2000

Frontier County Test Hole Logs

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FRONTIER COUNTY
Test-Hole Logs

Duane A. Eversoll

Nebraska Water Survey
Test-Hole Report No. 32

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

September 2000

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Publication and price lists are furnished upon request.

September 2000

ACKNOWLEDGMENTS

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Many others contributed to the test-hole drilling, both in the field and in the office. Jim Goeke provided geological expertise and knowledge of southwestern Nebraska and Vince Dreeszen shared cross-sections and geological data.

INTRODUCTION

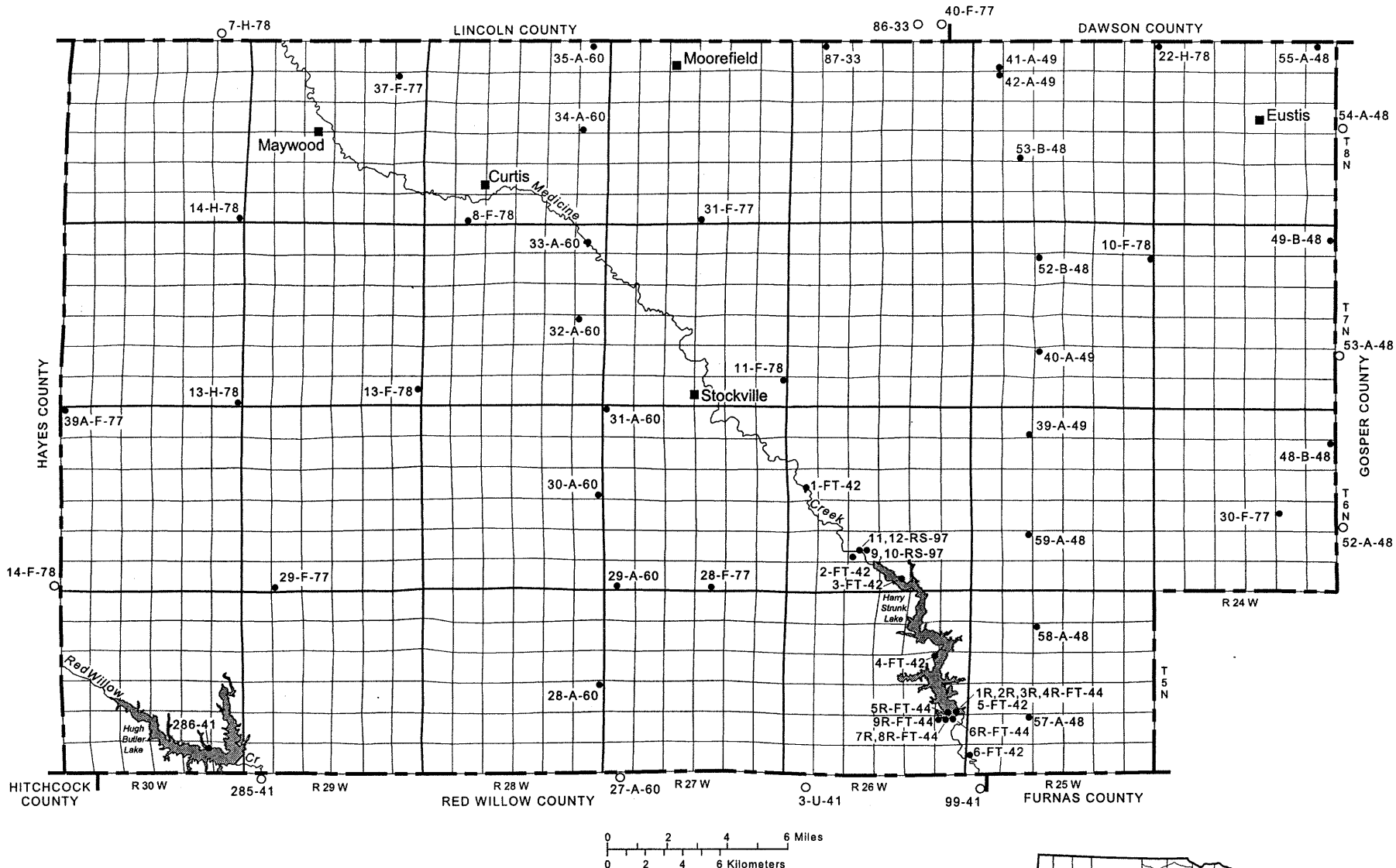
In 1930, the Conservation and Survey Division (CSD) of the University of Nebraska and the U.S. Geological Survey began a program of cooperative groundwater studies in Nebraska. Since then test drilling by use of rotary drilling equipment has been an integral part of that program. This report contains 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 (figure 1) shows the location of all test holes drilled in the county since 1933.

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. 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.

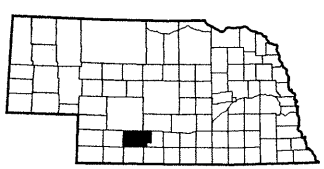
Beginning in September 1951, some of the test holes have been logged electrically. Geophysical logs (e-logs) often can be used to determine formation boundaries more precisely than by field sampling, especially where difference in rock types from the formation to another occur at the boundary. Figures 2 and 2a are examples of geophysical logs of two test holes from Frontier County 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 Frontier County, descriptions of strata done in earlier test hole reports are included with some revised formation information in this report.



● Test hole description published in this report

○ Test hole description published in other reports



County Location Map

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

Figure 2a. Frontier County sample geophysical log (13-H-78)

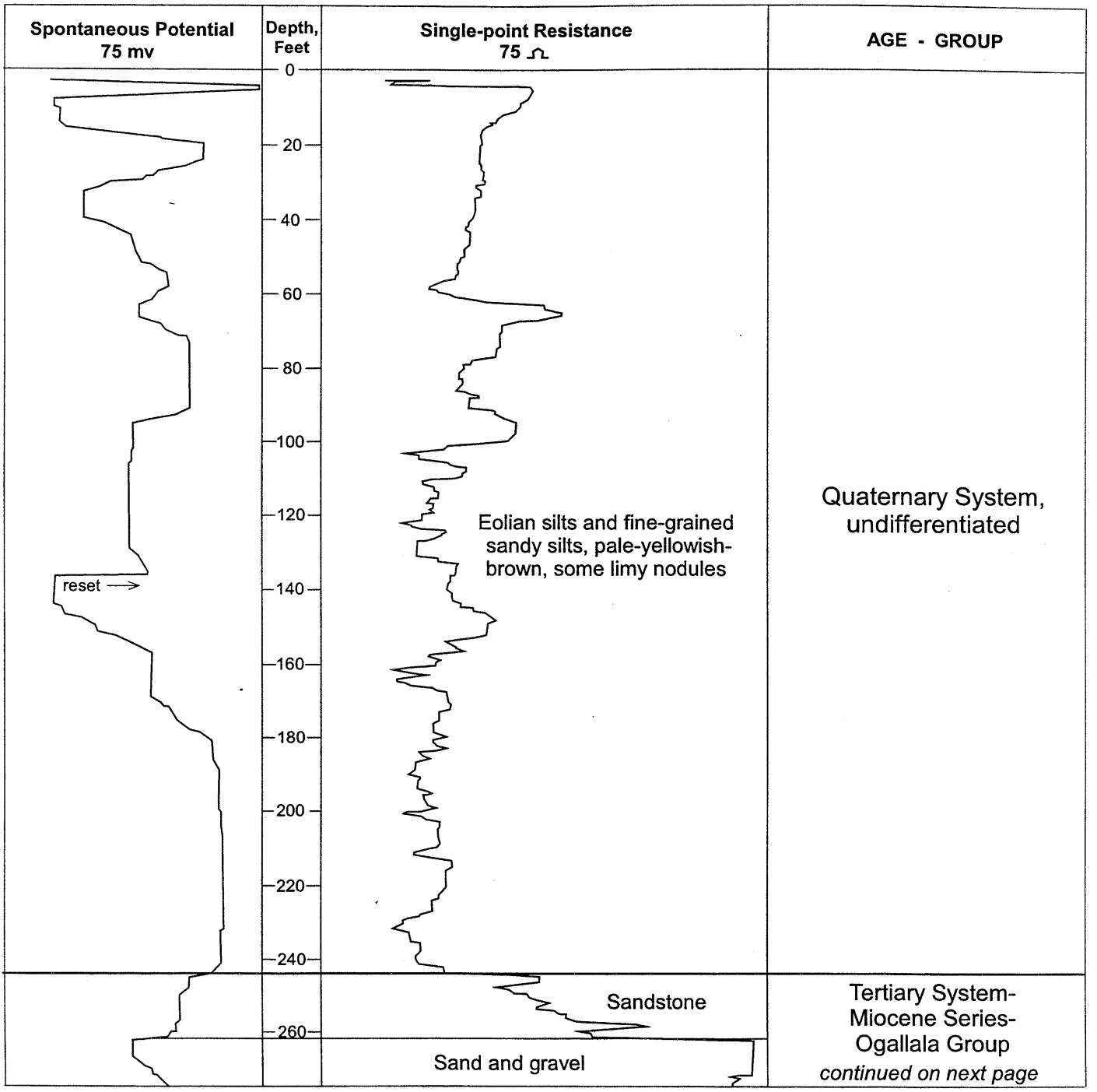


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Figure 2a continued. Frontier County sample geophysical log (13-H-78)

