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Phelps County Test Hole Logs

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PHELPS COUNTY
Test-Hole Logs

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Test-Hole Report No. 69

Conservation and Survey Division
Institute of Agriculture and Natural Resources
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Publication and price lists are furnished upon request.

December 1999

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INTRODUCTION

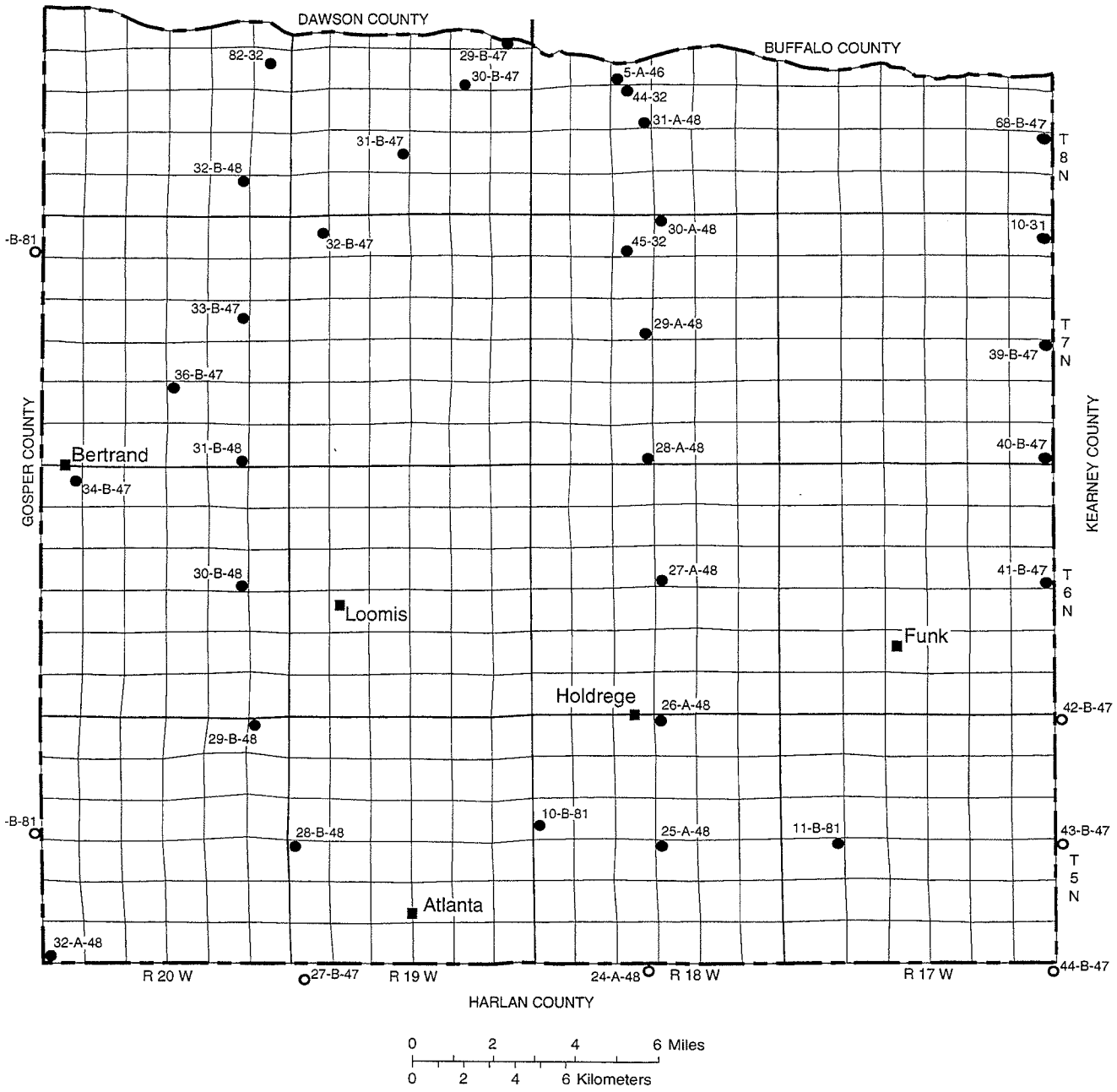
In 1930, the Conservation and Survey Division of the University of Nebraska and the U.S. Geological Survey began a program of cooperative groundwater studies in Nebraska. Since then test drilling by use of rotary drilling equipment has been an integral part of that program. This report contains logs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

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

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, the test holes have been logged electrically. All samples are processed and kept on open file in the offices of Conservation and Survey Division, 113 Nebraska Hall, University of Nebraska-Lincoln, 68588-0517.

Beginning in September 1951, some of the test holes have been logged electrically. Geophysical logs (e-logs) often can be used to determine formation boundaries more precisely than by field sampling, especially where difference in rock types occur at the boundary from one formation to another. Figure 2 is an example of a geophysical log from Phelps County (test hole #11-B-81) with formation boundaries shown. A notation on each test hole log indicates if geophysical logs are part of the original test hole data on file in the CSD office in Lincoln.

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. In the case of Phelps County, descriptions of the strata done in earlier test hole reports as well as formation names have been revised where necessary in this report.



● Test hole description published in this report

○ Test hole description published in other report

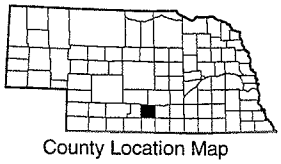


Fig. 1. Test-hole location map of Phelps County.

Figure 2. Phelps County sample geophysical log (11-B-81)

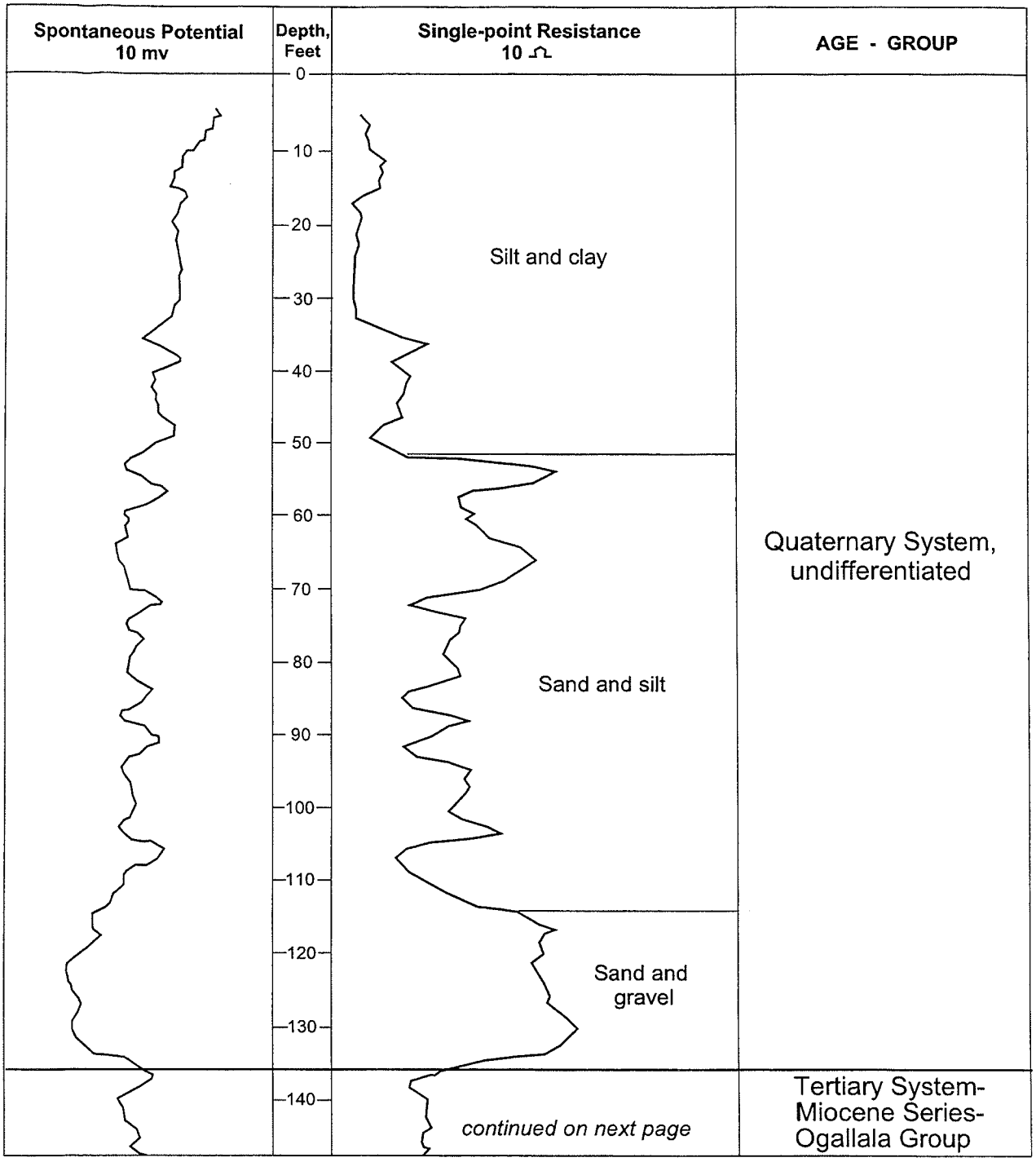
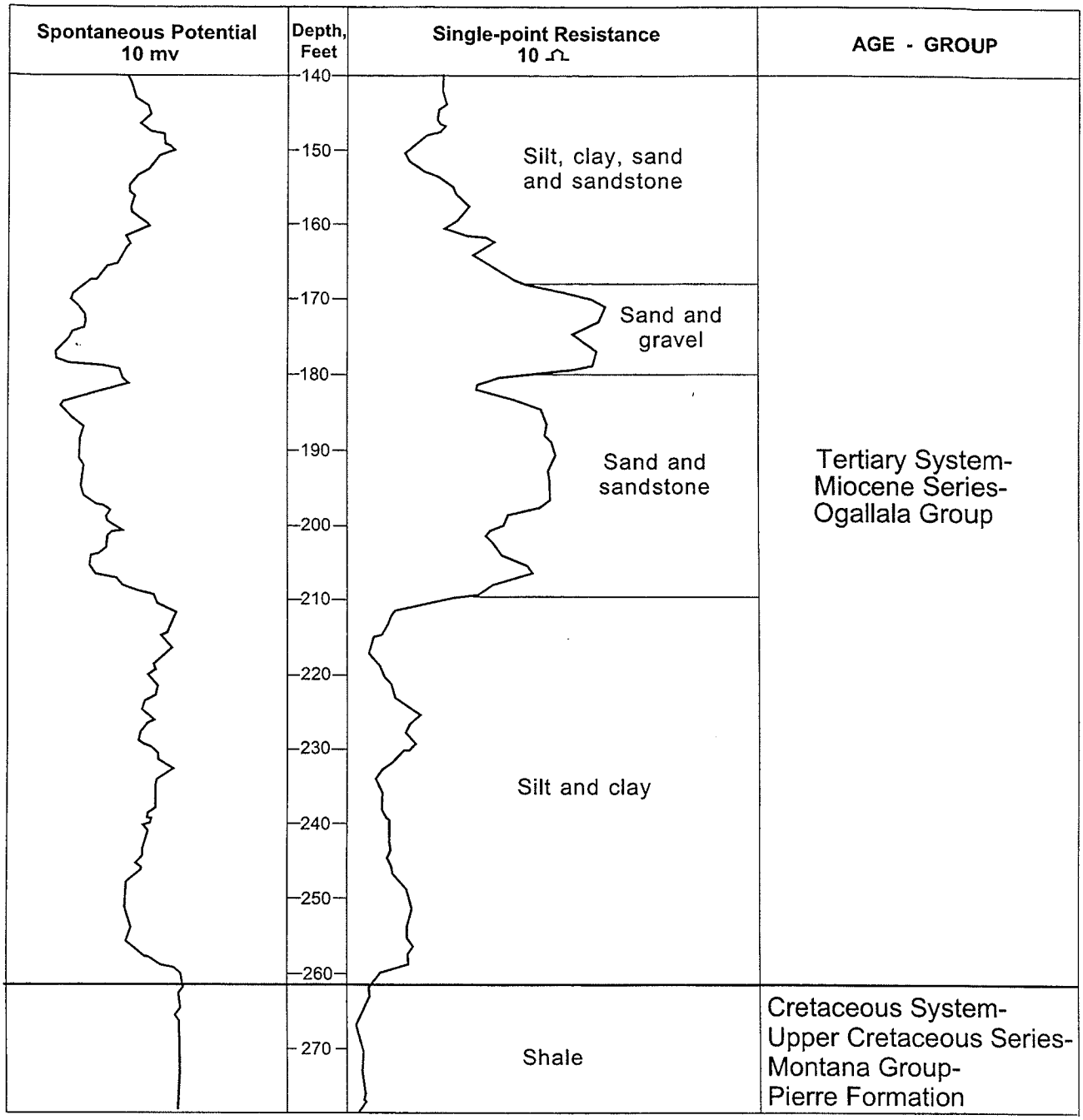


Figure 2. Phelps County sample geophysical log (11-B-81)



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. For each test hole log, the name of the 7.5 minute USGS topographic map on which the hole is located is also included in the heading.

The test-hole records accurately 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 the Conservation and Survey Division.

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 and so on to the quarter-quarter-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-quarter-quarter section and is only utilized if more than one test hole is present in that area. This system of identification is also utilized by the USGS.

Another way of indicating a legal location for a test-hole is shown on figure 3. For example, 5N-4E-15CADC, could also be described as SW SE NE SW Section 15, T 5N, R4E; that is, the test hole is located in the Southwest quarter of the Southeast quarter of the Northeast quarter of the Southwest quarter of Section 15, Township 5 North, Range 4 East. This method to describe the subdivision of a section is used by most other people and agencies, including the CSD. Both methods are shown in Figure 3.

