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Howard County Test Hole Logs

Vincent H. Dreeszen

University of Nebraska-Lincoln

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HOWARD COUNTY Test-Hole Logs

Vincent H. Dreeszen

**Nebraska Water Survey
Test-Hole Report No. 47**

**Conservation and Survey Division
Institute of Agriculture and Natural Resources
University of Nebraska-Lincoln**



August 1999



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UNIVERSITY OF NEBRASKA-LINCOLN CREDITS

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The Conservation and Survey Division of the University of Nebraska is the agency designated by statute to investigate and interpret the geologically related natural resources of the state, to make available to the public the results of these investigations, and to assist in the development and conservation of these resources.

The division is authorized to enter into agreements with federal agencies to engage in cooperative surveys and investigations in the state. Publications of the division and the cooperating agencies are available from the Conservation and Survey Division, University of Nebraska, Lincoln, Nebraska 68588-0517.

The Conservation and Survey Division provides information and educational programs to all people without regard to race, color, national origin, sex or handicap.

Publication and price lists are furnished upon request.

August 1999

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INTRODUCTION

In 1930, the Conservation and Survey Division (CSD) of the University of Nebraska and the U.S. Geological Survey (USGS) began a program of cooperative groundwater studies in Nebraska. Since then test drilling by use of rotary drilling equipment has been an integral part of that program. This report contains logs of all the test holes drilled in the county under the program as well as those drilled by CSD with financial assistance from other government agencies.

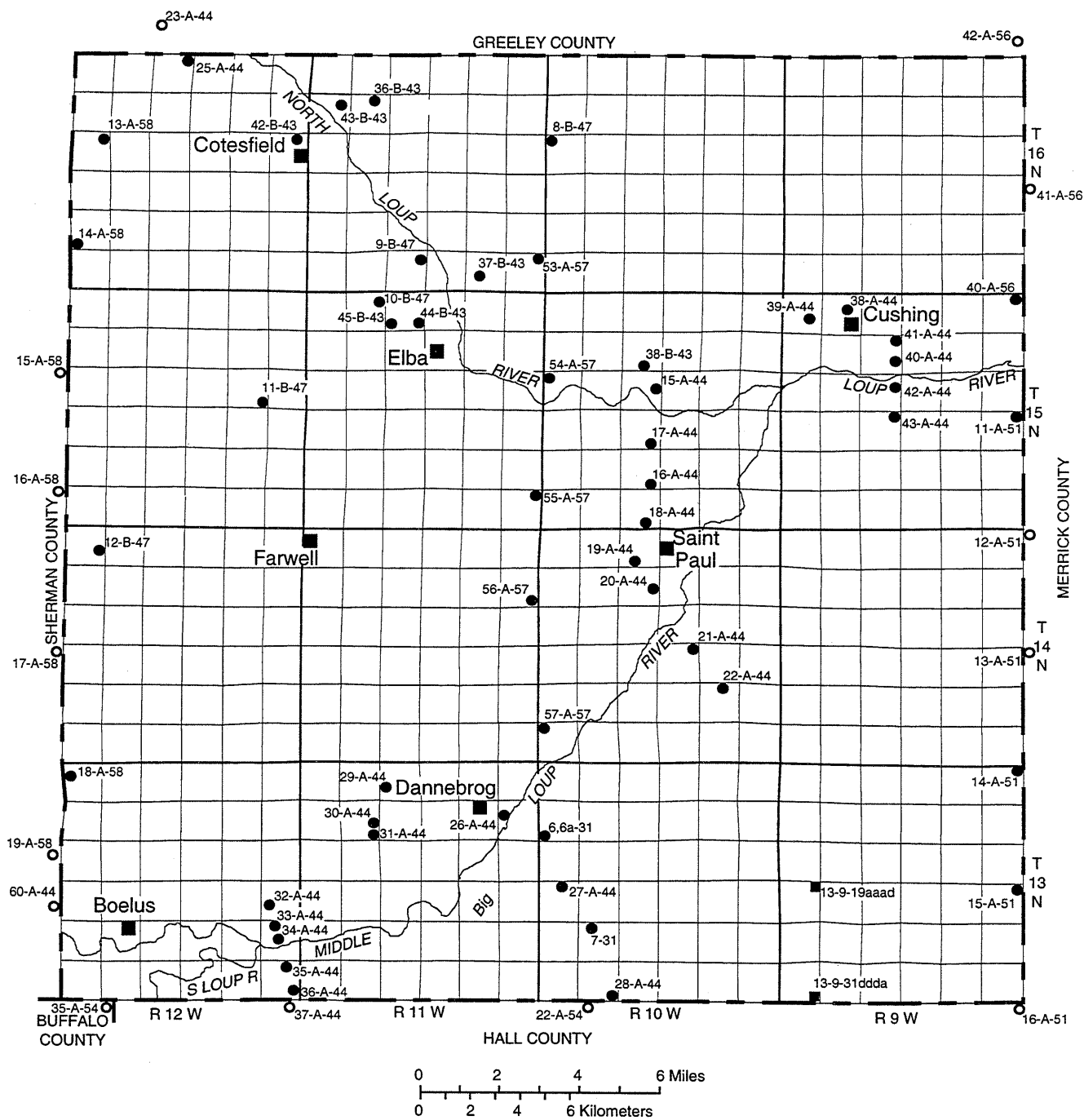
The map in this report (see figure 1) shows the location of all test holes drilled in the county since 1930.

Present techniques of test-hole logging and sampling include use of drilling mud suitable to drilling conditions, timing by stopwatch of the drilling of each 5-foot increment of depth, and removal of all cuttings from the test hole at intervals of 5 feet or less. During the drilling of the hole, cuttings from each interval are examined immediately; samples representing each 5-foot interval and each recognizable change in material are retained. After samples are washed, they are described lithologically and the color is evaluated by comparison with standard color charts. The samples then are dried, stored, and cataloged. Beginning in September 1951, most test holes have been logged electrically (see sample e-log in figure 2). All samples are processed and kept on open file in the offices of Conservation and Survey Division, 113 Nebraska Hall, University of Nebraska-Lincoln, 68588.

This publication is one of a series being issued to make more readily available the record of test holes drilled since 1930. The series of publications is made on a county basis and includes, with some exceptions, logs of all test holes drilled in each of the counties. The logs have not been reviewed for conformance with editorial standards and nomenclature.

The method whereby the altitude of the land surface at testhole sites was determined is indicated in the heading of each log, as follows: a = altimeter, h = hand leveling, i = spirit leveling, t = estimated from topographic map.

The test-hole records reflect subsurface conditions only at the locations where the test holes were drilled. Interpretive data reflecting probable subsurface conditions between test-holes are being compiled for publication in county reports and are available for inspection in the office of CSD or in press.



- Test hole description published in this report
- Test hole description published in other reports
- U.S. Bureau of Reclamation test hole description published in this report (*drilled in 1965*)

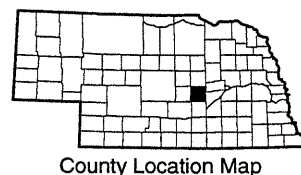
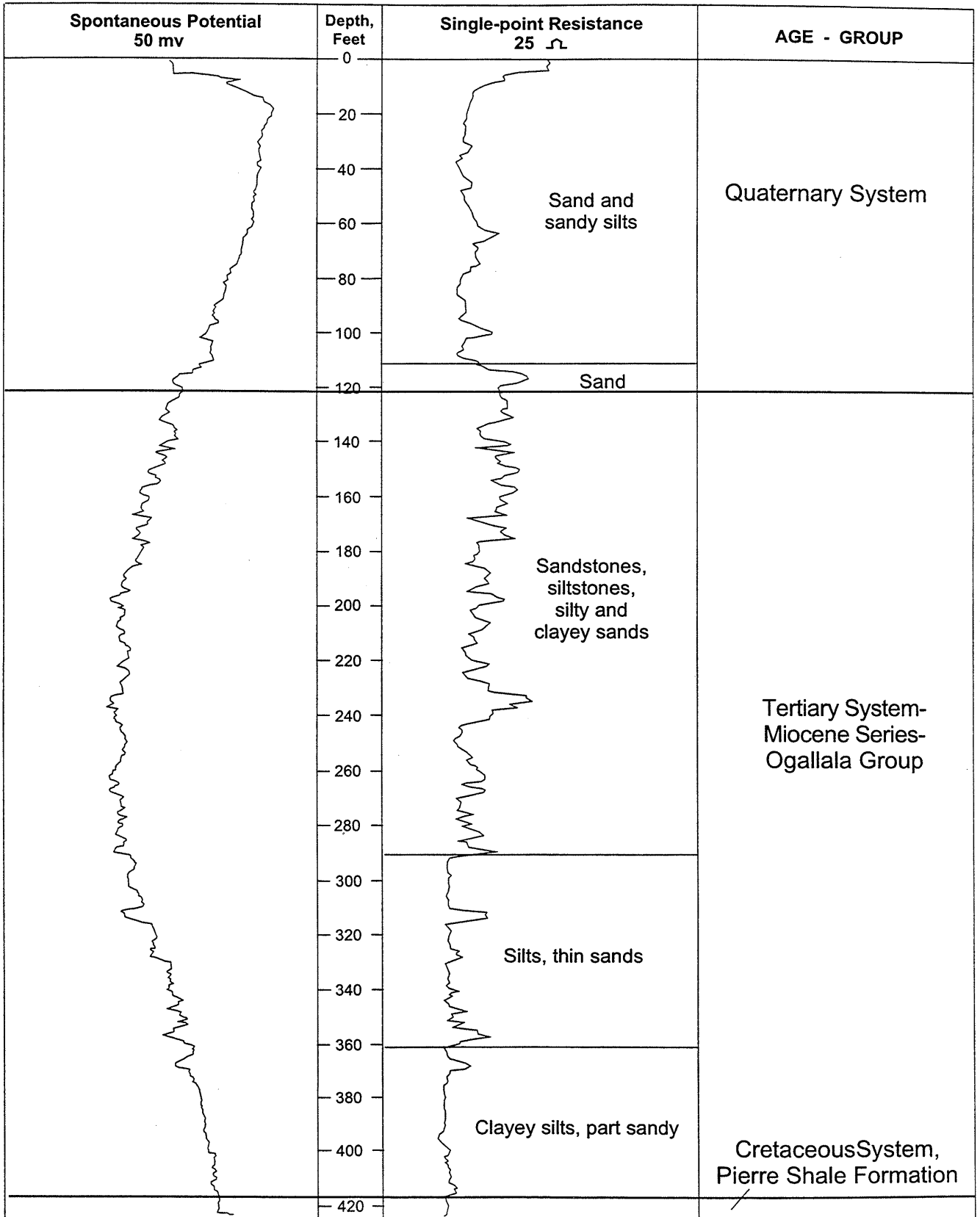


Fig. 1. Test-hole location map of Howard County.

Figure 2. Howard County sample geophysical log 16-11-36aaaa (53-A-57)



Each test hole is identified by a number assigned in the field (for example #3-B-67, #41-79), and most are also identified by a number indicating its location within the land divisions of the U.S. Bureau of Land Management's survey of Nebraska. Location numbers of test holes east of the 6th principal meridian, which passes through Columbus in a north-south direction, are preceded by the capital letter A; those west of the principal meridian have no preceding letter. The first numeral indicates the township, the second the range, and the third the section. As shown in figure 3, the letters that follow the section number indicate the location of the test hole within the section, the first letter indicating the quarter section and the second letter indicating the quarter-quarter section. The letters A, B, C, and D are applied in counterclockwise direction beginning with A in the northeast quadrant. The last numeral is the serial number of the test hole within the quarter-quarter section. No number is shown unless more than one test hole is within the given quarter-quarter section. For example, a test hole located in the SW NW SW NW section 31-10N-10W is also located as 10-10-31bcbc or 10 10W 31 BCBC.

The logs of test holes drilled by the United States Bureau of Reclamation (USBR) are included in this report. Test holes were drilled in 1965 as a part of the Mid-State investigation to supplement the grid pattern of test drilling previously established by CSD and the USGS. Samples, field logs, and geologic logs are on file with CSD. Test holes were drilled with hydraulic rotary equipment. Some intervals were sampled with use of a split spoon or by coring equipment. The author, and/or Frank A. Smith, CSD geologist emeritus, visually examined all of the available samples (some were submitted for laboratory analysis).

The author or other CSD scientist examined the available samples microscopically. The age of sediments in the paleovalley fills is in question. Although included with the Quaternary in this report, some of the sediments may be late Tertiary (Pliocene) in age. Likewise there is a fine-grained Tertiary unit underlying typical Ogallala sediments. The sediments are probably a part of the Ogallala Group.

Test holes are arranged in this publication by township, range and section starting with 13N-9W and progressing numerically to 13N-10W and then to 14N-9W and so on.

A = NE 1/4
 B = NW 1/4
 C = SW 1/4
 D = SE 1/4
 1 Section =
 1 Mile² =
 640 Acres

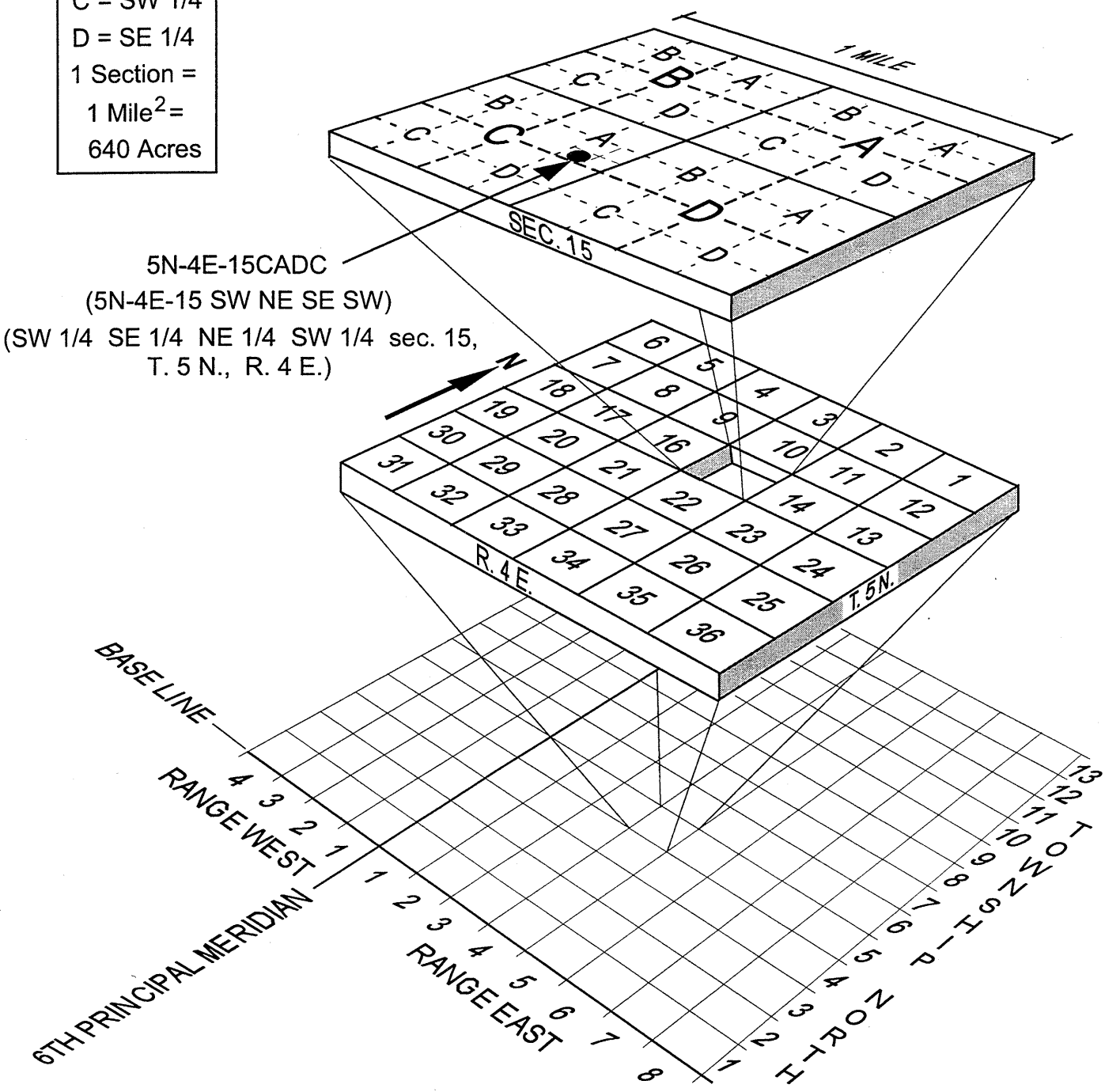


Fig. 3. System for identifying test-hole according to its location.

SELECTED REFERENCES

A few of the most recently published selected references to geology, soils and groundwater resources of Howard County are included below. The interested reader may find citations to earlier published studies noted in these references.

Some Publications that are Guides to Earth Resources of Howard County

- Lugn, A. L., and Wenzel, L. K., Geology and Ground-Water Resources of South-Central Nebraska, with special references to the Platte River valley between Chapman and Gothenberg. U. S. Geological Survey Water-Supply Paper 779, 1936.
- Souders, V. L., and Stoffey, P., Configuration of the Water Table in Sherman and Howard Counties, prior to completion of Sherman Dam in 1962. Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, open-file map, September, 1967.
- Bentall, R., and Dreeszen, V. H., and others, Hydrology, Nebraska Mid-State Division, and associated areas. Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, 1975.
- Souders, V. L., Bedrock Maps and Cross Sections Showing Configuration of Bedrock Surfaces, Broken Bow 1° x 2° Quadrangle, Nebraska. Prepared in cooperation with the Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, and the U. S. Geological Survey, Geologic Investigation Map, in press.

**Howard County
Test-Hole Table of Contents**

Legal Descrip Twp Rge Sec	Test-Hole Number	Page
13N 09W 01AAAD	14-A-51	1
13N 09W 19AAAD	USBR Profile 13 (a)	3
13N 09W 24AAAA	15-A-51	4
13N 09W 31DDDA	USBR Profile 13 (b)	6
13N 10W 07CCC	06-31 and 6a-31	8
13N 10W 19ABBA	27-A-44	9
13N 10W 29BB	07-31	10
13N 10W 32DDDD	28-A-44	11
13N 11W 04CBCC	29-A-44	12
13N 11W 08DAAA	30-A-44	13
13N 11W 08DDDD	31-A-44	14
13N 11W 12BCDC	26-A-44	15
13N 12W 06BBBC	18-A-58	16
13N 12W 24CACB	32-A-44	20
13N 12W 25BAAB	33-A-44	21
13N 12W 25DBBB	34-A-44	22
13N 12W 36ABDA	35-A-44	23
13N 12W 36DDAA	36-A-44	24
14N 10W 04CDDD	19-A-44	25
14N 10W 09DAAD	20-A-44	26
14N 10W 22AAAA	21-A-44	27
14N 10W 26ABB	22-A-44	28
14N 10W 31BBBB	57-A-57	29
14N 11W 12DDDD	56-A-57	31
14N 12W 06DADD	12-B-47	34
15N 09W 01AAAD	40-A-56	37
15N 09W 05ACCC	38-A-44	41
15N 09W 06DABB	39-A-44	42
15N 09W 09AAAA	41-A-44	43
15N 09W 09DAAD	40-A-44	44
15N 09W 16DAAA	42-A-44	45
15N 09W 21AAAA	43-A-44	46
15N 09W 24AAAA	11-A-51	47
15N 10W 09DCDD	38-B-43	49
15N 10W 16ADDD	15-A-44	50
15N 10W 18BBBB	54-A-57	51
15N 10W 21DDDC	17-A-44	54
15N 10W 28DDCC	16-A-44	55
15N 10W 33CDDD	18-A-44	56
15N 11W 04CCBC	45-B-43	57

15N 11W 04DDAD	44-B-43	. . . . .	58
15N 11W 05AAAD	10-B-47	. . . . .	59
15N 11W 36AAAA	55-A-57	. . . . .	62
15N 12W 14DDDD	11-B-47	. . . . .	65
16N 10W 18BBBB	08-B-47	. . . . .	68
16N 11W 07ADBA	43-B-43	. . . . .	71
16N 11W 08ABAA	36-B-43	. . . . .	72
16N 11W 33AADA	09-B-47	. . . . .	74
16N 11W 35CADD	37-B-43	. . . . .	76
16N 11W 36AAAA	53-A-57	. . . . .	77
16N 12W 04AAA	25-A-44	. . . . .	81
16N 12W 13ABAB	42-B-43	. . . . .	82
16N 12W 18AAAA	13-A-58	. . . . .	83
16N 12W 30CCDC	14-A-58	. . . . .	87

Letters in parenthesis are for Conservation and Survey Division internal use.