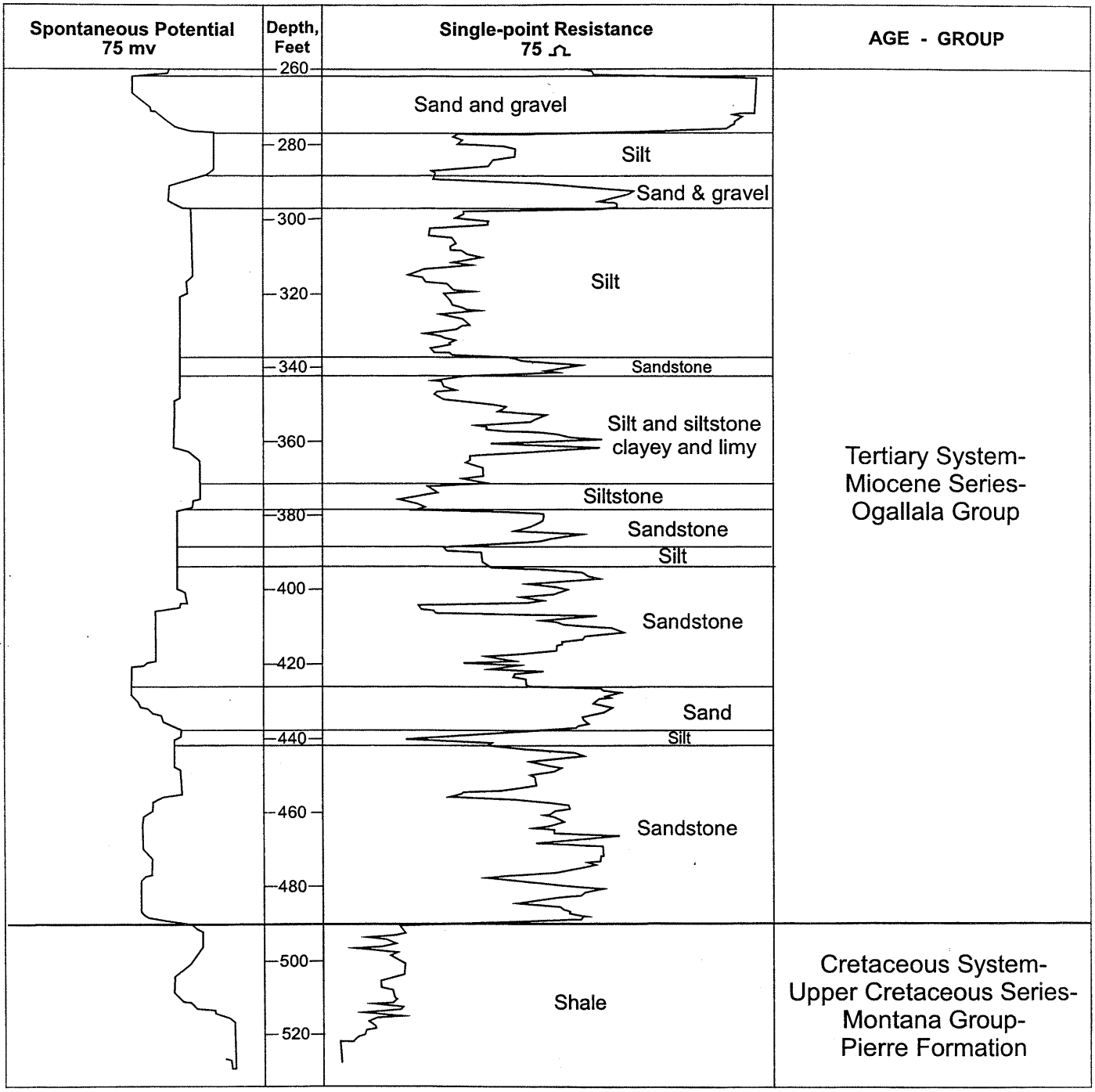
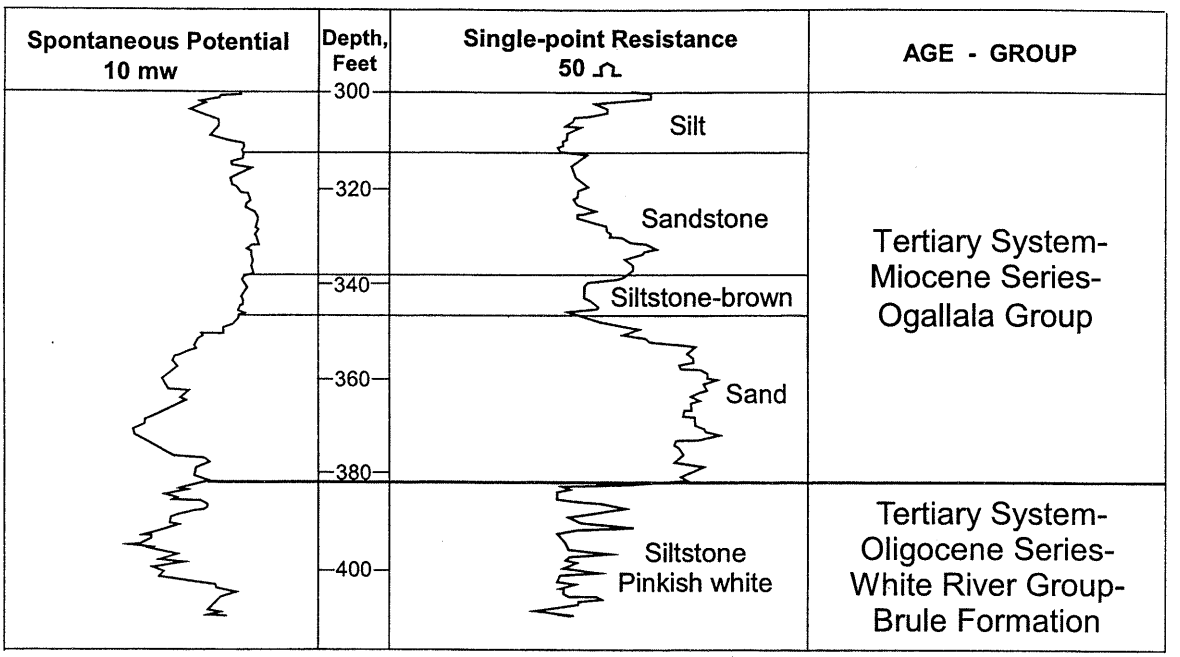


Figure 2b. Frontier County sample geophysical log (31-F-77)



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

The test hole records 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 #13-H-78), 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 (see USGS test hole identification in figure 3). 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. As shown in figure 3, the letters that follow the section number indicated the location of the test hole within the section, the first letters (NE) indicating the quarter section, the second letter (NW) indicating the quarter-quarter section, the third letter (SW) indicating the quarter-quarter-quarter section, and the fourth letter (SE) indicating the quarter-quarter-quarter-quarter section. The last numeral is the serial number of the test hole within the quarter-quarter-quarter-quarter section if more than one well is present in that area.