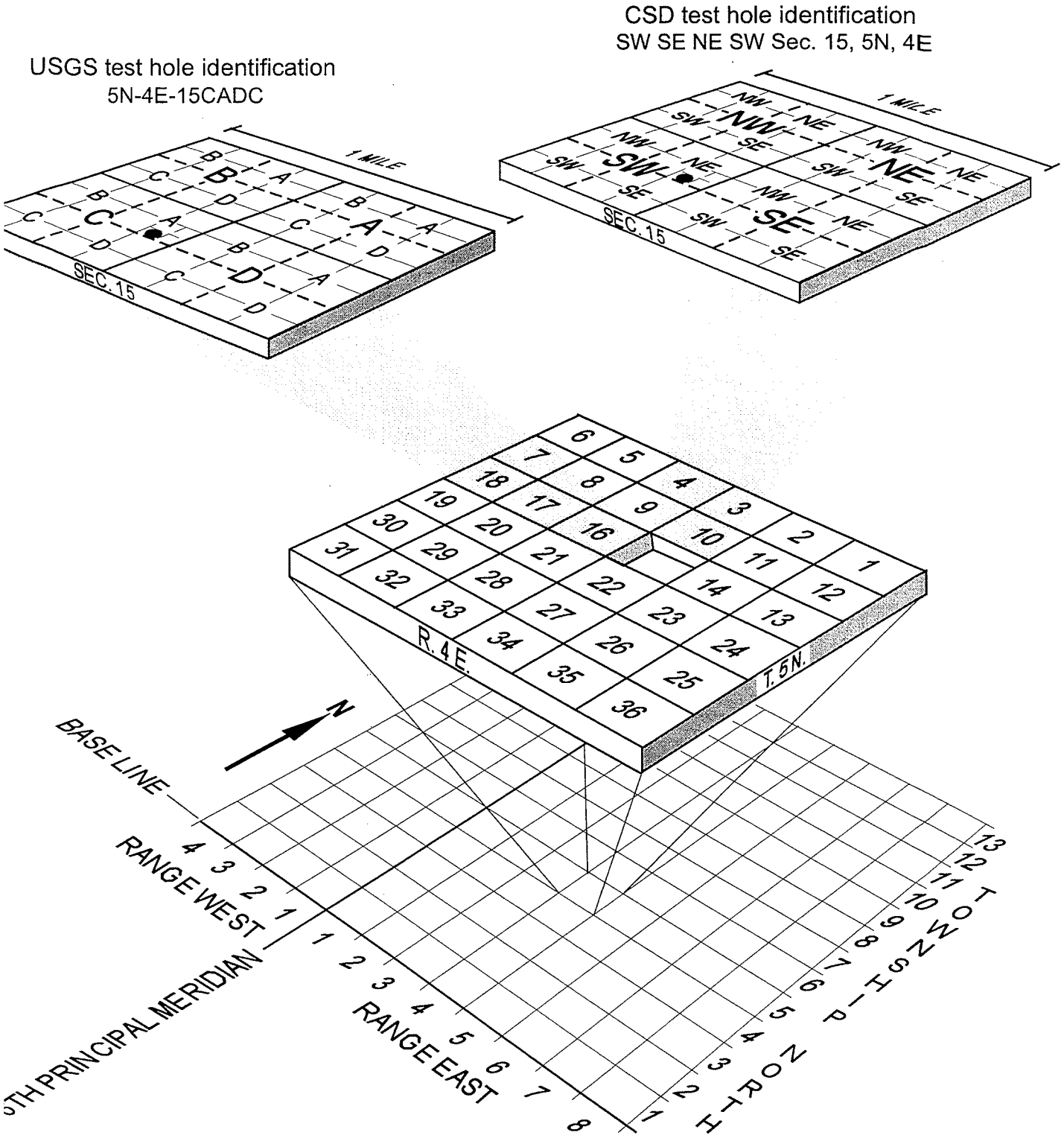


Fig. 3. System for identifying test-hole according to its location.

SELECTED REFERENCES

A few of the most recently published selected references to geology, soils and groundwater resources of Phelps 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 Phelps County

Bowman, G.A., L.G. Ragon, C.L. Hammond, L.E. Brown, and R.A. Boccheciamp 1973, Soil Survey of Phelps County, Nebraska: U.S. Department of Agriculture, Soil Conservation Service, and University of Nebraska, Conservation and Survey Division, 91 p. and accompanying maps.

Dreeszen, V.H., E.C. Reed, R.R. Burchett, and G.E. Prichard.1973. Bedrock geologic map showing thickness of overlying Quaternary deposits , Grand Island quadrangle, Nebraska and Kansas: U.S. Geological Survey Miscellaneous Investigations Map I-819.

Link, M., 1990, A study of nonpoint source ground water contamination in near Wilcox and Hildreth, Nebraska: A Special Protection Area Report: Nebraska Department of Environmental Control, 59 p.

Peckenpaugh, J. M., J.T. Dugan, R.A. Kern, and W.J. Schroeder, 1987. Hydrogeology of the Tri-Basin and Parts of the Lower Republican and Central Platte Natural Resources Districts, Nebraska: U.S. Geological Survey Water-Resources Investigations Report 87-4176, 117 p.

Phelps County
Test-Hole Table of Contents

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

Phelps County
Test-Hole Table of Contents

Arranged by year drilled, test-hole number.

1981

Test Hole #11-B-81
(5-17-19aaaa)
Phelps County

Location: NE NE NE NE sec. 19, T. 5 N., R. 17 W., approximately 147 ft south and 9 ft west of northeast corner.
Ground elevation: 2,253 ft (t). (Holdrege East 7.5 min. quadrangle)
Depth to water: Unknown.
E-log is available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Roadfill and topsoil	0.0	2.5
Clay, very silty, dark grayish brown	2.5	4.2
Silt, slightly to moderately clayey, dark grayish brown to brown	4.2	15.0
Silt, very clayey, dark grayish brown	15.0	15.5
Clay, very silty, dark grayish brown	15.5	16.5
Clay, very silty, light olive gray	16.5	17.5
Silt, moderately to very clayey, olive gray to light brownish gray; contains some iron staining	17.5	35.0
Silt, light yellowish brown; contains some very fine sand	35.0	38.5
Silt, moderately sandy, slightly clayey, light brownish gray; sand is very fine to medium	38.5	40.0
Silt, moderately to very sandy, brown; sand is very fine to fine	40.0	47.0
Silt, moderately to very clayey, slightly sandy, pale-brown; sand is very fine	47.0	51.3
Sand, very fine to fine; contains some medium sand	51.3	56.3
Sand, very silty; sand is very fine to fine; contains some medium sand	56.3	59.5
Sand, very fine to fine; contains some medium sand	59.5	60.2
Sand, very silty; sand is very fine to medium	60.2	61.0
Sand, very fine to coarse; contains some very coarse sand	61.0	70.5
Silt, very sandy, light brownish gray; sand is very fine to fine; contains iron staining	70.5	72.0
Sand, very fine to medium, some coarse	72.0	83.5
Silt, very sandy; sand is very fine to medium	83.5	84.4
Sand, very fine to medium, slightly to moderately silty	84.4	86.0
Sand, very fine to medium	86.0	88.0
Sand, very fine to medium, moderately silty	88.0	91.5
Sand, very fine to coarse; contains a few silt layers	91.5	107.0
Sand, very fine to medium; contains some silt and volcanic ash	107.0	113.5
Sand, fine to coarse; contains some very coarse sand to fine gravel; contains some volcanic ash	113.5	115.0

Sand and gravel, fine sand to medium gravel, 20 percent gravel	115.0	120.0
Sand and gravel, fine sand to medium gravel, 30 percent gravel	120.0	125.0
Gravel, moderately sandy; texture grades from fine sand to coarse gravel (70 percent gravel)	125.0	130.0
Gravel, very sandy; texture grades from fine sand to medium gravel (60 percent gravel); contains trace coarse gravel	130.0	134.5
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, sand is very fine to fine; contains rootlets	134.5	136.4
Silt, very sandy, moderately clayey, very calcareous, light olive gray to white; sand is very fine to medium; contains rootlets very calcareous below 137.5	136.4	140.0
Sand, slightly silty, moderately calcareous, sand is very fine to medium	140.0	146.2
Sand, slightly silty, slightly clayey, slightly calcareous; sand is very fine to medium	146.2	157.0
Clay, moderately silty, moderately sandy, very calcareous, white; sand is very fine to fine; contains rootlets	157.0	163.0
Sand and gravel, fine sand to medium gravel, 70 percent gravel	163.0	179.4
Sand, moderately silty, marly; sand is very fine to medium; contains a lime-cemented sandstone layer from 181.7 to 181.9	179.4	181.9
Sand, very fine to medium, some coarse; below 207.5 ft., marly with interbedded sandstone	181.9	209.5
Silt, moderately sandy, moderately clayey, slightly to moderately calcareous, light gray; sand is very fine to fine; contains limestone layers from 211.5 to 213 ft and from 214.1 to 214.5 ft	209.5	259.4
Clay, slightly calcareous, pale yellow; contains reworked shale, marl, and limestone gravel	259.4	260.5
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Shale, clay, slightly calcareous, pale yellow, weathered; contains some marl and some bentonite lenses; yellow-brown below 269.0 ft	260.5	270.0
Shale, clay, dark gray	270.0	275.0

Test Hole #26-A-48
(5-18-3bbbb)
Phelps County

Location: NW NW NW NW sec. 3, T. 5 N., R. 18 W., approximately 120 feet south and 14 feet east of northwest corner.
Ground elevation: 2,306 ft (i). (Holdrege East 7.5 min. quadrangle)
Depth to water: 129.3 ft (8-20-48).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, moderately clayey, dark brownish gray, slightly lighter below 2.0 ft.....	0.0	2.5
Silt, slightly clayey, slightly calcareous, light brownish gray, contains a few limy nodules.....	2.5	4.5
Silt, slightly calcareous, very light yellowish gray, coarse texture, contains a few limonitic flecks, and gastropods, less yellow below 10.0 ft., noncalcareous below 15.0 ft.....	4.5	20.0
Silt, slightly calcareous, light buff gray with a yellow tint, fine to coarse texture.....	20.0	27.0
Silt, soil-like, slightly clayey to slightly sandy, grayish brown with a slight red tint, contains very fine to medium sand.....	27.0	30.0
Silt, very sandy, yellowish brown, contains very fine sand, slightly sandy below 35.0 ft., moderately sandy, slight red tint and contains very fine to coarse sand below 40.0 ft.....	30.0	46.0
Sand, very light brown, texture grades from very fine to medium sand, rounded and frosted, principally quartz with a trace of pink feldspar and dark minerals, contains a trace of coarse sand below 50.0 ft.....	46.0	60.0
Silt, clayey, light brownish gray with a pink tint, embedded very fine to medium sand.....	60.0	65.0
Silt, moderately clayey to slightly sandy, yellowish brown with a slight red tint, contains very fine to fine sand.....	65.0	68.0
Sand, yellowish brown, texture grades from very fine to medium sand, principally quartz, much rounded, moderately frosted.....	68.0	70.0
Sand, silty, to silt, sandy, yellowish brown with a red tint, contains very fine to medium and a trace of coarse sand, less silty below 75.0 ft.....	70.0	80.0
Sand, light yellowish brown, texture grades from very fine to medium sand, principally quartz, moderately rounded and frosted, contains some coarse sand below 95.0 ft.....	80.0	98.0

Silt, moderately clayey, yellowish red, coarse texture, very light gray below 104.5 ft.....	98.0	105.5
Sand, texture grades from very fine to medium sand, principally quartz, moderately rounded and frosted	105.5	113.5
Silt, slightly clayey to very sandy, very light gray with a slight yellow tint, contains very fine to medium sand and a trace of coarse sand.....	113.5	114.5
Sand, texture grades from fine to medium and some coarse sand, principally quartz, rounded and frosted, slightly coarser texture below 120.0 ft..	114.5	125.0
Sand, texture grades from very fine to fine and some medium sand, principally quartz, very rounded and frosted, contains some coarse sand below 130.0 ft.	125.0	135.0
Sand, texture grades from very fine to very coarse sand, principally quartz, moderately rounded and frosted, some polished grains.....	135.0	150.0
Sand and gravel, texture grades from medium sand to medium gravel, principally quartz with some pink and light colored feldspars, and a few dark minerals, 40 percent gravel, 55 percent gravel below 160.0 ft., trace of coarse gravel below 165.0 ft..	150.0	170.0
Sand and some gravel, texture grades from fine to very coarse sand and some fine to coarse gravel, principally quartz and some feldspar, contains 15 to 20 percent gravel.....	170.0	184.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand, texture grades from very fine to medium sand, principally quartz, well rounded, slightly frosted, contains some calcareous cement.....	184.0	193.0
Sandstone, slightly silty, light brownish gray, texture grades from very fine to medium sand, contains some siliceous rootlets, contains a trace of coarse sand and less indurated below 195.0 ft..	193.0	200.0
Sand, light brownish gray, texture grades from very fine to medium sand, slightly indurated.....	200.0	245.0
Sand, texture grades from fine to very coarse sand, contains much quartz, moderately rounded and polished, grades coarser with depth.....	245.0	270.0
Sand and gravel, texture grades from fine sand to fine gravel with a trace of medium gravel, contains much quartz and a trace of pink feldspar, moderately rounded and polished.....	270.0	290.0
Sand, texture grades from fine to medium sand, principally quartz, subangular, rounded and very polished.....	290.0	303.5

Cretaceous System - Upper Cretaceous Series - Montana Group:

Pierre Formation:

Clay, silty, very calcareous, yellow mottled white and yellowish brown, contains some aragonite and chalk grains below 305.0 ft., white to very light yellowish gray below 310.0 ft., less silty below 315.0 ft.....	303.5	323.0
Clay shale, silty, moderately to very calcareous, medium gray, slightly more silty below 335.0 ft...	323.0	340.0

Test Hole #10-B-81
(5-18-18cbcb)
Phelps County

Location: NW SW NW SW sec. 18, T. 5 N., R. 18 W., approximately 1896 ft north and 11 ft east of southwest corner.
Ground elevation: ~~2,293~~ 2393 ft (t). (Holdrege West 7.5 min. quadrangle)
Depth to water: 231 ft (estimated from e-log).
E-log is available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Roadfill	0.0	1.8
Soil: Silt, slightly to moderately clayey, dark to very dark grayish brown	1.8	3.2
Silt, moderately clayey, dark brown to brown	3.2	6.5
Silt, slightly clayey, dark grayish-brown	6.5	10.0
Silt, slightly clayey to moderately clayey, slightly calcareous, light yellowish brown; contains some iron-staining	10.0	29.0
Silt, slightly clayey, slightly calcareous, brownish yellow to yellowish-brown	29.0	33.5
Soil: Silt, slightly clayey, dark brown	33.5	37.0
Silt, slightly to moderately clayey, dark yellowish-brown; contains some very fine sand	37.0	39.0
Silt, moderately clayey, slightly sandy, yellowish-brown; contains some iron-staining; moderately sandy below 46 ft	39.0	50.0
Silt, slightly to moderately clayey, slightly to moderately sandy, brown to light yellowish-brown; sand is very fine; below 74 ft, very sandy	50.0	80.0
Sand, slightly silty; sand is very fine to fine	80.0	83.0
Silt, moderately sandy, light yellowish brown; sand is very fine to fine	83.0	85.0
Sand, very fine to medium	85.0	92.0
Silt, very sandy: sand is very fine to fine	92.0	98.3
Sand, very fine to medium, some coarse	98.3	114.5
Silt, very sandy, slightly clayey, yellowish brown; sand is very fine to fine	114.5	121.0
Sand, very fine to medium, some coarse	121.0	155.3
Silt, sandy, slightly clayey, brownish-yellow	155.3	155.8
Sand, very fine to medium	155.8	160.0
Silt, slightly to moderately clayey, slightly sandy, yellowish brown; sand is very fine	160.0	165.0
Silt, moderately to very sandy, slightly clayey, yellowish-brown to light yellowish-brown; sand is very fine to medium	165.0	180.0
Sand, very silty; sand is very fine to medium	180.0	188.0
Silt, very sandy, light yellowish-brown; sand is very fine to fine	188.0	193.0