Test-holes are arranged in this publication by township, range and section.

**Howard County
Test-Hole Table of Contents**

Arranged by year drilled, test-hole number.

1931

13N 10W 07CCC	06-31 and 6a-31	. . . . .	8
13N 10W 29BB	07-31	. . . . .	10

1943

16N 11W 08ABAA	36-B-43	. . . . .	72
16N 11W 35CADD	37-B-43	. . . . .	76
15N 10W 09DCDD	38-B-43	. . . . .	49
16N 12W 13ABAB	42-B-43	. . . . .	82
16N 11W 07ADBA	43-B-43	. . . . .	71
15N 11W 04DDAD	44-B-43	. . . . .	58
15N 11W 04CCBC	45-B-43	. . . . .	57

1944

15N 10W 16ADDD	15-A-44	. . . . .	50
15N 10W 28DDCC	16-A-44	. . . . .	55
15N 10W 21DDDC	17-A-44	. . . . .	54
15N 10W 33CDDD	18-A-44	. . . . .	56
14N 10W 04CDDD	19-A-44	. . . . .	25
14N 10W 09DAAD	20-A-44	. . . . .	26
14N 10W 22AAAA	21-A-44	. . . . .	27
14N 10W 26ABB	22-A-44	. . . . .	28
16N 12W 04AAA	25-A-44	. . . . .	81
13N 11W 12BCDC	26-A-44	. . . . .	15
13N 10W 19ABBA	27-A-44	. . . . .	9
13N 10W 32DDDD	28-A-44	. . . . .	11
13N 11W 04CBCC	29-A-44	. . . . .	12
13N 11W 08DAAA	30-A-44	. . . . .	13
13N 11W 08DDDD	31-A-44	. . . . .	14
13N 12W 24CACB	32-A-44	. . . . .	20
13N 12W 25BAAB	33-A-44	. . . . .	21
13N 12W 25DBBB	34-A-44	. . . . .	22
13N 12W 36ABDA	35-A-44	. . . . .	23
13N 12W 36DDAA	36-A-44	. . . . .	24
15N 09W 05ACCC	38-A-44	. . . . .	41
15N 09W 06DABB	39-A-44	. . . . .	42
15N 09W 09DAAD	40-A-44	. . . . .	44

15N 09W 09AAAA	41-A-44	. . . . .	43
15N 09W 16DAAA	42-A-44	. . . . .	45
15N 09W 21AAAA	43-A-44	. . . . .	46

1947

16N 10W 18BBBB	08-B-47	. . . . .	68
16N 11W 33AADA	09-B-47	. . . . .	74
15N 11W 05AAAD	10-B-47	. . . . .	59
15N 12W 14DDDD	11-B-47	. . . . .	65
14N 12W 06DADD	12-B-47	. . . . .	34

1951

15N 09W 24AAAA	11-A-51	47
13N 09W 01AAAD	14-A-51	1
13N 09W 24AAAA	15-A-51	4

1956

15N 09W 01AAAD	40-A-56	37
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1957

16N 11W 36AAAA	53-A-57	77
15N 10W 18BBBB	54-A-57	51
15N 11W 36AAAA	55-A-57	62
14N 11W 12DDDD	56-A-57	. . . . .	31
14N 10W 31BBBB	57-A-57	. . . . .	29

1958

16N 12W 18AAAA	13-A-58	. . . . .	83
16N 12W 30CCDC	14-A-58	. . . . .	87
13N 12W 06BBBC	18-A-58	. . . . .	16

1965

13N 09W 19AAAD	USBR Profile 13(a)	. . . . .	3
13N 09W 31DDDA	USBR Profile 13(b)	. . . . .	6

**13-9-1aaad
14-A-51
Howard County**

Location: SE NE NE NE, 377 ft S and 8 ft W of NE cor sec. 1-13N-9W
 Ground elevation: 1,841.1 ft (i)
 Depth to water: 23.17 ft 7/24/51

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Sand, silty, sand is very fine to medium, medium brown; light brown 1 to 5 ft; dark brown 5 to 7 ft.....	0.0	9.0
Sand, slightly silty, very fine to medium, light brown.....	9.0	10.3
Silt, slightly clayey, sandy, sand is very fine, light brown.....	10.3	11.0
Sand, slightly silty, sand is very fine to medium, light brown.....	11.0	12.7
Silt, very sandy, sand is very fine to fine, light brown.....	12.7	13.3
Sand, slightly silty, sand is fine to coarse, quartz with some pink silicates; silt lenses 6.2 to 6.5 ft and 17 to 20 ft.....	13.3	20.0
Clay, silty, very light gray, limonitic nodules, blocky structure.....	20.0	20.5
Sand, slightly silty, sand is very fine to medium...	20.5	23.7
Silt, very clayey, very light gray, many limonitic nodules and rootlets.....	23.7	25.0
Sand, very fine to medium, white opaque quartz.....	25.0	30.0
Silt, slightly clayey and sand interbedded, sand is very fine to fine, light brownish-gray, iron stain and limonitic rootlets.....	30.0	33.0
Sand, very fine to fine with some medium and trace of coarse, quartz with dark and pink grains; much medium sand 35 to 40 ft.....	33.0	50.0
Sand, fine to coarse, a little very coarse, quartz with pink silicates.....	50.0	60.0
Sand, very fine to very coarse, trace of fine gravel, quartz with some pink, green and rare anorthosite grains; approximately 30 percent coarse sand; more very coarse sand and fine gravel below 70 ft.....	60.0	76.0
Sand and gravel, quartz with common pink and green Silicates; 25 percent gravel; 50 percent gravel below 80 ft.....	76.0	90.5
Silt, slightly clayey, light-gray; contains small pelecypod shells.....	90.5	94.5
Silt, very clayey, light gray.....	94.5	99.5

Silt, slightly clayey , slightly sandy, light brownish gray.....	99.5	101.0
Sand, very fine to medium, some coarse and very coarse, mostly dark silicates; a little fine gravel below 105 ft; slightly silty 110 to 115 ft, 50 percent fine to medium sand; thin silt layers 115 to 120 ft; peat layers 137 to 137.5 and 140 to 140.1 ft, also thin clay layer 137 to 137.5 ft....	101.0	140.1
Sand, very fine to very coarse, a little fine gravel, approximately 60 percent fine to medium sand; silt layers 150 to 153 ft; slightly finer below 155 ft.....	140.1	170.0
Sand, very fine to coarse, mostly fine to medium sand, quartz with light and dark silicates; some green silicates below 180 ft; thin silt layers 214 to 215 ft and 222 to 223 ft, brown.....	170.0	223.0
Sand, very fine to medium, a little coarse sand, much medium sand, quartz with light and dark silicates; silt layer 248 to 249.5 ft, snail shells; mostly quartz and light colored silicates below 249.5 ft; contains a little coarse sand, clay and chalk grains and pelecypod shells below 264 ft....	223.0	274.0
Silt, coarse grained, light gray, sandy below 278 ft, sand is mostly very fine; medium gray below 278 ft.....	274.0	283.5
Sand and gravel; contains many lithic grains of chalk.....	283.5	285.5
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, chalky, white and yellow to 285.7 ft, light gray below.....	285.5	300.0

13-9-19aaad
USBR Mid-State Division (Profile 13)
Howard County

Location: SE NE NE NE, 500 ft S and 44 ft W of NE cor sec. 19-13N-9W

Ground elevation: 1877.9 ft (i)

Depth to water: 6 ft 5/18/65

Note: Log compiled from sample descriptions by
 F.A. Smith and interpretation of USBR
 geologic and field logs

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, slightly sandy, sand is very fine with a little fine, dark brown-gray.....	0.0	0.8
Silt, moderately clayey, very slightly sandy, sand is very fine, pale yellow; light yellow-brown below 4 ft.....	0.8	11.0
Sand, very fine to medium, slightly silty 11 to about 42 ft.....	11.0	65.0
Sand, fine to very coarse, much fine to medium sand, contains a little gravel up to 3/8 inch.....	65.0	76.0
Sand, slightly gravelly, fine sand to fine with a trace of medium gravel up to 3/8 inch, approximately 20 percent gravel.....	76.0	91.0
Silt, moderately clayey, slightly sandy, sand is very fine, very pale brown, in part slightly calcareous, firm, massive, medium thread, no dilatancy; moderately calcareous below 158 ft, some limy fragments.....	91.0	177.0
Silt, clayey, may be Pierre shale, sample appears to contain some sand and limy fragments, moderately calcareous, brown with some yellow-brown..	177.0	182.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Shale, "fat clay", medium plasticity, color grades from yellow and yellow-brown in upper part to dark gray at 184 ft.....	182.0	185.5

13-9-24aaaa
15-A-51
Howard County

Location: NE NE NE NE, 75 ft S and 10 ft W of NE cor sec. 24-13N-9W
 Ground elevation: 1805.1 ft (i)
 Depth to water: 3.0 ft 7/24/51

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Road fill.....	0.0	0.5
Silt, moderately clayey, dark gray.....	0.5	1.0
Silt, slightly clayey, sandy, sand is mostly very fine, light grayish brown.....	1.0	3.5
Silt, very clayey, light brown, slightly calcareous.	3.5	4.5
Silt, moderately clayey, light medium brown-gray, moderately calcareous.....	4.5	5.5
Silt, slightly clayey, light brownish gray, moderately calcareous, a few limy nodules.....	5.5	6.5
Silt, light brownish gray, small iron oxide nodules, trace of limy nodules, slightly calcareous.....	6.5	9.0
Sand, slightly silty, sand is very fine to medium, principally quartz.....	9.0	10.0
Sand, very fine to very coarse, a little fine gravel, much medium to coarse sand, quartz with pink feldspar, iron stained in upper foot; slightly finer grained below 25 ft, a few greenish silicates.....	10.0	30.0
Sand and some gravel, medium to very coarse sand with 25 percent fine gravel, quartz with much feldspar and some green silicates.....	30.0	35.5
Silt, clayey, light gray to 36.5 ft, light brownish gray below.....	35.5	37.0
Silt, moderately clayey, light brownish gray; pale brown, slightly more clayey 38.5 to 43.5 ft; very clayey below 43.5 ft.....	37.0	44.0
Silt, slightly clayey, slightly sandy, sand is mostly very fine, noncalcareous with some limy areas, light brownish gray; light grayish brown below 46 ft; slightly more clayey below 52 ft.....	44.0	53.0
Silt, slightly clayey, very pale brown, granular structure below 54 ft; slightly sandy and silt is coarse grained below 55 ft.....	53.0	60.0
Silt to siltstone, poorly indurated, light brown, granular to blocky structure; contains volcanic ash layer in upper 3 ft.....	60.0	64.0

Silt, slightly sandy, silt is coarse, sand is very fine, light grayish brown.....	64.0	66.0
Silt, moderately clayey, light brown to light brown-gray, pale brown below 68.5 ft; slightly clayey below 68.5 ft.....	66.0	73.5
Silt, slightly clayey, light brown, contains limy nodules below 75 ft; moderately calcareous 76.5 to 80 ft; limy areas below 80 ft.....	73.5	87.5
Silt, clayey, very light brown, moderately to very calcareous.....	87.5	89.0
Silt, slightly clayey, light brown, moderately calcareous, contains a few limy nodules.....	89.0	95.0
Silt, sandy, contains very fine sand, very light brown, very calcareous.....	95.0	98.0
Silt, moderately clayey, very light brown, moderately calcareous; contains hard limy layers or nodules below 105 ft.....	98.0	110.0
Silt, poorly indurated as siltstone, light brown, granular to blocky structure, very calcareous; essentially noncalcareous 120 to 135 ft and moderately calcareous below 135 ft.....	110.0	145.0
Silt, slightly clayey, light yellow-brown, moderately calcareous.....	145.0	157.5
Silt, moderately clayey, light brown, slightly calcareous.....	157.5	160.0
Silt, very clayey, light yellow-brown, very calcareous, contains a few chalk grains.....	160.0	160.5
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, chalky, yellow and white, very calcareous; very light gray below 167.5 ft.....	160.5	175.0

13-9-31ddda
USBR Mid-State Division (Profile 13)
Howard County

Location: NE SE SE SE, 503 ft N and 30 ft W of SE cor sec 31-13N-9W

Ground elevation: 1868.5 ft (i)

Depth to water: 5.2 ft 8/9/65

Note: Log compiled from sample descriptions by

F.A. Smith and interpretation of USBR

geologic and field logs

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Sand, silty, sand is very fine to fine with some medium, 10 percent organic silt, no thread, dark brown-gray.....	0.0	0.8
Sand, moderately silty, principally very fine to fine, 70 percent low plasticity fines, pale olive, slightly rusty stain, very slightly calcareous....	0.8	1.5
Silt, very clayey, slightly sandy, 90 percent medium plasticity fines, medium thread, no dilatancy, dark gray (buried soil).....	1.5	7.0
Silt, moderately clayey, very slightly sandy, fine sand, 85 percent low to medium plasticity fines, medium thread, no dilatancy, pale yellow, a few iron-oxide streaks.....	7.0	16.0
Sand, slightly silty, very fine to fine with a little medium sand, 12 percent non plasticity fines, thin dark lenses of dark gray silt, saturated.....	16.0	35.0
Sand, fine to very coarse, 15 percent fine gravel, trace of gravel up to 1/4 inch.....	35.0	70.5
Tertiary System - Miocene Series - Ogallala Group:		
Silt, slightly clayey, slightly sandy, principally very fine sand, 75 percent low plasticity fines, lightly cemented as sandstone, some volcanic ash, noncalcareous, light yellow to light greenish gray.....	70.5	79.0
Silt, very clayey, slightly sandy, sand is very fine, light olive gray.....	79.0	82.0
Sand, moderately silty, slightly clayey, sand is very fine to medium, moderately calcareous, light olive-gray.....	82.0	85.0
Silt, slightly clayey, slightly sandy, pale yellow brown, moderately calcareous, considerable volcanic ash.....	85.0	88.0

Sandstone, silty, sand is very fine to fine with some medium, poorly consolidated, some limy areas, root casts and concretions, light olive-gray.....	88.0	96.0
Silt, moderately clayey, moderately sandy, sand is very fine to fine with some medium, in part cal- careous, light olive-gray.....	96.0	103.0

**13-10-7ccc
6-31 (also 6a-31)
Howard County**

Location: SW SW SW sec 7-13N-10W (distances not recorded)

Ground elevation: 1837 ft (i)

Depth to water: 4.8 ft 7/6/31

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Sand, fine, dark gray to 0.9 ft, buff to gray below.	0.0	7.0
Sand, fine to coarse, a little fine to medium gravel, common green, some dark grains, contains rounded grains of dark gray and green clay and a few limy grains.....	7.0	31.0*
Note: 7 to 22 ft in 6a-31 (100 ft S of 6-31)		
Tertiary System - Miocene Series - Ogallala Group:		
Clayey to sandy silt and sandstone, light greenish and whitish-gray, in part very calcareous, hard layers 76 to 77 and 98 to 99 ft.....	31.0*	100.0
Clayey to sandy silt with some silty clay and hard limestone layers or nodules, buff-gray and very light greenish gray; much clay below 114 ft.....	100.0	118.5
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Note: samples poor, top of Pierre may be at 119 or 121.5 ft		
Clay, yellow and white, very hard layer 119 to 121.5 ft.....	118.5	124.0

**13-10-19abba
27-A-44
Howard County**

Location: NE NW NW NE, on S shoulder of road and approximately 0.1
 mile E of NW cor NE1/4 sec 19-13N-10W
 Ground elevation: 1858 ft (t) Dannebrog 7.5 min. quadrangle
 Depth to water: 4.9 ft 8/5/44

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Silt, sandy, dark gray.....	0.0	5.0
Silt, sandy, yellow and gray, contains some fine gravel 9 to 14 ft and a trace of fine to medium gravel below 14 ft.....	5.0	29.0
Sand and gravel, quartz with pink silicates.....	29.0	42.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, clayey and silty, light greenish gray, contains some rootlets.....	42.0	49.0
Sandstone, silty, moderately well indurated, very calcareous, abundant rootlets.....	49.0	55.0
Sandstone, silty, slightly indurated, light greenish and whitish gray, calcareous, some hard layers, common rootlets.....	55.0	109.0

**13-10-29bb
7-31
Howard County**

Location: Contradictory information, probably near north line NW NW
sec 29-13N-10W

Ground elevation: 1890.07 ft (i)

Depth to water: 12.2 ft 7/15/31

Note: no samples, log from WSP 779 p. 70

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Sand and soil; 8 inches of dark sandy loam at top; remainder is fine quartz sand except a 2-inch layer of gravelly sand at bottom.....	0.0	2.0
Clay, yellowish at the top and gray lower down; looks much like loess clay; friable, somewhat sandy.....	2.0	9.0
Sand, gray, medium to fine texture; lower part contains admixture of coarser sand and fine gravel...	9.0	28.0
Sand, fine to coarse; fine gravel, coarser- and finger-layered; lower 2 ft somewhat greenish; thin clay layer at bottom.....	28.0	55.0
Sand and gravel; upper 2 ft finer and greenish gray, lower 10 ft pinkish and coarser.....	55.0	67.0
Sand, gray; very little gravel.....	67.0	74.0
Sand and gravel, in equal amounts, greenish gray....	74.0	85.0
Gravel, coarse; some sand.....	85.0	96.0
Sand and gravel, coarse granitic gravel; lower 11 ft coarse gravel.....	96.0	112.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand, fine, greenish gray and whitish, indurated with calcium carbonate in a "limy grit", hard and soft layers, much silt and some clay.....	112.0	157.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Shale, whitish to dark bluish gray, sticky, tough; some parts ocherous yellow, somewhat calcareous...	157.0	167.0

**13-10-32dddd
28-A-44
Howard County**

Location: SE SE SE SE, near SE cor sec 32-13N-10W
 Ground elevation: 1920± ft (t) St. Paul SW 7.5 min. quadrangle
 Depth to water: 23.3 ft 8/5/44

Note: Field log and samples of questionable quality

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Sand, fine.....	0.0	5.0
Silt, "loess", yellow to light gray.....	5.0	50.0
Sand and gravel, fine to medium, some clay 50 to 55 ft and 70 to 75 ft, common gray silicates below 80 ft.....	50.0	100.0
Silt, clayey, light gray, may be some sand in inter- val, logged as blue in color.....	100.0	110.0
Silt, clayey, light brown.....	110.0	130.0
Tertiary System - Miocene Series - Ogallala Group?:		
Logged as rock and lime rock, white to very light gray.....	130.0	140.0

**13-11-4cbcc
29-A-44
Howard County**

Location: SW SW NW SW, approximately 0.25 mile N of SW cor sec 4-13N-11W

Ground elevation: 1928 ft (t) Dannebrog 7.5 min. quadrangle

Depth to water: Not measured

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, clayey, dark gray to light brown.....	0.0	5.0
Silt, clayey, brownish gray.....	5.0	9.0
Silt, light gray, some yellow brown limonitic streaks, moderately calcareous, contains shell fragments.....	9.0	39.0
Silt, light and dark gray, calcareous, contains gastropods and a trace of gravel.....	39.0	44.0
Silt, light and dark gray, contains some organic material and lithic gravel grains 69 to 74 ft.....	44.0	74.0
Logged as clayey silt, light gray and tan, contains organic material; sample contains considerable sand and lithic grains.....	74.0	89.0
Logged as above, sample mostly sand and gravel with lithic grains.....	89.0	95.0
Silt, clayey and sandy, sand is probably mostly fine, light brown, calcareous, some volcanic ash and ash silt 95 to 100 and in interval 105 to 110 ft; nodular limestone in interval 105 to 112 ft...	95.0	112.0
Silt, slightly clayey, sandy, principally very fine sand, slightly indurated, light brownish gray and light brown, calcareous, a few root casts and limy areas.....	112.0	139.0