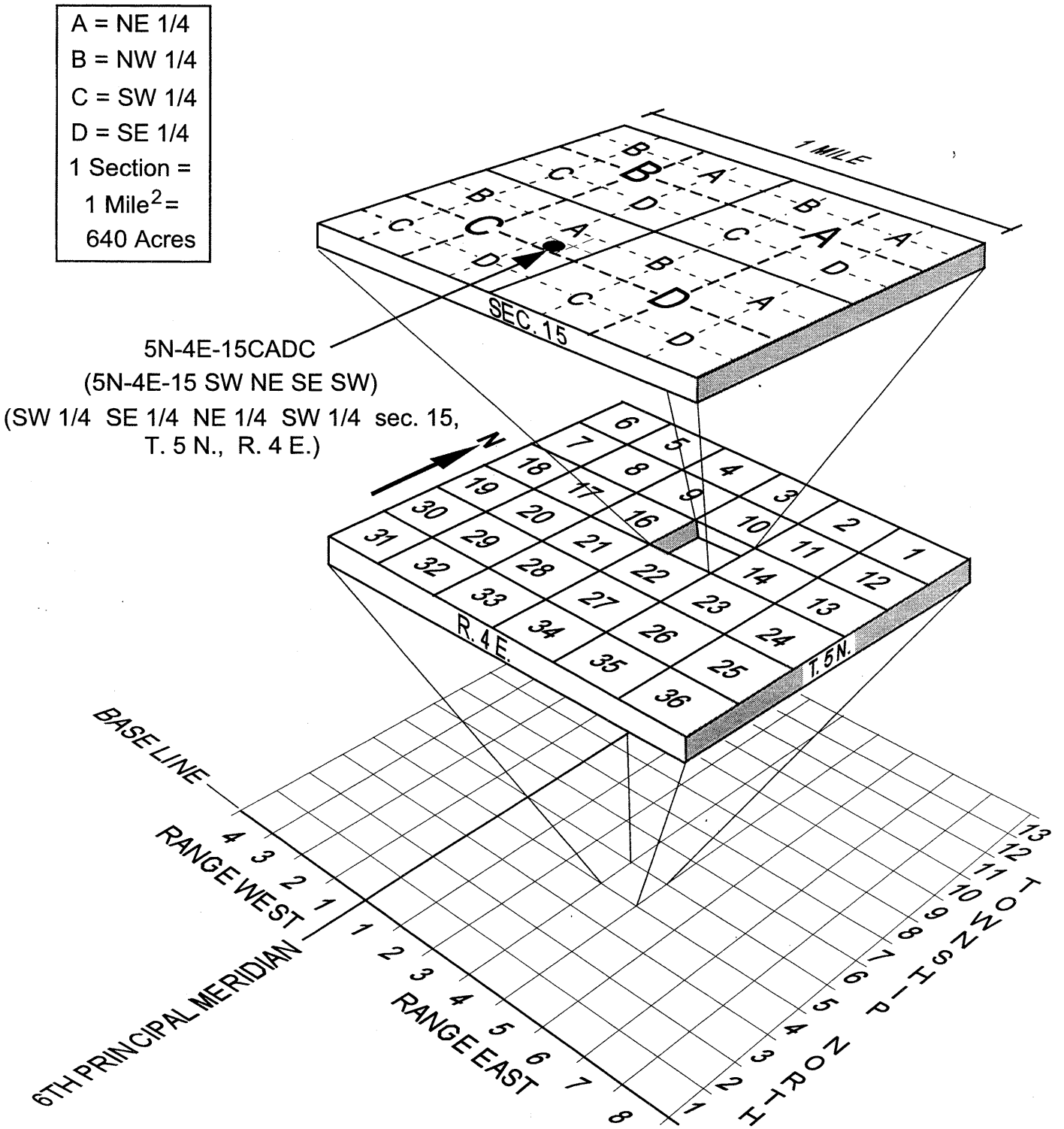


Fig. 3. System for identifying test-hole according to its location.

SELECTED REFERENCES

Some Publications that are Guides to
Earth Resources in Frontier County

Some of the published references pertinent to an understanding of the geologic and hydrologic resources of Frontier County are included below. The interested reader will find citations of other studies in these reports.

Bacon, S.R., Bruce, W.L., Franzen, D., Dodson, D.B. and Tyner, E.H. *Soil Survey of Frontier County Nebraska*, U.S. Department of Agriculture, SCS in cooperation with the Conservation and Survey Division, University of Nebraska-Lincoln, 1939 and 1978.

Cardwell, W.D.E., and Jenkins, E.D., *Ground-Water Geology and Pump Irrigation in Frenchman Creek Basin above Palisade, Nebraska* with a section on The Chemical Quality of the Water by Jochens, E.R., and Krieger, R.A., U.S. Geological Survey Water-Supply Paper 1577, 1963.

Eversoll, D.A., Dreeszen, V.H., Burchett, R.R., and Prichard, G.E., *Bedrock Map Showing the Configuration of the Bedrock Surface, McCook 1°x2° Quadrangle, Nebraska and Kansas and part of the Sterling 1°x2° Quadrangle, Nebraska and Colorado*, U.S. Geological Survey Map I-1878, 1988.

Goeke, J.W., Peckenpaugh, J.M., Cady, R.E., and Dugan, J.T., *Hydrogeology of the Twin Platte and Middle Republican Natural Resources Districts, Southwestern Nebraska*, with a section on water quality by R.A. Engberg, Nebraska Water Survey Paper No. 70, Conservation and Survey Division, University of Nebraska-Lincoln, prepared in cooperation with the U.S. Geological Survey, 1992.

Hiergesell, R.A., *Descriptive, Geologic, and Borehole Geophysical Logs for 23 Test Holes in South-Central Nebraska*, U.S. Geological Survey Open-File Report 84-073.

Keech, C.F., *Logs of Test Holes, Frenchman Creek Basin, Nebraska*, Conservation and Survey Division, University of Nebraska, Lincoln, 1957.

Selected References for Frontier County Continued

Lappala, E.G., *Quantitative Hydrogeology of the Upper Republican Natural Resources District, Southwest Nebraska*, U.S. Geological Survey Water-Resources Investigations 78-73, 1978.

Swinehart, J.B. and others, *Quaternary Geologic Map of the Platte River 4°x6° Quadrangle, United States*, U.S. Geological Survey, Map I-1420 (NK-14), 1994.

Frontier County
Test-Hole Log Table of Contents

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

Frontier County
Test-Hole Log Table of Contents

Arranged by year drilled, test-hole number.

1949

1960

1977

1978

1997

Test Hole #58-A-48 (No e-log)
(5-25-9bbbb)
Frontier County

Location: NW NW NW NW sec. 9, T. 5 N., R. 25 W., 206 ft. south and 21 ft. east of northwest corner.
Ground elevation: 2,395 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: 43.2 ft. (11-17-48)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, sandy, light brownish-gray; contains fine sand	0.0	4.0
Silt, dark brownish-gray, soil zone from 4 to 5 ft..	4.0	10.0
Silt, light buff-gray; contains few limy rootlets at 20 ft, hard calcareous nodules from 30 to 38 ft.....	10.0	38.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, sandy, calcareous light grayish-white to light reddish brown: contains sand from 40 to 42 ft.....	38.0	42.0
Sand and gravel, gray and yellow to reddish-brown; texture grades from medium sand to coarse gravel..	42.0	45.0
Silt, moderately calcareous, medium brownish-gray...	45.0	47.0
Sand and gravel, grayish-yellow to reddish-brown; texture grades from coarse sand to coarse gravel..	47.0	60.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, chalky, very calcareous, bright yellow, slightly granular.....	60.0	70.0
Shale, chalky, clayey, very calcareous, yellow with pinkish speckles.....	70.0	75.0
Shale, chalky, very calcareous, mottled bright yellow and white.....	75.0	106.0
Shale, silty clay, very calcareous, gray.....	106.0	110.0

Test Hole #57-A-48 (No e-log)
(5-25-29aaaa)
Frontier County

Location: NE NE NE NE sec. 29, T. 5 N., R. 25 W., 123 ft. south and 24 ft. west of northeast corner.
Ground elevation: 2,478 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: 161.9 ft. (11-30-48)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, brownish-gray	0.0	0.6
Silt, dark brownish-gray; slightly granular	0.6	2.0
Silt, medium buff-gray; contains a few gastropod shells, slightly granular from 2 to 5 ft	2.0	29.5
Silt, dark reddish-brown	29.5	34.0
Silt, slightly to moderately calcareous, medium reddish-buff	34.0	45.0
Silt, moderately calcareous, light grayish-buff; contains many calcareous nodules	45.0	50.0
Silt, buff-gray; contains moderately calcareous white silt layer from 50 to 51 ft	50.0	55.0
Silt, medium buff-gray; contains intermittent hard calcareous zones	55.0	60.0
Silt, slightly calcareous, dark buff-gray	60.0	65.0
Silt, dark buff-gray, coarse texture; contains calcareous zones from 67 to 67.5 ft	65.0	75.0
Silt, moderately calcareous, medium buff-gray; contains few calcareous nodules	75.0	95.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, coarse, buff-gray very calcareous 95-100 ft., and a few sand and gravel grains below 100 ft	95.0	110.0
Silt, very slightly calcareous, light brownish-gray, more calcareous and mottled white from 115 to 120 ft	110.0	129.0
Sand and gravel, reddish-brown with gray, yellow and pink grains; texture grades from medium sand to medium gravel; contains hard calcareous layer at 129 ft., some coarse gravel 130 to 140 ft	129.0	189.5
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, chalky, slightly silty, very calcareous, brown to yellowish-orange	189.5	190.0
Shale, chalky, very calcareous, yellowish-gray	190.0	193.0
Clay, silty, very calcareous, light yellowish-gray	193.0	195.0
Clay shale, very calcareous, dark brownish-gray	195.0	210.0

Test hole #6-FT-42 (No e-log)
(5-25-31bcbc)
Frontier County

Location: SW NW SW NW sec. 31, T. 5 N., R. 25 W., approximately 0.3 miles south of north section line, 250 ft. north of bridge, on east side of road.
Ground elevation: 2,304 ft. (i) (Cambridge 7.5 minute quadrangle)
Depth to water: not measured. (12-22-42)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Sand, yellow.....	0.0	8.0
Gravel, fine, medium, coarse, red; some lime.....	8.0	28.0
Gravel, fine, medium, coarse, blue.....	28.0	38.0
Sand and fine gravel, blue.....	38.0	48.0
Gravel, fine, medium, coarse, blue.....	48.0	58.0
Sand and fine gravel, blue.....	58.0	63.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, dark.....	63.0	69.0

Field number changed from 250-42 as per carbon copies

Test hole #4-FT-42 (No e-log)
(5-26-14aaaa)
Frontier County

Location: NE NE NE NE sec. 14, T. 5 N., R. 26 W.
Ground elevation: 2,381 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: not measured. (12-23-42)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Clay, sandy, yellow	0.0	4.0
Clay, sandy, dark	4.0	12.0
Clay, yellow	12.0	32.0
Clay, hard, yellow	32.0	42.0
Sand and fine to medium gravel; some clay	42.0	53.0
Sand and fine gravel	53.0	63.0
Gravel, fine, and hard clay	63.0	69.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, light, yellowish-white, very solid	69.0	79.0

Field number changed from 254-42 as per carbon copies

Test hole #5R-FT-44 (No e-log)
(5-26-24cddc)
Frontier County

Location: SW SE SE SW sec. 24, T. 5 N., R. 26 W., approximately 2,000 ft. east of southwest corner.
(U.S. Bureau of Reclamation test hole - Published 1944 - Drilled 1944 - Original log unavailable)
Ground elevation: 2,314 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: not measured.