Sand, very fine to very coarse, some very coarse....	193.0	200.0
Sand and gravel, coarse sand to medium gravel (60 percent gravel).....	200.0	230.0
Silt, sandy, slightly clayey, light yellowish-brown; sand is very fine.....	230.0	231.0
Sand and gravel, medium sand to medium gravel, much coarse sand to fine gravel.....	231.0	259.0
Silt, moderately to very sandy, yellowish-brown; sand is very fine.....	259.0	262.5
Tertiary System - Miocene Series - Ogallala Group:		
Silt, marly, very pale-brown.....	262.5	266.0
Silt, moderately clayey, slightly sandy, very pale brown; sand is very fine; moderately calcareous below 269 ft.....	266.0	273.0
Sand, very silty.....	273.0	275.0
Marl, very sandy, pale yellow.....	275.0	278.0
Sand, very fine to fine, marly.....	278.0	281.0
Silt, very sandy, slightly to moderately clayey, olive.....	281.0	285.0
Sand, very fine to medium, much fine.....	285.0	288.0
Clay, slightly silty, slightly sandy, pale olive....	288.0	289.0
Sand, slightly silty; sand is very fine to fine; contains some sandstone and a few rootlets.....	289.0	305.0
Silt, moderately sandy, slightly to moderately clayey, very slightly calcareous, olive; sand is very fine to fine.....	305.0	311.0
Silt, slightly to moderately clayey, slightly sandy, very slightly calcareous, dark brown; sand is very fine.....	311.0	313.0
Sand, moderately silty; sand is very fine to fine...	313.0	315.0
Silt, very sandy, light brownish-gray.....	315.0	318.0
Sand, slightly silty, very calcareous; sand is very fine to fine, some medium.....	318.0	322.0
Sand, very fine to medium; contains a few rootlets and limy nodules.....	322.0	328.0
Silt, very sandy, slightly clayey, moderately calcareous, light gray; sand is very fine to fine.	328.0	332.0
Sand, very fine to coarse, much fine to medium sand; contains rootlets.....	332.0	359.0
Silt, slightly to moderately clayey, slightly sandy, light gray to light brownish gray; sand is very fine.....	359.0	370.0
Sand, very fine to coarse; contains rootlets.....	370.0	372.0
Silt, moderately sandy, slightly clayey, brown; sand is very fine to fine.....	372.0	378.0
Sand, slightly gravelly, fine sand to fine gravel (5 percent gravel), rootlets.....	378.0	413.0
Silt, slightly to moderately clayey, yellowish brown to light brownish-gray.....	413.0	419.0

Sand, slightly gravelly, fine sand to fine gravel (3 to 5 percent gravel); contains a clay lense from 442 to 443 feet.....	419.0	451.0
Clay, moderately silty, olive.....	451.0	453.0
Sand, slightly gravelly. Fine sand to fine gravel (5 percent gravel), much medium to coarse sand....	453.0	475.0
Claystone, siliceous, olive.....	475.0	476.0
Gravel, lithic claystone and calcareous rock fragments.....	476.0	478.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Shale, gray, slightly calcareous.....	478.0	480.0
Shale, dark gray, slightly calcareous.....	480.0	500.0

Test Hole #25-A-48
(5-18-22bbbb)
Phelps County

Location: NW NW NW NW sec. 22, T. 5 N., R. 18 W., approximately 26 feet south and 163 feet east of northwest corner.
Ground elevation: 2,317 ft (t). (Holdrege East 7.5 min. quadrangle)
Depth to water: Unknown. Test-hole caved at 161 ft (8-19-48).
No e-log available

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, dark brown	0.0	3.0
Silt, medium buff to dark gray	3.0	29.0
Silt, light to medium reddish brown	29.0	50.0
Silt, in part sandy, light buff to gray, contains very fine sand, slightly calcareous from 70.0 to 81.0 ft	50.0	117.5
Sand and gravel, grayish tan to yellow and pink, texture grades from fine sand to coarse gravel	117.5	183.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, moderately calcareous, grayish tan	183.0	185.0
Sand, medium grayish tan, medium texture	185.0	190.0
Sandstone and marl, interbedded, medium gray to white	190.0	207.5
Silt and sand, interbedded, moderately calcareous, light gray to tan	207.5	214.5
Sand, medium grayish tan, texture grades from fine to medium sand	214.5	240.0
Sandstone and siltstone, interbedded, slightly to moderately calcareous, light tan to white	240.0	245.0
Sandstone, slightly to moderately calcareous, light grayish tan	245.0	260.0
Sandstone, slightly silty, medium tan, few pebbles	260.0	270.0
Sandstone, reddish tan, silty below 275.0 ft	270.0	287.5
Silt, clayey to sandy, dark reddish tan, contains fine sand	287.5	294.0
Sand and gravel, gray to yellow and pink, texture grades from fine sand to fine gravel	294.0	298.0
Sand, silty, light gray	298.0	306.0
Sand, light grayish tan, texture grades from fine to coarse sand, few clay shale fragments below 310 ft	306.0	313.5
Clay, medium reddish brown, some interbedded, light gray sandy clay from 320.0 to 325.0 ft	313.5	334.0
Sand and gravel, texture grades from coarse sand to medium gravel, few red clay fragments	334.0	362.5
Silt, moderately calcareous, light gray, some interbedded sand below 370.0 ft	362.5	378.0

Cretaceous System - Upper Cretaceous Series - Montana Group:
Pierre Formation:

Clay shale, moderately calcareous, medium gray.....	378.0	400.0

Test Hole #28-B-48
(5-19-19bbbb)
Phelps County

Location: NW NW NW NW sec. 19, T. 5 N., R. 19 W., approximately 53 feet south and 19 feet east of northwest corner.
Ground elevation: 2,391 ft (i). (Loomis 7.5 min. quadrangle)
Depth to water: 187.8 ft (8-17-48).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, slightly clayey, dark brownish gray....	0.0	2.0
Silt, in part moderately calcareous, brownish buff with gray tint, few gastropod shells.....	2.0	28.0
Silt, soil-like, reddish brown.....	28.0	32.0
Silt, in part sandy, reddish tan, contains very fine sand.....	32.0	40.0
Silt, slightly clayey, slightly to very calcareous, light reddish tan.....	40.0	50.0
Silt, moderately calcareous, tannish gray, contains very fine to fine sand below 57.0 ft., reddish tan below 60.0 ft.....	50.0	75.0
Silt, very sandy, slightly to moderately calcareous, brownish tan with gray tint, contains very fine to medium sand with some coarse sand, contains a few rootlets below 84.5 ft.....	75.0	93.0
Silt, in part sandy silt, reddish tan, contains very fine sand, brownish gray to buff and moderately calcareous below 110.0 ft.....	93.0	120.0
Silt, slightly calcareous, brownish gray, contains very fine to medium sand below 125.0 ft.....	120.0	140.0
Silt, sandy, to sand, silty, tannish brown, contains fine to medium sand with some coarse sand.....	140.0	145.0
Sand, brownish gray with some pink grains, texture grades from fine to medium sand with some coarse sand.....	145.0	170.0
Silt, sandy, moderately calcareous, light brownish gray, contains some fine sand.....	170.0	173.0
Sand and gravel, brownish gray to pink, texture grades from fine sand to medium gravel with some coarse gravel.....	173.0	298.0
Silt, in part clayey to sandy, light gray.....	298.0	300.0
Sand and gravel, brownish gray to pink, texture grades from medium sand to medium gravel.....	300.0	316.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, sandy to slightly clayey, light greenish to brownish gray, contains very fine to fine sand, slightly calcareous below 320.0 ft.....	316.0	325.0

Silt, slightly sandy, slightly to moderately calcareous, grayish tan with pink tint, light gray and very calcareous below 330.5 ft	325.0	334.5
Silt, very calcareous, brownish tan	334.5	338.0
Silt, very sandy, light gray with green tint	338.0	342.5
Silt, clayey, slightly calcareous, brownish tan with pink tint	342.5	350.0
Sand and some gravel, gray with pink tint, texture grades from very fine sand to fine gravel	350.0	353.0
Silt, slightly sandy, very calcareous, light gray	353.0	354.5
Silt, slightly clayey, slightly calcareous, light greenish gray	354.5	385.0
Silt, slightly sandy, very slightly calcareous, light greenish gray	385.0	395.0
Silt, slightly clayey to slightly sandy, light brownish tan	395.0	400.5
Sand and some gravel, light brownish gray, texture grades from fine sand to fine gravel, silty in upper part	400.5	418.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, moderately to very calcareous, very light gray	418.0	422.0
Clay shale, moderately calcareous, medium gray	422.0	440.0

Test Hole # 29-B-48
(5-20-1bbbb)
Phelps County

Location: NW NW NW NW sec. 1, T. 5 N., R. 20 W., approximately 12 feet south and 60 feet east of northwest corner.
Ground elevation: 2,443 ft (i). (Loomis 7.5 min. quadrangle)
Depth to water: Unknown. Test-hole caved at 21.2 ft (8-19-48).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, very slightly sandy, dark brownish gray, contains very fine to fine sand.....	0.0	2.0
Silt, moderately clayey, dark grayish brown, medium grayish brown below 3.0 ft.....	2.0	3.5
Silt, slightly to moderately calcareous, very light buff gray, fine texture, contains a few gastropods, very light brownish yellow below 5.0 ft., less gastropods from 15.0 to 20.0 ft.....	3.5	25.0
Silt, slightly clayey, very light brown.....	25.0	27.5
Silt, soil-like, brown, moderately clayey and grayish brown below 30.0 ft.....	27.5	32.5
Silt, moderately clayey, light yellowish brown, coarse texture, embedded very fine and fine sand, slightly calcareous and very light brown with a pink tint below 35.0 ft.....	32.5	40.0
Silt, slightly to moderately calcareous, very light brown, fine to coarse texture, embedded very fine to fine sand, contains a few limy nodules, slightly clayey from 42.5 to 45.0 ft., slightly lighter and very calcareous below 60.0 ft.....	40.0	70.0
Silt, sandy, moderately calcareous, light brown with a red tint, contains very fine to fine sand.....	70.0	75.0
Sand, moderately silty, slightly calcareous, light brown, texture grades from very fine to medium with a trace of coarse sand, moderately rounded and very frosted, more silty below 80.0 ft.....	75.0	82.5
Sand, very light brown, texture grades from very fine to coarse sand, principally quartz and a trace of pink feldspar, very rounded and frosted..	82.5	99.0
Silt, sandy, moderately calcareous, very light brown, contains very fine to coarse sand.....	99.0	101.5
Sand, texture grades from fine to coarse sand, principally quartz, very rounded, moderately frosted and slightly polished.....	101.5	109.0
Silt, slightly sandy, moderately calcareous, light brown, coarse texture, contains very fine to fine sand, contains a few rootlets.....	109.0	112.0

Sand, texture grades from very fine to medium and some coarse sand, very rounded, moderately frosted and polished.....	112.0	127.0
Silt, slightly sandy, very slightly calcareous, yellowish brown, coarse texture, contains very fine to fine sand.....	127.0	130.0
Silt, sandy, very slightly calcareous, yellowish brown, contains very fine sand, contains a few limy concretions below 135.0 ft.....	130.0	140.0
Silt, very slightly calcareous, light brown with a yellow tint, fine to coarse texture.....	140.0	142.5
Siltstone, slightly sandy, very calcareous, light brownish gray, contains very fine sand and a trace of fine sand, in part marly and well indurated, less sandy and slightly calcareous below 145.0 ft.	142.5	149.0
Silt, light brown, fine to coarse texture, slightly clayey from 152.8 to 155.0 ft. and below 165.0 ft., yellow tint below 155.0 ft., slightly sandy, very fine below 175.0 ft., contains very fine to medium sand below 180.0 ft.....	149.0	185.0
Silt, moderately sandy, in part very calcareous and indurated, very light brown, contains very fine to fine sand with some medium sand, light brown, more medium sand below 190.0 ft.....	185.0	194.0
Sand, texture grades from very fine to very coarse sand and a trace of fine gravel, principally quartz and a trace of light colored and pink feldspar, some rounded, frosted and a few polished grains.....	194.0	200.0
Sand and gravel, texture grades from medium sand to fine gravel and some medium gravel, principally quartz and some pink feldspars, contains 35 percent gravel.....	200.0	205.0
Sand and some gravel, texture grades from fine to very coarse sand and some fine to medium gravel, principally quartz and some feldspar, contains 15 percent gravel, rounded, frosted and moderately polished.....	205.0	210.0
Sand and gravel, texture grades from medium sand to medium gravel, quartz and feldspar, contains 50 percent gravel, some iron stains from 210.0 to 220.0 ft., very polished below 220.0 ft.....	210.0	240.0
Sand and gravel, texture grades from fine to very coarse sand and some fine gravel, principally quartz, moderately rounded and frosted with a trace of polished grains, 15 to 20 percent gravel to 245.0 ft.....	240.0	250.0
Sand and gravel, light yellow, texture grades from medium sand to medium gravel, quartz and feldspar, 40 percent gravel from 250.0 to 255.0 ft., 50 to 70 percent gravel below 255.0 ft.....	250.0	285.0

Silt, slightly clayey, moderately calcareous, light brown, grading very fine to medium sandy, some white calcareous spots and slightly indurated below 290.0 ft	285.0	297.0
Sand, texture grades from fine to very coarse and a trace of fine gravel, contains much quartz and a trace of pink feldspar, very polished	297.0	300.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, very calcareous, white, texture grades from very fine to medium and a trace of coarse sand, contains a few rootlets	300.0	306.0
Sand, texture grades from fine to very coarse sand, contains much quartz and some feldspar, moderately rounded, very polished, slightly finer below 310ft	306.0	322.0
Marl, slightly sandy, white, contains very fine to fine sand	322.0	323.0
Silt, sandy, light yellowish gray, in part calcareous, contains very fine to fine, some medium sand	323.0	326.0
Sand, texture grades from fine to very coarse sand, contains much quartz, moderately rounded, very polished	326.0	331.0
Sandstone, very calcareous, light yellowish gray, texture grades from very fine to fine and a trace of medium sand	331.0	334.0
Silt, moderately sandy, light gray, contains very fine sand, in part marly	334.0	335.0
Sand, silty, to silt, sandy, light yellow with a green tint, contains very fine to fine sand, consolidated below 342.5 ft	335.0	345.0
Sandstone, in part silty and clayey, light yellow with a green tint, contains very fine to fine sand	345.0	350.0
Silt, clayey, light brownish gray, mottled brown from 354.5 to 360.5 ft., moderately to very calcareous and light greenish gray below 360.5 ft., sandy and contains a few thin limy nodular zones below 365.0 ft	350.0	370.5
Sand, texture grades from fine to coarse sand and a trace of fine gravel, principally quartz	370.5	376.0
Silt, sandy, moderately calcareous, very light gray with a brown tint, contains many calcareous nodular fragments below 390.0 ft	376.0	400.0
Silt, clayey, moderately calcareous, brownish tan	400.0	410.0
Sandstone to marl, light gray with a pink tint	410.0	416.0
Silt, slightly clayey to slightly sandy, slightly calcareous, light greenish gray, some pink limy layers below 420.0 ft., very sandy below 426.0 ft.	416.0	430.0
Sandstone and some silt, sandy, interbedded, light greenish gray	430.0	434.0
Silt, clayey to slightly sandy, slightly calcareous, reddish brown	434.0	445.0

Sand, light brownish gray, texture grades from very fine to very coarse, contains some fine gravel below 460.0 ft.....	445.0	467.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, slightly silty, moderately to very calcareous, very light gray.....	467.0	471.5
Clay, very calcareous, very light gray with some yellow limonite stains.....	471.5	475.0