**13-11-8daaa
30-A-44
Howard County**

Location: NE NE NE SE, near NE cor SE1/4 sec 8-13N-11W
 Ground elevation: 1911 ft (t) Dannebrog 7.5 min. quadrangle
 Depth to water: 35.2 ft 8/8/44

Depth, in feet
From To

Quaternary System, undifferentiated:

Silt, moderately clayey, slightly sandy, sand is very fine, dark gray; contains some carbonaceous material 5 to 10 ft; medium dark brown-gray below 15 ft.....	0.0	20.0
Silt, slightly clayey, very slightly sandy, sand is mostly very fine, light gray with some mottled yellow and dark gray; light olive-gray below 25 ft; slightly calcareous below 30 ft; contains some shell and wood fragments 35 to 45 ft; slightly more clayey below 50 ft.....	20.0	±60.0
Sand, fine to very coarse with a little gravel, contains some peaty silt, wood and shell fragments and limy gains.....	±60.0	±65.0
Silt, slightly clayey, slightly sandy, sand mostly very fine to fine, light brownish gray and light brown, some limy areas; contains a few root casts below 110 ft.....	±65.0	129.0

**13-11-8dddd
31-A-44
Howard County**

Location: SE SE SE SE, 40 ft S of school house and near SE cor sec
8-13N-11W

Ground elevation: 1914 ft (t) Dannebrog 7.5 min. quadrangle

Depth to water: 47.5 ft 8/10/44

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Soil and road fill; clayey to sandy silt, dark brown.....	0.0	5.0
Silt, slightly clayey, light gray, some yellowish brown staining, moderately calcareous.....	5.0	35.0
Sand, silty, gray, moderately calcareous, contains a few shell fragments.....	35.0	±70.0
Sand and gravel, gravel mostly fine with a little medium to coarse gravel; contains a few lithic grains.....	±70.0	±80.0
Silt, sandy, light gray, moderately calcareous; contains a few shell fragments; may be some sand and gravel below 95 ft.....	±80.0	±100.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, silty, very light gray, very calcareous, considerable limy material; well indurated below 110 ft.....	±100.0	119.0

**13-11-12bcdc
26-A-44
Howard County**

Location: SW SE SW NW, approximately 2500 ft S and 1000 ft E of NE cor
sec 12-13N-11W

Ground elevation: 1844 ft (t) Dannebrog 7.5 min. quadrangle

Depth to water: 10.1 ft 8/5/44

Depth, in feet
From To

Quaternary System, undifferentiated:

Sand, fine to medium; some coarse sand below 10 ft, common dark grains.....	0.0	15.0
Sand and gravel, pink with some gray and dark grains; slightly more gravel below 20 ft; con- tains some Ogallala lithic grains.....	15.0	±35.0

Tertiary System - Miocene Series - Ogallala Group:

Sandstone, fine grained, moderately calcareous, light gray; contains some rootlets, slightly indurated; moderately to well indurated below 95 ft.....	±35.0	104.0
Siltstone, sandy, very calcareous, very light gray..	104.0	119.0
Marl, white to light gray.....	119.0	139.0

13-12-6bbbc
18-A-58
Howard County

Location: SW NW NW NW, 631 ft S and 9 ft E of NW cor sec 6-13N-12W
 Ground elevation: 2065 ft (t) Farwell 7.5 min. quadrangle
 Depth to water: 98.2 ft 8/15/58

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, silt is coarse grained, very dark brown-gray; slightly clayey below 2 ft, medium brown, blocky structure.....	0.0	2.5
Silt, slightly clayey, moderately sandy, sand is very fine, medium brown; small limy nodules, slight yellow stain, slightly calcareous.....	2.5	5.0
Silt, slightly clayey, moderately to very sandy, sand is very fine to medium, light to medium yellow gray, slightly calcareous; some gastropod shells.....	5.0	15.0
Silt, slightly clayey, slightly sandy, silt is coarse, sand is mostly very fine, light medium yellow gray, slightly to moderately calcareous; moderately sandy below 17.5 ft, sand is very fine to fine; occasional gastropod shells; noncalcareous below 30 ft, slightly more clayey.....	15.0	34.5
Silt, moderately clayey, slightly sandy, sand is very fine, dark brown; medium dark brown below 36 ft; moderately sandy below 37.3 ft, sand is very fine to fine with some medium sand; very sandy below 38.4 ft, medium brown.....	34.5	39.5
Silt, very clayey, slightly sandy, sand is very fine, medium brown; moderately sandy below 42 ft; very sandy below 47.2 ft, sand is very fine to medium, rare coarse sand.....	39.5	54.0
Sand, very silty, sand is very fine to medium, rare coarse sand, medium brown.....	54.0	56.3
Silt, moderately clayey, slightly sandy, sand is very fine, light gray, possibly some diatomaceous silt.....	56.3	58.0
Silt, moderately clayey, moderately sandy, sand is very fine to fine, light yellow-gray; moderately sandy below 58 ft; slightly clayey, very sandy below 59 ft, sand is very fine to medium.....	58.0	64.0
Sand, slightly silty, sand is very fine to medium with some coarse.....	64.0	68.8

Silt, very sandy and silty sand, both slightly clayey, sand is very fine to medium with some coarse.....	68.8	73.5
Silt, slightly clayey, very sandy, sand is mostly very fine to fine, light brown-gray; light yellow-gray below 75 ft; sand is very fine to medium 79.4 to 80 ft; light olive-gray below 86.5 ft; very sandy below 88 ft.....	73.5	93.2
Sand, slightly silty, sand is very fine to medium with some coarse.....	93.2	102.5
Silt, slightly clayey, moderately sandy, sand is very fine to fine with some medium, light olive-gray below 103.7 ft.....	102.5	105.0
Silt, slightly clayey, very sandy, sand is very fine to medium, medium dark brown; sand is mostly very fine to fine below 112.5 ft.....	105.0	115.0
Silt, moderately clayey, moderately sandy, sand is very fine to fine, medium brown, moderately calcareous; contains small limy nodules; light yellow-gray 118.5 to 120 ft; light olive-gray below 120 ft.....	115.0	122.2
Silt, slightly clayey, moderately sandy, sand is very fine to fine; medium yellow-brown, moderately calcareous, moderately clayey below 125 ft, medium brown, contains limy nodules, granular structure..	122.2	140.0
Silt, slightly clayey, very sandy, sand is very fine, light olive-gray, slightly to moderately calcareous.....	140.0	145.0
Silt, slightly clayey, very sandy, sand is very fine to medium, medium dark brownish gray, slightly calcareous, contains limy nodules and shell fragments.....	145.0	149.0
Sand, moderately silty, sand is very fine to medium with some coarse sand; contains sandy silt layer 151.5 to 153.1 ft, common limy areas.....	149.0	156.7
Silt, slightly clayey, very sandy, sand is very fine to medium, light yellow-gray; slightly to moderately calcareous, slightly more clayey, moderately sandy below 165 ft; light olive-gray 165 to 175 ft; medium dark brownish gray below 175 ft.	156.7	175.0
Silt, slightly to moderately clayey, moderately sandy, sand is very fine to medium, light olive-gray, moderately calcareous, contains some limy areas; medium gray below 180 ft with some dark gray below 185 ft; very sandy below 185 ft.....	175.0	188.8
Sand, silty, sand is very fine to medium with some coarse.....	188.8	192.2

Silt, moderately clayey, very sandy, sand is very fine to fine, light olive gray, moderately calcareous; contains some medium sand below 190 ft.....	192.2	197.0
Silt, moderately clayey, moderately sandy, sand is very fine to fine, silt is coarse, medium brown, contains limy areas and nodules.....	197.0	205.0
Silt, moderately clayey, moderately sandy, sand is mostly very fine, light medium brown, moderately calcareous, contains some limy areas; slightly clayey below 218 ft, granular structure below 220 ft; very sandy below 227.6 ft; essentially non-calcareous below 230 ft, contains some fine sand, light medium yellow-gray; slight yellow stain below 245 ft.....	205.0	250.0
Sand, very silty, sand is very fine to medium with some coarse, contains some grains of Ogallala siltstone, sandstone and rootlets; sand is very fine to very coarse with some gravel below 255 ft; sandy silt layer 264.7 to 265 ft; sand is very fine to coarse with some very coarse below 265 ft.	250.0	267.2
Tertiary System - Miocene Series - Ogallala Group:		
Silt, slightly clayey, very sandy, sand is very fine to medium, light olive-gray, very calcareous; moderately calcareous below 270 ft, in part indurated as sandstone; moderately well indurated below 285 ft.....	267.2	290.0
Sandstone, silty, sand is mostly very fine to fine, with olive-gray, some calcareous areas.....	290.0	298.5
Silt, slightly clayey, very sandy, sand is very fine to fine with some medium, little greenish gray, moderately calcareous; very calcareous 301 to 302.3 ft; contains some indurated layers below 305 ft; essentially noncalcareous 307.5 to 310 ft.....	298.5	315.0
Sand, silty, sand is very fine to medium, slightly indurated, contains some rootlets and limy areas; slightly clayey, mostly very fine to fine sand below 319.8 ft, moderately calcareous.....	315.0	320.0
Sand, slightly silty, sand is very fine to medium with some coarse; contains silt, slightly clayey, very sandy 322 to 322.4 and 328.3 to 328.4 ft.....	320.0	331.5
Silt, moderately clayey, silt is coarse, light olive-gray, very calcareous.....	331.5	335.0
Silt, slightly clayey, very sandy, sand is very fine to fine, light olive-gray.....	335.0	341.0
Sand, slightly silty, sand is very fine to medium, trace of coarse sand; mostly very fine to medium below 345 ft.....	341.0	355.0

Silt, slightly clayey, very sandy, sand is very fine to fine with some medium, light olive-gray, contains some limy areas.....	355.0	360.8
Tertiary System - Series and Formation undetermined, may be part of Ogallala Group:		
Silt, moderately clayey, moderately sandy, sand is mostly very fine, light medium brown, matrix essentially noncalcareous, some limy areas.....	360.8	367.3
Silt, slightly to moderately clayey, silt is coarse, light yellow-gray, limy areas, moderately calcareous; moderately sandy below 370 ft, sand is very fine to fine; noncalcareous 373 to 375 ft; slightly calcareous below 375 ft; contains lithic grains of aragonite below 377.3 ft.....	367.3	378.3
Silt, moderately clayey, slightly sandy, sand is mostly very fine, light medium brown; slightly calcareous 378.3 to 380 ft and moderately calcareous below 385 ft; contains some dark stained limy areas below 383 ft.....	378.3	385.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, very light gray with some yellow-brown, moderately to very calcareous.....	385.0	400.0

**13-12-24cacb
32-A-44
Howard County**

Location: NW SW NE SW, approximately 1800 ft N and 1400 ft E of SW
cor sec 24-13N-12W

Ground elevation: 1996.5 ft (i)

Depth to water: 20.4 ft perched or drilling fluid level

Note: USBR Boelus Dam Site

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, clayey, light brownish gray.....	0.0	24.0
Silt, clayey, dark brown.....	24.0	29.0
Silt, clayey, brown, sandy in lower part.....	24.0	49.0
Note: started losing circulation below 30 ft, hole abandoned		

13-12-25baab
33-A-44
Howard County

Location: NW NE NE NW, approximately 300 ft S and 2100 ft E of NW cor
 sec 25-13N-12W

Ground elevation: 1,992.7 ft (i).

Depth to water: 37.7 ft 8/12/44

Note: USBR Boelus Dam Site

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Silt, dark brown-gray.....	0.0	5.0
Silt, clayey, light brownish gray.....	5.0	9.0
Silt, clayey to sandy, medium light gray, slightly calcareous, probably some limy nodules below 30 ft.....	9.0	35.0
Silt, interbedded slightly and moderately clayey, in part sandy, mostly very fine sand, light brown, some limy nodules; ashy silt in interval 30 to 35 ft.....	35.0	±100.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, sandy and clayey, indurated to siltstone- sandstone, calcareous, very light gray.....	±100.0	109.0

**13-12-25dbbb
34-A-44
Howard County**

Location: NW NW NW SE; approximately 10 ft S and 210 ft E of center
sec 25-13N-12W

Ground elevation: 1899.7 ft (i).

Depth to water: 20.8 ft 8/12/44

Note: USBR Boelus Dam Site

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Silt, sandy, dark brown-gray.....	0.0	1.0
Sand, silty, fine to coarse, light gray.....	1.0	4.0
Silt, in part sandy, medium and dark gray.....	4.0	12.0
Sand and gravel, feldspathic.....	12.0	19.0
Silt, clayey to sandy, principally very fine sand, light gray, some limy areas and nodules; contains some volcanic ash.....	19.0	25.0
Silt, clayey to sandy, light brown; contains limy areas and nodules or nodular layers.....	25.0	54.0
Sand, silty, sand is mostly fine to medium; contains some limy fragments; may be a gravelly sand 64 to 67 ft.....	54.0	67.0
Silt, clayey to sandy, sand mostly very fine, light brown, calcareous.....	67.0	±90.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, clayey and silty, moderate induration, light gray, calcareous; contains some root casts..	±90.0	99.0

**13-12-36abda
35-A-44
Howard County**

Location: NE SE NW NE, approximately 800 ft N and 1340 ft W of NE cor
sec 36-13N-12W

Ground elevation: 1900.1 ft (i)

Depth to water: 9.2 ft 8/16/44

Note: USBR Boelus Dam Site

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, loam, light brown.....	0.0	5.0
Silt, clayey, sandy, fine sand, light brown; light gray below 5 ft.....	5.0	10.0
Silt, in part very clayey, light gray.....	10.0	20.0
Sand and gravel, medium.....	20.0	30.0
Silt, very slightly clayey, moderately sandy, sand is very fine, very light yellow and brown-gray, contains some volcanic ash; granular structure, volcanic ash in interval, limy areas below 35 ft, a few small root casts.....	30.0	40.0
Silt, slightly clayey, slightly sandy, sand is very fine, very light brown, slightly calcareous; mod- erately clayey below 50 ft, limy areas and nodules common; some silty clay below 55 ft; moderately sandy 60 to 65 ft, in part very light olive-gray; contains a few shell fragments below 65 ft.....	40.0	70.0

**13-12-36ddaa
36-A-44
Howard County**

Location: NE NE SE SE, approximately 1000 ft N and 200 ft W of SE cor
sec 36-13N-12W

Ground elevation: 1904 ft (i)

Depth to water: at land surface 8/16/44

Note: USBR Boelus Dam Site

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, moderately sandy, sand is very fine to fine, light yellow-brown.....	0.0	4.0
Silt, slightly clayey, moderately sandy, sand is very fine, dark gray to black.....	4.0	9.0
Sand, probably silty and with some clayey to sandy silt, sand is very fine to coarse with some coarser grains, some fragments of white silty clay.....	9.0	19.0
Sand, fine to medium, some coarse and very coarse sand, a few rounded and flat light gray silty clay grains and Ogallala sandstone and rootlet grains..	19.0	39.0
Sand, very fine to medium, a few coarser grains, rare lithic grains.....	39.0	54.0
Sand, fine to very coarse, common lithic grains of the Ogallala Group.....	54.0	70.0
?Tertiary System - Miocene Series - Ogallala Group:		
Silt, clayey, slightly sandy, sand principally very fine to fine, very light olive gray, in part calcareous, contains a few root casts, some limy areas and nodules below 79 ft; some sandstone below 84 ft, a few bone and shell fragments.....	70.0	99.0

**14-10-4cddd
19-A-44
Howard County**

Location: SE SE SE SW, 53 ft N and 7 ft W of SE cor SW1/4 sec 4-14N-10W

Ground elevation: 1817 ft (t) St. Paul 7.5 min. quadrangle

Depth to water: 22.1 ft 7/24/44

Depth, in feet
From To

Quaternary System, undifferentiated:

Silt, sandy, brownish gray, dark brownish gray in upper part.....	0.0	12.0
Sand and gravel.....	12.0	15.0
Sand, some gravel, some sandy silt 29 to 34 ft.....	15.0	38.0
Silt, slightly clayey, slightly sandy, sand mostly very fine, light brownish gray, moderately calcareous, some limy areas and limy concretions.....	38.0	±84.0

Tertiary System - Miocene Series - Ogallala Group:

Sandstone, silty to clayey, light gray, calcareous, common root casts in lower 10 ft.....	±84.0	104.0
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**14-10-9daad
20-A-44
Howard County**

Location: SE NE NE SE, approximately 600 ft S and 10 ft W of NE cor
SE1/4 sec 9-14N-10W
Ground elevation: 1799 ft (t) St. Paul 7.5 min. quadrangle
Depth to water: 8.2 ft 7/25/44

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Road fill: sand and silt, sand is fine to medium....	0.0	3.0
Sand, silty, brownish gray and dark brown-gray.....	3.0	6.0
Sand, silty, brownish gray.....	6.0	12.0
Sand and gravel, gravel, fine to medium.....	12.0	16.0
Silt, slightly clayey, sand is fine, light brownish gray and light brown, slightly calcareous in upper part, moderately to very calcareous in lower part; some calcareous concretions and some root casts; contains a few pieces of carbonized wood 91 to 93 ft.....	16.0	±94.0
Tertiary System - Miocene Series - Ogallala Group:		
Siltstone-sandstone, light gray to greenish, moderately to very calcareous, calcareous rootlets...	±94.0	139.0

**14-10-22aaaa
21-A-44
Howard County**

Location: NE NE NE NE, near NE cor sec 22-14N-10W
 Ground elevation: 1800 ft (t) St. Paul 7.5 min. quadrangle
 Depth to water: 5.3 ft 7/26/44

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Sand, fine to medium, some coarse.....	0.0	14.0
Sand and gravel, gravel is mostly fine to medium; slightly coarser below 29 ft, bluish gray.....	14.0	43.0
Silt, slightly to moderately clayey, slightly sandy, mostly very fine sand, slight induration, light brown and very pale brown, calcareous, some limy concretions 85 to 90 and 105 to 130 ft.....	43.0	±135.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, silty and silt, clayey and sandy, very fine to medium sand, whitish gray and pale brown..	±135.0	139.0

**14-10-26abb
22-A-44
Howard County**

Location: NW NW NE, on side of road and approximately 0.4 mile W of
NE1/4 sec 26-14N-10W
Ground elevation: 1845 ft (a) and (t) St. Paul 7.5 min. quadrangle
Depth to water: 21.5 ft 7/27/44

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Silt, very sandy, clayey in upper part, light yellow-brown.....	0.0	5.0
Sand, very silty, light gray to light yellow-brown..	5.0	14.0
Sand, fine to very coarse, sand is mostly fine to medium, scattered gravel grains, contains abundant siliceous root casts.....	14.0	29.0
Sand and gravel, gravel mostly fine to medium, pinkish gray and light gray, contains some grains of Ogallala siltstone and siliceous rootlets.....	29.0	50.0
Silt, slightly to moderately clayey interbedded, slightly sandy, sand mostly fine, slight induration, very light gray and light brown, slightly calcareous 50 to 60 ft and moderately calcareous below; contains some volcanic ash shards 60 to 80 ft; may contain some sand layers 90 to 100 and 105 to 110 ft.....	50.0	119.0

**14-10-31bbbb
57-A-57
Howard County**

Location: NW NW NW NW, 7 ft S and 137 ft E of NW cor sec 31-!4N-10W
 Ground elevation: 1856 ft (t) Nysted 7.5 min. quadrangle
 Depth to water: 21.6 ft 10/11/57
 Electric log