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Top soil and clay	0.0	10.0
Silt, fine, sandy	10.0	15.0
Sand	15.0	18.0
Sand and gravel	18.0	20.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, blue	20.0	45.0

Test hole #4R-FT-44 (No e-log)
(5-26-24cddd)
Frontier County

Location: SE SE SE SW sec. 24, T. 5 N., R. 26 W., approximately 250 ft. north and 2,750 ft. east of southwest corner of section. (irregular section)
(U.S. Bureau of Reclamation test hole - Published 1944 - Drilled 1944 - Original log unavailable)
Ground elevation: 2,314 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: not measured.

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Top soil	0.0	5.0
Sand, silty, fine	5.0	17.0
Sand and gravel	17.0	62.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, blue	62.0	87.0

Test hole #5-FT-42 (No e-log)
(5-26-24dccd)
Frontier County

Location: SE SW SW SE sec. 24, T. 5 N., R. 26 W., approximately on south section line, about 300 ft. east of creek.
Ground elevation: 2,315 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: not measured. (12-22-42)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Clay, sandy, yellow	0.0	5.0
Clay, sandy, dark	5.0	14.0
Sand and fine to medium gravel, red; some lime	14.0	24.0
Gravel, lime, medium, coarse, blue	24.0	34.0
Gravel, fine to medium, blue	34.0	44.0
Gravel, fine to medium, blue and red	44.0	54.0
Sand and fine gravel	54.0	62.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, dark	62.0	69.0

Field number changed from 251-42 as per carbon copies

Test hole #3R-FT-44 (No e-log)
(5-26-24dccd)
Frontier County

Location: SE SW SW SE sec. 24, T. 5 N., R. 26 W., approximately 200 ft. north and 3,000 ft. east of southwest corner of section. (U.S. Bureau of Reclamation test hole - Published 1944 - Drilled 1944 - Original log unavailable)
Ground elevation: 2,315 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: not measured.

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Top soil and silt.....	0.0	10.0
Silt, sandy, fine.....	10.0	20.0
Sand, coarse.....	20.0	60.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, blue.....	60.0	88.0

Test hole #1R-FT-44 (No e-log)
(5-26-24dcdb)
Frontier County

Location: NW SE SW SE sec. 24, T. 5 N., R. 26 W., approximately 400 ft. north and 3,800 ft. east of southwest corner of section. (irregular section)
(U.S. Bureau of Reclamation test hole - Published 1944 - Drilled 1944 - Original log unavailable)
Ground elevation: 2,384 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: not measured.

	Depth, in feet	
	From	To
Tertiary System - Miocene Series - Ogallala Group:		
Lime, chalky, white.....	0.0	40.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Chalk, yellow.....	40.0	70.0
Shale, blue.....	70.0	100.0

Test hole #2R-FT-44 (No e-log)
(5-26-24dccb)
Frontier County

Location: NW SW SW SE sec. 24, T. 5 N., R. 26 W., approximately 400 ft. north and 3,400 ft. east of southwest corner of section. (irregular section)
(U.S. Bureau of Reclamation test hole - Published 1944 - Drilled 1944 - Original log unavailable)
Ground elevation: 2,316 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: not measured.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Top soil	0.0	4.0
Silt	4.0	10.0
Silt and lime pebbles	10.0	17.0
Sand and gravel, coarse	17.0	24.0
Silt and small lime pebbles	24.0	33.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, blue	33.0	100.0

Test hole #6R-FT-44 (No e-log)
(5-26-25abbb)
Frontier County

Location: NE NW NW NE sec. 25, T. 5 N., R. 26 W., approximately 200 ft. south and 3,000 ft. east of northwest corner of section. (irregular section)
(U.S. Bureau of Reclamation test hole - Published 1944 - Drilled 1944 - Original log unavailable)
Ground elevation: 2,313 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: not measured.

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Top soil and silt	0.0	8.0
Sand	8.0	15.0
Sand, coarse	15.0	20.0
Sand, fine, silty	20.0	25.0
Sand and gravel	25.0	60.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, blue	60.0	90.0

Test hole #8R-FT-44 (No e-log)
(5-26-25baac)
Frontier County

Location: SW NE NE NW sec. 25, T. 5 N., R. 26 W., approximately 400 ft. south and 2,100 ft. east of northwest corner of section. (irregular section)
(U.S. Bureau of Reclamation test hole - Published 1944 - Drilled 1944 - Original log unavailable)
Ground elevation: 2,376 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: not measured.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Top soil and buff-yellow clay.....	0.0	10.0
Clay, buff-yellow.....	10.0	47.0
Sand, fine.....	47.0	57.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, yellow.....	57.0	62.0
Shale, brown.....	62.0	70.0
Shale, blue.....	70.0	100.0

Test hole #7R-FT-44 (No e-log)
(5-26-25bada)
Frontier County

Location: NE SE NE NW sec. 25, T. 5 N., R. 26 W., approximately 600 ft. south and 2,500 ft. east of northwest corner of section. (irregular section)
(U.S. Bureau of Reclamation test hole - Published 1944 - Drilled 1944 - Original log unavailable)
Ground elevation: 2,335 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: not measured.

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Top soil and silty clay	0.0	10.0
Silt, black	10.0	15.0
Clay, silty, yellow	15.0	30.0
Sand, fine	30.0	35.0
Sand and gravel	35.0	40.0
Sand, coarse	40.0	44.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, blue	44.0	70.0

Test hole #9R-FT-44 (No e-log)
(5-26-25bbdb)
Frontier County

Location: NE SE NW NW sec. 25, T. 5 N., R. 26 W., approximately 900 ft. south and 1,100 ft. east of northwest corner of section. (irregular section)
(U.S. Bureau of Reclamation test hole - Published 1944 - Drilled 1944 - Original log unavailable)
Ground elevation: 2,384 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: not measured.

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Top soil and clay	0.0	10.0
Clay, yellow	10.0	57.0
Sand, fine	57.0	60.0
Gravel and clay, coarse	60.0	80.0
Sand and gravel	80.0	90.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, blue	90.0	115.0

Test hole #28-A-60 (E-log)
(5-28-24aaaa)
Frontier County

Location: NE NE NE NE sec. 24, T. 5 N., R. 28 W., 108 ft. south of north section line and 10 ft. west of east section line.
Ground elevation: 2,718 ft. (t) (Bartley NW 7.5 minute quadrangle)
Depth to water: not measured. (7-27-60)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, very dark brown-brown-dark yellow brown	0.0	10.0
Silt, slightly clayey, trace iron stain and snail shells, light olive brown	10.0	35.0
Silt, slightly-very clayey, slightly sandy, very fine marly, lime cemented zones, yellow brown, very pale brown-white	35.0	115.0
Clay, limy, slightly sandy, very fine, very pale brown	115.0	119.0
Tertiary System - Miocene Series - Ogallala Group:		
Limestone with clayey marl, white-very pale brown	119.0	122.0
Silt, very limy-marly, slightly-moderately sandy, very fine-medium, trace sandstone, white-pale olive	122.0	133.0
Sand and gravel, fine-very coarse sand to fine gravel, trace rootlets	133.0	147.0
Silt-siltstone, very sandy, fine sand-fine gravel, slightly clayey, very pale brown	147.0	150.0
Sand-sandstone with interbedded silt, sand is very fine-medium, silt is moderately sandy, slightly clayey, trace lime cement, pale brown	150.0	162.0
Sand, medium-coarse, trace very coarse, trace lime cement	162.0	165.0
Sandstone, very fine-fine, lime cemented, brown	165.0	170.0
Sand, medium-very coarse, trace fine gravel, rootlets, in part lime cemented	170.0	178.0
Sand and gravel, coarse sand-fine gravel, rootlets	178.0	184.0
Sandstone, very fine-medium, trace light brown siltstone, in part lime cemented, brown	184.0	194.0
Sand, fine-coarse, rootlets, siltstone and limestone fragments, brown	194.0	205.0
Silt, very sandy, very fine-fine, slightly clayey, marly	205.0	211.0
Sand, very fine-medium, lime cemented	211.0	223.0
Sandstone, very fine-fine, moderately silty, lime cemented, grayish brown-pale brown	223.0	235.0
Silt, moderately sandy, marly, volcanic ash 236-237.7 ft. white	235.0	240.0

Sand, very fine-coarse, interbedded sandstone, rootlets	240.0	252.0
Silt-siltstone, very sandy, interbedded sandstone, fine-coarse, slightly-moderately clayey, rootlets, light yellow brown-pale olive-olive gray	252.0	275.0
Sand-sandstone, very fine-medium, moderately silty, olive gray-pale olive	275.0	283.0
Silt, very clayey, slightly sandy, limy areas, light brown	283.0	290.0
Sand-sandstone, very fine-fine, with thin interbedded clayey silt seams, rootlets, moderately limy, pale yellow-pale olive-light olive gray	290.0	345.2
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Chert, very hard, conchoidal fracture, brownish yellow	345.2	345.3
Clay, yellow and white, chalky, very limy, very hard at 349.8 ft	345.3	349.8