Test Hole #32-A-48
(5-20-31cccc)
Phelps County

Location: SW SW SW SW sec. 31, T. 5 N., R. 20 W., approximately 3 feet north and 324 feet east of southwest corner.
Ground elevation: 2,279 ft (t). (Oxford 7.5 min. quadrangle)
Depth to water: 88.4 ft. (8-27-48)
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil and road fill: silt, sandy, dark brown, contains fine sand	0.0	1.5
Soil: clay, silty, medium brown	1.5	3.0
Silt, brownish buff, few gastropod shells	3.0	27.0
Silt, clayey, medium brownish buff	27.0	28.5
Silt, clayey, soil-like, dark brown	28.5	32.0
Silt, clayey, light to medium brownish tan, few thin calcareous zones, slightly sandy below 70.0 ft	32.0	75.0
Silt, clayey to sandy, light brownish tan, contains fine sand, few thin calcareous zones	75.0	80.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, very calcareous, white and brownish tan	80.0	83.0
Silt, sandy, and sand, calcareous, light grayish white to brown	83.0	87.0
Silt, sandy, light greenish gray with yellow tint	87.0	88.0
Sandstone, slightly calcareous, light gray to white.	88.0	94.0
Sand to sandstone, light brownish gray, texture grades from fine to coarse sand with trace of fine gravel	94.0	110.0
Sand and gravel, brownish gray to pink, texture grades from medium sand to medium gravel with some coarse gravel	110.0	116.0
Sandstone, light brownish gray, contains many rootlets, texture grades from fine to medium sand	116.0	125.0
Silt, slightly calcareous, white	125.0	129.5
Sandstone, brownish gray, texture grades from fine to medium sand	129.5	134.5
Silt and clay, in part slightly calcareous, grayish white	134.5	139.5
Sandstone, brownish gray to white, texture grades from fine to medium sand	139.5	170.0
Sand, light brownish gray, texture grades from fine to medium sand, few calcareous zones below 180.0 ft	170.0	193.0
Silt, sandy, light gray	193.0	194.5
Silt, light reddish brown, some clay below 200.0 ft.	194.5	206.0
Sand and some gravel, light brownish gray to pink, texture grades from fine sand to fine gravel	206.0	235.0

Cretaceous System - Upper Cretaceous Series - Montana Group:

Pierre Formation:

Clay, light gray, few limonitic flecks and fragments	235.0	243.0
Clay shale, very dark gray with brown tint.....	243.0	248.0
Clay shale, in part slightly calcareous, dark gray..	248.0	260.0

Test Hole #41-B-47
(6-17-13dddd)
Phelps County

Location: SE SE SE SE sec. 13, T. 6 N., R. 17 W., approximately 116 feet north and 10 feet west of southeast corner.
Ground elevation: 2,217 ft (i). (Axtell West 7.5 min. quadrangle)
Depth to water: Unknown; Test-hole caved at 65.2 ft (8-21-47).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Road fill: silt, slightly clayey, dark brownish gray	0.0	1.0
Soil: silt, very dark brownish gray.....	1.0	3.5
Silt, moderately clayey, very slightly calcareous, medium grayish brown.....	3.5	5.0
Silt, slightly clayey, moderately calcareous, light brownish gray, contains a few limonitic flecks....	5.0	7.5
Silt, moderately calcareous, light buff to yellowish gray, contains a few limonitic flecks and nodules.	7.5	10.0
Silt, moderately calcareous, very light buff gray, contains many limonitic flecks and nodules from 15.0 to 17.5 ft., less calcareous below 20.0 ft...	10.0	27.0
Silt, very slightly clayey, very light brown, slightly darker from 27.0 to 28.0 ft.....	27.0	30.5
Silt, slightly clayey, soil-like, brown and a trace of dark grayish brown, embedded fine to very coarse sand, medium grayish brown with a yellow tint from 32.0 to 33.5 ft.....	30.5	33.5
Silt, sandy, very slightly calcareous, light brownish gray with a yellow tint, contains very fine to fine sand.....	33.5	40.0
Silt, sandy, to sand, silty, light brownish gray with a yellow tint; sand is very fine to medium...	40.0	45.0
Sand, silty, very light yellowish brown, texture grades from very fine to coarse and a trace of very coarse sand.....	45.0	50.0
Sand, slightly silty, very light brownish gray, texture grades from very fine to medium and some coarse sand, principally quartz, very rounded and frosted, slightly coarser below 55.0 ft., contains some silty zones below 64.5 ft.....	50.0	68.5
Silt, slightly clayey to slightly sandy, very slightly calcareous, very light brown, contains very fine to fine sand.....	68.5	70.0
Silt, slightly clayey to very sandy, very light brown, contains very fine to medium sand, some embedded coarse sand and gravel below 75.0 ft.....	70.0	80.0
Silt, very sandy, contains very fine to fine sand, some coarser sand and fine to coarse gravel.....	80.0	85.5

Sand and gravel, brownish gray, texture grades from fine sand to fine gravel, contains some limonitic stains	85.5	90.0
Sand and gravel, light brownish gray, texture grades from fine sand to medium gravel, contains a trace of coarse gravel below 100.0 ft., slightly finer and some limonitic stains below 130.0 ft., contains a yellowish brown clayey silt from 137.0 to 138.0 ft	90.0	138.0
Sand, light brownish gray with a yellow tint, texture grades from fine to very coarse sand and a trace of fine to medium gravel	138.0	150.0
Sand and gravel, light brownish gray with a yellow tint, texture grades from medium sand to medium gravel with a trace of coarse gravel	150.0	164.0
Sand and some gravel, light brownish gray, texture grades from fine to coarse sand with some very coarse sand to fine gravel	164.0	174.5
Silt, slightly clayey, slightly sandy, slightly calcareous, light brownish gray; sand is very fine to fine, trace medium sand; moderately clayey from 185 to 195 ft below 195, moderately sandy	174.5	200.0
Silt, slightly clayey, slightly sandy, slightly calcareous, brownish gray; sand is very fine; contains hard zones from 200.0 to 200.5 ft. and from 209.8 to 210.0 ft; contains a few rootlets from 205 to 210 ft	200.0	229.0
Sand and gravel, light brownish gray, texture grades from fine sand to fine gravel	229.0	235.0
Tertiary System - Miocene Series - Ogallala Group:		
Clay and limestone, interbedded, light brownish tan.	235.0	240.5
Silt, clayey, light reddish tan, contains several thin hard limy layers, blocky, contains some green clay below 255.0 ft	240.5	260.0
Silt, clayey, reddish brown, contains a brown sandstone layer from 260.0 to 261.0 ft	260.0	269.0
Sandstone, light brownish tan, texture grades from very fine to medium sand	269.0	276.0
Marl, white	276.0	278.0
Silt, slightly clayey to sandy, slightly calcareous, light greenish gray, contains some hard limy zones below 285.0 ft	278.0	290.0
Clay, very calcareous, light gray	290.0	292.0
Silt, sandy, light greenish gray, contains very fine to fine sand, moderately calcareous with hard zones below 295.0 ft	292.0	300.0
Silt, sandy, and clay, interbedded, moderately calcareous, light greenish gray, contains very fine sand	300.0	321.5
Sand, silty, slightly calcareous, light greenish gray	321.5	327.0

Cretaceous System - Upper Cretaceous Series - Montana Group:

Pierre Formation:

Clay shale, moderately calcareous, medium gray, dark gray below 330.0 ft.....	327.0	340.0

Test Hole #27-A-48
(6-18-15cccc)
Phelps County

Location: SW SW SW SW sec. 15, T. 6 N., R. 18 W., approximately 17 feet north and 68 feet east of southwest corner.
Ground elevation: 2,323 ft (i). (Holdrege East 7.5 min. quadrangle)
Depth to water: 124.9 ft (8-20-48).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: Silt, dark brown	0.0	1.5
Silt, light to medium buff, few calcareous nodules	1.5	15.0
Silt, sandy, medium reddish brown, contains very fine sand	15.0	20.0
Sand, light reddish brown to tan, texture grades from fine to coarse sand	20.0	61.5
Silt, light reddish brown to tan	61.5	70.0
Silt, sandy, reddish tan, contains very fine sand	70.0	80.0
Silt, slightly clayey, medium brown	80.0	82.0
Silt, light gray, few calcareous nodules	82.0	96.0
Silt, sandy, grayish tan, contains very fine sand	96.0	99.5
Sand, slightly silty, tan, very fine texture	99.5	105.0
Sand, grayish tan to yellowish gray, texture grades from fine to coarse sand, silty from 120.0 to 124.5 ft	105.0	136.0
Silt, sandy, grayish tan, very calcareous below 143.5 ft	136.0	145.0
Sand and gravel, gray to yellow and pink, texture grades from medium sand to medium gravel	145.0	170.0
Tertiary System - Miocene Series - Ogallala Group:		
Siltstone, sandy, light brown, calcareous rootlets	170.0	177.0
Silt, very slightly clayey, light gray	177.0	181.0
Sandstone, grayish tan, granular	181.0	198.0
Limestone, white to light blue	198.0	199.0
Sandstone, very calcareous, grayish white to light gray	199.0	221.0
Sand, in part slightly silty, light gray, fine texture	221.0	240.0
Sandstone, light tannish gray with greenish tint	240.0	257.0
Siltstone, moderately calcareous, light gray	257.0	260.0
Sandstone, tannish gray, granular	260.0	265.0
Siltstone, very calcareous, light gray	265.0	270.0
Sandstone, tannish gray, granular	270.0	280.0
Sand, slightly calcareous, tannish gray, very fine texture	280.0	285.0
Siltstone, slightly calcareous, light gray, some very fine sand below 290.0 ft	285.0	300.0

Silt to sandstone, very calcareous.....	300.0	311.0
Gravel, reddish gray, medium textured.....	311.0	317.0

Cretaceous System - Upper Cretaceous Series - Montana Group:

Pierre Formation:

Clay, moderately calcareous, yellowish gray and white.....	317.0	348.0
Clay shale, moderately calcareous, dark gray.....	348.0	360.0

Test Hole #34-B-47
(6-20-6addd)
Phelps County

Location: SE SE SE NE sec. 6, T. 6 N., R. 20 W., approximately 2,618 feet south and 14 feet west of northeast corner.
Ground elevation: 2,516 ft (t). (Bertrand SE 7.5 min. quadrangle)
Depth to water: Unknown. Test-hole caved at 230 ft (8-7-47).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil and road fill: silt, clayey, to clay, silty, dark brownish black.....	0.0	3.5
Silt, slightly clayey, slightly calcareous, brownish to buff gray, few calcareous nodules, few gastropod shells and limonitic nodules below 8.0 ft.....	3.5	39.0
Silt, soil-like, slightly clayey, dark brown with slight reddish tint, some limonitic stains.....	39.0	42.0
Silt, in part slightly clayey, slightly calcareous, grayish tan with slight pinkish tint.....	42.0	70.0
Silt, slightly calcareous, tannish gray with pinkish tint, moderately calcareous with few rodent bones below 75.0 ft.....	70.0	80.0
Silt, in part slightly clayey, slightly calcareous, grayish tan with pinkish tint, less clayey below 90.0 ft.....	80.0	95.0
Silt, sandy, to sand, silty, slightly calcareous, tannish gray, contains very fine to fine sand with some medium sand.....	95.0	150.0
Sand, brown to tannish gray, texture grades from fine to medium sand with some coarse sand, a few silt layers from 150.0 to 155.0 ft.....	150.0	170.0
Silt, sandy to slightly clayey, in part slightly calcareous, tannish gray, contains fine sand.....	170.0	190.0
Silt, tannish gray, intermittent calcareous zones...	190.0	207.0
Silt, sandy, to sand, silty, tannish gray, contains fine to coarse sand with some gravel.....	207.0	228.0
Sand and gravel, brownish gray, texture grades from very fine sand to medium gravel.....	228.0	245.0
Gravel and some sand, tannish gray, texture grades from medium sand to coarse gravel.....	245.0	262.5
Tertiary System - Miocene Series - Ogallala Group:		
Sand, brownish gray, texture grades from fine to coarse sand.....	262.5	267.0
Sand, silty, to sand, tannish gray, fine texture, some sandstone below 270.0 ft.....	267.0	278.0
Sandstone, very calcareous, light tannish gray.....	278.0	280.0
Silt, clayey to slightly sandy, very calcareous, very light greenish gray.....	280.0	282.5

Silt, in part slightly clayey, reddish tan, calcareous zones and rootlets below 285.0 ft.....	282.5	290.0
Limestone, light tannish gray.....	290.0	290.5
Sand and some gravel, tannish gray, texture grades from fine sand to fine gravel, some interbedded silt to sandy silt.....	290.5	300.0
Sand, silty, to silt, sandy, tannish gray.....	300.0	306.0
Silt, reddish brown.....	306.0	308.0
Sand and gravel, tannish gray, texture grades from fine sand to medium gravel with some coarse gravel	308.0	315.0
Sand, silty, in part very calcareous, light green to light gray, few rootlets.....	315.0	329.0
Sandstone, very calcareous, light gray, few rootlets	329.0	330.0
Sand, silty, to silt, sandy, moderately to very calcareous, very light buff gray.....	330.0	340.0
Sandstone to limestone, white to very light buff gray.....	340.0	350.0
Sandstone, in part slightly calcareous, grayish green.....	350.0	358.0
Silt, sandy, to sand, silty, light greenish gray with slight brownish tint.....	358.0	404.0
Sand, in part slightly silty, light brownish gray with slight greenish tint, texture grades from fine to coarse sand.....	404.0	411.0
Silt, sandy, brownish gray, some interbedded light grayish green clayey silt.....	411.0	414.0
Sand, grayish tan, texture grades from medium to coarse sand, slightly silty below 421.0 ft.....	414.0	428.0
Sand, brownish gray with slight greenish tint, texture grades from medium to coarse sand.....	428.0	434.5
Sandstone to limestone, light gray with slight buff tint.....	434.5	441.0
Silt, clayey, to clay, silty, brownish gray with slight greenish tint, grayish green and calcareous below 445.0 ft.....	441.0	470.0
Clay, brownish tan, few calcareous zones.....	470.0	475.0
Sand, silty, to sandstone, light gray to brownish tan.....	475.0	480.0
Sand, silty, very calcareous, light gray with slight buff tint.....	480.0	485.0
Clay, reddish tan, few thin calcareous zones.....	485.0	494.5
Sand, in part slightly silty, brownish gray, texture grades from very fine to medium sand.....	494.5	505.0
Silt, sandy, to sandstone, very calcareous, light gray.....	505.0	510.0
Sand, in part slightly silty, brownish gray, texture grades from very fine to medium sand, medium to coarse sand below 520.0 ft.....	510.0	538.0

Cretaceous System - Upper Cretaceous Series - Montana Group:

Pierre Formation:

Clay, slightly calcareous, light to medium gray, many limonitic stains.....	538.0	540.5
Clay shale, slightly to moderately calcareous, dark gray.....	540.5	560.0

Test Hole #30-B-48
(6-20-14dddd)
Phelps County

Location: SE SE SE SE sec. 14, T. 6 N., R. 20 W., approximately 228 feet north and 6 feet west of southeast corner.
Ground elevation: 2,448 ft (i). (Loomis 7.5 min. quadrangle)
Depth to water: Unknown. Test-hole caved at 192.93 ft (8-19-48).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil and road fill: silt, medium grayish brown.....	0.0	2.0
Soil: silt, dark to very dark brownish gray.....	2.0	5.0
Silt, light brownish tan, few gastropod shells, slightly calcareous from 13.5 to 17.0 ft., granular below 15.0 ft.....	5.0	33.5
Silt, soil-like, very slightly calcareous, dark reddish brown.....	33.5	38.0
Silt, sandy, light brownish tan, contains very fine sand, slightly calcareous below 40.0 ft.....	38.0	53.0
Silt, light brownish tan with gray tint, contains some very fine sand below 58.0 ft.....	53.0	66.5
Silt, sandy, slightly to moderately calcareous, very light brownish tan, contains very fine sand, few calcareous nodules.....	66.5	124.0
Silt, sandy to slightly clayey, slightly to moderately calcareous, light gray with tan tint, contains very fine to fine sand.....	124.0	131.0
Silt, sandy, to sand, silty, light gray with tan tint, contains very fine to coarse sand, some limonitic stains.....	131.0	140.0
Sand and some gravel, light gray, texture grades from very fine sand to fine gravel.....	140.0	153.0
Silt, sandy, light brownish tan, contains very fine to fine sand, some limonitic stains.....	153.0	166.0
Silt, light grayish tan, some limonitic stains from 166.0 to 170.0 ft.....	166.0	175.0
Silt, very slightly sandy, light grayish tan, contains very fine to fine sand.....	175.0	183.0
Sand and gravel, brownish gray to pink, texture grades from fine sand to coarse gravel.....	183.0	228.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, slightly clayey to sandy, light pinkish gray, contains fine sand.....	228.0	230.0
Silt, sandy, to sand, slightly to moderately calcareous, light brownish gray, texture grades from fine to medium sand.....	230.0	233.5
Silt, clayey, moderately to very calcareous, light gray to light brownish tan.....	233.5	240.0