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Road fill, silt, moderately clayey, dark gray.....	0.0	1.0
Silt, slightly clayey, slightly sandy, sand is very fine to fine, medium dark gray.....	1.0	1.5
Silt, moderately to very clayey, very slightly sandy, mostly very fine sand, medium brown; slightly more clayey below 3 ft; moderately clayey below 6.5 ft; moderate to very sandy below 7.5 ft, medium dark brown.....	1.5	8.0
Silt, very sandy, slightly clayey, sand is very fine to medium with some coarse and trace of very coarse, medium dark brown.....	8.0	10.0
Silt, very sandy, slightly clayey, sand is very fine to fine with a trace of medium, light yellow-gray.	10.0	14.5
Sand, gravelly, approximately 40 percent very coarse sand and fine gravel.....	14.5	15.5
Silt, moderately clayey, slightly sandy, mostly very fine sand, silt is coarse, little yellow-gray; medium dark gray, below 21 ft some wood fragments and peat.....	15.5	30.5
Silt and sand interbedded, sand is very fine to medium with some coarse.....	30.5	35.0
Sand, very fine to fine with some medium, mostly quartz, a few heavy minerals.....	35.0	40.0
Sand and gravel, approximately 30 percent very coarse sand and fine gravel.....	40.0	45.0
Gravel, sandy, very fine sand to medium and some coarse gravel.....	45.0	52.5
Silt, moderately clayey, slightly sandy, sand is very fine, silt is coarse, light medium gray; slightly more sand below 57.5 ft, some fine sand, light yellow-brown; contains a few limy areas below 65 ft, light brown.....	52.5	76.0
Silt, slightly clayey, moderately sandy, sand is very fine to fine with some medium, light brown...	76.0	77.4

Silt, slightly to moderately clayey, slightly sandy, sand is mostly very fine to fine, light brown, contains a few limy areas and limy nodules; slight induration below 80 ft, some marly areas.....	77.4	82.0
Silt, moderately to very clayey, silt is coarse grained, light brown, very slight induration, limy area at 88 ft; moderately clayey 90 to 93 ft; slightly sandy below 93 ft, very fine sand.....	82.0	95.0
Silt, slightly to moderately clayey, slight to moderate induration, light yellow-brown; moderately to very clayey 97 to 99 ft; contains limy areas 99 to 100 ft and at 108 ft; light brown below 100 ft; slightly sandy below 110 ft, sand is very fine to fine; moderately sandy below 130 ft, sand is very fine to fine.....	95.0	140.0
Silt, moderately clayey, slightly sandy, sand is very fine to fine, light brown, marly zones 142 to 145 ft; moderately to very clayey below 150.5 ft; very clayey 155 to 158 ft.....	140.0	160.0
Silt, moderately clayey, slightly to moderately sandy, sand is mostly very fine to fine, light medium brown; slightly sandy below 170 ft, sand is mostly very fine, silt is coarse.....	160.0	173.0
Sand, slightly to moderately silty, sand is very fine to medium with a trace of coarse; interbedded with very sandy silt below 180 ft, silty is moderately clayey, light medium brown.....	173.0	187.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, moderately silty, sand is very fine to fine with some medium, light olive-gray; contains some rootlets and lithic grains of aragonite and siltstone; sand is very fine to very coarse below 195 ft and a little gravel below 200 ft, quartz with some feldspar; some shale clasts and fossil fragments.....	187.0	202.3
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, very light yellow-gray with some mottled yellow-brown, slightly calcareous.....	202.3	217.5
Shale, clayey, dark gray, slightly calcareous, thin bentonite layers below 220 ft.....	217.5	230.0

14-11-12dddd
56-A-57
Howard County

Location: SE SE SE SE, 106 ft N and 8 ft W of SE cor sec 12-14N-11W
 Ground elevation: 1936 ft (t) Nysted 7.5 min. quadrangle
 Depth to water: 86.14 ft 10/11/57
 Electric log

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Road fill, clayey silt, dark brown-gray.....	0.0	1.0
Silt, moderately clayey, silt is coarse, medium brown; light brown, slightly less clayey below 2.5 ft.....	1.0	5.0
Silt, slightly clayey, slightly sandy, contains very fine sand, silt is coarse, light yellow-brown; matrix essentially noncalcareous, contains a few gastropod shells; some mottled very light gray below 28 ft, slight yellow stain; slightly more clayey below 33 ft.....	5.0	37.5
Silt, moderately clayey, medium dark brown.....	37.5	38.4
Silt, moderately to very clayey, slightly sandy, sand is very fine to fine, light medium brown; thin dark zone 41.5 to 42 ft; light yellow-brown below 42 ft; light medium brown, very slightly sandy below 48.5 ft, sand is very fine; slightly more clayey below 51 ft; some mottled dark brown-gray below 54 ft.....	38.4	55.0
Silt, very clayey, contains a trace of very fine sand, medium dark brown.....	55.0	57.0
Silt, moderately to very clayey, contains a trace of very fine sand, medium brown; light medium brown below 65 ft, very clayey coarse grained silt below 68.7 ft, contains limy nodules 70 to 74 ft; light yellow-brown below 75 ft; slightly to moderately clayey 76 to 77 ft; light medium brown-gray 77 to 83 ft; light medium brown 83 to 85 ft; contains limy nodules 85 to 87 ft; moderately clayey 87 to 90 ft; rare limy nodules 90 to 92 ft; some mottled dark brown-gray 92 to 94.5 ft.....	57.0	98.0
Silt, slightly to moderately clayey, light medium yellow-brown, slight induration; slightly sandy 100 to 103 ft, some limy areas; moderately sandy 103 to 105 ft, sand is very fine to fine; some small iron concretions below 105 ft.....	98.0	109.0

Silt, ashy and volcanic ash; light medium gray and light brown; in part slightly to moderately clayey; some bentonitic clay 110 to 115 ft; some limy areas 110 to 115 ft.....	109.0	115.0
Silt, slightly to moderately clayey, slightly sandy, sand is very fine, light brown, in part slightly indurated, noncalcareous 115 to 119 ft; some limy areas 119 to 120 ft, interbedded, slightly and moderately clayey below 120 ft; in part slightly calcareous below 130 ft; a few small limy nodules 135 to 137.5 and 140 to 145 ft.....	115.0	145.0
Silt, moderately to very clayey, very slightly sandy, mostly very fine sand, silt is coarse; limy areas below 155 ft.....	145.0	160.0
Silt to poorly indurated siltstone, moderately clayey, light brown, granular structure, limy areas 160 to 168 ft; very slightly sandy below 170 ft, sand is very fine.....	160.0	187.2
Silt, moderately to very clayey, light brown; very calcareous 191.2 to 192.3 ft; slightly calcareous with limy areas below 192.3 ft.....	187.2	195.0
Siltstone, poorly indurated, moderately clayey, light brown; slightly sandy below 199 ft, contains limy areas.....	195.0	200.0
Siltstone, poorly indurated, slightly sandy, silt is coarse, sand is very fine to fine with some medium, light brown; slightly clayey, moderately sandy below 210 ft; contains rare limy areas below 211.5 ft, a few root holes and root casts to 215 ft; slightly clayey, slightly less sandy below 215 ft.....	200.0	216.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, slightly clayey, moderately to very sandy, sand is very fine to fine with some medium, light olive-gray, contains limy areas and a few root-lets; some cemented volcanic ash 221.7 to 222.4 ft.....	216.0	222.4
Silt, moderately clayey, slightly sandy, sand is very fine to medium, light medium olive-gray.....	222.4	225.3
Limestone, marly and slightly clayey, very calcareous, very light gray.....	225.3	229.0
Sand, very silty, slightly clayey, sand is very fine to medium, light olive-gray; slightly indurated below 230 ft, contains a trace of coarse sand.....	229.0	235.0
Sand, slightly to moderately silty, sand is very fine to medium with a trace of coarse, light olive-gray; slightly indurated below 240 ft.....	235.0	244.0
Silt, slightly clayey, very sandy, light olive-gray.	244.0	246.5

Sandstone, sand is very fine to medium with a trace of coarse, poorly indurated.....	246.5	248.5
Silt, moderately to very clayey, very slightly sandy, light olive-gray.....	248.5	250.8
Sandstone, very silty, sand is very fine to medium, light olive-gray, poorly indurated; moderate induration, very calcareous below 255 ft.....	250.8	256.5
Silt, slightly clayey, moderately to very sandy, sand is very fine to fine with some medium; moderately to very clayey below 258.5.....	256.5	261.0
Sandstone, slightly silty, sand is very fine to medium with a trace of coarse, poorly indurated...	261.0	264.2
Silt, moderately clayey, slightly to moderately sandy, light olive-gray, in part slightly indurated; very sandy below 267.7 ft.....	264.2	270.0
Sand, slightly silty, sand is very fine to medium with a trace of coarse, contains a few rootlets...	270.0	276.5
Silt, moderately clayey, very slightly sandy, sand is very fine, light olive-gray.....	276.5	280.0
Siltstone, moderately to very sandy, sand is very fine to fine, very light olive-gray; moderate induration to 284 ft, well indurated 284 to 287 ft, limy areas and cementation.....	280.0	287.0
Sand and gravel, approximately 50 percent coarse sand to fine gravel, a little medium gravel, thin silty layers, some lithic well indurated siltstone grains.....	287.0	294.7
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Shale, clayey, mottled light olive-gray and light brown-yellow, contains a trace of bentonite and aragonite in upper few feet.....	294.7	305.0
Shale, clayey, medium olive-gray and yellow-brown, noncalcareous.....	305.0	310.0
Shale, dark gray, noncalcareous, thin bentonite layers 310 to 320 ft.....	310.0	335.0

**14-12-6dadd
12-B-47
Howard County**

Location: SE SE NE SE, 1380 ft N and 9 ft W of SE cor sec 6-14N-12W
 Ground elevation: 1993 ft (t) Farwell 7.5 min. quadrangle
 Depth to water: 24.14 ft 6/25/47

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Road fill and soil, silty, slightly clayey, dark brown-gray.....	0.0	2.0
Silt, very clayey, dark brownish gray.....	2.0	3.0
Silt, moderately clayey, dark brownish gray.....	3.0	8.0
Silt, slightly clayey, light yellowish brown.....	8.0	9.5
Silt, moderately clayey, medium brown-gray.....	9.5	10.0
Silt, light yellowish to brownish gray, some yellow stain, some limy nodules below 12 ft; slightly darker in color below 16 ft.....	10.0	19.5
Silt, moderately clayey, dark brown, granular structure.....	19.5	21.0
Silt, brownish gray; in part clayey below 24 ft, some limy concretions.....	21.0	24.0
Silt, light yellowish to brownish gray; very calcareous below 25 ft, contains abundant limy nodules, small gastropods and pelecypods, rodent tooth, ostracods and a few rootlets.....	24.0	29.0
Silt, sandy, sand is mostly very fine to fine, very light gray, calcareous, limy nodules, a few pelecypods.....	29.0	31.0
Silt, sandy, sand is very fine to fine, light medium gray with some yellow gray.....	31.0	33.0
Silty sand and sandy silt, mostly very fine to fine sand, medium gray, many wood fragments.....	33.0	40.0
Sand, silty, some sandy silty, sand is very fine to medium, medium gray, contains wood fragments and gastropods.....	40.0	48.5
Silt, medium to medium dark gray, a few wood fragments and small gastropods, in part clayey below 50 ft.....	48.5	55.5
Sand, fine to very coarse, some fine and a little medium gravel, pink and gray silicates, some lithic Ogallala grains, a few gastropods.....	55.5	60.0
Sand and gravel, gravel is fine to medium, brownish gray to pink.....	60.0	63.5

Silt, slightly clayey, light brownish to yellowish gray; granular structure below 70 ft, limy nodules 80 to 90 ft, slightly calcareous below 80 ft, some moderately clayey silt below 85 ft; moderately calcareous below 95 ft., slight yellow stain.....	63.5	98.0
Silt, sandy, sand is very fine to fine, light brownish gray, contains some volcanic ash; very sandy below 100 ft, very fine to fine sand.....	98.0	107.0
Sand and gravel, gravel fine to medium, common lithic Ogallala grains.....	107.0	111.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, silty, very light yellowish gray, very calcareous, thin hard layers.....	111.0	113.0
Sandstone, sand mostly very fine to fine, light brownish gray, dark speckled; moderately well consolidated below 130 ft.....	113.0	140.0
Sand, slightly silty, sand is very fine to medium, light brownish to greenish gray.....	140.0	158.0
Sandstone, very fine to fine with some medium sand, light brownish gray, greenish tints; slightly indurated below 160 ft; fine to medium with some coarse sand below 165 ft, some rootlets.....	158.0	170.0
Sandstone, silty, sand is very fine to medium, light brownish to whitish gray, in part calcareous, many rootlets.....	170.0	174.0
Sandstone-siltstone, sand is very fine to fine with some medium, very light olive-gray, moderately calcareous with very calcareous zones.....	174.0	186.0
Silt, sandy to slightly clayey, sand is very fine to medium, light greenish gray.....	186.0	188.0
Sand, very fine to medium, some coarse, a little very coarse sand.....	188.0	195.0
Sandstone, silty, sand is very fine to medium, light brownish to greenish gray; poorly consolidated below 200 ft.....	195.0	204.0
Silt, slightly to very sandy, in part slightly clayey, sand is very fine to fine, light greenish gray.....	204.0	210.0
Sand, moderately silty, sand is very fine to fine with some medium, light brownish to greenish gray; slightly silty below 220 ft, very fine to medium. some coarse sand.....	210.0	225.0
Sand, very fine to medium, much medium.....	225.0	231.0
Sandstone, sand is very fine to medium, much medium, moderately to very calcareous, well indurated.....	231.0	234.5
Sand, moderately silty, very fine to fine, some medium sand, light greenish gray; calcareous below 238 ft.....	234.5	240.0

Sand to sandstone, silty, sand is very fine to fine, very light brownish gray, calcareous zones; very calcareous below 247 ft.....	240.0	248.5
Sandstone, mostly very fine to fine sand, light brownish to greenish gray, limy areas.....	248.5	250.0
Sand, in part silty, sand is very fine to medium, light brownish gray.....	250.0	258.0
Silt, moderately clayey, slightly sandy, sand is very fine to fine, light brownish to olive-gray...	258.0	259.5
Sand, very fine to medium.....	259.5	271.0
Sand and silty sand interbedded, sand is very fine to fine, whitish to very light olive-gray, moderate to in part very calcareous and indurated....	271.0	290.0
Sandstone, sand is very fine to fine, light grayish brown, limy zone 294 to 295 ft.....	290.0	300.0
Sand, very fine to medium, light brownish gray, slightly indurated in upper few feet.....	300.0	314.5
Tertiary System - Series and Formation not determined, may be part of Ogallala Group:		
Silt, slightly sandy, sand is very fine to fine, in part clayey, light greenish-gray, blocky structure, limy layer or nodule.....	314.5	319.0
Silt, clayey to sandy, sand is very fine to fine, very light brown and light greenish gray, speckled limestone or nodule 321 to 321.3 ft; very thin nodular layer below 325 ft.....	319.0	330.0
Silt, very clayey, very light gray and light brown, thin nodular limestone layers.....	330.0	350.0
Silt, very clayey, slightly sandy, mostly very fine sand, light yellow-brown; very light yellow brown below 355 ft; some light greenish gray silty clay in interval 365 to 370 ft; contains some fine to very coarse sand below 370 ft including lithic grains of aragonite and limonite.....	350.0	373.5
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, light yellow, yellow, brown and light gray, moderately calcareous; very calcareous 380 to 385 ft; much yellow stain below 390 ft.....	373.5	400.0
Shale, clay, medium dark gray, moderately to very calcareous; thin bentonite layers below 415 ft....	400.0	430.0

**15-9-1aaad
40-A-56
Howard County**

Location: SE NE NE NE, 411 ft S and 9 ft W of NE cor sec 1-15N-9W
 Ground elevation: 1,830 ft (t) Cushing 7.5 min. quadrangle
 Depth to water: 74.16 ft 10/5/56
 Electric log

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Road fill and soil, silt, moderately clayey, medium brown-gray.....	0.0	1.0
Silt, moderately clayey, light brown-gray, slightly calcareous.....	1.0	1.5
Silt, slightly clayey, very light gray with a yellow tint, slightly calcareous, contains small limy nodules and a few gastropod shells; light yellow-gray below 2.5 ft, some mottled very light gray below 5 ft; very light gray 13.5 to 16 ft and below 18 ft; noncalcareous below 20 ft, no snails.	1.5	27.0
Silt, moderately clayey, very slightly sandy, sand is very fine to medium, light brown; moderately sandy 25 to 33 ft; in part very sandy below 35 ft.	27.0	36.5
Silt, very clayey, very light gray; moderately clayey below 40 ft.....	36.5	42.5
Silt, moderately clayey, very dark brownish gray....	42.5	45.0
Silt, moderately clayey, slightly sandy, sand is very fine to fine, light brown-gray, very light gray, slightly less clayey, slightly more sandy below 47 ft.....	45.0	48.5
Silt, moderately clayey, light brown-gray; slightly clayey below 49.5 ft, very light yellow-gray; silt is coarse below 51 ft, light brown; very light gray below 52 ft.....	48.5	52.5
Silt, interbedded, slightly and moderately clayey, very slightly sandy, sand is very fine, very light brownish gray, slightly calcareous below 61 ft....	52.5	61.0
Silt, slightly clayey, slightly sandy, sand is very fine to fine, light brown, slightly calcareous; very little sand below 62 ft.....	61.0	66.0
Silt, very slightly clayey, silt is coarse, contains some very fine sand, light brown, slightly calcareous; slightly clayey below 66 ft, slightly sandy, sand is very fine to fine.....	66.0	69.0

Silt, very slightly clayey, moderately sandy, sand is very fine to medium with a trace of coarse sand. light brown, slightly calcareous; contains two thin silty clay layers between 70 and 75 ft; contains a few small limy nodules below 75 ft; in part very sandy below 80 ft.....	69.0	85.0
Silt, very sandy, sand is very fine to fine with some medium and a little coarse sand; grades to a silty sand below 88.5 ft, contains lithic grains of clay and limestone fragments.....	85.0	90.0
Sand, very silty, interbedded with some slightly sandy silt, sand is very fine to medium with a few coarser grains, light brown; contains thin gravel layer 93 to 95 ft.....	90.0	95.0
Gravel, sandy, consists mainly of rounded nodular limestone grains.....	95.0	98.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand, slightly silty, sand is very fine to medium, light greenish gray.....	98.0	100.0
Sandstone, sand is very fine to medium, very calcareous, marly in part, contains a few volcanic ash shards.....	100.0	103.0
Sand, very silty, sand is very fine to medium, light greenish gray; only slightly silty below 105 ft...	103.0	109.5
Silt, slightly clayey, moderately sandy, sand is very fine to fine with a little medium sand, light greenish gray.....	109.5	110.0
Sandstone, sand is very fine to medium, poorly indurated.....	110.0	113.0
Clay, silty, very light greenish gray.....	113.0	114.5
Silt, moderately clayey, moderately sandy; sand is very fine to fine with some medium, very light olive-gray; contains limy nodular areas below 116 ft, medium to very sandy, slightly indurated.....	114.5	120.0
Sand, slightly clayey, very silty, sand is very fine to fine with some medium, very light olive-gray, slightly indurated, contains limy areas.....	120.0	127.0
Silt, slightly clayey, very sandy, sand is very fine to fine with some medium sand, very light olive-gray, contains some white limy areas.....	127.0	130.0
Sand, slightly clayey, very silty, sand is very fine to fine with some medium.....	130.0	133.5
Silt, moderately clayey, moderately sandy, sand is very fine to fine with some medium, little olive-gray; very sandy below 135 ft, contains some limy areas and nodules.....	133.5	145.0