Test Hole #286-41 (No e-log)
(5-30-35adad)
Frontier County

Location: SE NE SE NE sec. 35, T. 5 N., R. 30 W., approximately 400 ft. south of Red Willow Creek bridge, west side of road.
Ground elevation: 2,540 ft. (t) (Red Willow Dam 7.5 minute quadrangle)
Depth to water: 1.5 ft. (10-16-41)

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Soil, silt, sandy and slightly clayey, dark brown-gray	0.0	7.0
Clay, sandy, medium gray	7.0	10.0
Sand and gravel, medium to very coarse, red	10.0	41.0
Tertiary System - Miocene Series - Ogallala Group:		
Clay, silty and sandy, buff-yellow, some hard streaks	41.0	47.0
Sand and gravel, very coarse sand to very coarse gravel	47.0	53.0
Sand, very fine to medium, fairly compact	53.0	66.0
Silt, clayey and sandy limy streaks, buff to light gray, pinkish-gray and clayey	66.0	88.0
Clay, slightly silty, compact, tan-yellow buff	88.0	105.0
Gravel and sand, very coarse gravel to very coarse Sand, mostly gravels, red	105.0	119.0

Test Hole #48-B-48 (No e-log)
(6-24-12aaaa)
Frontier County

Location: NE NE NE NE sec. 12, T. 6 N., R. 24 W., 20 ft. south and 122 ft. west of northeast corner.
Ground elevation: 2,531 ft. (i) (Elwood SW 7.5 minute quadrangle)
Depth to water: 165.8 ft. (10-30-48)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, dark brownish-gray, slightly lighter 1 to 2 ft	0.0	2.0
Silt, light brownish-gray	2.0	3.0
Silt, sandy, moderately calcareous, light buff-gray; contains very fine sand and few snails, slightly calcareous and few limonitic nodules from 5 to 12.5 ft., slightly more gray and finer texture 12.5 to 15 ft., light gray from 15 to 21 ft	3.0	21.0
Silt, light brownish-gray; texture coarse, granular; contains occasional medium to coarse sand grains	21.0	37.0
Silt, very slightly clayey, dark reddish-brown, grades to reddish-tan at 42.5 ft	37.0	42.5
Silt, buff-tan; contains red tint 45 to 48 ft., moderately to very calcareous and buff-gray from 48 to 50 ft	42.5	50.0
Silt, slightly sandy, moderately calcareous, buff-gray; contains limy nodules, slight tan tint 55 to 58 ft	50.0	58.0
Silt, sandy, light brownish-tan with red tint; contains very fine sand	58.0	62.0
Silt, slightly sandy, moderately calcareous, white; contains very fine sand	62.0	63.0
Silt, moderately to very calcareous, brownish-gray with tan tint; texture coarse, moderately calcareous and brownish-tan from 65 to 70 ft., slightly calcareous 70 to 79 ft., intermittent white calcareous silt layers 75 to 77 ft	63.0	79.0
Silt, moderately calcareous, white	79.0	82.5
Silt, slightly calcareous, buff-tan with gray tint, more gray 85 to 90 ft.; contains intermittent light gray calcareous silt and embedded sand and gravel grains 105 to 110 ft	82.5	112.5
Tertiary System - Miocene Series - Ogallala Group:		
Silt, sandy, moderately to very calcareous, light-gray; contains very fine to fine and some medium sand	112.5	114.5
Sand, light gray; texture grades very fine to fine; contains fine to coarse gravel zones	114.5	120.0

Silt, slightly-sandy, light gray; contains very fine to fine sand, calcareous nodular fragments...	120.0	123.0
Sand and gravel, light brownish-gray; texture grades from fine sand to fine gravel.....	123.0	124.5
Marl, white.....	124.5	126.0
Sand and gravel, brownish-gray to pink; texture grades from fine sand to medium gravel.....	126.0	144.0
Sandstone, reddish-tan; texture grades from fine to medium; contains some coarse sand and traces of gravel.....	144.0	149.0
Sand, silty, brownish-tan; texture grades from fine to coarse with a trace of gravel.....	149.0	155.0
Sandstone, moderately calcareous, light brownish-gray; texture grades from fine sand to medium gravel, finer texture 160 to 165.5 ft. and 170 to 175.5 ft.; contains silty sand layers, light gray, grading from very fine to fine sand, 165.5 to 166.6 ft. and 175.5 to 177 ft.....	155.0	194.0
Sand, silty, to sandstone, very light gray with slight green tint; texture grades very fine to medium sand.....	194.0	200.0
Sand, silty, very light gray; texture grades very fine to medium sand.....	200.0	203.0
Sandstone, very light brownish-gray; texture grades from very fine to fine, moderately to very calcareous 206 to 212 ft.....	203.0	212.0
Silt, very slightly sandy, light tan-gray; contains a few speckled limestone fragments.....	212.0	215.0
Silt, sandy, light gray; contains very fine to medium sand.....	215.0	220.0
Sand, silty, to silt, sandy, light gray; texture grades from fine to medium with some coarse sand and a trace of gravel, less silty 225 to 236 ft...	220.0	236.0
Sandstone, moderately to very calcareous, light tan-gray to light gray; texture grades from fine to medium sand.....	236.0	247.0
Silt, slightly sandy, in part calcareous, light brownish-gray.....	247.0	248.5
Silt, sandy, very calcareous, very light brownish-gray; contains very fine sand.....	248.5	250.0
Sand and gravel, brownish-gray; texture grades from fine sand to fine gravel.....	250.0	254.0
Silt, clayey, moderately to very calcareous, light gray; contains marl, white, from 254 to 254.5 ft., green tint from 255 to 256 ft., tan tint from 256 to 257 ft., light greenish-gray from 257 to 260 ft.....	254.0	260.0
Silt, sandy, light greenish-gray; contains silty sand and sandstone from 260 to 265 ft., hard limy zone at 260 ft., less sandy, light gray and moderately to very calcareous 267.5 to 269 ft.....	260.0	269.0

Silt, clayey, light greenish-gray, in part calcareous from 271 to 274 ft., very calcareous from 274 to 277 ft. and 280.5 to 282.5 ft.....	269.0	282.5
Silt, sandy, to sand, silty, moderately to very calcareous, light gray to white with light green tint; texture grades from fine to coarse sand.....	282.5	305.0
Silt, sandy, light greenish-gray, very calcareous below 306.5 ft.....	305.0	309.0
Sand to sandstone, light brownish-gray with green tint; texture grades from fine to medium.....	309.0	316.0
Silt, sandy, moderately calcareous, white; contains very fine sand.....	316.0	318.0
Sand, brownish-gray; texture grades from fine to medium.....	318.0	319.5
Silt, sandy, very slightly calcareous, light greenish-gray; white below 320 ft., occasional limonitic stain 328 to 330 ft.....	319.5	333.0
Silt, sandy, to sandstone, light green; contains very fine sand.....	333.0	335.0
Silt, clayey, light greenish-gray, slight iron-stain.....	335.0	335.5
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Clay, very light gray, very iron-stained, darker 345 to 361 ft.....	335.5	361.0
Clay shale, slightly silty, black.....	361.0	370.0

Test Hole #30-F-77 (E-log)
(6-24-23bcbb)
Frontier County

Location: NW NW SW NW sec. 23, T. 6 N., R. 24 W., 1390 ft. south and 58 ft. east of northwest corner.
Ground elevation: 2,505 ft. (t) (Cambridge NE 7.5 minute quadrangle)
Depth to water: 182 ft. (10-19-77)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, brown	0.0	5.0
Silt, slightly clayey, pale-brown; some very fine sand; below 3 ft. lighter in color	5.0	37.0
Silt, moderately clayey, gray brown, slightly calcareous	37.0	45.0
Silt, slightly clayey with some very fine to fine sand, tan to buff	45.0	70.0
Silt, slightly clayey and sandy, sand is very fine, some marly silts from 70-75 ft., tan to light brown	70.0	100.0
Silt, slightly clayey, some very fine sand, limy in areas to 105 ft. then limy interbeds to 115 ft.	100.0	145.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt to very fine sand, some coarse sand grains, some volcanic ash, light brown to tan	145.0	155.0
Sand and gravel, fine sand to coarse gravel, slightly silty	155.0	160.0
Silt and interbedded fine sand, light tan to whitish tan, marly zones, some gravel grains	160.0	185.0
Sand and gravel, fine sand to coarse gravel, very silty and some interbedded silty clay, compact limy, 194-195 ft., limy silts 195-205 ft., hard between 200-205 ft., some sand and fine gravel 210-235 ft	185.0	235.0
Sand, very fine with some fine gravel, light gray, some silty clay layers to 240 ft., white limy silt 245-250 ft., light gray to tan	235.0	265.0
Sand, very fine to fine some medium, slightly silty, light gray	265.0	275.0
Silt to very fine sand, some medium, light gray, very ashy below 280 ft	275.0	287.0
Silt, slightly sandy, very limy, light gray-grayish white, slightly clayey in places, some reworked Niobrara fragments	287.0	313.0
Cretaceous System, Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, clay, yellowish-white, calcareous	313.0	340.0