Marl, light gray	240.0	240.5
Siltstone, sandy, moderately calcareous, light brownish tan	240.5	242.0
Silt, sandy, light greenish gray, contains very fine to fine sand	242.0	245.0
Sandstone, moderately calcareous, light brownish gray, few rootlets	245.0	253.0
Silt, clayey, brownish tan, blocky, few calcareous zones, brown to light tan below 260.0 ft	253.0	265.0
Sandstone, moderately to very calcareous, light green to tannish gray	265.0	275.0
Sandstone, silty, slightly to moderately calcareous, light grayish tan, texture grades from fine to medium sand	275.0	280.0
Sand, slightly silty, light gray, texture grades from very fine to medium sand with some coarse sand	280.0	286.5
Sandstone, silty, very calcareous, light gray with tan tint	286.5	296.0
Sand, silty, to silt, sandy, light gray with slight greenish tint	296.0	305.0
Sandstone, light greenish gray, texture grades from very fine to coarse sand, moderately calcareous and tannish gray below 310.0 ft	305.0	312.5
Silt, sandy, to sandstone, very calcareous, light gray with tan tint	312.5	316.0
Sandstone, silty, in part moderately calcareous, grayish tan	316.0	319.5
Sand, silty, to silt, sandy, slightly to very calcareous, light gray with tan tint	319.5	323.0
Sandstone, moderately to very calcareous, very light tannish gray	323.0	329.0
Sand, silty, moderately calcareous, light gray, some very calcareous sandstone below 332.0 ft	329.0	335.0
Sandstone, moderately to very calcareous, light greenish gray with tan tint	335.0	337.0
Sand, silty, to silt, sandy, slightly to very calcareous, light gray	337.0	345.0
Sandstone, slightly to very calcareous, light brownish gray with tan tint, few rootlets	345.0	354.0
Sand and gravel, light gray to pink, texture grades from very fine sand to medium gravel with some coarse gravel	354.0	373.0
Silt, sandy, light green to brownish gray, contains very fine to coarse sand, some interbedded sandstone from 378.0 to 385.5 ft., calcareous below 385.5 ft	373.0	400.5
Sand and gravel, light gray to pink and light green, texture grades from fine sand to medium gravel	400.5	408.0
Silt, light brownish tan with pink tint	408.0	410.0
Silt, sandy, brownish tan, texture grades from fine to medium sand with some coarse sand	410.0	414.5

Sand and some gravel, light brownish gray to pink and light green, texture grades from fine sand to fine gravel.....	414.5	427.0
Sandstone, silty, light greenish to tannish gray, very fine texture.....	427.0	430.0
Silt, sandy, slightly to moderately calcareous, light tannish gray, contains very fine to fine sand.....	430.0	436.0
Sandstone, slightly calcareous, light tannish gray, texture grades from very fine to medium sand.....	436.0	456.0
Silt, sandy to slightly clayey, moderately to very calcareous, light gray with tan tint.....	456.0	464.0
Sand and gravel, greenish gray, texture grades from fine sand to medium gravel, few limonitic nodules.	464.0	496.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, moderately calcareous, light greenish gray, some limonitic stains, light gray below 499.0 ft..	496.0	505.0
Clay shale, very calcareous, medium gray, darker with depth, contains some aragonite below 515.0 ft.....	505.0	520.0

Test Hole #10-31
(7-17-1da)
Phelps County

Location: NE SE sec. 1, T. 7 N., R. 17 W., original field log unavailable, location is approximate.
Ground elevation: 2,183 (i). (Kearney SW 7.5 min. quadrangle)
Depth to water: 19.4 ft (1931) .
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Sand, gray, very fine texture, principally quartz, well rounded and frosted.....	0.0	19.0
Sand and gravel, texture grades from medium sand to gravel.....	19.0	50.0
Gravel, texture grades from fine to coarse gravel...	50.0	73.0
Gravel and sand, fine gravel, contains reworked limy material.....	73.0	80.0
Sand, gray, principally quartz, rounded.....	80.0	85.0
Tertiary System - Miocene Series - Ogallala Group:		
Clay, greenish gray, contains much silt, fine sand and marl.....	85.0	105.0
Silt, sandy, calcareous, grayish green.....	105.0	122.0

Test Hole #39-B-47
(7-17-24aaaa)
Phelps County

Location: NE NE NE NE sec. 24, T. 7 N., R. 17 W., approximately 91 feet south and 28 feet west of northeast corner.
Ground elevation: 2,227 ft (i). (Kearney SW 7.5 min. quadrangle)
Depth to water: 60.9 ft (8-19-47).
No e-log available.

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Soil: silt, slightly clayey to slightly sandy, dark brownish gray, contains very fine to fine sand....	0.0	1.0
Silt, very slightly calcareous, light brownish gray with a yellow tint.....	1.0	2.0
Silt, slightly to moderately calcareous, light buff gray, contains many gastropods, slightly calcareous and less gastropods below 15.0 ft.....	2.0	20.0
Silt, buff gray to light yellowish brown.....	20.0	26.0
Silt, soil-like, slightly to moderately sandy, medium brownish gray with a yellow tint, contains very fine to medium sand.....	26.0	27.5
Sand, slightly silty, light brownish gray, texture grades from very fine to coarse sand.....	27.5	34.0
Silt, soil-like, sandy, in part slightly clayey, medium grayish brown, contains very fine to medium sand.....	34.0	38.5
Sand, light brownish gray, principally quartz, texture grades from very fine to medium with a trace of coarse sand.....	38.5	40.0
Sand, texture grades from fine to medium sand and a trace of very fine and coarse sand, principally quartz with traces of pink feldspar, texture grades from very fine to medium with a trace of coarse sand below 45.0 ft.....	40.0	50.0
Sand, texture grades from very fine to coarse with some very coarse sand, principally quartz and a trace of pink feldspar, slightly coarser texture below 55.0 ft.....	50.0	62.0
Sand, silty to slightly clayey, very slightly calcareous, light yellowish brown, texture grades from very fine to medium sand with a trace of coarse sand and fine gravel, contains slight limonitic stains.....	62.0	70.5
Sand, texture grades from fine to very coarse sand with a trace of fine gravel, quartz and some pink feldspar, some limonite stains, slightly coarser texture below 75.0 ft.....	70.5	90.0

Sand and gravel, texture grades from medium sand to medium gravel and a trace of coarse gravel, quartz and some pink feldspar, much gravel below 110.0 ft	90.0	120.0
Sand and gravel, texture grades from medium sand to medium gravel, quartz and pink and light colored feldspar	120.0	141.0
Silt, slightly clayey, slightly sandy, light brown; sand is very fine to fine; contains calcareous zones at 148.5 ft, from 150.0 to 151.0 ft., and from 177.5 to 177.6 ft; contains a few rootlets below 175.0 ft	141.0	180.0
Silt, slightly clayey, slightly sandy, slightly calcareous, light brown; texture grades from coarse silt to very fine sand; contains some thin hard limy layers; moderately to very calcareous below 215.0 ft	180.0	220.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, moderately sandy, slightly clayey, light yellow-brown-gray; sand is very fine to medium; contains small limy nodules	220.0	222.0
Silt, clayey, light grayish green, contains some limy nodular zones, blocky and reddish brown below 223.0 ft	222.0	228.0
Sandstone, light brownish gray with a green tint, fine texture, contains some rootlets, in part calcareous from 235.0 to 240.0 ft., grading silty and darker and contains thin limy zones below 240.0 ft	228.0	245.0
Clay, silty, reddish brown, occasional thin limy layers, interbedded with greenish gray clay below 264.5 ft	245.0	288.5
Sandstone, moderately calcareous, light yellowish to greenish gray, fine texture	288.5	300.0
Sand to sandstone, light greenish gray, texture grades from very fine to medium sand, fine texture below 310.0 ft	300.0	320.0
Sand, light brownish gray in part light green, texture grades from fine to medium with a trace of coarse sand, slightly coarser texture below 325.0 ft., contains some sandstone and bright green silt fragments below 335.0 ft	320.0	337.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay shale, moderately to very calcareous, medium gray, contains a thin light gray limonitic stained layer at 337.0 ft., dark gray below 340.0 ft., contains thin limonitic zones at 347.0 and 353.0 ft	337.0	360.0

Test Hole #40-B-47
(7-17-36dddd)
Phelps County

Location: SE SE SE SE sec. 36, T. 7 N., R. 17 W., approximately 98 feet north and 8 feet west of southeast corner.
Ground elevation: 2,221 ft (i). (Kearney SW 7.5 min. quadrangle)
Depth to water: Unknown; Test-hole caved at 57.5 ft (8-20-47).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, dark brownish gray.....	0.0	2.0
Silt, moderately clayey, medium grayish brown.....	2.0	3.0
Silt, moderately calcareous, very light buff gray, contains a few limy nodules.....	3.0	6.0
Silt, very slightly calcareous, light buff gray, contains a few limonitic flecks.....	6.0	9.0
Silt, slightly calcareous, light brownish yellow mottled very light gray, contains many limonitic stains.....	9.0	13.0
Silt, very slightly calcareous, very light buff gray, contains limonitic flecks, slightly calcareous and a yellow tint below 15.0 ft.....	13.0	20.0
Silt, light buff gray.....	20.0	27.0
Silt, soil-like, slightly clayey, moderately calcareous, medium gray, contains a few gastropods.....	27.0	31.0
Silt, soil-like, slightly clayey to slightly sandy, moderately calcareous, medium grayish brown, contains very fine to medium sand, contains a few small gastropods.....	31.0	33.0
Silt, slightly clayey to moderately sandy, slightly calcareous, light brown with a yellow tint, contains very fine to fine sand and some medium sand, contains a few gastropod fragments.....	33.0	37.5
Sand, texture grades from very fine to medium with some coarse sand, principally quartz, texture grades from very fine to coarse with a trace of very coarse sand below 40.0 ft.....	37.5	60.0
Sand, texture grades from very fine to coarse sand, principally quartz, contains a trace of light yellowish gray silt from 60.0 to 66.5 ft., some very coarse sand from 70.0 to 85.0 ft., contains a trace of pink feldspar, slightly limonitic stains, and texture grades from fine to very coarse sand below 85.0 ft.....	60.0	90.0
Sand, in part silty, texture grades from very fine to coarse sand, much quartz.....	90.0	94.0

Sand and gravel, texture grades from medium sand to fine gravel with some medium gravel, quartz and some feldspar, contains some limonitic stains.....	94.0	100.0
Gravel and some sand, brownish gray, texture grades from fine to medium sand some coarse gravel and some coarse to very coarse sand, quartz, some feldspar and a few dark grains.....	100.0	120.0
Sand and gravel, texture grades from medium sand to fine gravel and some medium gravel, quartz and some feldspars, slightly coarser texture below 126.0 ft.....	120.0	132.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, slightly sandy, light olive gray; sand is very fine; contains ash shards; below 135 ft, contains a few siliceous rootlets; below 140 ft, sand is very fine to medium.....	132.0	144.0
Sand, light grayish green, texture grades from fine to very coarse with some fine gravel.....	144.0	152.0
Silt, moderately clayey, slightly to very calcareous, white.....	152.0	154.0
Sand, light brownish gray, texture grades from very fine to fine with some medium sand, slightly consolidated.....	154.0	162.0
Marl, light gray.....	162.0	164.0
Sandstone, brownish gray, texture grades from very fine to fine with a trace of medium sand, contains a few rootlets from 164.0 to 177.0 ft.....	164.0	182.0
Silt, light brown and light gray.....	182.0	184.0
Sandstone, very light gray, in part a green tint, fine texture, contains some rootlets and hard calcareous zones.....	184.0	224.5
Sand, silty, to silt, sandy, light greenish gray, contains several hard thin limy layers.....	224.5	241.5
Clay, in part silty, reddish tan, blocky, in part greenish gray from 245.0 to 250.0 ft., in part light gray and slightly calcareous below 265.0 ft., contains a few hard thin limy layers below 245.0 ft.....	241.5	288.0
Silt to siltstone, light greenish gray.....	288.0	314.5
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, moderately calcareous, light gray, many limonitic stains.....	314.5	325.0
Clay shale, moderately calcareous, medium gray, contains a few aragonite fragments, thin limonite layers below 330.0 ft.....	325.0	340.0

Test Hole #30-A-48
(7-18-3bbbb)
Phelps County

Location: NW NW NW NW sec. 3, T. 7 N., R. 18 W., approximately 25 feet south and 24 feet east of northwest corner.
Ground elevation: 2,314 ft (i). (Elm Creek SE 7.5 min. quadrangle)
Depth to water: Unknown. Test-hole caved at 76.5 ft (8-24-48).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, dark brown	0.0	3.0
Silt, light brown, granular, gastropod shells below 5.0 ft	3.0	10.0
Silt, medium buff to buff gray, few gastropod shells	10.0	52.0
Silt, medium grayish brown, coarse texture	52.0	55.0
Silt, sandy, dark reddish brown	55.0	59.5
Sand and gravel, grayish tan to pink, texture grades from fine sand to coarse gravel, some yellow and black grains below 105.0 ft	59.5	125.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, green	125.0	129.5
Silt, very calcareous, light grayish tan	129.5	138.0
Silt, light green, contains some sand and gravel	138.0	140.0
Sandstone, light green	140.0	154.0
Sand, greenish gray, fine texture	154.0	160.0
Sandstone, greenish gray	160.0	178.0
Silt, sandy, to sand, silty, light grayish green	178.0	195.0
Sandstone, light green to light greenish gray	195.0	210.0
Sand, in part silty, gray to light green	210.0	225.0
Sand, light grayish tan, texture grades from fine to medium sand, very slightly silty below 235.0 ft	225.0	255.0
Sandstone, light grayish green, contains a few fossil seeds below 265.0 ft	255.0	271.0
Marl, light gray and light blue	271.0	272.5
Silt, very calcareous, light gray to white	272.5	280.0
Sandstone, very calcareous, light gray	280.0	288.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, light to medium gray, yellow zone at top	288.0	309.0
Clay shale, black	309.0	330.0

Test Hole #45-32
(7-18-4cddd)
Phelps County

Location: SE SE SE SW sec. 4, T. 7 N., R. 18 W.
Ground elevation: 2,304 ft (t).(Elm Creek SE 7.5 min. quadrangle)
Depth to water: 70.0 ft (7-29-32).
No e-log available.

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Soil	0.0	2.0
Silt, buff	2.0	32.0
Silt, soil-like, black	32.0	35.0
Silt, reddish brown	35.0	47.0
Clay, silty, gray	47.0	62.0
Sand, fine, gray	62.0	92.0
Gravel	92.0	94.0
Clay, brown	94.0	102.0
Gravel	102.0	108.0

Test Hole #29-A-48
(7-18-16dddd)
Phelps County

Location: SE SE SE SE sec. 16, T. 7 N., R. 18 W., approximately 60 feet north and 9 feet west of southeast corner.
Ground elevation: 2,279 ft (i).
Depth to water: Unknown. Test-hole caved at 47 ft (8-24-48).
No e-log available.

