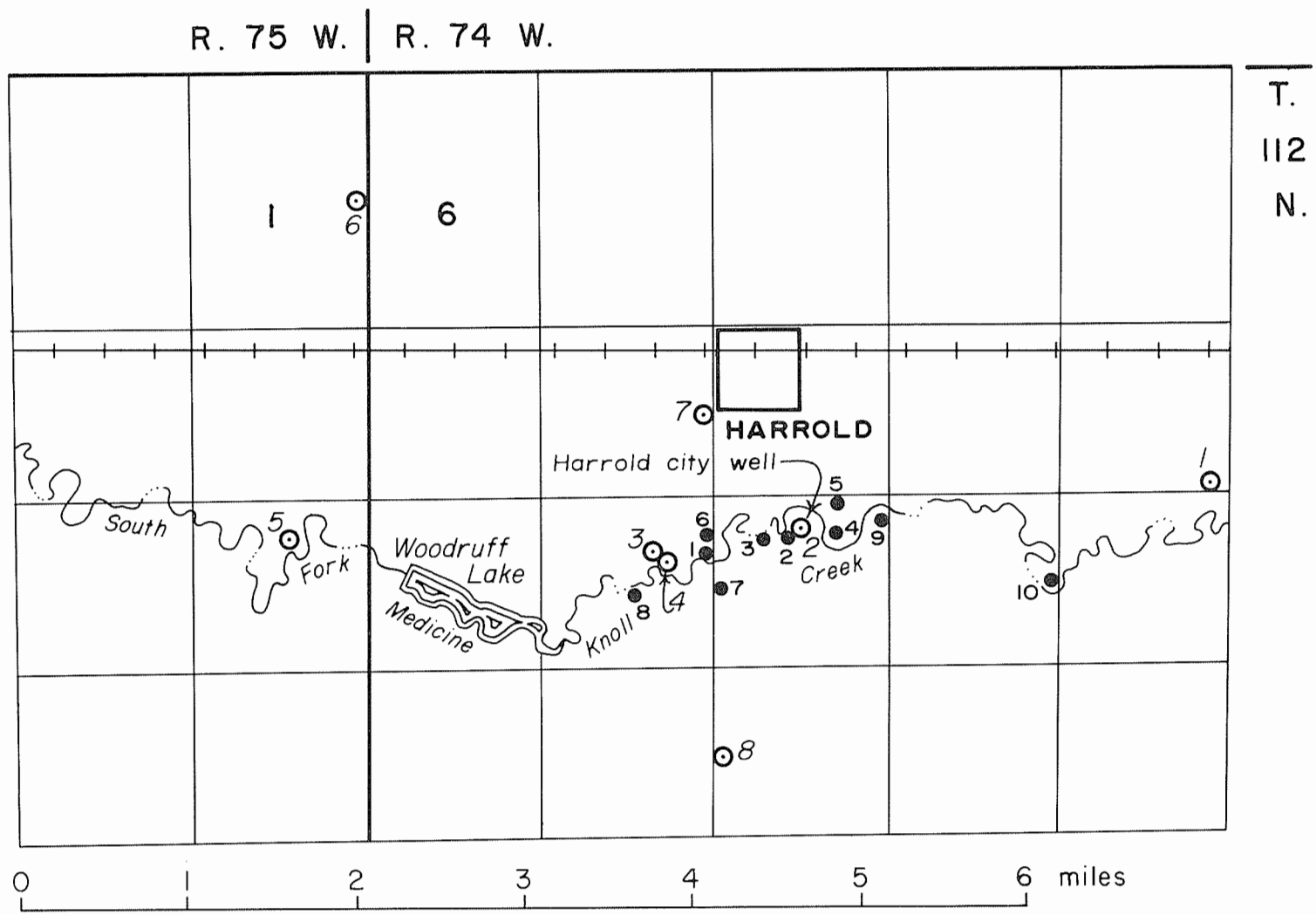
A – Drinking water standards, U.S. Public Health Service (1962).

[1] Proposed upper limit for sodium.

[2] Modified for South Dakota by the Department of Health (written communication, Water Sanitation Section, September 24, 1968).

All samples were analyzed by the South Dakota Geological Survey Laboratory.

Samples 1-5 were collected from the South Fork Medicine Knoll Creek Aquifer, sample 6 from the Fall River Formation, and samples 7 and 8 from the Dakota Formation.



3● Auger test hole (numbers refer to test holes listed in Appendix A.)