Test Hole #39-A-49 (No e-log)
(6-25-5dddd)
Frontier County

Location: SE SE SE SE sec. 5, T. 6 N., R. 25 W., 94 ft. north and 7 ft. west of southeast corner.
Ground elevation: 2,574 ft. (i) (Eustis SW 7.5 minute quadrangle)
Depth to water: 163.4 ft. (8-20-49)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Road fill: silt, slightly sandy, brownish-black....	0.0	1.0
Silt, blackish-gray.....	1.0	3.0
Silt, brownish-gray.....	3.0	5.0
Silt, slightly calcareous, light brown to brownish-tan.....	5.0	10.0
Silt, slightly clayey, slightly calcareous, light brownish-tan; contains some limonite-stain.....	10.0	20.0
Silt, tan to dark-buff.....	20.0	38.0
Silt, slightly sandy, slightly calcareous, dark-brown with red tint; contains some small limy nodules at 40 ft.....	38.0	42.0
Silt, light brownish-buff.....	42.0	45.0
Silt, very calcareous, light brown with pink tint; contains some limy zones.....	45.0	50.0
Silt, very calcareous, grayish-white; contains some limy nodules.....	50.0	60.0
Silt, slightly clayey, very calcareous, tan to grayish-white.....	60.0	65.0
Silt, slightly sandy, slightly calcareous, light brown; contains very fine sand.....	65.0	70.0
Silt, very calcareous, light brown.....	70.0	73.0
Silt, slightly clayey, moderately calcareous, light brownish-buff, grayish-brown below 75 ft.....	73.0	85.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt to sandstone, moderately calcareous silt, grayish-brown, to sandstone, reddish-brown; texture grades very fine to coarse; contains limy fragments.....	85.0	90.0
Sandstone, very calcareous, light brown and reddish-brown; texture grades very fine to medium, some coarse; contains large ash shards and some limy nodules, more calcareous 95 to 97 ft.....	90.0	97.0
Sand and clay, silty, interbedded; texture of sand grades very fine to medium; clay is moderately calcareous, reddish-brown.....	97.0	100.0
Sandstone, very calcareous, reddish-brown; texture grades very fine to medium; contains some limy fragments.....	100.0	105.0

Sand and silt, clayey, interbedded; texture of sand grades very fine to coarse, silt is very calcareous, reddish-brown; contains some limy fragments.	105.0	110.0
Sand, brown and pinkish-tan; texture grades very fine to coarse sand	110.0	113.0
Silt, slightly sandy, very calcareous, reddish-brown; contains very fine sand and some limy nodules	113.0	120.0
Sand and silt, very calcareous; texture of sand grades very fine to medium; silt is light brownish-gray	120.0	125.0
Sand, brown and pinkish-tan; texture grades very fine to very coarse; hard limy zone 131 to 132.5 ft with some black grains	125.0	135.0
Sandstone, moderately calcareous, light brown; texture grades very fine to fine; contains some limy nodules	135.0	139.0
Clay, silty, slightly calcareous, light green	139.0	140.0
Sandstone, very calcareous, light brownish-buff; texture grades very fine to medium; contains some intermittent hard limy layers	140.0	150.0
Clay, slightly silty, reddish-brown, blocky	150.0	154.0
Clay, slightly silty, reddish-brown; contains some intermittent hard limy layers	154.0	158.0
Clay, light-green to reddish-brown; contains limy layers, blocky	158.0	160.0
Sandstone, very calcareous, light green; very fine texture; contains some limy layers	160.0	165.0
Silt, clayey, slightly sandy, very calcareous, light green; contains limy zone	165.0	170.0
Clay, silty, slightly sandy, very calcareous, light green	170.0	176.0
Clay, slightly silty, reddish-brown, blocky; contains limy zones	176.0	180.0
Sandstone and clay, interbedded; clay is moderately calcareous, greenish-brown; contains limy zone	180.0	185.0
Sandstone, moderately calcareous, light green; very fine texture	185.0	190.0
Sandstone, moderately calcareous, greenish-brown; texture grades very fine to medium	190.0	200.0
Sand to sandstone, moderately calcareous, light greenish-brown; texture grades very fine to medium; contains some limy zones	200.0	210.0
Sand and sandstone, moderately calcareous, light green; texture grades very fine to medium; contains some limy zones and brown 214 to 217 ft	210.0	217.0
Silt, slightly sandy, very calcareous, light gray	217.0	220.0
Marl, slightly sandy, very calcareous, light gray; contains very fine sand	220.0	225.0
Sand, silty, very calcareous, light brown to brown; texture grades very fine to medium	225.0	230.0

Sand, brown and pinkish-tan, yellowish-green; texture grades very fine to very coarse; contains gravel at 260 ft	230.0	270.0
Sand and gravel, brown and pinkish-tan; texture grades very fine to very coarse sand and gravel	270.0	290.0
Sand, pink, green, yellow, and tan; texture grades very fine to very coarse	290.0	298.5
Silt, sandy, very calcareous, white and yellow; contains very fine sand	298.5	300.0
Silt, slightly clayey to slightly sandy, moderately calcareous, dark-green to grayish-white	300.0	305.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, chalky, very calcareous, yellow to grayish-white	305.0	320.0

Test Hole #59-A-48 (No e-log)
(6-25-29aaaa)
Frontier County

Location: NE NE NE NE sec. 29, T. 6 N., R. 25 W., 56 ft. south and 13 ft. west of northeast corner.
Ground elevation: 2,466 ft. (i) (Medicine Creek Dam 7.5 minute quadrangle)
Depth to water: 90.8 ft.(11-29-49)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, dark brownish-gray	0.0	0.6
Silt, medium brownish-gray	0.6	2.5
Silt, light buff-gray; contains some gastropod shells, slightly granular with limy nodules and rootlets 10 to 15 ft	2.5	38.0
Silt, dark reddish-brown	38.0	42.0
Silt, slightly to moderately calcareous, light reddish-brown	42.0	50.0
Silt, slightly calcareous, light brown, slightly mottled with light gray, few limy nodules and moderately calcareous 60 to 69 ft	50.0	69.0
Sand and gravel, silty, gray to reddish-brown; texture grades from fine sand to medium gravel	69.0	73.0
Silt, slightly calcareous, orange and brown; contains fine sand to fine gravel	73.0	76.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand to sandstone, light tannish-gray; texture grades fine to very coarse, with some gravel	76.0	80.0
Sandstone, light tannish-gray; texture grades from fine to coarse sand, hard calcareous layer 86.5 to 87 ft	80.0	93.0
Silt, very slightly calcareous, light brown to gray	93.0	94.0
Sandstone, light tannish-gray, texture grades very fine to coarse sand	94.0	105.0
Sandstone to silt, very calcareous, light gray	105.0	110.0
Silt, slightly clayey, moderately calcareous, light tannish-gray	110.0	115.0
Silt, sandy, moderately calcareous, light grayish-white; contains fine to medium sand; contains thin hard zones at 116 ft. and 118.5 to 119 ft.	115.0	120.0
Sandstone, light tannish-gray; texture grades fine to medium; sandy silt layer, moderately calcareous 125.5 to 130 ft	120.0	130.0
Silt, sandy, light reddish-brown, granular; contains fine to coarse sand	130.0	135.0
Sandstone, light tannish-gray; texture grades from fine to coarse	135.0	145.0

Silt, sandy, very slightly calcareous, light greenish-gray; contains fine sand	145.0	148.0
Siltstone, slightly calcareous, medium gray	148.0	150.0
Silt, sandy, very calcareous, light grayish-white; contains fine to medium sand	150.0	166.0
Silt to marl, moderately calcareous, white	166.0	167.0
Sandstone and silt, interbedded, moderately calcareous, light grayish-white; texture of sandstone grades fine to medium	167.0	175.0
Silt, moderately calcareous, white	175.0	180.0
Silt, very slightly clayey, moderately calcareous, light greenish-gray	180.0	190.0
Gravel, light greenish-gray; texture grades from fine to coarse gravel; contains some quartz, marl, siltstone and fine sandstone fragments	190.0	198.0
Silt, moderately calcareous, light greenish-gray	198.0	215.0
Silt, chalky, slightly clayey, very calcareous, light yellowish-green	215.0	224.0
Gravel, light greenish-orange to black-brown; texture grades fine to coarse, consists of claystone, limonitic and calcareous nodules	224.0	230.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Chalk, silty to clayey, very calcareous, mottled yellow and white	230.0	242.0
Shale, chalky, very calcareous, very dark brownish-gray	242.0	247.0
Chalk, silty to clayey, very calcareous, medium gray	247.0	248.0
Shale, chalky, very calcareous, very dark brownish-gray	248.0	250.0

Test hole #1-FT-42 (No e-log)
(6-26-18dbdd)
Frontier County

Location: SE SE NW SE sec. 18, T. 6 N., R. 26 W., approximately 100 ft. west of creek on north side of road.
Ground elevation: 2,389 ft. (i) (Freedom 7.5 minute quadrangle)
Depth to water: not measured. (12-24-42)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Clay, sandy.....	0.0	3.0
Clay, sandy, dark.....	3.0	12.0
Sand and fine to medium gravel.....	12.0	22.0
Sand and fine to medium gravel; some lime.....	22.0	42.0
Gravel and shale.....	42.0	45.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, very hard, brown.....	45.0	55.0