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Soil: silt, dark brown	0.0	1.5
Silt, light gray, some limonitic stains and few gastropod shells, yellowish gray from 5 to 8.5 ft.	1.5	30.0
Silt, sandy, moderately calcareous, dark gray	30.0	37.0
Sand, light grayish tan, texture grades from medium to coarse sand	37.0	50.0
Silt, medium brown with red tint, coarse texture	50.0	54.0
Silt, clayey, reddish tan	54.0	59.5
Sand and gravel, gray to yellow and pink, texture grades from coarse sand to coarse gravel	59.5	90.0
Gravel, greenish gray, texture grades from fine to coarse gravel	90.0	92.0
Silt, very slightly clayey, light grayish green	92.0	93.0
Silt, tan with reddish tint	93.0	100.0
Silt, very slightly clayey, reddish tan, slightly calcareous below 105.0 ft., contains some volcanic ash from 110.0 to 120.0 ft	100.0	120.0
Silt, sandy, moderately calcareous, reddish tan, light tan below 130.0 ft	120.0	137.5
Sand and gravel, gray to yellow and pink, texture grades from coarse sand to medium gravel	137.5	142.5
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, silty, light brown	142.5	145.0
Silt, sandy, light gray	145.0	150.0
Sandstone, light grayish brown, granular	150.0	176.0
Sand, silty, light gray	176.0	180.0
Sandstone, light grayish tan	180.0	184.0
Sand, silty, slightly calcareous, light gray	184.0	198.5
Sandstone, grayish tan	198.5	200.0
Sandstone, very calcareous, light gray	200.0	209.0
Silt, very calcareous, light gray	209.0	211.0
Sandstone, very calcareous, light gray, granular	211.0	225.0
Silt and sandstone, interbedded, very calcareous, light gray, light greenish gray below 235.0 ft	225.0	243.0

Cretaceous System - Upper Cretaceous Series - Montana Group:

Pierre Formation:

Clay, moderately calcareous, light gray, few limonitic nodules.....	243.0	251.0
Clay shale, moderately calcareous, dark gray.....	251.0	260.0

Test Hole #28-A-48
(7-18-33dddd)
Phelps County

Location: SE SE SE SE sec. 33, T. 7 N., R. 18 W., approximately 113 feet north and 6 feet west of southeast corner.
Ground elevation: 2,305 ft (i). (Elm Creek SE quadrangle)
Depth to water: 86.5 ft. (8-20-48).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil and road fill: silt, dark brown.....	0.0	3.5
Silt, light gray, few limonitic nodules, calcareous rootlets and gastropod shells.....	3.5	30.0
Silt, sandy, reddish gray, contains fine sand.....	30.0	34.0
Sand, grayish tan to pink, texture grades from fine to coarse sand.....	34.0	39.0
Silt, light reddish brown, coarse texture.....	39.0	45.0
Silt, sandy, to sand, silty, reddish tan, some limonitic stains in upper part.....	45.0	75.0
Sand, yellowish gray to tan, texture grades from fine to medium sand.....	75.0	90.0
Silt, light gray, some coarse sand.....	90.0	100.5
Sand and gravel, grayish tan to pink, texture grades from fine sand to medium gravel.....	100.5	129.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, sandy, very calcareous, light gray, few sandstone layers.....	129.0	134.0
Silt, medium gray, few calcareous zones.....	134.0	139.5
Sandstone, very calcareous, grayish brown.....	139.5	140.2
Silt, sandy, moderately calcareous, brownish gray...	140.2	144.0
Sandstone, light grayish tan.....	144.0	147.0
Siltstone, light gray.....	147.0	151.5
Sandstone, light grayish tan.....	151.5	155.0
Silt, very calcareous, light gray.....	155.0	160.0
Sandstone, very calcareous, tannish gray.....	160.0	210.0
Sand, silty, light gray.....	210.0	220.0
Sandstone, very calcareous, tannish gray, some light gray to white very calcareous silt from 227.0 to 234.0 ft., grayish tan and slightly calcareous below 234.0 ft.....	220.0	240.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Silt, clayey, moderately calcareous, light gray, hard limonitic zone at 241.0 ft.....	240.0	245.0

Clay shale, medium gray, contains much limonitic material and few calcareous nodules, contains some yellowish gray clay and moderately calcareous material below 265.0 ft.....	245.0	310.0

Test Hole #32-B-47
(7-19-6addd)
Phelps County

Location: SE SE SE NE sec. 6, T. 7 N., R. 19 W., approximately 2,440 feet south and 10 feet west of northeast corner.
Ground elevation: 2,365 ft (i). (Bertrand SE 7.5 min. quadrangle)
Depth to water: 53.7 ft (8-1-47).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, clayey to slightly sandy, dark brownish black, contains very fine sand.....	0.0	2.0
Silt, clayey, to clay, silty, brownish gray.....	2.0	3.0
Silt, clayey, slightly calcareous, light gray with very slight greenish tint, contains a few calcareous nodules.....	3.0	5.0
Silt, sandy to slightly clayey, slightly calcareous, light gray with slight greenish tint, contains very fine sand, few gastropod shells, more clayey below 20.0 ft.....	5.0	40.0
Sand, brownish gray, texture grades from medium to coarse sand.....	40.0	44.0
Clay, sandy, soil-like, dark grayish brown.....	44.0	46.0
Silt, clayey, tannish gray with green tint.....	46.0	47.5
Sand and some gravel, brownish gray, texture grades from fine sand to fine gravel.....	47.5	55.5
Sand, in part silty, brownish gray, texture grades from very fine to medium sand.....	55.5	60.0
Silt, clayey to sandy, light gray with greenish tint, contains very fine sand and a few limonitic flecks.....	60.0	72.0
Clay, silty, light gray with slight greenish tint, few limonitic flecks and calcareous nodules, buff gray and slightly calcareous below 75.0 ft.....	72.0	80.0
Sand, brownish gray to medium gray, fine texture, some sandstone and clayey silt from 85.0 to 90.0 ft.....	80.0	92.5
Silt, sandy, medium gray, few shell fragments.....	92.5	95.5
Sand and gravel, medium gray, texture grades from fine sand to coarse gravel, more gravel below 100.0 ft.....	95.5	115.0
Clay, silty, brownish tan with slight pinkish tint..	115.0	119.5
Sand and some gravel, grayish tan, texture grades from fine sand to fine gravel.....	119.5	122.0
Silt, clayey, brownish tan with pinkish tint.....	122.0	131.0
Sand and gravel, grayish tan, texture grades from fine sand to medium gravel.....	131.0	133.5

Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, brownish gray with slight tannish tint, fine texture	133.5	135.0
Silt, sandy, very light greenish gray, some reddish brown clay below 140.0 ft	135.0	145.5
Marl, light tannish gray, contains some sandstone and clayey silt	145.5	148.0
Sandstone, brownish gray-green to grayish brown, contains a few rootlets	148.0	166.0
Silt, clayey, to silt, sandy, light grayish green, contains very fine sand	166.0	170.0
Sandstone, moderately to very calcareous, brownish gray to grayish green, contains a few rootlets and fossil seeds	170.0	225.0
Sand and some gravel, grayish brown, texture grades from fine sand to fine gravel	225.0	237.0
Sand, in part silty, brownish gray with greenish tint, texture grades from very fine to medium sand, contains a few limonitic fragments below 250.0 ft	237.0	253.0
Silt, sandy, light grayish green	253.0	255.0
Sandstone to marl, light gray	255.0	256.0
Silt, sandy, calcareous, light gray	256.0	260.0
Sand, grayish brown, texture grades from fine to medium sand with some coarse sand	260.0	266.0
Silt, sandy, in part calcareous, grayish green, contains fossil seeds	266.0	270.0
Sandstone, very calcareous, light greenish gray	270.0	273.0
Sand, grayish brown, texture grades from fine to coarse sand	273.0	280.0
Silt, clayey, to clay, silty, very calcareous, grayish green, contains intermittent hard calcareous layers	280.0	288.5
Sandstone, moderately calcareous, grayish green with yellowish tint, contains a few rootlets below 300.0 ft	288.5	308.5
Siltstone, grayish green to green	308.5	310.0
Silt, in part clayey, grayish green, contains intermittent white to light tan limy layers	310.0	313.0
Clay, greenish gray to reddish brown	313.0	320.0
Silt, clayey to sandy, reddish brown, contains fine sand	320.0	326.0
Sand, in part silty, brownish gray to light greenish gray, texture grades from very fine to medium sand	326.0	355.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, moderately calcareous, grayish green to greenish gray, blocky, contains limonitic stains	355.0	375.0
Clay, in part moderately calcareous, light gray to medium gray, contains some limonitic stains, a few aragonite crystals in lower part	375.0	420.0

Test Hole #33-B-47
(7-20-14addd)
Phelps County

Location: SE SE SE NE sec. 14, T. 7 N., R. 20 W., approximately 2,583 feet south and 10 feet west of northeast corner.
Ground elevation: 2,444 ft (t). (Bertrand SE 7.5 min. quadrangle)
Depth to water: 145.4 ft (8-5-47).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Roadfill: silt, slightly clayey, dark brownish gray.	0.0	1.0
Soil: silt, slightly clayey, dark brownish gray to brownish black.....	1.0	3.0
Silt, clayey, to clay, silty, medium brownish gray..	3.0	5.0
Silt, sandy to slightly clayey, tannish buff-gray, contains very fine sand, few gastropod shells below 10.0 ft.....	5.0	25.0
Silt, sandy, tannish buff-gray, contains very fine sand, few gastropod shells.....	25.0	41.0
Silt, soil-like, sandy to clayey, dark tannish brown-gray.....	41.0	43.5
Sand, tannish brown-gray, texture grades from medium to coarse sand.....	43.5	50.0
Sand, silty, to silt, sandy, tan to buff gray, contains very fine to fine sand, some medium to coarse sand below 70.0 ft.....	50.0	80.5
Clay, silty, soil-like, light gray to dark brownish black.....	80.5	85.0
Clay, silty, to silt, clayey, light gray with slight greenish tint, few limonitic flecks, slightly sandy below 90.0 ft.....	85.0	92.0
Silt, sandy, to sand, silty, gray with slight greenish tint.....	92.0	97.5
Sand, silty, soil-like, tan to grayish brown.....	97.5	100.5
Sand, brownish gray, texture grades from fine to medium sand with some coarse sand.....	100.5	113.0
Silt, sandy to slightly clayey, light gray to brownish tan, contains very fine sand.....	113.0	120.0
Sand, tannish gray, texture grades from fine to coarse sand.....	120.0	134.0
Silt, clayey to sandy, dark grayish brown, contains fine sand.....	134.0	136.0
Silt, slightly clayey, light gray.....	136.0	137.0
Sand, brownish gray, texture grades from fine to coarse sand.....	137.0	152.0
Silt, sandy to slightly clayey, light greenish gray, contains very fine sand, in part slightly calcareous below 155.0 ft.....	152.0	165.5

Sand and gravel, brownish gray, texture grades from fine sand to medium gravel with some coarse gravel	165.5	186.0
Gravel and some sand, brownish gray, texture grades from medium sand to coarse gravel with some pebbles, iron stains	186.0	200.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, sandy to slightly clayey, light gray to very light tannish gray, contains very fine sand	200.0	205.0
Sandstone, very calcareous, light gray	205.0	206.5
Silt, sandy, in part slightly calcareous, light grayish green, contains very fine to fine sand	206.5	210.5
Sandstone, brownish gray to grayish brown	210.5	234.0
Silt, in part clayey, moderately calcareous, light greenish gray	234.0	241.0
Marl, light gray, contains a few rootlets	241.0	241.5
Sandstone, brownish gray with greenish tint, in part calcareous and yellowish gray to greenish gray below 245.0 ft	241.5	272.0
Marl, light buff to tannish gray	272.0	276.0
Sandstone, slightly calcareous, brownish gray with greenish tint, contains a few rootlets, yellowish gray and moderately to very calcareous below284 ft	276.0	295.0
Sand, in part silty, brownish gray, in part consolidated, texture grades from very fine to medium sand, light gray and very calcareous below 323 ft.	295.0	327.0
Sandstone, very calcareous, grayish white	327.0	328.0
Silt, sandy, to sand, silty, brownish gray with greenish tint, some clayey silt below 340.0 ft	328.0	348.0
Silt, clayey, very calcareous, grayish white	348.0	353.0
Silt, sandy, to sand, silty, light greenish gray, contains some light gray volcanic ash from 370.0 to 375.0 ft	353.0	383.0
Marl, grayish white	383.0	384.0
Sand, silty, and sandstone, very calcareous, light gray, contains few rootlets	384.0	389.0
Silt, clayey, and sand, silty, interbedded, brownish gray, contains fine to coarse sand	389.0	399.5
Sandstone to marl, light gray with slight buff tint.	399.5	403.0
Silt, slightly clayey to sandy, greenish gray with brownish tint	403.0	415.0
Sand, in part slightly silty, brownish gray with greenish tint	415.0	422.0
Silt, in part slightly clayey, grayish green with brownish tint	422.0	425.0
Sand, silty, to silt, sandy, slightly to moderately calcareous, light grayish green, contains very fine sand	425.0	455.0
Sand and gravel, greenish gray to pink, texture grades from medium sand to medium gravel, contains a few green silt pebbles	455.0	458.0

Cretaceous System - Upper Cretaceous Series - Montana Group:

Pierre Formation:

Clay shale, slightly to moderately calcareous, light to medium gray, some yellowish orange to brown stains at top, contains a few aragonite crystals..	458.0	490.0

Test Hole #36-B-47
(7-20-27bbcb)
Phelps County

Location: NW SW NW NW sec. 27, T. 7 N., R. 20 W., approximately 910 feet south and 5 feet east of northwest corner.
Ground elevation: 2,426 ft (t). (Bertrand SE 7.5 min. quadrangle)
Depth to water: Unknown.
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, slightly clayey, black to dark brownish gray, many roots and some iron stains.....	0.0	1.9
Clay, silty, to silt, clayey, dark brownish gray, few roots and some iron stains.....	1.9	3.0
Silt, clayey, dark buff gray.....	3.0	4.0
Clay, silty, to silt, clayey, soil-like, medium brownish gray.....	4.0	5.0
Clay, silty, dark buff to brownish gray.....	5.0	6.0
Silt, slightly clayey, buff gray.....	6.0	8.5
Clay, silty, to silt, clayey, buff gray, blocky, contains a few calcareous nodules.....	8.5	15.0
Silt, in part slightly clayey, buff gray with slight greenish tint, contains a few limonitic flecks and small gastropod shells, tannish gray below 49.0 ft.....	15.0	50.0
Silt, light tannish gray, in part yellowish brown below 55.0 ft.....	50.0	58.0
Sand, brownish tan-gray, texture grades from fine to medium sand.....	58.0	60.0
Silt, in part sandy, yellowish tan-gray, contains fine sand.....	60.0	62.5
Sand, tannish gray, texture grades from fine to medium sand with some coarse sand.....	62.5	100.0
Silt, sandy, buff gray with tannish tint, contains very fine sand.....	100.0	110.0
Silt, sandy to slightly clayey, tannish gray, contains very fine sand and a few calcareous nodules.	110.0	116.0
Silt, sandy, tannish gray, contains fine sand.....	116.0	120.0
Sand, tannish gray to brownish gray, texture grades from fine to medium sand with some coarse sand, contains some fine to medium gravel from 147.5 to 152.0 ft.....	120.0	166.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, in part sandy, grayish green, calcareous sandstone below 169.0 ft.....	166.0	170.0
Siltstone, grayish green, few light gray clayey silt nodules.....	170.0	173.0