7⊙ Water sample locations (numbers refer to samples listed in Table I.)

by R. N. Helgerson

Figure 3. Test hole and water sample site location map for Harrold.

dj

South Fork of Medicine Creek is approximately 50 feet thick and is the current source of water for the city of Harrold. It is recommended that this outwash be developed further in order to augment the city water supply. Test hole 2 (app. A) indicated the presence of 19 feet of relatively clean, saturated sand from 16 to 35 feet below ground surface. In addition to this, from 35 to 63 feet below ground surface clayey, silty sand is indicated, although this material is not as good as the overlying material, it may prove to be of sufficient quality to merit development. This is in the same depth range as the current city well and water taken from this zone can be expected to have similar chemical characteristics. Interference of a new well developed in the vicinity of test hole 2 is expected to be negligible. A possible problem with further development of this aquifer is that an extended severe drought may cause a depletion of the aquifer to a point at which a sufficient volume of water could not be obtained.

A second alternative to further development of the South Fork of Medicine Knoll Creek aquifer would be the construction of a deep well to either the Dakota or Fall River Formation. This is a secondary recommendation due to the poor chemical quality of the water obtained from these two aquifers and the high cost of this type of well.

A third alternative would be to explore the possibility of developing a well in the South Fork of Medicine Knoll Creek aquifer further east. The aquifer increases in thickness and areal extent approximately 5 miles east of Harrold. This recommendation is third in that the costs of constructing a delivery system of this length would be quite high.

If the city should decide to test the South Fork Medicine Knoll Creek aquifer for additional water, it is recommended that an engineering firm licensed in South Dakota be hired to coordinate the drilling of a pilot test hole in the vicinity of test hole 2. If the data on the pilot hole shows suitable materials to conduct a pump test, the pilot hole should be converted to a pump test hole. A pump test should be conducted for approximately 24 hours before completion of the well. Water samples should be collected and chemically analyzed. The South Dakota Geological Survey will provide technical assistance and supervise the conducting of the pump test. Recommendations of future well spacing will be based on the results of the pump test.

Before a permanent well is drilled, the city officials should contact the Division of Water Rights, Department of Natural Resource Development, to obtain water rights and a permit to drill a municipal well and the South Dakota Environmental Protection Agency to determine the biological and chemical suitability of the water.

APPENDIX A

Logs of test holes in the Harrold area
(For map location, see fig. 3)

Test Hole 1 (Auger Hole)
Location: NE¼NE¼SE¼NE¼ sec. 17, T. 112 N., R. 74 W.
Surface Elevation: 1742 feet

0- 4	Clay, brown (topsoil)
4- 5	Clay, brown, sandy
5- 7	Sand, brown, silty
7- 10	Clay, brown, silty
10- 19	Silt, brown, clayey, saturated
19- 24	Silt, medium-gray, saturated
24- 30	Sand and gravel, coarse, saturated
30- 39	Clay, medium-gray, shaley, saturated

* * * *

Test Hole 2 (Auger Hole)
Location: NE¼NE¼SE¼NW¼ sec. 16, T. 112 N., R. 74 W.
Surface Elevation: 1761 feet

0- 7	Clay, gray-brown, silty with coarse gravel
7- 12	Gravel, brown, silty
12- 16	Clay, brown, pebbly, saturated
16- 35	Sand, brown, medium-fine, some clay, saturated
35- 63	Sand, dark-brown, medium-fine, silty, clayey, saturated
63- 78	Shale, reworked
78- 80	Pierre Shale

* * * *

Test Hole 3 (Auger Hole)
Location: NE¼NE¼SW¼NW¼ sec. 16, T. 112 N., R. 74 W.
Surface Elevation: 1744 feet

0- 3	Clay, dark-brown, silty clay (topsoil)
3- 12	Clay, dark-brown, silty
12- 34	Silt, dark-brown, clayey, saturated
34- 40	Sand, dark-brown, silty, clayey, saturated
40- 48	Sand, gray, silty, clayey, saturated
48- 55	Clay, gray, reworked shale
55- 64	Pierre Shale

* * * *

Test Hole 4 (Auger Hole)
Location: NE¼SE¼NW¼NE¼ sec. 16, T. 112 N., R. 74 W.
Surface Elevation: 1953 feet

0- 3	Clay, dark-brown, silty (topsoil)
3- 9	Silt, brown, clayey
9- 10	Sand, brown

Test Hole 4 -- continued.