Field number changed from 256-42 as per carbon copies

Test Hole #9-RS-97 (No e-log)
(6-26-28dbbb)
Frontier County

Location: NW NW NW SE sec. 28, T. 6 N., R. 26 W., 2634 ft. north and 2510 ft. west of southeast corner.
Ground elevation: 2,411 ft. (t) (Freedom 7.5 minute quadrangle)
Depth to water: 46.9 ft. (10-10-97)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Topsoil: Silt, slightly clayey, very dark gray.....	0.0	4.0
Silt, slightly clayey, dark grayish brown.....	4.0	10.0
Silt, moderately clayey, some calcium-carbonate concretions; paleosol, very dark gray at 45.0 ft..	10.0	50.0
Silt, very clayey, olive brown.....	50.0	55.0
Silt, moderately clayey, very dark grayish brown....	55.0	60.0
Silt, moderately clayey, slightly sandy, dark olive gray; sand is very fine.....	60.0	68.0
Sand and gravel; fine sand to medium gravel, trace coarse gravel; much lithic Ogallala and Niobrara gravel pieces.....	68.0	75.0
Sand and gravel; coarse sand to fine gravel.....	75.0	80.0
Sand and gravel; very fine sand to very fine gravel; some fine gravel, trace medium to coarse gravel...	80.0	85.0
Sand and gravel; very fine sand to medium gravel....	85.0	90.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, olive brown, very calcareous.....	90.0	100.0

Test Hole #10-RS-97 (No e-log)
(6-26-28dbbb)
Frontier County

Location: NW NW NW SE sec. 28, T. 6 N., R. 26 W., 2634 ft. north and 2590 ft. west of southeast corner.
Ground elevation: 2,411 ft. (t) (Freedom 7.5 minute quadrangle)
Depth to water: 47.5 ft. (10-10-97)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Topsoil: Silt, moderately clayey, dark gray.....	0.0	6.0
Silt, slightly sandy, brown; sand is very fine to medium.....	6.0	10.0
Silt, moderately clayey, slightly sandy, brown; sand is very fine to fine.....	10.0	25.0
Silt, moderately clayey, moderately sandy, brown; sand is very fine.....	25.0	40.0
Silt, slightly clayey, slightly sandy, grayish brown; sand is very fine; moderately clayey below 50.0 ft.....	40.0	60.0
Silt, moderately clayey, grayish brown.....	60.0	68.0
Gravel, moderately sandy; very coarse sand to medium gravel; much feldspar, quartz as well as lithic Ogallala and Niobrara gravel pieces.....	68.0	75.0
Gravel, very fine to coarse, some very coarse.....	75.0	80.0
Sand and gravel; coarse sand to fine gravel.....	80.0	85.0
Sand and gravel; coarse sand to medium gravel.....	85.0	92.5
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, dark grayish brown, very calcareous.....	92.5	107.0

Test Hole #11-RS-97 (No e-log)
(6-26-28caaa)
Frontier County

Location: NE NE NE SW sec. 28, T. 6 N., R. 26 W., 2574 ft. north and 2572 ft. east of southwest corner.
Ground elevation: 2,410 ft. (t) (Freedom 7.5 minute quadrangle)
Depth to water: 47.4 ft. (10-10-97)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Topsoil: Silt, moderately clayey, black	0.0	2.0
Silt, moderately clayey, dark grayish brown	2.0	5.0
Silt, moderately clayey, brown	5.0	15.0
Silt, moderately clayey, slightly sandy, brown; sand is very fine; dark gray paleosol at 25 ft	15.0	45.0
Silt, moderately clayey, olive gray	45.0	60.0
Silt, very clayey, dark greenish gray; contains much woody material and charcoal from 71 to 72 ft	60.0	72.0
Sand and gravel; coarse sand to medium gravel	72.0	75.0
Sand and gravel; coarse sand to fine gravel; some medium gravel	75.0	85.0
Sand and gravel; coarse sand to medium gravel; some coarse gravel	85.0	92.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, olive gray, very calcareous; dark olive gray below 92.0 ft	92.0	102.0

Test Hole #12-RS-97 (No e-log)
(6-26-28caaa)
Frontier County

Location: NE NE NE SW sec. 28, T. 6 N., R. 26 W., 2515 ft. north and 2535 ft. east of southwest corner.
Ground elevation: 2,411 ft. (t) (Freedom 7.5 minute quadrangle)
Depth to water: 45.3 ft. (10-10-97)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Topsoil: Silt, slightly clayey, very dark grayish brown.....	0.0	5.0
No sample, lost circulation.....	5.0	20.0
Silt, slightly clayey, brown.....	20.0	25.0
Silt, sightly clayey, slightly sandy, brown; sand is very fine.....	25.0	45.0
Silt, sightly clayey, slightly sandy, dark grayish brown; sand is very fine.....	45.0	50.0
Silt, moderately clayey, slightly sandy, dark grayish brown; sand is very fine; contains small calcium carbonate concretions.....	50.0	60.0
Silt, moderately clayey, olive gray.....	60.0	65.0
Silt, moderately clayey, moderately sandy, dark greenish gray; sand is very fine to fine.....	65.0	68.0
Sand, very fine to very coarse; some very fine to fine gravel.....	68.0	75.0
Sand and gravel; very fine sand to medium gravel; trace coarse gravel below 85.0 ft.....	75.0	93.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, dark olive gray, very calcareous;.....	93.0	102.0

Test hole #2-FT-42 (No e-log)
(6-26-28ccbb)
Frontier County

Location: NW NW SW SW sec. 28, T. 6 N., R. 26 W., 33 ft. east of bridge across draw.
Ground elevation: 2,372 ft. (i) (Freedom 7.5 minute quadrangle)
Depth to water: not measured. (12-24-42)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Clay, sandy, yellow	0.0	5.0
Clay, sandy, dark	5.0	16.0
Gravel and clay, light brown	16.0	26.0
Sand and fine to medium gravel	26.0	37.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, very hard, brown	37.0	43.0

Field number changed from 257-42 as per carbon copies

Test hole #3-FT-42 (No e-log)
(6-26-34dbdd)
Frontier County

Location: SE SE NW SE sec. 34, T. 6 N., R. 26 W., approximately just south of bridge site, on west side of trail.
Ground elevation: 2,356 ft. (i) (Freedom 7.5 minute quadrangle)
Depth to water: not measured. (12-23-42)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Clay, sandy, yellow	0.0	4.0
Clay, sandy, dark	4.0	11.0
Sand and fine to medium gravel	11.0	22.0
Sand and fine to medium gravel; some sandstone fragments	22.0	32.0
Sand and fine to medium gravel; some sandstone fragments and clay	32.0	42.0
Gravel and dark clay	42.0	51.0
Gravel, fine	51.0	54.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, dark	54.0	59.0

Field number changed from 255-42 as per carbon copies
Test hole is now underwater

Test Hole #31-A-60 (E-log)
(6-27-6bbba)
Frontier County

Location: NE NW NW NW sec. 6, T. 6 N., R. 27 W., 21 ft. south of north section line and 433 ft. east of west section line.
Ground elevation: 2,675 ft. (t) (Stockville 7.5 minute quadrangle)
Depth to water: 179 ft. (est.)(8-5-60)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly-moderately clayey, dark gray brown...	0.0	3.0
Silt, slightly clayey, slightly sandy, very fine, trace iron stain and snail shells, light olive brown-grayish brown.....	3.0	54.0
Silt, slightly-very sandy, very fine to fine, slightly clayey, moderately-very limy with dark staining, light yellow brown-very pale brown.....	54.0	88.0
Sand and gravel, medium to very coarse sand and fine gravel, slightly clayey.....	88.0	91.0
Silt, slightly-moderately clayey, very sandy, very fine-medium, slightly-moderately limy, very pale brown-yellow brown.....	91.0	97.0
Sand and gravel, very coarse sand-medium gravel.....	97.0	102.0
Silt, slightly-moderately clayey, moderately-very sandy, very fine-medium, slightly-moderately limy, very pale brown-yellow brown.....	102.0	108.0
Sand, medium-very coarse, trace fine gravel, trace rootlets.....	108.0	115.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand-sandstone, medium-very coarse, rootlets.....	115.0	118.0
Silt-siltstone, moderately clayey, moderately sandy, very fine-medium sand, limy areas, very pale brown.....	118.0	130.0
Sand-sandstone, very fine-fine, silty with inter-bedded silt seams at 136 and 142 ft., rootlets, pale yellow brown.....	130.0	145.0
Sand, very fine-coarse, trace fine gravel, rootlets, lime cemented sandstone at 154 ft., very pale brown.....	145.0	155.0
Silt-siltstone, slightly-very clayey, slightly sandy, very fine-medium, slightly-moderately limy, brown-pale brown.....	155.0	195.0
Silt, sightly clayey, moderately-very sandy, very fine to fine, moderately limy, pale olive-light gray.....	195.0	203.0
Sand to sand and gravel, very fine to very coarse sand and fine gravel with clay lenses.....	203.0	227.0
Sand, very fine, lime cemented, white.....	227.0	228.0