Sandstone, moderately calcareous, grayish green to greenish gray, contains a few rootlets.....	173.0	196.0
Marl, pinkish tan, contains a thin brown siltstone layer.....	196.0	200.0
Sandstone, moderately calcareous, brownish tan.....	200.0	202.5
Silt, in part calcareous, grayish green.....	202.5	210.0
Siltstone, sand, in part calcareous, grayish green, contains few rootlets and seeds.....	210.0	214.0
Sandstone, silty, grayish green, contains marl layers.....	214.0	220.5
Sandstone, very calcareous, light buff gray.....	220.5	227.5
Clay, silty, dark reddish brown, blocky.....	227.5	228.5
Sandstone, grayish green to brownish tan, contains a few rootlets.....	228.5	245.0
Sandstone, moderately to very calcareous, light tan to light gray, contains a few rootlets.....	245.0	266.0
Sandstone, grayish green, contains a few rootlets...	266.0	288.0
Sandstone, moderately calcareous, light tan to pinkish gray, contains a few rootlets.....	288.0	300.0
Sand, silty, light greenish gray, texture grades from fine to medium sand.....	300.0	328.0
Sand, light brownish gray, medium texture, contains a few green silt pebbles.....	328.0	332.0
Sand, silty, to sandstone, light greenish gray with brown tint, contains a few rootlets.....	332.0	337.5
Sandstone, brownish gray with slight greenish tint..	337.5	344.0
Sand, in part silty, greenish gray to brownish gray, texture grades from fine to coarse sand with trace of fine gravel.....	344.0	358.0
Sand and some gravel, light brownish gray, texture grades from fine sand to fine gravel.....	358.0	362.0
Silt, clayey, in part calcareous, light gray to light greenish gray.....	362.0	369.0
Sandstone, moderately calcareous, brownish tan, light gray and very calcareous below 375.0 ft.....	369.0	386.5
Sand to sandstone, brownish gray, texture grades from fine to medium sand.....	386.5	394.0
Sandstone, tan, contains thin calcareous layers.....	394.0	398.0
Clay, in part sandy, brownish tan, contains fine sand.....	398.0	410.0
Sandstone and marl, interbedded, light yellowish gray.....	410.0	418.0
Sand, in part silty, light brownish gray, more silty below 420.0 ft.....	418.0	425.0
Sand and some gravel, light brownish gray, texture grades from medium sand to fine gravel.....	425.0	430.0
Sand, silty, light grayish green.....	430.0	438.0
Sand, in part silty, brownish gray-green, contains some gravel, limonitic fragments and silty clay pebbles below 450.0 ft.....	438.0	455.0
Sand and gravel, brownish gray-green, texture grades from sand to medium gravel.....	455.0	480.0

Gravel, grayish green to dark gray, texture grades from fine to coarse gravel, contains many limonite and rounded aragonite fragments.....	480.0	485.5
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, slightly to moderately calcareous, light gray, many yellowish buff stains.....	485.5	491.0
Clay shale, medium to dark gray, in part yellowish brown.....	491.0	500.0

Test Hole #31-B-48
(7-20-35ddda)
Phelps County

Location: NE SE SE SE sec. 35, T. 7 N., R. 20 W., approximately 411 feet north and 7 feet west of southeast corner.
Ground elevation: 2,402 ft (i). (Bertrand SE 7.5 min. quadrangle)
Depth to water: Unknown. Test-hole caved at 122.4 ft (8-25-48).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil and road fill: silt, dark brown.....	0.0	2.0
Soil: silt, slightly clayey, dark brownish gray....	2.0	3.5
Silt, clayey, medium brownish gray.....	3.5	4.5
Silt, slightly clayey, light brown to gray.....	4.5	5.0
Silt, brownish buff with grayish tint, contains a few gastropod shells below 10.0 ft.....	5.0	33.0
Silt, reddish brown, tan with brownish tint below 37.0 ft.....	33.0	40.0
Silt, sandy, brownish tan with reddish tint, contains very fine to fine sand with some medium and a trace of coarse sand, very slightly calcareous below 50.0 ft.....	40.0	55.0
Sand, silty, to silt, sandy, grayish tan to light gray, contains very fine to medium sand with some coarse sand, in part limonitic, slight greenish tint below 120.0 ft.....	55.0	125.5
Silt, sandy to slightly clayey, slightly calcareous, light tannish gray, contains some gravel and a few calcareous nodules, slight brown to green tint below 130.0 ft.....	125.5	138.0
Sand and some gravel, very slightly silty, light gray, texture grades from fine sand to medium gravel.....	138.0	144.5
Silt, sandy to slightly clayey, light greenish gray, contains very fine to fine sand.....	144.5	145.5
Sand, light tannish gray, texture grades from very fine to coarse sand.....	145.5	150.0
Silt, slightly sandy, moderately to very calcareous, light gray with tan tint.....	150.0	150.5
Sand and gravel, light brownish gray with pink tint, texture grades from fine sand to coarse gravel....	150.5	164.5
Silt, sandy, light grayish tan, contains very fine to fine sand.....	164.5	166.0
Sand and gravel, light brownish gray with pink tint, texture grades from fine sand to coarse gravel....	166.0	198.5
Tertiary System - Miocene Series - Ogallala Group:		
Silt, sandy, to sandstone, slightly to very calcareous, greenish gray to light gray.....	198.5	201.0

Silt, sandy, light greenish gray, contains very fine sand	201.0	208.0
Sand, in part silty, light tannish gray, texture grades from very fine to medium sand with some coarse sand	208.0	214.5
Marl, light gray	214.5	215.0
Marl, light yellowish gray, some light gray very calcareous sandstone	215.0	216.5
Sandstone, very calcareous, light gray, very light brownish gray and less calcareous from 223.0 to 225.0 ft	216.5	234.5
Silt, sandy to slightly clayey, moderately to very calcareous, light brownish gray	234.5	243.5
Sand and some gravel, light brownish gray, texture grades from fine sand to fine gravel, cemented in part	243.5	248.0
Sandstone, quartzitic in part, very calcareous, light gray	248.0	250.0
Sandstone, light brownish gray with greenish tint, texture grades from fine to medium sand, contains some interbedded silt below 280.0 ft	250.0	295.0
Sandstone, very calcareous, light grayish tan with greenish tint	295.0	300.0
Sand, silty, light tannish gray, texture grades from very fine to medium sand with some coarse sand	300.0	318.0
Sand, silty, to sandstone, light brownish gray with greenish tint	318.0	323.0
Sand and gravel, light brownish gray, texture grades from fine sand to medium gravel with some coarse gravel	323.0	351.0
Silt, clayey, in part sandy, brownish tan to greenish gray	351.0	355.0
Sand, light brownish gray, texture grades from fine to coarse sand	355.0	360.0
Silt, sandy, to sandstone, greenish gray	360.0	365.0
Silt, sandy, to sand, silty, light greenish gray	365.0	368.0
Sand and gravel, brownish gray to pink and green, texture grades from fine sand to fine gravel	368.0	378.5
Silt, sandy, grayish tan with pinkish tint, contains fine to medium sand	378.5	380.5
Sand and gravel, brownish gray to pink and green, texture grades from fine sand to fine gravel	380.5	387.0
Silt, clayey, reddish tan to greenish gray, contains hard calcareous zones from 387.0 to 388.0 ft	387.0	392.0
Sand and gravel, brownish gray to pink and green, texture grades from fine sand to fine gravel, contains a few calcareous fragments	392.0	395.0
Silt, sandy, very calcareous, light gray to greenish gray	395.0	400.5
Sandstone, light tannish gray	400.5	408.5

Silt, sandy, to sand, silty, light greenish gray, contains very fine to fine sand, some sandstone below 410.0 ft	408.5	415.0
Sandstone, light brownish gray, contains a few rootlets	415.0	418.0
Sand and gravel, brownish gray to pink and green, texture grades from fine sand to medium gravel with some coarse gravel, greenish gray with many limonitic, calcareous, and aragonite fragments below 440.0 ft	418.0	454.0
Silt, sandy, very slightly calcareous, light greenish gray, contains fine to coarse sand	454.0	458.0
Sand and gravel, light greenish gray, texture grades from fine sand to medium gravel with some coarse gravel	458.0	467.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, moderately to very calcareous, white, contains some limonitic stains, light gray below 468.0 ft	467.0	470.5
Clay shale, moderately calcareous, medium gray, contains some limonitic stains	470.5	480.0

Test Hole #68-B-47
(8-17-25aaaa)
Phelps County

Location: NE NE NE NE sec. 25, T. 8 N., R. 17 W., approximately 20 feet south and 17 feet west of northeast corner.
Ground elevation: 2,180 ft (i). (Alfalfa Center 7.5 min. quadrangle)
Depth to water: 6.5 ft. (9-29-47)
No e-log available. Drilled at location of test hole 09-31.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: sand, silty, dark grayish brown, texture grades from very fine to medium sand with some coarse sand and gravel, medium grayish brown below 0.5 ft	0.0	1.5
Sand, texture grades from fine to coarse sand with a trace of very coarse sand and fine gravel, principally quartz, contains some frosted and a few polished grains	1.5	3.0
Sand, texture grades from fine to very coarse sand with a trace of fine to coarse gravel, much quartz and some pink feldspar, contains a trace of limonitic stain, some frosted, many polished grains	3.0	5.0
Sand and gravel, texture grades from medium to very coarse sand and fine gravel, much quartz and a trace of pink feldspar and dark metamorphics, many polished grains, contains about 30 percent gravel below 10.0 ft	5.0	17.0
Sand and gravel, texture grades from medium sand to medium gravel, contains much quartz and some pink feldspar, and much dark stain, contains 50 to 80 percent gravel, less stain and many polished grains below 25.0 ft	17.0	40.0
Sand and gravel, texture grades from medium sand to fine gravel with some medium gravel, contains much quartz and a trace of pink feldspar, many polished grains, 30 to 50 percent gravel	40.0	52.0
Silt, slightly clayey to sandy, yellowish brown, contains very fine sand, limonitic stain at 52.0 ft	52.0	54.0
Silt, clayey, very calcareous, light greenish gray, moderately calcareous below 55.5 ft	54.0	57.0
Silt, moderately clayey to sandy, slightly calcareous, brown	57.0	60.0
Silt, slightly clayey to sandy, moderately calcareous, light brown, contains very fine sand, hard limy nodular zones	60.0	65.0
Siltstone, sandy, dark brownish tan, contains clayey to sandy silt from 68.0 to 70.0 ft	65.0	70.0

Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, silty, very calcareous, light greenish gray, contains very fine sand, many fossil rootlets, noncalcareous below 80.0 ft., contains thin hard limy zones from 81.0 to 81.2 ft., and at 83.0 and 85.0 ft	70.0	88.0
Sandstone, very calcareous, yellowish gray, texture grades from very fine to fine sand	88.0	96.0
Silt, in part sandy, in part calcareous, light greenish gray, in part consolidated, contains more sand below 105.0 ft	96.0	108.0
Sandstone, very calcareous, very light brownish gray, fine texture, contains some rootlets, reddish brown from 114.0 to 115.0 ft	108.0	119.0
Sandstone, very light greenish gray, texture grades from very fine to medium sand, contains a few rootlets, in part very light brownish gray below 124.0 ft	119.0	137.5
Sandstone, very calcareous, white to very light brownish gray, texture grades from very fine to fine sand, contains a few rootlets	137.5	141.0
Silt, sandy, and sandstone, greenish gray and light brown	141.0	143.0
Siltstone, very calcareous, light gray	143.0	145.0
Sandstone, silty, very calcareous, light yellowish gray, texture grades from very fine to medium sand, contains a few rootlets	145.0	160.0
Sandstone, light greenish gray, texture grades from very fine to fine sand, less consolidated and texture grades from very fine to medium sand below 170.0 ft	160.0	178.0
Silt, sandy, light gray, contains very fine sand, contains a thin sandstone layer and a silty clay layer from 180.5 to 184.0 ft	178.0	184.0
Sand, very light brownish gray, texture grades from very fine to medium and some coarse sand	184.0	190.0
Sandstone, very calcareous, yellow to very light brownish gray, texture grades from very fine to fine sand, contains a few rootlets, contains seeds from 205.0 to 210.0 ft	190.0	220.0
Marl, and sandstone, interbedded, white and light yellowish gray	220.0	226.0
Silt, sandy, light greenish gray, contains some limy zones	226.0	230.0
Silt, sandy, to sand, silty, light brownish gray with a slight green tint, contains very fine to medium sand, slightly consolidated from 238.0 to 262.5 ft	230.0	273.0
Clay, silty, very light greenish gray and some light brown, less clayey and slightly consolidated below 275.0 ft	273.0	281.5

Silt, sandy, light greenish gray, and some light brown, contains very fine to fine sand.....	281.5	288.0
Sand, silty, light greenish gray, texture grades from very fine to medium and some coarse sand.....	288.0	292.5
Silt, clayey, in part sandy, light greenish gray, contains very fine sand.....	292.5	302.0
Silt, sandy, light greenish gray, contains very fine sand, slightly clayey below 310.0 ft.....	302.0	317.5
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay shale, slightly calcareous, dark gray, contains black iron concretions at 317.5 ft., moderately calcareous below 320.0 ft.....	317.5	330.0

Test Hole #5-A-46
(8-18-16cccc)
Phelps County

Location: SW SW SW SW sec. 16, T. 8 N., R. 18 W., approximately 70 feet north and 60 feet east of southwest corner.
Ground elevation: 2,252 ft (i). (Elm Creek West 7.5 min. quadrangle)
Depth to water: 9.61 ft (6-17-46).
No e-log available.

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Soil and sand, silty; sand is fine	0.0	6.0
Sand and gravel; gravel is fine to medium	6.0	12.0
Gravel, medium to coarse, red	12.0	20.0
Gravel, fine to coarse; contains some sand	20.0	35.0
Gravel, coarse, red	35.0	41.0
Clay, silty, light brown	41.0	47.0
Clay, silty, soft, greenish-gray	47.0	48.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, white	48.0	60.0
Sandstone, olive-brown	60.0	63.0
Clay, grayish-brown	63.0	65.0
Sandstone, fine-grained, brown	65.0	70.0
Clay, light brownish gray	70.0	73.0
Clay, sandy, pink; light brownish-gray below 78 ft.	73.0	85.0
Sandstone, light gray	85.0	100.0
Clay, sandy, light gray	100.0	104.0
Sandstone, light gray; harder below 114.0 ft	104.0	130.0
Clay, brown	130.0	134.0
Sandstone, reddish-brown	134.0	139.0

Test Hole #44-32
(8-18-21baaa)
Phelps County

Location: NE NE NE NW sec. 21, T. 8 N., R. 18 W.
Ground elevation: 2,245 ft (i). (Elm Creek East 7.5 min. quadrangle)
Depth to water: 11.0 ft (July 1932).
No e-log available.