Siltstone-sandstone, sand is very fine to medium, very light olive-gray, moderately calcareous; poorly indurated below 155 ft.....	145.0	160.0
Silt, moderately clayey, moderately sandy, sand is very fine to fine; light olive-gray; very slightly sandy 162 to 165 ft.....	160.0	168.0
Silt, slightly clayey, very sandy, mostly very fine to fine sand, very light olive-gray; contains some limy areas; contains some small limy nodules below 170 ft; slightly indurated below 178 ft.....	168.0	181.0
Sandstone, slightly silty, sand is mostly very fine to fine, very light olive-gray, contains limy areas and small limy nodules.....	181.0	185.0
Sand, slightly clayey, very silty, sand is very fine to fine, contains some limy nodular areas.....	185.0	189.5
Silt, moderately clayey, slightly sandy, sand is very fine to fine with a trace of medium to coarse, very light olive-gray.....	189.5	194.5
Sand, slightly silty, sand is very fine to medium with a trace of coarse; sand is very fine to medium with some coarse and a little very coarse sand below 197.5 ft.....	194.5	202.5
Silt, very clayey, slightly sandy, sand is very fine to fine, very light olive-gray; moderately sandy below 204 ft, sand is very fine to fine with a trace of medium to coarse sand.....	202.5	204.5
Clay, silty, contains a trace of sand, mottled very light olive-gray and light yellow-brown; mostly light yellow-brown below 205 ft; slightly sandy below 210 ft, gravel is very fine.....	204.5	213.0
Silt, slightly clayey, very sandy, sand is very fine to fine, very light gray; contains thin silty sand layers below 215 ft.....	213.0	223.5
Silt, moderately to very clayey, slightly sandy, sand is very fine, very light gray; moderately to very sandy with thin silty sand layers 225 to 227.5 ft, sand is very fine to fine.....	223.5	230.0
Sandy silt and silty sand, interbedded, sand is very fine with some medium.....	230.0	240.0
Sand, very fine to fine with some medium, contains some thin sandy silty layers.....	240.0	244.5

Cretaceous System - Upper Cretaceous Series - Montana Group:

Pierre Formation:

Clay, mottled brownish yellow and light gray, slightly calcareous.....	244.5	245.6
Limestone, replacement of a bentonite layer?.....	245.6	246.5

Clay, medium yellow-gray, olive-gray and light gray, slightly calcareous, bentonite layers 249.3 to 249.5 ft and 253.5 to 254 ft.....	246.5	254.0
Shale, clay, dark gray with some medium brown-gray and yellow-brown, slightly calcareous, dark gray below 255 ft; thin ironstone concretion or layer at 265.5 ft.....	254.0	270.0

**15-9-5accc
38-A-44
Howard County**

Location: SW SW SW NE, 78 ft E of railroad track and S side of road
near the SE cor NE1/4 sec 5-15N-9W
Ground elevation: 1,795 ft (t) Cushing 7.5 min. quadrangle
Depth to water: 42.72 ft 8/28/44

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Road fill and soil: silt, clayey, dark brownish gray.....	0.0	4.0
Silt, slightly sandy, very light brown-gray, slightly calcareous.....	4.0	14.0
Silt, slightly clayey, very light brownish gray, contains scattered sand grains.....	14.0	35.0
Silt, sandy, light brownish gray to light gray, some organic material in lower part.....	35.0	50.0
Silt, sandy, light to medium gray, some wood fragments, some white calcareous material.....	50.0	60.0
Sand and gravel, poorly sorted, some medium feldspathic gravel in lower part, some shell fragments.	60.0	±66.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, sand is very fine to medium, light gray, somewhat calcareous; abundant calcareous rootlets.	±66.0	80.0
Sandstone, silty, in part clayey, whitish gray, moderately calcareous, some rootlets; very calcareous in lower 10 ft.....	80.0	109.0

15-9-6dabb
39-A-44
Howard County

Location: NW NW NE SE, near NW cor SE1/4 sec 6-15N-9W on S side of road and 97 ft E of bridge.

Ground elevation: 1980 ft (t) Wolbach SW 7.5 min. quadrangle

Depth to water: 27.4 ft 8/28/44

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Road fill and soil: silt, dark brown to black.....	0.0	5.0
Silt, sandy, light brownish gray.....	5.0	15.0
Sand and gravel, fine to coarse, some pebbles, a few lithic grains of Ogallala.....	15.0	±27.0
Tertiary system - Miocene Series - Ogallala Group:		
Sandstone, silty, very calcareous, light gray, some rootlets.....	±27.0	40.0
Siltstone, sandy, light gray, slightly calcareous; may be some sand, coarse to very coarse 45 to 48 ft.....	40.0	48.0
Sandstone, sand is very fine to medium, light greenish gray, moderately calcareous; common calcareous rootlets below 60 ft.....	48.0	79.0

15-9-9aaaa
41-A-44
Howard County

Location: NE NE NE NE, 8.5 ft S and 64 ft W of NE cor sec 9-15N-9W
 Ground elevation: 1783 ft (t) Cushing 7.5 min. quadrangle
 Depth to water: 33.5 ft 8/30/44

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Road fill and soil: clayey silt, dark brown-gray....	0.0	3.0
Silt, moderately clayey, light brownish gray.....	3.0	7.0
Silt, slightly clayey, light yellowish gray, scattered sand grains; light gray below 20 ft, slightly calcareous.....	7.0	33.0
Sand, some gravel, much fine to coarse sand, gravel fine to coarse, a few pebbles, feldspathic.....	33.0	47.0
Silt, clayey, light brown.....	47.0	58.5
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, silty and clayey, very light gray, cal- careous, common calcareous rootlets.....	58.5	79.0

**15-9-9daad
40-A-44
Howard County**

Location: SE NE NE SE, approximately 435 ft S and 100 ft W of NE cor
SE1/4 sec 9-15N-9W
Ground elevation: 1738 ft (t) Cushing 7.5 min. quadrangle
Depth to water: 6.1 ft 8/28/44

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Sand, silty, dark brownish gray.....	0.0	3.0
Sand, fine to very coarse, a little fine gravel.....	3.0	16.0
Sand, fine to medium, some coarse to very coarse sand.....	16.0	25.0
Sand and gravel, gravel is fine to coarse, trace of pebbles, feldspathic.....	25.0	±37.0
Silt, clayey, sandy, very light brownish gray and light brown.....	±37.0	±47.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, sandy, clayey, very light gray, moderately calcareous below 55 ft; some sandstone below 60 ft; light greenish gray below 75 ft, common cal- careous rootlets.....	±47.0	79.0

**15-9-16daaa
42-A-44
Howard County**

Location: NE NE NE SE, approximately 18 ft S and 33 ft W of NE cor
SE1/4 sec 16-15N-9W

Ground elevation: 1755 ft (t) Cushing 7.5 min. quadrangle

Depth to water: 11.7 ft 8/30/44

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Silt, moderately clayey, moderately sandy, principally very fine sand, a little medium to coarse sand, light brown, a few limy areas.....	0.0	4.0
Silt, slightly clayey, slightly sandy, silty is coarse, light brown, a few limy areas and nodular limestone fragments.....	4.0	16.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, sand is very fine to medium with a trace of coarse sand, very light olive-gray, a few siliceous root casts, moderate induration.....	16.0	24.0
Sandstone, silty, slightly clayey, sand is very fine to fine with a little medium, slightly calcareous, slight induration.....	24.0	39.0

**15-9-21aaaa
43-A-44
Howard County**

Location: NE NE NE NE, approximately 18 ft S and 25 ft W of NE cor
sec 21-15N-9W

Ground elevation: 1788 ft (t) Cushing 7.5 min. quadrangle

Depth to water: 18.9 ft 8/30/44

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Sand, silty, dark brownish gray.....	0.0	3.0
Sand, fine to medium, some coarse sand and a little fine to medium gravel, pinkish gray.....	3.0	9.0
Silt, sandy to clay, light brown.....	9.0	14.0
Sand, mostly fine to medium, some coarse sand and trace of gravel, contains some lithic Ogallala grains.....	14.0	34.0
Sand and gravel, gravel fine to medium; coarser below 40 ft.....	34.0	42.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, silty, very light greenish gray; calcar- eous and moderately well indurated below 55 ft....	42.0	59.0

**15-9-24aaaa
11-A-51
Howard County**

Location: NE NE NE NE, 18 ft S and 83 ft W of NE cor sec 24-15N-9W
 Ground elevation: 1737.6 ft (i).
 Depth to water: 4.98 ft 7/20/51

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Sand, silty, sand is very fine to medium, dark brown to black.....	0.0	0.5
Sand, slightly silty, sand is very fine to medium with some coarse, light brown.....	0.5	2.5
Sand, very silty, sand is very fine to medium, light grayish brown.....	2.5	5.0
Sand, very fine to very coarse, much medium sand, quartz with some pink silicates; some fine gravel below 25 ft.....	5.0	30.0
Sandy gravel, fine sand to medium gravel, approximately 60 to 70 percent gravel.....	30.0	33.5
Silt, moderately sandy, sand mostly very fine, light brown, slightly calcareous; slightly clayey 35 to 40 ft, very calcareous below 44 ft; granular structure 35 to 40 and 44 to 46.5 ft.....	33.5	46.5
Sand, slightly silty, sand is very fine to medium with some coarse sand, very light brown, slightly calcareous; thin moderately clayey layer 49 to 49.3 ft.....	46.5	50.5
Silt, moderately sandy, sand is mostly very fine, very light brown, slightly calcareous to 55 ft, very slight induration; moderately clayey 57.8 to 58.5 ft.....	50.5	58.5
Silt, slightly clayey, slightly sandy, sand is very fine to medium, light brown; moderately clayey 60 to 63.5 ft; moderately sandy 63.5 to 65.5 ft, sand is very fine to coarse.....	58.5	65.5
Silt, moderately clayey, slightly sandy, sand is very fine to medium, light brown.....	65.5	75.5
Sand, sand is fine to very coarse, some fine gravel, some sandstone grains.....	75.5	80.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, poorly indurated, sand is very fine to medium, some coarse, light green-gray; mostly very fine to fine with some medium sand below 85 ft; some rounded clay grains below 90 ft.....	80.0	95.0

Silt, moderately clayey, sandy, sand is mostly very fine to fine; very sandy below 100 ft.....	95.0	101.5
Sand, very fine to medium, principally quartz with some green and pink silicates; slightly coarser 110 to 115 ft, slightly silty below 115 ft.....	101.5	119.0
Silt, slightly clayey, moderately sandy, mostly very fine to fine sand, light greenish gray; very sandy 120 to 120.5 ft, slightly calcareous below 120.5 ft.....	119.0	121.5
Tertiary System - age not determined		
Limestone, light gray.....	121.5	122.5
Silt, moderately clayey, light green-gray, moderately calcareous.....	122.5	124.0
Marl, white, very calcareous.....	124.0	125.0
Silt, very clayey, light grayish brown, very calcareous.....	125.0	125.5
Silt, very clayey, very pale brown; contains limy nodules below 130 ft; slight iron stain below 133.5 ft.....	125.5	138.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, mottled and yellow-brown, noncalcareous except in upper foot; much yellow stain 145 to 150 ft; less yellow-brown below 150 ft, thin bentonite layers 153.5 to 155 ft, common yellow stain.....	138.0	160.5
Shale, clay, dark gray.....	160.5	171.5
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, chalky, medium gray, slightly clayey to 174 ft; light gray below 175 ft.....	171.5	180.0

**15-10-9dcdd
38-B-43
Howard County**

Location: SE SE SW SE, in road triangle and 34 ft W of sec line near
 SW cor SW1/4 SE1/4 sec 9-15N-10W
 Ground elevation: 1845 ft (i).
 Depth to water: 61.6 ft 10/31/43

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Silt, clayey, dark brown-gray.....	0.0	5.0
Silt, slightly to moderately clayey, light colored; probably light yellow-gray.....	5.0	25.0
Silt, slightly to moderately clayey, light brown....	25.0	44.0
Sand, mostly fine to coarse; some very coarse sand and gravel below 50 ft.....	44.0	54.0
Sand and gravel, pink, gravel mostly fine to medium.	54.0	58.0
Silt, probably slightly clayey, coarse silt with some very fine sand, may be in part moderately clayey, some limy areas.....	58.0	±128.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, silty, indurated, very light gray; very hard at 140 ft, did not penetrate.....	±128.0	140.0
Note: Samples very poor, essentially destroyed by washing in the laboratory		

**15-10-16addd
15-A-44
Howard County**

Location: SE SE SE NE, 10 ft N and 44 ft W of SE cor NE1/4 sec 16-15N-10W

Ground elevation: 1802 ft (t) Wolbach SW 7.5 min. quadrangle

Depth to water: 28.9 ft 7/18/44

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Road fill and soil: clayey silt, light brown and black.....	0.0	10.0
Silt, slightly clayey and sandy, light brownish gray.....	10.0	15.0
Silt, sandy, light brownish gray, some dark gray "soil".....	15.0	18.0
Sand, some silt, sand is fine to coarse; some very coarse sand and fine gravel below 25 ft.....	18.0	±30.0
Silt, interbedded, slightly and moderately clayey, slightly sandy, principally very fine sand, silt is coarse, slight induration, slightly to moderately calcareous, some very calcareous zones and nodular limestone, very light gray and light brown, contains root casts; may be some lithic sand and gravel in lower part.....	±30.0	±115.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, silty and clayey, calcareous, very light gray, hard limy layers.....	±115.0	139.0
Note: Log and samples inconclusive, Ogallala could be as high as 85 ft		

15-10-18bbbb
54-A-57
Howard County

Location: NW NW NW NW, 1 ft S and 25 ft E of NW cor sec 18-15N-10W
 Ground elevation: 1793 ft (t) Elba 7.5 min. quadrangle
 Depth to water: 4.55 ft 10/4/57
 Electric log

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, moderately sandy, sand is very fine to fine, dark brownish gray; slightly calcareous to 0.5 ft.....	0.0	2.5
Sand, fine to very coarse, a little fine gravel.....	2.5	6.9
Silt, moderately clayey, very sandy, sand is very fine to medium with some coarse, very dark brownish gray.....	6.9	7.3
Sand, very fine to medium, some coarse, scattered very coarse sand and fine gravel.....	7.3	13.7
Sandy gravel, composed mainly of lithic Ogallala grains of sandstone and siltstone, top of Ogallala may have been penetrated in 15 to 20 foot interval.....	13.7	20.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone-siltstone, sand is very fine to medium, moderate induration; slight induration below 25 ft.....	20.0	57.8
Sandstone, slightly clayey, some marl, limy cementation, very calcareous.....	57.8	60.0
Sandstone, sand is very fine to medium, moderate induration, some rootlets.....	60.0	65.0
Siltstone, sandy, sand is very fine to fine, moderate induration, in part very calcareous below 67.9 ft, some rootlets.....	65.0	69.0
Silt, slightly to moderately clayey, moderately sandy, sand is very fine to fine, light olive gray.....	69.0	70.0
Siltstone-sandstone, sand is very fine to medium, in part calcareous, moderate induration.....	70.0	75.5
Silt, slightly clayey, slightly sandy, in part moderately clayey and marly, very light olive-gray; contains some interbedded very sandy layers.....	75.5	90.0
Silt, slightly clayey, very sandy, sand is very fine to fine, limy cemented areas.....	90.0	95.0

Sandstone, in part silty, sand is mostly very fine to fine, very light yellow-gray, contains some limy areas.....	95.0	110.0
Sandstone, silty, sand is very fine to fine, slight to moderate induration, very calcareous 110 to 115 ft, limy areas below 115 ft; slight induration below 125 ft, contains rootlets.....	110.0	127.8
Silt, slightly clayey, moderately sandy, sand is very fine to fine, light yellow-gray, slightly calcareous with limy areas.....	127.8	135.0
Sand, silty, some sandy silt, sand is very fine to fine, contains some rootlets.....	135.0	137.7
Silt, slightly clayey, very sandy, sand is very fine to fine, light yellow-gray; slightly calcareous below 140 ft; moderately clayey with limy areas 142.5 to 145 ft; very calcareous marly layer 147.5 to 148.3 ft; sandstone layer 150 to 150.5 ft, very calcareous.....	137.7	150.5
Silt, slightly clayey, moderately sandy, sand is very fine to fine, trace of medium, light olive-gray, slightly calcareous; moderately clayey 152 to 155 ft, contains limy areas.....	150.5	155.0
Silt, slightly clayey, moderately sandy, sand is very fine to fine with a trace of medium, light olive-gray, slightly calcareous; contains some siltstone-sandstone layers below 156 ft, limy concretions.....	155.0	160.0
Tertiary System - Series and Formation not determined, may be part of Ogallala Group:		
Silt, moderately clayey, moderately sandy, sand is mostly very fine to fine, very light brown and very light gray, some limy nodules, matrix essentially noncalcareous, slightly clayey 165 to 167 ft; slightly sandy below 167 ft; contains limy areas below 170 ft.....	160.0	174.0
Silt, moderately to very clayey, very light brownish gray, blocky structure, moderately calcareous; slightly calcareous below 175 ft, contains limy nodular layers at 175.3 and 175.9 ft; noncalcareous below 180 ft, slight induration, light yellow-gray.....	174.0	181.5
Siltstone, moderately clayey, light yellow-gray; slight induration.....	181.5	182.5
Silt, very clayey, very light yellow-gray; very light brown-gray and very light brown below 185 ft; silt is coarse gained below 187 ft; very slightly sandy, sand is very fine to fine below 187.5 ft, very light yellow-gray.....	182.5	192.5

Siltstone, moderately clayey, coarse grained silt, very light yellow-gray; light yellow-brown below 196.5 ft, moderate induration 199.4 to 199.6 ft...	192.5	202.1
Sand, silty, sand is very fine to medium.....	202.1	207.0
Silt, moderately clayey, silt, sandy, sand is very fine to fine, light brown, contains thin bentonitic clay in interval 207 to 208.5 ft, medium brown below 208.5 ft, slightly clayey below 210 ft, slight to moderate induration below 211.1 ft; contains lithic grains below 215 ft.....	207.0	217.5
Sand, very fine to medium, contains some lithic gravel grains of ironstone, clay and limestone....	217.5	220.0
Silt, slightly clayey, very sandy, sand is very fine to coarse, contains lithic grains as above, light yellow-brown, moderately clayey below 221.5 ft; limestone layer or pebble 225.4 to 226.4 ft...	220.0	226.4
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, light gray and yellow-brown; bentonite layer in interval 235 to 241 ft; light medium gray below 214 ft, a little yellow-brown below 245 ft.....	226.4	250.0

**15-10-21dddc
17-A-44
Howard County**

Location: SW SE SE SE, approximately 100 ft N and 500 ft W of SE cor
sec 21-15N-10W

Ground elevation: 1795 ft (t) St. Paul 7.5 min. quadrangle

Depth to water: dry at 13 ft (caved) 7/21/44

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Sand, fine to medium, some coarse, light gray, scattered black grains.....	0.0	10.0
Sand and gravel, fine to medium gravel; very coarse below 45 ft; common lithic grains of Ogallala 25 to 35 ft.....	10.0	±55.0
Tertiary System - Miocene Series - Ogallala Group:		
Silty to clayey siltstone and sandstone, light greenish gray, slightly calcareous, whitish gray and very calcareous below 74 ft.....	±55.0	84.0

15-10-28ddcc*
16-A-44
Howard County

Location: *Not clear, either in SW SW SE SE or near SW cor SE1/4 sec.
 28-15N-10W
 Ground elevation: 1810 ft (t) St. Paul 7.5 min. quadrangle
 Depth to water: caved at 25 ft 7/21/44

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Road fill and soil: sandy silt, dark brownish gray..	0.0	3.0
Sand, silty in upper part, sand is fine to coarse, some gravel, feldspathic.....	3.0	19.0
Sand and gravel, gravel is fine to coarse, felds- pathic, contains dark pebbles and cobbles below 65 ft, some lithic grains of Ogallala.....	19.0	±75.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone-siltstone, light brownish and light green- ish gray, sand is very fine to fine with some medium, slight to moderate induration, moderately calcareous.....	±75.0	139.0