10- 22	Silt, brown, clayey
22- 39	Silt, gray, clayey, saturated
39- 42	Sand, medium and silt, gray, saturated
42- 49	Pierre Shale

* * * *

Test Hole 5 (Auger Hole)
Location: NW¼NW¼NE¼NE¼ sec. 16, T. 112 N., R. 74 W.
Surface Elevation: 1772 feet

0- 2	Silt, brown, clayey (topsoil)
2- 5	Silt, brown
5- 18	Silt, brown, with some gravel
18- 22	Sand, brown, silty
22- 38	Silt, brown, clayey, saturated
38- 62	Clay, gray, silty, saturated
62- 69	Pierre Shale

* * * *

Test Hole 6 (Auger Hole)
Location: NE¼SE¼NE¼NE¼ sec. 17, T. 112 N., R. 74 W.
Surface Elevation: 1780 feet

0- 3	Silt, brown, clayey (topsoil)
3- 6	Clay, brown, silty
6- 11	Clay, light-brown, silty
11- 27	Silt, light-brown, clayey
27- 39	Clay, gray, silty

* * * *

Test Hole 7 (Auger Hole)
Location: NW¼NW¼NW¼SW¼ sec. 16, T. 112 N., R. 74 W.
Surface Elevation: 1803 feet

0- 3	Silt, brown, clayey (topsoil)
3- 17	Clay, brown, silty
17- 34	Clay, dark-brown, silty
34- 39	Clay, brown, sandy, silty

* * * *

Test Hole 8 (Auger Hole)
Location: NW¼NW¼NW¼SE¼ sec. 17, T. 112 N., R. 74 W.
Surface Elevation: 1748 feet

0- 3	Sand and gravel, brown
3- 5	Sand, brown, medium, saturated
5- 6	Clay, red-brown, pebbly, saturated
6- 33	Clay, dark-gray, saturated
33-	Pierre Shale

* * * *

Test Hole 9 (Auger Hole)
Location: NE¼SE¼NE¼NE¼ sec. 16, T. 112 N , R. 74 W.
Surface Elevation: 1758 feet

0-	3	Silt, brown, clayey (topsoil)
3-	11	Clay, dark-brown, silty
11-	13	Clay, brown, silty, sandy
13-	20	Silt, brown, sandy, saturated
20-	28	Sand, brown, silty, saturated
28-		Pierre Shale

* * * *

Test Hole 10
Location: SE¼SE¼SE¼NE¼ sec. 15, T. 112 N., R. 74 W.
Surface Elevation: 1761 feet

0-	3	Silt, brown, sandy (topsoil)
3-	4	Sand, brown, silty
4-	15	Clay, brown, sandy, pebbly
15-	30	Sand, brown, medium, silty, saturated
30-	35	Silt, brown, sandy, saturated
35-	38	Silt, gray, sandy, saturated
38-	40	Shale, reworked
40-	44	Pierre Shale

* * * *

APPENDIX B

Well Records in the Harrold Area

Use: D, domestic; S, stock

Source: SD, glacial sand; GVL, glacial gravel; DF, Dakota Formation; FR, Fall River

Depth to water: F, flowing well

Name	Location	Depth of Well (feet)	Depth to Water (feet)	Source	Use	Sample
Hoffman, E.	NW¼NW¼SW¼NW¼ sec. 4, T. 112 N., R. 74 W.	1547	10	DF	S,D	-------
Hobert O.	NE¼NE¼NE¼SE¼ sec. 8, T. 112 N., R. 74 W.	1470	60	DF	S	no. 7
Stiefel, R.	SE¼SE¼SE¼SE¼ sec. 11, T. 112 N., R. 74 W.	18	9	SD & GVL	S,D	no. 1
Hoffman, O.	NW¼NW¼NW¼SW¼ sec. 15, T. 112 N , R. 74 W.	1500	50	DF	S,D	-------
Harrold City Well	NE¼SE¼NE¼NW¼ sec. 16, T. 112 N., R. 74 W.	40	18	SD & GVL	D	no. 2
Reding, S.	SW¼NE¼SW¼NE¼ sec. 17, T. 112 N., R. 74 W.	60		SD & GVL	S,D	no. 3
Reding, S.	SE¼NE¼SW¼NE¼ sec. 17, T. 112 N., R. 74 W.	40		SD & GVL	S	no. 4
Pfeil, R.	SE¼SW¼NW¼NE¼ sec. 13, T. 112 N., R. 75 W.	30		SD & GVL	S,D	no. 5
Hobert, J.	SW¼SW¼NW¼SW¼ sec. 19, T. 112 N., R. 74 W.	1500	20	DF	S,D	-------
Hobert, O.	NW¼NW¼NW¼SW¼ sec. 21, T. 112 N., R. 74 W.	1520		DF	S,D	no. 8
Gregg, G.	NE¼NE¼NE¼SE¼ sec. 1, T. 112 N., R. 75 W.	1985	F	FR	S,D	no. 6