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Silt, sandy, dark gray.....	0.0	8.0
Sand and gravel, very coarse.....	8.0	47.0
Tertiary System - Miocene Series - Ogallala Group:		
Clay, calcareous, white.....	47.0	51.0

Test Hole #31-A-48
(8-18-21dddd)
Phelps County

Location: SE SE SE SE sec. 21, T. 8 N., R. 18 W., approximately 165 feet north and 17 feet west of southeast corner.
Ground elevation: 2,249 ft (i). (Elm Creek East 7.5 min. quadrangle)
Depth to water: 9.8 ft (8-24-48).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Sand and some gravel, silty, medium brown to light brownish gray, texture grades from fine sand to medium gravel	0.0	1.0
Sand and gravel, light tan to brownish gray, texture grades from fine sand to coarse gravel, contains some very coarse gravel below 40.0 ft	1.0	43.5
Silt, clayey to slightly sandy, light gray	43.5	45.0
Silt, sandy to very slightly clayey, light greenish gray	45.0	52.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, light greenish gray, contains interbedded clayey to sandy silt	52.0	61.0
Silt, clayey to sandy, light greenish gray with tan tint, slightly to moderately calcareous and brownish gray with pink tint below 65.0 ft	61.0	73.5
Silt, sandy, light reddish brown, contains a few clayey zones, some embedded gravel	73.5	75.0
Sandstone, light reddish tan to greenish gray, texture grades from very fine to coarse sand, contains some fine to coarse gravel	75.0	91.0
Silt, sandy to slightly clayey, light grayish tan	91.0	95.5
Sandstone, light greenish gray, texture grades from very fine to medium sand, contains some interbedded light brown silty sand	95.5	105.0
Clay, light reddish brown	105.0	110.5
Clay, bentonitic, slightly calcareous, very light gray with a green tint	110.5	114.1
Sandstone, light greenish gray, texture grades from fine to medium sand, contains a few bone fragments from 120.0 to 125.0 ft	114.1	140.0
Sandstone, in part slightly calcareous, light gray with green tint, texture grades from fine to coarse sand	140.0	148.0
Sandstone, slightly calcareous, light greenish gray, texture grades from fine to medium sand, contains a few rootlets and seeds	148.0	187.0
Sand, silty, light greenish gray	187.0	190.0

Sandstone, light greenish gray, texture grades from fine to medium sand.....	190.0	200.0
Sand, light brownish gray with a green tint, texture grades from fine to medium with some coarse sand..	200.0	219.0
Silt, slightly clayey to sandy, slightly calcareous, light gray with a green tint.....	219.0	222.5
Sandstone, light greenish gray, texture grades from fine to medium sand.....	222.5	228.5
Marl, light bluish gray.....	228.5	229.5
Sand, in part silty, very slightly calcareous, light greenish gray, texture grades from fine to medium sand.....	229.5	231.0
Siltstone, slightly calcareous, very light gray with greenish tint.....	231.0	240.0
Silt, sandy, to siltstone, light green.....	240.0	243.0
Clay, slightly silty, light gray with green tint....	243.0	245.0
Clay, light greenish gray.....	245.0	250.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, light brownish gray from 250.0 to 270.0 ft., medium gray with limonitic stain below 270.0 ft...	250.0	279.0
Shale, dark gray, slightly darker below 285.0 ft....	279.0	290.0

Test Hole #29-B-47
(8-19-12cddd)
Phelps County

Location: SE SE SE SW sec. 12, T. 8 N., R. 19 W., approximately 10 feet north and 2,639 feet east of southwest corner.
Ground elevation: 2,264 ft. (i). (Elm Creek West 7.5 min. quadrangle)
Depth to water: 4.1 ft (7-28-47) .
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, sandy, dark brownish gray, contains very fine sand	0.0	1.0
Silt, sandy, slightly to moderately calcareous, grayish brown, contains very fine to fine sand and a few calcareous nodules	1.0	2.5
Soil: silt, sandy, moderately to very calcareous, dark brownish gray, contains fine sand to medium gravel	2.5	3.5
Sand, clayey, buff gray, fine texture, contains some limonitic stain	3.5	4.5
Sand and gravel, grayish tan, texture grades from very fine sand to very coarse gravel	4.5	32.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, clayey, slightly to very calcareous, very light green to gray	32.0	34.5
Silt, clayey to sandy, pinkish tan, contains some interbedded pinkish to greenish gray sandstone	34.5	40.0
Sandstone, in part calcareous, pinkish to greenish gray, contains a few rootlets and seeds, reddish brown below 58.0 ft., grades into a siltstone below 75.0 ft	40.0	80.0
Siltstone to claystone, brownish to greenish gray, blocky	80.0	90.0
Sandstone, slightly to very calcareous, grayish green, contains a few rootlets, quartzitic layer from 96.0 to 98.5 ft., few yellowish gray marl beds below 110.0 ft	90.0	120.0
Marl, grayish yellow	120.0	121.0
Sandstone, very calcareous, greenish gray with a slight brownish tint, contains many rootlets	121.0	133.0
Sand, silty, to silt, sandy, slightly calcareous, grayish green	133.0	142.5
Sandstone, slightly to moderately calcareous, brownish gray-green, fine textured, few rootlets, texture grades from fine to medium sand below 170.0 ft	142.5	202.5
Sandstone, very calcareous, very light grayish green, fine texture	202.5	215.0

Silt, clayey, very calcareous, light gray to very light grayish green.....	215.0	217.5
Clay, green, contains some limonitic stain and reworked clay fragments.....	217.5	223.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, light gray, contains much limonitic material..	223.0	259.0
Clay shale, dark gray to black.....	259.0	270.0

Test Hole #30-B-47
(8-19-14cddd)
Phelps County

Location: SE SE SE SW sec. 14, T. 8 N., R. 19 W., approximately 12 feet north and 2,639 feet east of southwest corner.
Ground elevation: 2,280 ft (i). (Elm Creek West 7.5 min. quadrangle)
Depth to water: 8.2 ft (7-30-47).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil and road fill: silt, slightly sandy, brownish black	0.0	1.0
Soil: silt, clayey to slightly sandy, brownish black	1.0	3.0
Soil: silt, clayey, dark brownish gray	3.0	4.5
Silt, clayey to sandy, buff gray, contains fine sand	4.5	5.5
Clay, soil-like, sandy to silty, dark buff gray, contains very fine sand	5.5	7.5
Silt, sandy to slightly clayey, grayish buff, contains very fine sand, a few calcareous nodules, light brownish gray below 9.0 ft	7.5	10.0
Clay, silty, to silt, sandy, grayish brown, contains very fine sand, limonitic stain in lower foot	10.0	14.0
Sand and gravel, pinkish gray, texture grades from fine sand to medium gravel with some coarse gravel, texture grades from coarse sand to coarse gravel below 40.0 ft	14.0	51.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, brownish gray-green, fine texture	51.0	53.5
Sandstone, very calcareous, light gray, contains a few seeds	53.5	56.5
Sandstone, brownish gray-green, fine texture, in part calcareous, contains rootlets and seeds below 60.0 ft	56.5	64.0
Sandstone, light gray to brownish gray-green, very calcareous from 64.0 to 67.0 ft., reddish brown below 70.0 ft	64.0	76.0
Sand and some sandstone, grayish tan, texture grades from fine to coarse sand with some fine gravel	76.0	79.5
Sandstone, very calcareous, light greenish gray, grading to a slightly sandy silt from 85.0 to 91.0 ft., pinkish tan below 91.0 ft	79.5	97.0
Silt, clayey, very calcareous, light greenish gray, contains a few marl layers below 100.0 ft	97.0	105.5
Sandstone, slightly calcareous, greenish to brownish gray, fine texture, few rootlets and seeds, light gray and very calcareous from 119.0 to 130.0 ft. and 145.5 to 148.0 ft	105.5	151.0

Sand and gravel, light grayish brown with pinkish tint, texture grades from fine sand to fine gravel	151.0	155.0
Sandstone, moderately calcareous, brownish gray to grayish green, fine texture, very calcareous from 174.0 to 175.0 ft., some interbedded silt from 180.0 to 185.0 ft.....	155.0	195.0
Silt, sandy, to sandstone, in part slightly calcareous, light grayish green.....	195.0	201.0
Clay, silty, to silt, clayey, light gray to light grayish green, few marl layers.....	201.0	207.0
Siltstone, sandy, grayish green, contains very fine sand.....	207.0	224.5
Gravel, consists mainly of green silt pebbles and limonitic fragments, contains some volcanic ash...	224.5	233.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, light to medium gray, contains some weathered material at top.....	233.0	239.0
Clay shale, dark gray to black, contains some weathered material, trace of light gray bentonitic clay from 240.0 to 245.0 ft.....	239.0	250.0

Test Hole #31-B-47
(8-19-28daaa)
Phelps County

Location: NE NE NE SE sec. 28, T. 8 N., R. 19 W., approximately 2,610 feet north and 9 feet west of southeast corner.
Ground elevation: 2,316 ft (i).(Elm Creek West 7.5 min. quadrangle)
Depth to water: 28.0 ft (8-1-47).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, sandy to slightly clayey, brownish black, contains very fine sand.....	0.0	1.0
Soil: clay, sandy to silty, slightly to moderately calcareous, brownish gray, contains very fine sand	1.0	3.0
Silt, clayey, slightly to moderately calcareous, buff gray, few small calcareous nodules.....	3.0	4.0
Silt, in part sandy, slightly to moderately calcareous, tannish gray, contains very fine sand, limonitic flecks and calcareous rootlets, slightly coarser texture below 17.0 ft.....	4.0	20.0
Sand, tan to buff gray, texture grades from fine to coarse sand, contains some limonitic stain and small gastropod shells, some fine to medium gravel below 45.0 ft.....	20.0	66.0
Silt, clayey to slightly sandy, grayish green.....	66.0	69.5
Sand and gravel, pinkish gray, texture grades from fine sand to coarse gravel.....	69.5	80.0
Clay, silty, light gray with a slight greenish tint.	80.0	84.0
Clay, silty, to silt, clayey, pinkish tan, calcareous nodules in lower part.....	84.0	93.5
Silt, reddish brown, contains a few rootlets.....	93.5	96.0
Silt, clayey, moderately to very calcareous, light gray to brownish tan, slightly calcareous with some sandy silt below 110.0 ft.....	96.0	114.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, slightly to very calcareous, brownish tan, fine texture, contains a few rootlets and seeds, grayish green 126.0 to 140.0 ft., brownish gray to grayish brown below 140.0 ft.....	114.0	142.0
Clay, reddish brown, and marl, grayish white, interbedded.....	142.0	147.0
Clay, slightly calcareous, reddish brown, blocky....	147.0	155.0
Sandstone, brownish tan to grayish green, contains a few rootlets and seeds, moderately to very calcareous below 160.0 ft., some fine to coarse sand below 190.0 ft.....	155.0	195.0

Sand, greenish gray, texture grades from fine to coarse sand, slightly finer texture and some interbedded silty sand below 205.0 ft.....	195.0	210.0
Sand, slightly silty, grayish green, texture grades from fine to medium sand.....	210.0	220.0
Sandstone, slightly to moderately calcareous, light grayish green to brownish gray-green, contains a few rootlets.....	220.0	238.0
Silt, clayey, grayish green.....	238.0	243.0
Quartzite, in part calcareous, grayish green.....	243.0	244.3

Test Hole #82-32
(8-20-13bddd)
Phelps County

Location: SE SE SE NW sec. 13, T. 8 N., R. 20 W.
Ground elevation: 2,308 ft (t). (Overton 7.5 min. quadrangle)
Depth to water: unknown.
No e-log available.

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Soil, black	0.0	5.0
Clay, yellow	5.0	7.0
Clay and gravel	7.0	9.0
Gravel, very coarse	9.0	44.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, sandy, calcareous, gray and white	44.0	60.0

Test Hole #32-B-48
(8-20-35aaaa)
Phelps County

Location: NE NE NE NE sec. 35, T. 8 N., R. 20 W., approximately 118 feet south and 11 feet west of northeast corner.
Ground elevation: 2,386 ft (i). (Overton 7.5 min. quadrangle)
Depth to water: 63.3 ft (8-26-48).
No e-log available.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, medium brown	0.0	0.5
Silt, slightly clayey, light brownish gray	0.5	3.5
Silt, clayey, slightly calcareous, light gray with tan tint, contains a few gastropod shells	3.5	10.0
Silt, sandy to very slightly clayey, very slightly calcareous, light gray with tan tint, contains very fine sand, few limonitic concretions and gastropod shells	10.0	20.0
Silt, slightly sandy, light tannish gray, contains some limonitic stain and few gastropod shells	20.0	41.0
Silt, sandy to slightly clayey, medium brownish gray with a red tint, contains fine sand	41.0	42.5
Sand, light tannish gray, texture grades from very fine to medium sand with some coarse sand	42.5	66.0
Silt, sandy, light brownish gray, contains some limonitic stain	66.0	67.5
Silt, sandy to slightly clayey, light reddish tan to brownish gray, contains a few rootlets and moderately calcareous below 92.0 ft	67.5	100.0
Silt, clayey, slightly calcareous, light brownish gray with tan tint	100.0	101.5
Silt, slightly clayey to sandy, slightly to moderately calcareous, medium brownish gray, contains very fine to medium sand	101.5	102.5
Sand and gravel, light brownish tan, texture grades from very fine sand to medium gravel with some coarse gravel	102.5	122.0
Silt, sandy, light brownish tan, contains fine to medium sand	122.0	127.0
Silt, slightly clayey to sandy, light tan with pinkish tint, contains fine to medium sand	127.0	133.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, light brownish tan to gray, contains a few rootlets and calcareous zones	133.0	145.0
Sand, light brownish gray with tan tint, contains a sandstone layer below 152.0 ft	145.0	153.5
Silt, sandy, light reddish brown, contains fine to medium sand	153.5	154.5

Sand and gravel, light brownish tan to tannish gray, texture grades from fine sand to medium gravel....	154.5	163.0
Sandstone, silty, very calcareous, light gray with tan tint.....	163.0	170.0
Sand, silty, slightly to very calcareous, very light gray, few calcareous zones.....	170.0	172.5
Silt, slightly clayey to sandy, light greenish gray, contains some interbedded marl from 172.5 to 175.0 ft., some sandstone below 175.0 ft.....	172.5	180.0
Silt, very sandy, light greenish gray.....	180.0	183.0
Sandstone, light greenish gray, contains a few calcareous nodules.....	183.0	187.0
Siltstone, light brownish tan, contains a few interbedded sandstone layers.....	187.0	190.0
Sandstone, moderately to very calcareous, light greenish gray with a tan tint, light brownish gray below 195.0 ft.....	190.0	204.0
Sandstone, very calcareous, light gray with tan tint	204.0	205.0
Silt, sandy, very calcareous, light tan with a grayish tint, contains many limy layers.....	205.0	210.0
Sandstone, light reddish brown, contains a few thin sandy silt layers and calcareous zones.....	210.0	218.0
Sand, to silt, sandy, light gray with tan tint, texture grades from very fine to fine sand.....	218.0	220.0
Sand, moderately calcareous, light gray with a brownish tint, texture grades from very fine to coarse sand.....	220.0	225.0
Sandstone, moderately to very calcareous, light tan with a brownish tint, light greenish gray with a few calcareous rootlets below 230.0 ft.....	225.0	237.0
Sand, light tan to greenish gray, texture grades from very fine to coarse sand, contains a few calcareous rootlets, some interbedded sandstone...	237.0	283.0
Sandstone, light greenish gray, contains a few rootlets and bone fragments, some interbedded sandy silt, moderately to very calcareous from 327.0 to 340.0 ft.....	283.0	354.0
Sand, silty, moderately to very calcareous, light gray with tan tint, contains very fine to fine sand, few interbedded sandstone layers.....	354.0	360.0
Silt, sandy to slightly clayey, slightly calcareous, light greenish gray, contains fine sand, some interbedded sandstone from 375.0 to 390.0 ft., a medium to coarse textured gravel zone from 397.5 to 398.0 ft.....	360.0	400.0
Silt, clayey to slightly sandy, in part slightly calcareous, light gray with greenish tint, contains some interbedded fine to coarse gravel.....	400.0	403.5

Cretaceous System - Upper Cretaceous Series - Montana Group:

Pierre Formation:

Clay, slightly to very calcareous, light gray, contains some limonitic stain, a few calcareous zones	403.5	414.0
Clay shale, moderately to very calcareous, dark gray	414.0	420.0