**15-10-33cddd
18-A-44
Howard County**

Location: SE SE SE SW, approximately 31 ft N and 150 ft W of SE cor
SW1/4 sec 33-15N-10W
Ground elevation: 1814 ft (t) St. Paul 7.5 min. quadrangle
Depth to water: 22.4 ft 7/21/44

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Road fill and soil: clayey silt, dark brownish gray, light gray in lower part, slightly calcareous, in part sandy below 15 ft.....	0.0	18.0
Sand and gravel, some sandy silt in middle part, coarser in basal part.....	18.0	±52.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandy siltstone, slightly clayey, light greenish to brownish gray; moderately to in part very calcareous 90 to 110 ft, slightly calcareous 110 to 130 ft; few rootlets 90 to 95 ft; common calcareous rootlets and a few siliceous rootlets below 125 ft.....	±52.0	139.0

**15-11-4ccbc
45-B-43
Howard County**

Location: SW NW SW SW, approximately 0.2 mile N of SW cor sec 4-15N-11W and on east edge of road
 Ground elevation: 1,880.3 ft (i)
 Depth to water: 37.0 ft 11/8/43

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, coarse, slightly sandy, sand is very fine, light yellowish gray, a little medium dark brownish gray.....	0.0	5.0
Silt, slightly to moderately clayey, very slightly sandy, sand is very fine, light yellow-gray, essentially noncalcareous, trace limy nodules and limy rootlets.....	5.0	10.0
Silt, slight clayey, fine to coarse silt, light yellow-gray, rare small limy rootlets; light brownish gray below 20 ft; in part yellowish gray below 25 ft, contains a trace of wood.....	10.0	30.0
Silt, slightly to in part moderately clayey, mostly dark gray, contains trace of wood.....	30.0	35.0
Sand, very fine to medium, much fine sand, gastropod shell and shell fragments.....	35.0	40.0
Sand, some gravel, fine sand to fine gravel, trace of medium gravel, quartz with pink feldspar; a few lithic Ogallala grains below 50 ft.....	40.0	55.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand, medium to in part very clayey, very light olive-gray; in part indurated below 55 ft., sand is very fine to fine with some medium, contains a trace of siliceous rootlets.....	55.0	65.0
Sandstone, poorly indurated, sand is very fine to medium with some coarse.....	65.0	70.0
Sandstone, in part silty, poorly indurated, sand is very fine to medium, very light olive-gray, contains a few rootlets; mostly very fine to fine below 75 ft, calcareous cemented areas 81 to 85 ft, rootlets rare below 80 to 90 ft; some medium sand below 95 ft.....	70.0	100.0

**15-11-4ddad
44-B-43
Howard County**

Location: SE NE SE SE, approximately 700 ft N and between highway
and railroad tracks in SE cor sec 4-15-11W
Ground elevation: 1854.7 ft (i)
Depth to water: 28.4 ft 11/8/43

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, clayey, dark brownish gray.....	0.0	6.0
Silt, clayey, light brownish gray, sandy in lower part.....	6.0	17.0
Sand, fine to medium, contains a few lithic Ogallala grains, light gray.....	17.0	28.0
Sand, fine to coarse, some very coarse sand and fine to medium gravel, contains some lithic Ogallala grains.....	28.0	55.0
Sand and gravel, pink and greenish gray, some lithic Ogallala grains.....	55.0	60.0
Sand, a little gravel.....	60.0	70.0
Sand and gravel, gravel is fine to medium, some coarse gravel below 75 ft.....	70.0	81.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone-siltstone, in part clayey, fine grained, light greenish gray, some limy cementation, con- tains a few rootlets 105 to 120 ft.....	81.0	150.0

**15-11-5aaad
10-B-47
Howard County**

Location: SE NE NE NE, 592 ft S and 9 ft W of NE cor sec 5-15N-11W
 Ground elevation: 1868 ft (t) Elba 7.5 min. quadrangle
 Depth to water: 22.1 ft 6/10/47

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Road fill, clayey silt, dark brown-gray.....	0.0	1.0
Silt, moderately clayey, very dark brown-gray.....	1.0	2.5
Silt, moderately to very clayey, medium dark brown..	2.5	4.0
Silt, slightly clayey, slightly calcareous, light yellow-brown, contains small limy nodules.....	4.0	10.5
Silt, moderately clayey, medium to dark yellow- brown, a few limy nodules.....	10.5	13.0
Silt, moderately clayey, dark yellow-brown, granular structure.....	13.0	18.0
Silt, very clayey, dark brown-gray.....	18.0	20.5
Sand, fine to coarse, a little very coarse; sand is fine to very coarse below 24.5 ft.....	20.5	30.0
Sand and gravel, gravel is mostly fine, quartz with pink silicates; gravel is fine to medium below 35 ft.....	30.0	40.0
Sand, some gravel, gravel fine to medium.....	40.0	50.0
Sand and gravel, gravel mostly fine.....	50.0	55.0
Sand and gravel, gravel is fine to medium, a little coarse gravel and a few pebbles; contains lithic Ogallala grains below 60 ft.....	55.0	68.5
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, mostly very fine to fine, light gray to light brown, very calcareous, common rootlets.....	68.5	75.0
Sandstone, mostly very fine to fine sand, light brownish gray, some limy areas, common rootlets...	75.0	85.0
Sandstone, mostly very fine to fine sand, very light brownish gray, very calcareous; silty and less indurated below 86.5 ft.....	85.0	90.0
Sandstone, mostly very fine to fine sand, light olive-gray; sand is very fine to medium below 95 ft.....	90.0	98.0
Sand, silty, sand is very fine to medium, light olive-gray.....	98.0	100.0
Sand, silty, moderately clayey, very light olive- gray.....	100.0	110.0

Sandstone, mostly very fine to fine sand, light olive-gray, hard limy layer 113 to 114 ft; moderately calcareous, common rootlets below 114 ft..	110.0	119.5
Silt, very clayey, very light gray, some thin limy layers, very calcareous below 122 ft.....	119.5	125.0
Sandstone, silty, moderately clayey, light greenish gray, contains thin hard limy layers; slight induration below 130 ft.....	125.0	137.0
Sandstone, mostly very fine to fine sand, light greenish gray, contains siliceous rootlets; moderately calcareous below 140 ft; contains some silty sand layers below 145 ft.....	137.0	150.0
Sandstone, mostly very fine to fine sand, light greenish gray, in part slightly calcareous.....	150.0	154.0
Sand, silty, slightly clayey, sand is very fine to fine with some medium, light greenish gray.....	154.0	170.0
Sandstone, mostly very fine to fine sand, light greenish gray; moderately well indurated below 180 ft.....	170.0	188.0
Silt, moderately clayey, slightly sandy, light greenish gray, contains hard white limy layers....	188.0	190.0
Sandstone, mostly very fine to fine sand, medium greenish gray, in part silty.....	190.0	195.0
Sand, silty, moderately clayey, light olive-gray, some induration.....	195.0	200.0
Sand, silty and sandstone, sand is mostly very fine to fine, light olive and greenish gray; a few limy nodules below 221 ft.....	200.0	225.0
Silt, sandy and moderately clayey, light olive to greenish gray.....	225.0	235.0
Siltstone, very light greenish gray, very calcareous, thin hard layers.....	235.0	240.0
Silt, clayey, slightly sandy, light greenish gray, thin limy nodules or layers; some light greenish gray silty clay below 245 ft.....	240.0	250.0
Sandstone, silty and silty sand, light greenish gray.....	250.0	260.0
Silt, very clayey, light brownish gray; sandy and less clayey below 265 ft.....	260.0	270.0
Tertiary System - Series and Formation not determined, may be part of Ogallala Group:		
Siltstone, sandy, light brownish gray.....	270.0	277.0
Silt, very clayey, light brownish gray, blocky structure; slightly sandy below 280 ft.....	277.0	288.0
Clay, silty, light brownish gray; some thin sandy siltstone layers.....	288.0	295.0
Silt, very clayey, slightly sandy, light brown.....	295.0	300.0

Silt, very clayey, light brown; a few limy and limonitic nodules or lithic grains below 320 ft, common below 330 ft.....	300.0	336.0
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Cretaceous System - Upper Cretaceous Series - Montana Group:

Pierre Formation:

Clay, light and medium gray with some yellow brown, some bentonite layers; mostly medium, some dark gray below 345 ft.....	336.0	350.0
Shale, clay, dark gray to black.....	350.0	370.0

**15-11-36aaaa
55-A-57
Howard County**

Location: NE NE NE NE, 150 ft S and 6 ft W of NE cor sec 36-15N-11W
 Ground elevation: 1919 ft (t) Nysted 7.5 min. quadrangle
 Depth to water: 120.9 ft 10/11/57
 Electric log

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, silt is coarse, dark brown...	0.0	2.0
Silt, slightly clayey, silt is coarse, medium brown; slightly calcareous below 5 ft, light yellowish brown; some shell fragments below 16.5 ft; some mottled light gray below 20 ft, some yellow stain; very slightly clayey below 32 ft; noncalcareous 35 to 40 ft and 45 to 46.3 ft.....	2.0	46.3
Silt, slightly clayey, silt is coarse, dark brown, slightly more clayey below 48 ft.....	46.3	51.0
Silt, slightly to moderately clayey, medium brown; slightly more clayey 53 to 55 ft.....	51.0	55.0
Silt, slightly clayey, silt is fine to coarse, medium brown, some light brown below 56 ft.....	55.0	58.0
Silt, slightly to moderately clayey, silt is coarse, light medium brown, moderately clayey 58 to 60 ft; contains dark brown stain 60 to 65 ft and 66.5 to 67.5 ft; slightly finer grained 66 to 66.5 ft.....	58.0	67.5
Silt, moderately clayey, very slightly sandy, sand is mostly very fine, medium brown, contains some dark stain.....	67.5	70.0
Silt, slightly moderately clayey, slightly sandy, sand is mostly very fine to fine, light medium brown; slightly to moderately sandy below 73.5 ft; slightly clayey 75 to 77 ft.....	70.0	77.0
Silt, moderately clayey, slightly sandy, sand is very fine to fine, medium brown; moderately sandy below 81.5 ft.....	77.0	84.0
Silt, moderately to very clayey, moderately sandy, sand is mostly very fine to fine; limy areas 88 to 89 ft.....	84.0	90.7
Sand, silty, sand is very fine to fine with some medium.....	90.7	92.0

Silt, slightly clayey, moderately sandy, sand is very fine to fine with some medium, light medium brown; moderately clayey, slightly sandy below 93 ft, mostly very fine to fine sand; some silty sand interbedded below 97.5 ft.....	92.0	98.0
Sand, very fine to medium, silt lens 104.3 to 104.4 ft.....	98.0	105.0
Sand, fine to very coarse, some fine gravel.....	105.0	110.0
Sand, some gravel, much coarse to very coarse sand; 10 to 15 percent fine to medium gravel.....	110.0	122.5
Silt, slightly clayey, slightly sandy, sand mostly very fine to fine, medium brown; moderately sandy below 125 ft, contains limy areas; very sandy below 131 ft.....	122.5	133.0
Sand, very silty, sand is very fine to fine, little medium brown.....	133.0	135.0
Silt, slightly clayey, slightly sandy, silt is coarse, sand is mostly very fine, slight induration, medium brown; contains some limy areas; moderately sandy below 140 ft, sand is very fine to fine, contains some rootlets.....	135.0	145.0

Tertiary System - Miocene Series - Ogallala Group:

Siltstone, moderately sandy, very light olive-gray, some limy cementation, common rootlets; contains a trace of bentonitic clay 147 to 147.5 ft, light gray; marly with some bentonitic clay below 150 ft.....	145.0	155.0
Sandstone, sand is very fine to fine, very light olive-gray, some limy cementation, some rootlets..	155.0	158.5
Sand, silty, slightly clayey, sand mostly very fine to fine, medium olive-gray, rare limy areas.....	158.5	160.0
Sandstone, sand is very fine to fine with some medium, some limy and siliceous cementation; contains bone fragments and a little clayey silt below 170 ft.....	160.0	175.5
Siltstone, slightly clayey, slightly sandy, sand is mostly very fine, light olive-gray, contains hard limy layer 177 to 177.2 ft; light brown 176 to 180 ft, moderately calcareous and marly 181.5 to 185 ft; some interbedded siltstone-sandstone below 185 ft, some rootlets.....	175.5	190.0
Sandstone, mostly very fine to fine sand, slight induration, light olive-gray, some rootlets.....	190.0	194.5
Siltstone, slightly clayey, slightly sandy, sand is mostly very fine, some limy cementation.....	194.5	197.5
Sandstone, sand is mostly very fine to fine, poorly indurated, very light olive-gray, some rootlets; limy, sandy silt 197.5 to 197.6 ft.....	197.5	203.0

Silt, slight clayey, very sandy, sand is very fine to medium, light medium olive-gray.....	203.0	205.0
Sandstone, sand is mostly very fine to fine, poorly indurated, some rootlets; contains some silty lenses below 214.5 ft.....	205.0	219.5
Silt, very sandy, slightly clayey, sand is very fine to fine, light medium olive-gray; slightly more clayey below 224.3 ft.....	219.5	227.0
Sand, silty, sand is mostly very fine to fine, light medium olive-gray; slightly indurated below 230 ft, contains rootlets; contains silt lenses below 235 ft.....	227.0	240.0
Siltstone-sandstone, sand is very fine to fine, light olive-gray, slight induration, contains rootlets.....	240.0	250.0
Sandstone, slightly silty, sand is very fine to fine, light olive-gray, moderate induration, contains rootlets; contains some lithic claystone grains below 255 ft.....	250.0	257.0
Silt, slightly clayey, silty is coarse, light medium olive-gray, blocky structure, slight induration below 260 ft; sand in lower part.....	257.0	265.0
Sand, slightly silty, sand is very fine to fine with some medium, light medium olive-gray; contains a layer of clayey silt.....	265.0	270.0
Sand, very fine to medium with some coarse, quartz with 10 to 15 percent dark minerals.....	270.0	273.0
Silt, slightly clayey, very light olive-gray, slightly indurated; moderately clayey below 275 ft; some sandstone lenses below 278 ft.....	273.0	280.0
Sandstone-siltstone, sand is very fine, very light olive-gray, slight induration.....	280.0	284.0
Sand, mostly very fine to fine sand, contains dark mineral grains and approximately 10 percent lithic grains of clayey silt.....	284.0	290.0
Sand, some gravel, sand is very fine to medium, contains 15 to 20 percent lithic gravel grains of clayey silt to 295 ft and 25 to 30 percent 295 to 330 ft; contains some aragonite and marly areas below 295 ft, a few rootlets.....	290.0	315.0
Silt, moderately clayey, very sandy, sand is fine to very coarse, contains approximately 40 to 50 percent lithic grains of clayey silt and aragonite...	315.0	321.3
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, bright yellow and orange.....	321.3	328.0
Shale, clay, dark gray, noncalcareous; contains thin bentonite layers below 335 ft.....	328.0	340.0

15-12-14ddd
11-B-47
Howard County

Location: SE SE SE SE, 17 ft N and 56 ft W of SE cor sec 14-15N-12W
 Ground elevation: 2063 ft (t) Cotesfield 7.5 min. quadrangle
 Depth to water: 144.5 ft 6/24/47

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, clayey, medium dark brown-gray.....	0.0	2.0
Silt, clayey, light brownish gray.....	2.0	7.0
Silt, light yellowish to brownish gray, slightly calcareous, small gastropods; slightly clayey below 10 ft; some yellow stain below 20 ft, some very light gray.....	7.0	36.0
Silt, slightly clayey, dark brown.....	36.0	38.0
Silt, slightly to moderately clayey, light reddish brown, granular structure.....	38.0	40.0
Silt, slightly clayey, light brown; light pinkish brown below 45 ft.....	40.0	55.0
Silt, slightly sandy, sand mostly very fine to fine, some medium sand, light brown.....	55.0	60.0
Silt, sandy and sand silty, in part slightly clayey, sand mostly very fine to fine, some medium, light reddish brown.....	60.0	75.0
Silt, slightly to moderately clayey, light reddish brown, some dark reddish brown in upper part; moderately clayey below 80 ft.....	75.0	95.0
Silt, light reddish to yellow-brown; limy nodules below 95 ft; slight to moderately calcareous below 105 ft.....	95.0	110.0
Silt, light yellow to light brown-gray, slightly to in part very calcareous, thin hard limy nodular layers; moderate to very calcareous below 125 ft; a few gravel grains, in part lithic Ogallala fragments.....	110.0	138.5
Tertiary System - Miocene Series - Ogallala Group:		
Siltstone, whitish gray, very calcareous.....	138.5	140.0
Sandstone, sand mostly very fine to fine, whitish to very light olive-gray, very calcareous; slightly calcareous 143 to 145 ft.....	140.0	147.5
Sandstone, silty, mostly very fine to fine sand, very light olive to greenish gray, poorly indurated, moderately calcareous, a few rootlets.....	147.5	157.5

Sand, very fine to fine, some medium; fine to medium with a little coarse to very coarse sand 160 to 165 ft; fine to coarse sand with some very coarse below 165 ft; fine to very coarse with a little fine to medium gravel 180 to 185 ft; mostly fine to coarse sand below 185 ft, thin silty to clayey layer at 188 ft.....	157.5	190.0
Sandstone, silty, sand is very fine to fine, light greenish gray.....	190.0	197.0
Silt, moderately clayey, sandy, light greenish gray.	197.0	200.0
Sandstone, very fine to fine sand, very light gray, moderately calcareous, poorly indurated, contains some thin silt layers.....	200.0	210.0
Silt, very sandy, light olive-gray.....	210.0	221.0
Sandstone, sand is very fine to fine, very light brownish gray.....	221.0	227.0
Silt, very sandy, slightly clayey, very light grayish green, calcareous, slightly indurated.....	227.0	230.0
Sandstone, very fine to medium with a few coarser grains, very light brown-gray, slightly calcareous, many rootlets; in part silty below 238 ft...	230.0	243.0
Silt, very sandy and silty sand, sand is very fine to fine with some medium, light greenish to brownish gray.....	243.0	250.0
Sand, mostly very fine to fine.....	250.0	255.0
Sandstone, mostly very fine to fine sand, light brownish to olive-gray, some limy areas, many rootlets; silty below 260 ft.....	255.0	265.0
Sandstone, mostly very fine to fine sand, light brownish to greenish gray, poorly indurated.....	265.0	280.0
Sand, some silty sand, very fine to fine with some medium sand, light brownish gray.....	280.0	295.0
Sandstone, mostly very fine to fine sand, very light olive to greenish gray, slightly to moderately calcareous, a few rootlets.....	295.0	300.0
Sand, very fine to fine, slight induration, very light brown-gray.....	300.0	308.0
Siltstone-sandstone, sand is very fine to fine, very light brownish to greenish gray, moderately to very calcareous, hard layer 308 to 309.5 ft....	308.0	320.0
Sand, very fine to medium, light brownish gray to light gray, slight induration 320 to 330 ft and below 350 ft; slightly calcareous 350 to 355 ft with some sandy siltstone.....	320.0	365.0
Sandstone, mostly very fine to fine sand, light brownish to whitish gray, moderately calcareous with some hard very calcareous layers.....	365.0	370.0

Sand, very fine to medium, very light brownish gray, some calcareous cemented zones.....	370.0	375.0
Sandstone, sand mostly very fine to fine, light brownish to greenish gray, moderately calcareous..	375.0	382.0
Silt, moderately clayey, light greenish gray.....	382.0	385.0
Sand, very fine to fine with some medium, in part silty, light brownish gray; a few coarse to very coarse sand grains 395 to 400 ft; some limy areas below 405 ft.....	395.0	410.0
Sand, very fine to medium, thin olive-green clayey silt layer in interval 415 to 420 ft.....	410.0	420.0
Sand, silty with some sandy silt, sand mostly very fine to fine, light brown-gray to olive-green, thin hard limy layer in lower 5 ft.....	420.0	435.0
Tertiary System - Series and Formation not determined, may be part of Ogallala Group:		
Silt, clayey, slightly sandy, light brownish to greenish gray, some light brown, thin hard limy layers or nodules.....	435.0	450.0
Silt, slightly to moderately clayey, light brownish gray; very clayey below 460 ft.....	450.0	466.5
Sand, silty, sand is very fine to fine, light brownish gray.....	466.5	490.0
Sand, very fine to medium, some coarse, limonitic fragments 497 to 501 ft, sand may be slightly indurated or be slightly clayey; medium to very coarse grained below 520 ft, common limonitic lithic grains.....	490.0	526.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Shale, silty clay, medium gray, very calcareous; medium to dark gray below 530 ft.....	526.0	535.0
Shale, silty clay, dark gray, thinly laminated, slightly calcareous, noncalcareous below 540 ft; some bentonite in interval 550 to 555 ft.....	535.0	560.0

16-10-18bbbb
8-B-47
Howard County

Location: NW NW NW NW, 133 ft S and 18 ft E of NW cor sec 18-16N-10W
 Ground elevation: 2007 ft (t) Elba 7.5 min. quadrangle
 Depth to water: 100.4 ft 6/3/47

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, medium dark brown, slightly calcareous.....	0.0	1.5
Silt, light yellowish to brownish gray, slightly calcareous, contains gastropod shells.....	1.5	10.5
Silt, moderately clayey, dark brown-gray.....	10.5	13.0
Silt, moderately to very clayey, light medium brown; light reddish brown below 15 ft.....	13.0	20.0
Silt, moderately clayey, light yellow-brown; slightly sandy below 25 ft.....	20.0	30.0
Silt, moderately sandy, sand mostly very fine to fine, light yellowish to reddish brown; slightly clayey below 40 ft.....	30.0	42.5
Silt, moderately clayey, slightly sandy, light yellowish to reddish brown.....	42.5	50.0
Silt, light yellow-brown.....	50.0	79.5
Tertiary System - Miocene Series - Ogallala Group:		
Sand, silty, light greenish gray.....	79.5	82.5
Sandstone, sand is mostly very fine to fine, light brownish to greenish gray.....	82.5	96.0
Silt, slightly clayey, sandy, sand is very fine to fine, light yellowish green, in part indurated....	96.0	100.0
Sandstone, mostly very fine to fine, sandy, slightly to moderately indurated calcareous layers.....	100.0	112.0
Silt, very clayey, in part sandy, light greenish gray, thin hard limy layers below 115 ft; calcareous and sandy below 118 ft.....	112.0	120.0
Silt, clayey, sandy, sand mostly very fine to fine, contains rootlets; calcareous below 125.5 ft, whitish gray.....	120.0	133.0
Sandy silt and silty sand, interbedded, sand very fine to medium, light olive-gray, calcareous and hard below 144 ft.....	133.0	145.0
Sand and silty sand, interbedded, sand is very fine to fine with some medium, light greenish gray.....	145.0	154.0
Silt, sandy, slightly clayey, light greenish gray...	154.0	159.0
Sandstone, sand mostly very fine to fine, very light gray, contains siliceous rootlets.....	159.0	172.5
Silt, clayey to sandy, light olive-gray.....	172.5	175.0

Sandstone, sand mostly very fine to fine, very light brownish gray.....	175.0	188.0
Silt, slightly clayey, sandy, very light olive-gray; very calcareous below 190.5 ft.....	188.0	194.0
Sandstone, silty, sand very fine to fine, calcareous zones, hard 202.5 to 207 ft.....	194.0	210.0
Sand, very fine to medium, thin indurated layers below 215 ft.....	210.0	220.0
Sandstone, mostly very fine to fine sand, light brownish gray to whitish gray, hard indurated layer 220 to 220.5 ft.....	220.0	235.0
Sand, very fine to medium, in part slightly indurated, light brown-gray.....	235.0	240.0
Sand, mostly very fine to fine.....	240.0	252.0
Silt, sandy, slightly clayey, light olive-gray; some interbedded silty sand.....	252.0	268.5
Sandstone, silty, very fine to fine sand, very light brownish gray, calcareous, abundant rootlets; slightly more silty below 278 ft, white and light brownish-gray; interbedded light green silty sand below 285 ft, in part calcareous.....	268.5	290.0
Sand, very fine to medium.....	290.0	302.0
Sand, silty, slightly clayey, mostly very fine to fine sand, light olive-gray; some interbedded sand below 310 ft; thin limy layer 318 to 319 ft.....	302.0	320.0
Sandstone, slightly silty, very fine to fine sand, calcareous, light brownish to whitish gray, contains many rootlets.....	320.0	334.0
Silt, moderately clayey, sandy, light olive to greenish gray, some limy areas; slightly more clay below 339 ft; some thin sandstone layers below 350 ft.....	334.0	355.0
Sand, silty, slightly clayey, sand mostly very fine to fine, contains thin hard limy layers below 360 ft.....	355.0	363.0
Sand, very fine to medium, light brownish to greenish gray.....	363.0	371.0
Silt, moderately clayey, sandy, very light gray.....	371.0	376.0
Silt, very clayey, light greenish gray; some clayey to sandy silt, light brown below 380 ft.....	376.0	380.0
Silt, sandy, slightly clayey, light brown.....	380.0	390.0
Silt, very clayey, light brown, some white in upper few feet; drilled fast 406 to 408.5 ft.....	390.0	410.0
Sand, very fine to medium; a little coarse sand, much medium sand below 425 ft; fine to coarse sand with rounded lithic clay grains below 430 ft, a few fine gravel grains.....	410.0	437.0

**Tertiary System - Series and Formation not determined,
may be part of Ogallala Group.**

Silt, very clayey, light gray; slightly sandy below
445 ft; contains thin limy silt layer below 450
ft..... 437.0 452.0

Cretaceous System - Upper Cretaceous Series - Montana Group:

Pierre Formation:

Clay, mottled yellow brown, light gray and dark
gray..... 452.0 476.0
Shale, clay, dark gray..... 476.0 490.0

**16-11-7adba
43-B-43
Howard County**

Location: NE NW SE NE, SW cor of road intersection approximately
 1200 ft S and 800 ft N of NE cor sec 7-16N-11W
 Ground elevation: 1890.6 ft (i).
 Depth to water: 41.1 ft 11/8/43

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, in part sandy, light brown and brownish gray, may be some interbedded sand, some Ogallala lithic grains in samples.....	0.0	19.0
Sand, fine to coarse; some very coarse below 25 ft, contains Ogallala lithic grains.....	19.0	±25.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone-siltstone, light olive-gray.....	±25.0	35.0
Siltstone, white, common rootlets, very calcareous below 40 ft.....	35.0	45.0
Sandstone, silty, clayey, very light olive-gray; very calcareous below 50 ft, common rootlets.....	45.0	55.0
Sandstone, silty, very light greenish gray, slightly calcareous to 60 ft; many rootlets below 60 ft....	55.0	65.0
Sandstone, sand is very fine to medium, poorly indurated, very hard below 82 ft.....	65.0	84.0

16-11-8abaa
36-B-43
Howard County

Location: NE NE NW NE, approximately 1400 ft W and 26 ft S of NE cor
 sec 8-16N-11W

Ground elevation: 2065.6 ft (i).

Depth to water: dry at 100 ft 10/31/43

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, dark brown.....	0.0	3.0
Silt, light brownish to yellowish gray, contains numerous shell fragments and a few gastropods.....	3.0	25.0
Silt, light brown to tan, contains scattered sand grains.....	25.0	62.0
Silt, dark brown, contains scattered sand grains....	62.0	65.0
Silt, slightly sandy, dark reddish brown, contains a few shell fragments and gastropods to 75 ft; light yellowish brown below 75 ft.....	65.0	78.0
Sand, fine to medium, light gray to pink; contains a trace of light brown bentonitic clay in lower part.....	78.0	88.0
Sand, silty, light reddish brown, contains a trace of coarse to very coarse sand.....	88.0	91.0
Sand, fine to medium, light gray.....	91.0	±110.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, silty, moderately indurated.....	±110.0	130.0
Sandstone, silty, partly clayey, light olive to brownish gray.....	130.0	155.0
Sandstone, silty, grayish white, moderately to very calcareous.....	155.0	190.0
Sandstone, silty, slightly clayey.....	190.0	200.0
Sandstone, fine to medium sand.....	200.0	210.0
Sandstone, silty, in part clayey, very light olive-gray; moderately calcareous with some hard layers below 245 ft.....	210.0	255.0
Sandstone, silty, light olive-gray, contains a few rootlets.....	255.0	260.0
Sandstone-siltstone, very light to whitish gray, very calcareous.....	260.0	280.0
Sandstone, silty, very light olive-gray.....	280.0	300.0
Siltstone, sandy, light brownish gray; moderately calcareous 320 to 330 ft; contains some interbedded pink bentonitic clay below 340 ft.....	300.0	345.0
Siltstone, sandy, very light olive-gray, alternately hard and soft layers.....	345.0	395.0

Siltstone, sandy, grayish white, very calcareous....	395.0	410.0
Sandstone, silty, very light olive-gray, calcareous to 420 ft.....	410.0	425.0
Siltstone, in part sandy, very light olive-gray, in part calcareous.....	425.0	430.0

16-11-33aada
9-B-47
Howard County

Location: NE SE NE NE, 685 ft S and 8 ft W of NE cor sec 33-16N-11W
 Ground elevation: 1829 ft (t) Elba 7.5 min. quadrangle
 Depth to water: 7.65 ft 6/7/47

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, dark brown-gray; medium brown-gray below 1.5 ft.....	0.0	2.5
Silt, sandy, mostly very fine to fine sand, black...	2.5	3.5
Silt, sandy, mostly very fine to fine sand, light brownish to whitish gray.....	3.5	5.0
Silt, very clayey, light gray, greenish tint.....	5.0	6.0
Sand, fine to coarse, a little very coarse.....	6.0	8.0
Sand, some gravel, sand fine to very coarse, gravel mostly fine, brown to pinkish gray.....	8.0	13.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, mostly very fine to fine sand, light brownish to whitish gray, many limy areas; less calcareous below 18 ft, a few rootlets and a hackberry seed.....	13.0	29.5
Sandstone-siltstone, very fine to fine sand, calcareous, very light brown-gray to whitish gray, many rootlets; moderate induration, very calcareous below 38 ft.....	29.5	41.0
Sandstone, mostly very fine to fine sand, light brownish to greenish gray, some limy areas.....	41.0	46.0
Sandstone, mostly very fine to fine sand, poorly indurated, medium brown and light gray.....	46.0	59.5
Silt, very clayey, light greenish gray.....	59.5	60.0
Silt, clayey to sandy, light greenish gray.....	60.0	64.0
Clay, pale greenish gray.....	64.0	66.0
Silt, clayey to sandy, whitish gray, calcareous.....	66.0	71.5
Sandstone, mostly very fine to fine sand, light brownish to whitish gray, calcareous, many rootlets; some clayey to sandy silt layers below 78 ft.....	71.5	83.0
Silt, slightly clayey, sandy, light olive to greenish gray, contains thin silty sand layers.....	83.0	90.0
Sand, very silty, mostly very fine to fine sand, light greenish gray.....	90.0	111.0
Sand, fine to medium, light gray, contains thin sandy silt layers.....	111.0	120.0
Sand, silty, slightly clayey, light olive-gray.....	120.0	124.0

Sandstone, mostly very fine to fine sand, light gray to brownish gray, very calcareous below 136 ft....	124.0	138.5
Sandstone, silty, sand is very fine to fine, light greenish gray; light brown-gray, less silty below 140 ft.....	138.5	146.5
Sandstone, silty, mostly very fine to fine sand, light brownish to whitish gray, very calcareous; some slightly calcareous layers below 150 ft.....	146.5	155.0
Sandy silt and silty sand, very light gray and whitish gray, in part calcareous.....	155.0	160.0
Sandstone, sand is mostly very fine to fine, light brownish to greenish gray, some siliceous rootlets.....	160.0	177.0
Silt, clayey to sandy, very light gray, moderately sandy below 182 ft, hard limy layer 188 to 188.5 ft.....	177.0	195.0
Silt, very clayey, light greenish gray, hard limy layer 204 to 204.5 ft; some light brown-gray clay below 205 ft.....	195.0	210.0
Clay, silty, light brown-gray; light brown and light green-gray 220 to 225 ft.....	210.0	230.0
Sand, very fine to medium.....	230.0	247.0

Cretaceous System - Upper Cretaceous Series - Montana Group:

Pierre Formation:

Clay, light gray, white and yellow; slightly calcareous below 260 ft; moderately calcareous below 275 ft, some medium dark gray.....	247.0	282.5
Shale, silty clay, medium dark gray, moderately calcareous; dark gray below 290 ft, slightly calcareous.....	282.5	300.0

**16-11-35cadd
37-B-43
Howard County**

Location: SE SE NE SW, approximately 0.25 mile N and 93 ft W of SE
cor SW1/4 sec 35-16N-11W

Ground elevation: 1853.4 ft (i)

Depth to water: 33.3 ft 10/31/43

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, clayey, dark brownish gray.....	0.0	5.0
Silt, light brownish to yellowish gray, in part cal- careous, contains limonitic and calcareous root- lets and shell fragments.....	5.0	25.0
Silt, sandy, light brownish gray, slightly calcar- eous.....	25.0	30.0
Sand, silty and silt, gray, sand is fine to medium, contains a few calcareous rootlets, shell frag- ments and gastropods; contains a little coarse to very coarse sand in lower part.....	30.0	+46.0
Tertiary System - Miocene Series - Ogallala Group:		
Siltstone, clayey, very light olive-gray, very cal- careous.....	+46.0	50.0
Sandstone, silty, very light olive-gray, slightly calcareous, contains abundant rootlets.....	50.0	59.0
Siltstone, whitish gray, marly in upper part grading to very calcareous silty sandstone in lower part..	59.0	75.0
Sandstone, silty to clayey, fine grained, light gray to greenish gray.....	75.0	78.0
Sand, fine to medium, very light olive-gray, in part indurated.....	78.0	90.0
Siltstone, very light gray, calcareous.....	90.0	95.0
Sandstone, sand very fine to fine, very calcareous to 100 ft, moderately calcareous below with many rootlets.....	95.0	110.0
Sandstone, sand is very fine to fine, greenish gray, slightly calcareous, abundant rootlets.....	110.0	115.0
Siltstone, in part sandy, white, very calcareous, in part a marl.....	115.0	120.0
Sandstone, very fine to fine, white, slightly to moderately calcareous, contains a little bento- nitic clay.....	120.0	130.0
Sandstone, silty, sand is mostly very fine to fine, very light olive-gray, interbedded slightly to noncalcareous; contains many rootlets 160 to 175 ft; hard chalky limestone below 201 ft.....	130.0	203.0

**16-11-36aaaa
53-A-57
Howard County**

Location: NE NE NE NE, 310 ft S and 7.5 ft W of NE cor sec 36-16N-11W
 Ground elevation: 1916 ft (t) Elba 7.5 min. quadrangle
 Depth to water: 78.6 ft 10/4/57
 Electric log

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, coarse grained, medium yellow-gray with some dark gray in upper part.....	0.0	2.0
Silt, slightly clayey, slightly sandy, sand is mostly very fine to fine, dark brownish gray; moderately clayey below 4.4 ft, medium brown; moderately sandy below 8 ft and very sandy below 11.3 ft.....	2.0	13.4
Silt, slightly clayey, slightly sandy, sand is mostly very fine, medium brown; in part moderately clayey 16.5 to 29.5 ft.....	13.4	34.0
Silt, moderately clayey, moderately sandy, sand is very fine to fine, medium brown; slightly sandy below 38 ft.....	34.0	40.0
Silt, moderately clayey, slightly sandy, silt is coarse, sand is very fine, medium brown, slightly calcareous; sand is very fine to fine below 45 ft; some limy areas, in part moderately calcareous....	40.0	53.5
Silt, very slightly to slightly clayey, coarse silt, sand is very fine, light to light medium brown, moderately calcareous.....	53.5	64.2
Silt, slightly clayey, moderately sandy, sand is very fine to fine, light medium brown, slightly calcareous; noncalcareous 66.5 to 72 ft; moderately to very sandy below 68 ft; contains some yellow stain 66.5 to 72 ft; contains some limy areas below 72 ft.....	64.2	77.3
Silt, moderately clayey, slightly sandy, sand is very fine to fine, light medium brown, slightly calcareous; slightly less sandy below 80 ft, noncalcareous; light yellow-gray with some yellow stain below 87.5 ft; very slightly calcareous below 85 ft; medium brown below 89 ft; contains a trace of limy nodules below 93.6 ft, slightly to moderately sandy; very sandy below 99.3 ft, contains a few coarse sand to gravel grains of lithic sandstone, siltstone and rootlets.....	77.3	103.0

Silt, moderately clayey, slightly sandy, silt is coarse, sand is very fine to fine, light yellow-gray, moderately calcareous; contains limy areas to 107.6 ft; noncalcareous below 107.6 ft.....	103.0	112.5
Sand, silty in upper part, sand is very fine to medium with a few coarse sand to gravel grains including lithic grains of sandstone, clay and rootlets.....	112.5	+122.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, sand is very fine to medium, poorly indurated; moderate induration below 125 ft; slightly silty below 130 ft.....	+122.0	135.0
Sand, very silty and sandy silt, light olive-gray, sand is very fine to fine with some medium.....	135.0	140.0
Sandstone, slightly silty, sand is very fine to medium, very light olive-gray, contains some rootlets, moderate induration; contains a clayey to sandy silt layer 144 to 144.7 ft; moderately silty 155 to 157.5 ft.....	140.0	160.0
Silty sand and sandy silt, sand is very fine to medium, slight induration, light olive-gray.....	160.0	165.0
Silt, slightly to in part moderately clayey, slightly sandy, sand mostly very fine, some induration, moderately calcareous with limy areas; very sandy below 170 ft.....	165.0	172.0
Sandstone, silty, sand is very fine to medium, very light olive-gray, moderate induration, contains rootlets.....	172.0	178.0
Silt, very sandy, slightly clayey, sand is very fine to medium, light olive-gray, limy areas, moderately calcareous; noncalcareous below 180 ft....	178.0	185.0
Silt, slightly clayey, very sandy, sand is very fine to medium, very light olive-gray, contains limy areas, moderately calcareous.....	185.0	195.0
Siltstone, slightly clayey, slightly sandy, sand mostly very fine to fine, very light olive-gray, moderately calcareous with thin hard limy layer 196.3 to 196.4 ft.....	195.0	197.5
Sandstone, silty, sand is mostly very fine to fine, very light olive-gray, contains rootlets.....	197.5	201.4
Silt, moderately clayey, very sandy, sand is very fine to medium, light olive-gray; some thin indurated areas, very calcareous; moderately calcareous below 207.2 ft.....	201.4	221.8
Sand, slightly silty, sand is very fine to medium, slight induration.....	221.8	224.0

Silt, slightly clayey, slightly sandy, sand is mostly very fine, light olive-gray, slightly calcareous; slight induration below 226 ft.....	224.0	228.3
Sandstone, sand is very fine to medium, very slight induration; contains a marly sandy limestone layer 234 to 235 ft; moderate induration below 235 ft, rare limy areas; some rootlets below 239.8 ft.....	228.3	243.3
Silt, slightly clayey, moderately sandy, sand is very fine to fine with some medium, light olive-gray; very light yellow-gray below 250 ft; mottled light gray and light brown below 252 ft.....	243.3	254.5
Sandstone, in part slightly silty, sand is very fine to medium, poorly indurated, very light olive-gray, some rootlets; contains a slightly clayey silt layer 266.5 to 267.5 ft.....	254.5	270.0
Silt, slightly clayey, slightly sandy, sand is very fine to fine, very light olive-gray, limy areas, moderately calcareous; very sandy below 271.1 ft; slightly calcareous below 275 ft; sandstone layer below 276 ft.....	270.0	276.5
Silt, slightly clayey, slightly sandy, sand is very fine to medium, light olive-gray, slightly calcareous; very sandy below 279.3 ft.....	276.5	280.3
Sandstone, sand is very fine to fine, very light olive-gray, slightly indurated, contains rootlets.	280.3	281.4
Silt, slightly clayey, very sandy, sand is very fine to fine with some medium and trace of coarse; mostly very fine to fine with some medium sand below 286.9 ft.....	281.4	290.0
Sand, very fine to medium with scattered coarse sand to gravel, contains lithic grains, bone fragments and some green silicates.....	290.0	292.5
Silt, moderately to very clayey, very light yellow-gray, nodular limestone lens 296 to 296.3; slightly sandy, slightly clayey below 305 ft, sand is very fine to fine with some medium sand...	292.5	310.0
Silt, slightly clayey, silt is coarse grained, light yellow-gray, slight induration.....	310.0	313.0
Sand, slightly silty, sand is very fine to medium...	313.0	316.0
Silt to siltstone, slightly to moderately clayey, slightly sandy, light olive-gray, moderately calcareous, contains limy areas; slightly calcareous 320 to 323 ft; noncalcareous below 323 ft.....	316.0	325.0
Sand, slightly silty, sand is very fine to medium...	325.0	327.3
Silt, slightly clayey, slightly sandy, silt is coarse, sand is very fine, micaceous, slight induration; fine sand layer 330 to 330.4 ft; slightly calcareous 330.4 to 334.3 ft.....	327.3	334.3

Silt, moderately clayey, silt is coarse to very coarse with some very fine sand; very light yellow-gray; slight induration below 340 ft.....	334.3	341.7
Sand, slightly silty, sand is very fine to medium...	341.7	342.6
Silt, slightly to moderately clayey, slight sandy, silt is coarse to very coarse, sand is very fine, light yellow-gray, slight induration.....	342.6	349.0
Silt, slightly clayey, moderate to very sandy, sand is very fine to medium, contains thin siltstone layers below 350 ft.....	349.0	360.0
Siltstone, contains a few lithic grains, very light yellow-gray.....	360.0	363.0
Tertiary System - Series and Formation undetermined, may be part of Ogallala Group		
Silt, moderately to very clayey, silt is coarse, light olive-gray; medium brown below 366.5 ft.....	363.0	367.5
Silt, slightly to moderately clayey, moderately sandy, sand is very fine to fine, medium brown; moderately to very clayey, slightly sandy below 371.5 ft, mottled olive-gray and light brown; very clayey below 380 ft, slightly sandy, very fine sand, light yellow-gray; moderately sandy below 400 ft.....	367.5	405.0
Silt, slightly to moderately clayey, in part very clayey, moderately sandy, sand is very fine to medium, contains lithic grains of ironstone, limy grains and shale, grains range in size to gravel..	405.0	417.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Shale, clay, medium dark gray.....	417.0	425.0

**16-12-4aaa
25-A-44
Howard County**

Location: NE NE NE, approximately 300 ft S of sec line and near NE
cor sec 4-16N-12W

Ground elevation: 2023 ft (i).

Depth to water: Dry (8-2-44)

Note: USBR Davis Creek Dam Site

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, clayey, slightly sandy, dark brown-gray.....	0.0	5.0
Silt, moderately to very clayey, slightly sandy, light pinkish gray to reddish brown.....	5.0	±20.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, silty, sand mostly fine, light gray to greenish, some siliceous rootlets, slight indura- tion; moderate induration 49 to 54 ft; abundant rootlets below 70 ft.....	±20.0	89.0

**16-12-13abab
42-B-43
Howard County**

Location: NW NE NW NE, approximately 1950 W and 115 S of NE cor sec
13-16N-12W

Ground elevation: 1894.8 ft (i).

Depth to water: 37.0 ft 11/8/43

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Soil and silt, clayey, brownish gray.....	0.0	2.0
Silt, clayey, light yellow-brown, scattered sand grains.....	2.0	11.0
Sand, fine to medium, light gray.....	11.0	25.0
Sand, fine to coarse, light pinkish gray; contains some very coarse sand and a few lithic grains.....	25.0	32.0
Sand and gravel, pinkish gray.....	32.0	37.0
Tertiary System - Miocene Series - Ogallala Group:		
Siltstone, sandy, grayish white, calcareous; some chalky sandy limestone.....	37.0	43.0
Sandstone, silty, grayish white, calcareous; marly below 50 ft.....	43.0	60.0
Sandstone, fine grained, very light olive-gray, very calcareous to 70 ft.....	60.0	90.0
Siltstone, sandy, whitish gray, very calcareous, contains many rootlets; marly in lower part, soft; very hard at 100 ft.....	90.0	100.0

**16-12-18aaaa
13-A-58
Howard County**

Location: NE NE NE NE, 17 ft S and 157 ft W of NE cor sec 18-16N-12W
 Ground elevation: 2060 ft (t) Cotesfield 7.5 min. quadrangle
 Depth to water: 115.5 ft 7/25/58
 Electric log

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, moderately clayey, slightly sandy, sand fine, dark brown-gray; medium brown below 1.5 ft, blocky structure.....	1.5	5.0
Silt, moderately clayey, slightly sandy, mostly fine sand, medium dark brown-gray; medium gray below 7.5 ft, blocky structure.....	5.0	8.0
Silt, very sandy, slightly clayey, sand is very fine to medium, a little coarse sand, medium brown.....	8.0	9.5
Sand, silty, slightly clayey, sand is fine to very coarse, trace of fine gravel.....	9.5	10.0
Silt, moderately sandy, slightly clayey, sand is very fine to medium, medium brown, very slightly calcareous to 14.5 ft, moderately clayey and very sandy below 14.5 ft.....	10.0	15.0
Silt, slightly clayey, moderately sandy, sand is very fine to fine, silt is coarse, medium brown; slightly less clayey below 20 ft; slightly clayey, slightly sandy 25 to 25.5 ft, moderately clayey, moderately sandy below 27.3 ft, slightly calcareous in part below 29.9 ft, a few small limy grains; a few aggregates below 37.2 ft, noncalcareous 33.5 to 35 ft.....	15.0	35.0
Silt, moderately clayey, moderately sandy, sand is very fine to fine with a little medium to coarse sand, medium brown, slightly calcareous.....	35.0	40.0
Silt, slightly clayey, slightly sandy, sand is very fine to fine, medium brown; moderately sandy below 45 ft.....	40.0	48.5
Sand, some gravel, approximately 25 percent gravel..	48.5	49.3
Silt, very sandy, moderately clayey, sand is very fine to medium with some coarse, little yellow-brown, slightly calcareous; very calcareous, light brown-gray 50 to 51.5 ft.....	49.3	53.8
Sand, some gravel, very silty, gravel is fine; slightly silty below 53.8 ft, dark speckled, trace of medium gravel.....	53.8	60.7

Tertiary System - Miocene Series - Ogallala Group:

Silt, slightly clayey, medium olive-gray, coarse silt.....	60.7	61.5
Sand, very fine to medium, a little coarse, olive-green and dark silicates; very fine to coarse sand below 65 ft.....	61.5	68.5
Silt, very sandy, slightly clayey, sand is very fine to fine, medium olive-gray.....	68.5	70.0
Siltstone-sandstone, sand is very fine to fine, light olive-gray, moderately well indurated.....	70.0	74.8
Sandstone, silty, sand is very fine to fine, medium dark gray; contains a few rootlets below 80 ft....	74.8	85.0
Sand, very fine to medium, a little coarse, slight induration, contains olive-gray and dark silicates and rootlets.....	85.0	110.0
Sand, very fine to medium, slight induration, many rootlets; moderately calcareous, moderately well indurated below 115 ft; very calcareous below 120 ft.....	110.0	123.2
Silt, very sandy, slightly clayey, sand is very fine to fine, light olive-gray, moderately calcareous, limy indurated areas to 125 ft.....	123.2	128.0
Sandstone, slightly silty, sand is very fine to fine, medium olive-gray contains a few rootlets below 130 ft.....	128.0	143.5
Silt, very sandy, slightly clayey, sand is very fine to fine, light olive-gray.....	143.5	145.0
Sand, very fine to medium, light olive-gray; mostly very fine to fine sand 155 to 160 ft; some coarse sand below 160 ft, slight induration, contains some clay silt and chert grains and a few siliceous rootlets.....	145.0	165.3
Silt, very sandy, slightly clayey, sand is very fine to fine with a little medium, contains a few rootlets.....	165.3	169.0
Sand, very fine to fine with some medium, slight induration, contains a few rootlets.....	169.0	175.0
Sandstone and silty sand, mostly very fine to fine sand, some beds with a little medium sand, very light olive-gray, poorly indurated, contains a few siliceous rootlets and chert grains below 185 ft; a few small limy areas below 190 ft.....	175.0	200.0
Sand, very silty, slightly clayey, interbedded with some sandy to clayey silt, sand is mostly very fine to fine, light olive-gray, contains some rootlets; moderately clayey below 208.2 ft.....	200.0	209.3

Sandstone, slightly silty, sand is mostly very fine to fine, moderately well indurated, common rootlets; contains a slightly clayey to sandy silt layer 215 to 217 ft.....	209.3	225.0
Silt, slightly clayey, very sandy, sand is mostly very fine to fine, light medium olive-gray, a few limy areas, some induration; very calcareous below 232.5 ft.....	225.0	235.0
Sandstone, silty, sand is very fine to medium, very light olive to whitish gray, very calcareous; contains a few rootlets below 240 ft.....	235.0	243.8
Silt, very sandy, slightly clayey, sand is very fine to fine, very light yellow-gray, moderately calcareous.....	243.8	244.2
Sandstone, slightly silty, sand is very fine to fine, whitish gray, moderately calcareous, moderately well indurated, contains a few rootlets.....	244.2	250.0
Sandstone, sand is mostly very fine to fine, light yellow-to olive-gray, slight induration, a few rootlets.....	250.0	256.4
Silt, slightly clayey, very sandy, sand is very fine to fine, light olive-gray.....	256.4	260.0
Sandstone, moderately silty, sand is very fine to fine, moderately calcareous.....	260.0	263.0
Silt, slightly clayey, very sandy, sand is very fine to fine, light olive-gray, moderately calcareous, contains some medium sand below 265 ft.....	263.0	269.2
Sandstone, sand is very fine to medium, moderately well indurated; slight induration below 275 ft, contains a trace of limy areas.....	269.2	276.4
Silt, slightly clayey, very sandy, sand is very fine to medium, light gray, slightly calcareous.....	276.4	284.2
Sandstone, slightly silty, sand is very fine to medium, marly and very calcareous to 258.5 ft, some marl below 288.5 ft.....	284.2	292.5
Silt, very sandy, marly, sand is very fine to medium, very light olive-gray, very calcareous, slightly indurated below 295 ft, very calcareous 300 to 305 ft; moderately calcareous below 310 ft.	292.5	311.5
Sand, very fine to medium, slight induration, rare limy areas, contains a few rootlets; sandy silt layers 315.8 to 316.7 ft; some dark silicates below 325 ft.....	311.5	329.3
Silt, very sandy and sand, very silty, sand is very fine to medium, light olive-gray; some interbedded siltstone and limy areas below 330 ft.....	329.3	335.0

Silt, slightly clayey, very sandy, sand is very fine to fine, light olive-gray, contains some limy areas; very calcareous, marly areas below 340 ft..	335.0	350.0
Sandstone, slightly silty, sand is very fine to fine, calcareous cementation, a few rootlets; contains some medium and a little coarse sand below 355 ft, silty layer 363 to 364 ft.....	350.0	365.0
Sandstone, sand is very fine to fine, calcareous cementation, contains a few rootlets.....	365.0	366.7
Silt, moderately clayey, very sandy, sand is very fine, light olive-gray, contains a few limy areas; sand is very fine to fine with a little medium sand 375 to 380 ft; some interbedded sandstone below 380 ft, sand is very fine to fine.....	366.7	386.4
Tertiary System - Series and Formation not determined, may be part of Ogallala Group.		
Silt, moderately clayey, moderately sandy, sand mostly very fine, pale brown, moderately calcareous, blocky structure, contains marly areas; very calcareous below 395 ft.....	386.4	400.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, light olive-gray and yellow-brown, moderately calcareous, contains some limonite and hematite...	400.0	410.0
Shale, clay, light medium gray, some yellow-brown, slightly calcareous to 415 ft; a little reddish brown below 415 ft.....	410.0	420.0

**16-12-30ccdc
14-A-58
Howard County**

Location: SW SE SW SW, 10 ft N and 765 ft E of SW cor sec 30-16N-12W
 Ground elevation: 2130 ft (t) Cotesfield 7.5 min. quadrangle
 Depth to water: 140.1 ft 12/1/58
 Electric log

	<u>Depth, in feet</u>	
	From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, slight sandy, sand is very fine, medium yellow-gray, slightly calcareous; medium dark yellow-gray below 2.5 ft; some gastropod shells; medium olive-gray, some yellow stain below 8.5 ft.....	0.0	9.5
Silt, slightly clayey, moderately sandy, sand is very fine, medium dark olive-gray, slightly calcareous, contains a few gastropods; medium yellow-gray below 19 ft; noncalcareous below 20 ft.....	9.5	23.7
Silt, slightly clayey, very slightly sandy, mostly very fine, sandy, medium dark brown-gray, contains some thin dark-gray layers.....	23.7	24.5
Silt, moderately clayey, very slightly sandy, sand is mostly very fine to fine, dark brown-gray; moderately to very clayey 29 to 30 ft, slightly sandy below 30 ft.....	24.5	41.0
Silt, slight to moderately clayey, slightly sandy, sand is very fine, silt is coarse, medium brown; granular structure 49.5 to 50 ft, contains a few shell fragments below 55 ft.....	41.0	58.5
Silt, slightly clayey, moderately sandy, sand is very fine to fine, medium brown, some granular silt particles or lithic grains; slightly calcareous with limy areas below 60 ft, contains a few shells.....	58.5	65.0
Silt, slightly clayey, moderately sandy, mostly very fine sand, medium dark brown, contains a few shells and rootlets, very slightly indurated in upper 0.2 ft; granular structure below 70 ft.....	65.0	72.5
Silt, moderately clayey, moderately sandy, sand is very fine with some fine sand, medium brown, limy nodule at 74.5 ft.....	72.5	75.0

Silt, slightly clayey, slightly sandy, sand is very fine with some fine, medium brown, granular structure in part; limy nodule or layer 77.8 to 78 ft; moderately clayey below 82 ft; contains a few rootlets below 85 ft.....	75.0	89.0
Silt, moderately clayey, slightly sandy, sand is very fine, medium brown, very calcareous 89 to 90 ft, slightly calcareous below 90 ft; limy areas below 92 ft; contains very fine to fine sand below 105 ft; very thin sand and gravel layer at 108.5 ft, marly areas.....	89.0	110.0
Silt, moderately clayey, moderately sandy, sand is very fine to medium, medium dark brown.....	110.0	113.0
Sand, very fine to very coarse, a little fine gravel (10 percent); silty zones.....	113.0	120.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand, silty, moderately clayey, sand is very fine to fine, light olive-gray.....	120.0	123.3
Sand, silty, sand is very fine to medium with a little coarse to very coarse sand; mostly very fine to medium sand below 125 ft, common green silicates and a few rootlets.....	123.3	130.0
Sand, very silty, sand is very fine to fine, slightly clayey to 133 ft, slightly indurated in part, contains a few rootlets.....	130.0	135.0
Sand, slightly silty, sand is very fine to medium, some rootlets.....	135.0	140.0
Sandstone, very silty, sand is very fine to fine, light medium olive-gray, slightly indurated, contains some thin silty sand to sandy silt and sandy siltstone layers; contains rootlets below 148.8 ft; slightly calcareous 154.5 to 165 ft; moderately calcareous 167 to 170 ft.....	140.0	170.0
Siltstone-sandstone, sand mostly very fine, light olive-gray, contains some rootlets.....	170.0	175.0
Silt, very sandy, sand is very fine to medium, olive-gray, some rootlets.....	175.0	178.5
Sand, fine to medium, a little coarse sand, contains rootlets; limy areas below 180 ft.....	178.5	181.0
Silt, very sandy, sand is very fine to fine, olive-gray.....	181.0	188.4
Sandstone, sand is very fine to fine, limy cementation.....	188.4	192.0
Silt, very sandy, sand is very fine to fine with some medium, very calcareous to marl; slight induration below 195 ft; some rootlets below 200 ft...	192.0	201.3
Sand, very fine to medium with some coarse, slightly indurated, contains rootlets.....	201.3	217.9

Silt, slightly clayey, very sandy, sand is very fine, light olive-gray, slightly sandy below 220 ft, slight induration.....	217.9	222.0
Sand, very fine to medium, some coarse; silt layer 237.3 to 238.3 ft.....	222.0	240.0
Silt, slightly clayey, very sandy, very fine to medium sand, light olive-gray; sand layer 250 to 250.7 ft.....	240.0	256.1
Sand, very fine to coarse, some very coarse, contains a trace of fine gravel, slightly indurated, contains rootlets to 270 ft; contains lithic clay grains 275 to 279.7 ft; clayey to sandy silt layer 279.5 to 280.5.....	256.1	285.0
Silt, slightly clayey, sandy, sand is very fine to fine, light olive-gray, granular structure.....	285.0	287.0
Sand, very fine to medium, moderately silty to 290 ft.....	287.0	292.1
Silt, moderately clayey, light olive-gray, granular structure; slightly sandy below 295 ft.....	292.1	297.4
Sand-sandstone, very fine to medium sandy, contains rootlets; very calcareous layer 307.8 to 308.1 ft.	297.4	310.0
Silt, very sandy and sandstone, sand is very fine to fine, whitish to light olive-gray; very calcareous 310 to 315 ft; moderately calcareous 315 to 320 ft; contains rootlets below 320 ft; very calcareous 325.4 to 344.7 ft.....	310.0	345.0
Sand, very fine to medium, some coarse; silty 348.7 to 348.8 ft; contains some lithic grains below 350 ft.....	345.0	350.0
Silt, very sandy, sand is very fine to fine with some medium, moderately calcareous.....	350.0	365.0
Sand, moderately silty, sand is very fine to medium, slight induration.....	365.0	370.0
Silt, very sandy, sand is very fine to fine, some medium, light olive-gray, slight induration.....	370.0	373.8
Marl and limestone, sandy, sand is very fine to fine with some medium.....	373.8	380.0
Sand, very silty, sand is very fine to fine, very calcareous, whitish gray; sandy silt 383 to 384.1 ft.....	380.0	385.0
Silt, very sandy, slightly clayey, sand is very fine to fine, light olive-gray, some limy areas, matrix very slightly calcareous.....	385.0	397.0
Sand, very fine to fine, some medium.....	397.0	405.0
Silt, slightly clayey, very sandy, sand is very fine to medium, light olive-gray, some induration, moderately calcareous.....	405.0	418.0

Sand, very fine to fine, some medium, marly areas, slight induration; some silty areas; very calcareous 425 to 438.7 ft, moderately indurated as sandstone; slightly clayey to sandy, silty layer 438.7 to 440 ft; slightly silty, slight induration below 440 ft; limy areas below 455 ft.....	418.0	460.0
Sand, moderately silty, sand is very fine to fine with some medium sand, very light olive-gray; very silty below 465 ft.....	460.0	467.5
Tertiary System - Series and Formation not determined, may be part of Ogallala Group.		
Silt, moderately clayey, very sandy, sand is very fine to fine, light olive gray; slightly calcareous below 470 ft, very clayey below 480 ft; slight induration below 485 ft.....	467.5	490.0
Silt, very clayey, slightly sandy, sand is very fine, light brown, moderately calcareous; very light olive-gray below 500 ft, moderately sandy below 508 ft; moderately clayey and very sandy 511 to 515 ft; very clayey, slightly sandy below 515 ft.....	490.0	520.5
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, light olive-gray, moderately to very calcareous.....	520.5	530.0