Sand-sandstone, very fine to fine, limy, rootlets, moderately silty	228.0	247.0
Silt, very sandy, very fine to medium, limy, very pale brown	247.0	260.0
Sand to sandstone, very fine to medium, limy, very pale brown	260.0	268.0
Sand and gravel, very fine to very coarse sand and fine gravel	268.0	275.0
Sand to sandstone, very fine to medium, trace coarse, slightly limy	275.0	290.0
Sand to sandstone, very fine to medium, very silty, marly and lime cemented	290.0	304.0
Silt, very sandy, very fine to medium, moderately-very clayey, reworked shale, siltstone, and iron-stone 329-333 ft., pale olive	304.0	331.5
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, yellow, light gray and white with iron stains, bentonite in places	331.5	351.9
Limestone, light gray	351.9	353.0
Clay-shale, light gray-dark gray, bentonite seams at 355.2-355.5 ft. and 360-360.3 ft	353.0	370.0

Test Hole # 29-A-60 (E-log)
(6-27-31cddd)
Frontier County

Location: SE SE SE SW sec. 31, T. 6 N., R. 27 W., 32 ft. north of south section line and 256 ft. west of half section line.
Ground elevation: 2,760 ft. (t) (Bartley NW 7.5 minute quadrangle)
Depth to water: 264 ft. (est.)(8-2-60)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly-moderately clayey, dark gray brown to light brownish gray.....	0.0	10.0
Silt, slightly clayey, slightly marly, trace snail shells, brown-yellowish brown.....	10.0	50.0
Sand, very fine-medium, very silty, trace limey sandstone, pale brown.....	50.0	70.0
Silt, slightly clayey, slightly-moderately sandy, very fine-fine, pale yellow.....	70.0	80.0
Sand, very fine to fine, very silty, light yellow brown.....	80.0	83.0
Silt, slightly-very clayey, slightly-moderately sandy, very fine to fine, limy-marly 83-128.6 ft., light yellow brown-very pale brown.....	83.0	169.0
Clay, slightly sandy, very fine to fine, trace medium and coarse, limy areas, very pale brown-yellow brown-white.....	169.0	175.0
Silt, moderately-very clayey, slightly sandy, very fine-medium, light yellow brown.....	175.0	180.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand, very fine-coarse, trace fine gravel and lime cemented sandstone, slightly clayey, pale brown...	180.0	187.0
Silt, moderately-very clayey, very sandy, medium-coarse, trace fine gravel, marly-limy areas, light brown.....	187.0	190.0
Sand and gravel, medium-very coarse sand and fine gravel.....	190.0	197.0
Sand, fine-medium, trace coarse sand, very pale brown.....	197.0	200.0
Silt, slightly clayey, slightly-moderately sandy, very fine-medium, trace coarse, moderately limy, light yellow brown-brown-very pale brown.....	200.0	220.0
Sand, very fine-medium, very silty, trace lime cemented sandstone, marly, pale brown.....	220.0	223.0
Silt, very sandy, fine-medium, trace coarse, slightly clayey, marly in part lime cemented, yellow brown-white.....	223.0	236.0
Sand, very fine-fine, trace coarse sand and fine gravel, limy rootlets, light gray.....	236.0	240.0

Silt, slightly clayey, very sandy, very fine-fine, very limy, white.....	240.0	243.0
Sand, very fine-medium, very silty, reddish yellow..	243.0	245.0
Silt, very sandy, very fine-coarse, trace fine gravel, slightly-moderately clayey, moderately-very limy, reddish yellow-light yellow brown-very pale brown white.....	245.0	266.0
Sand to sand and gravel, fine to very coarse sand, some fine-medium gravel, silty at 287 and 324 ft., brown.....	266.0	332.0

Test Hole #28-F-77 (E-log)
(6-27-34dccb)
Frontier County

Location: NW SW SW SE sec. 34, T. 6 N., R 27 W., 2597 ft. west and 490 ft. north of southeast corner.
Ground elevation: 2,674 ft. (t) (Freedom 7.5 minute quadrangle)
Depth to Water: 204 ft. (10-11-77)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, slightly sandy, brown to black; sand is very fine	0.0	3.0
Silt, slightly sandy, slightly clayey, yellowish-brown; sand is very fine	3.0	38.0
Silt, moderately sandy, slightly clayey, brown; sand is very fine	38.0	41.0
Silt, slightly clayey, slightly sandy, yellowish-brown to brownish-gray, slightly calcareous; some limy areas	41.0	92.0
Tertiary System - Miocene Series - Ogallala Formation:		
Silt, clayey, white, very calcareous	92.0	99.0
Silt, moderately sandy, slightly clayey, reddish-brown, slightly calcareous; sand is very fine, some limy areas	99.0	105.0
Silt, moderately sandy, slightly clayey, gray, slightly calcareous; sand is very fine-coarse, with trace of very coarse sand; some volcanic ash.	105.0	110.0
Silt, moderately sandy, slightly clayey, reddish-brown; slightly calcareous in places	110.0	134.0
Sand, gravelly; very fine sand-fine gravel	134.0	145.0
Silt, slightly sandy, slightly clayey, pale-brown to reddish-brown; sand is very fine to medium, some lime nodules	145.0	195.0
Silt, clayey, limy, grayish-white, some very fine to fine sand	195.0	200.0
Sand, very fine to very coarse with a little fine gravel	200.0	211.0
Silt, very sandy, slightly clayey, light gray, limy; sand is very fine	211.0	222.0
Siltstone, clayey, brown with pinkish tint, slightly calcareous	222.0	226.0
Silt, slightly clayey, in places very clayey, sandy, brownish-white; sand is very fine-fine; limy areas 227-230 ft. and 241-244 ft	226.0	256.0
Sand, very fine to coarse, little very coarse, in part silty	256.0	270.0
Silt, very clayey, gray, some olive-gray	270.0	280.0
Sand, very fine-medium, little coarse-very coarse...	280.0	286.0

Clay, silty, gray, some olive-gray, moderately calcareous; in places interbedded silty sandstone.....	286.0	318.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, clayey brownish-gray to dark gray, very calcareous.....	318.0	520.0

Test Hole #30-A-60 (E-log)
(6-28-13ddda)
Frontier County

Location: NE SE SE SE sec. 13, T. 6 N., R. 28 W., 2491 ft. north of south section line and 9.5 ft. west of east section line.
Ground elevation: 2,660 ft. (t) (Bartley NW 7.5 minute quadrangle)
Depth to water: 162 ft. (est.)(8-4-60)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, contains snail shells and iron stains, dark brown-brown-grayish brown.....	0.0	20.0
Silt, slightly-moderately clayey, moderately sandy, very fine, slightly-very limy, light yellow brown to pale brown.....	20.0	58.0
Silt, very sandy, very fine to very coarse, trace fine gravel, slightly-moderately clayey, trace lime cemented sandstone, yellow brown-brown-light brown.....	58.0	71.0
Sand and gravel, fine sand to fine gravel, moderately clayey, brown.....	71.0	77.0
Silt, moderately clayey, very sandy, fine-medium, trace coarse, slightly limy, very limy 83.3-84.5, light yellow brown-pale brown, slightly olive.....	77.0	85.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand, fine-coarse, trace very coarse sand and fine gravel, slightly-very silty, slightly limy, very pale brown.....	85.0	87.0
Sandstone, very fine to fine, trace medium, lime cemented, some limestone, very pale brown.....	87.0	92.0
Silt, very sandy, very fine-medium, slightly clayey, moderately limy, brown.....	92.0	94.0
Sand-sand and gravel, medium-very coarse with fine gravel, occasional thin sandy silt lens.....	94.0	122.0
Silt, slightly-moderately clayey, very sandy, very fine-coarse, sandstone and bentonite seams, limestone and lime cemented areas, light yellow brown-reddish brown-very pale brown.....	122.0	155.0
Sandstone fine-medium, lime cemented, pale brown....	155.0	162.0
Sand and gravel, medium-very coarse sand, much fine gravel, trace medium gravel.....	162.0	173.0
Sandstone, very fine-medium, very silty, lime cemented and marly, limestone seams, very pale brown-white.....	173.0	202.0
Sand-sandstone, very fine-medium, trace coarse to very coarse, very silty, slightly moderately clayey, pale brown-light yellow brown.....	202.0	215.0
Sand, fine-very coarse, trace fine gravel.....	215.0	230.0

Sand and gravel, medium-very coarse sand and fine gravel	230.0	240.0
Sand-sandstone, very fine-medium, moderately-very silty, slightly clayey, trace rootlets, limy-lime cemented, light gray, ashy	240.0	253.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay-shale, light yellow and white	253.0	265.0
Clay-shale, light yellow-light yellow brown-light gray-dark gray	265.0	280.0

Test Hole #29-F-77 (No e-log)
(6-29-32cccc)
Frontier County

Location: SW SW SW SW sec. 32, T. 6 N., R. 29 W., 31 ft. north of the south section line and 127 ft. east of the west section line.
Ground elevation: 2,826 ft. (t) (Quick 7.5 minute quadrangle)
Depth to water: 245 ft. (10-13-77)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, moderately sandy, dark grayish brown sand is very fine-medium	0.0	3.0
Silt, slightly sandy, light yellowish brown, occasional snail shells 5-30 ft., slightly calcareous	3.0	51.0
Silt, slightly clayey and sandy, brown, calcareous	51.0	55.0
Silt, slightly sandy, very pale brown, occasional lime streaks, slightly ashy 65-74 ft. and 95-105 ft	55.0	111.0
Silt, slightly clayey and sandy, white to very pale brown, slightly-moderately calcareous	111.0	118.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, slightly clayey and sandy, white-very pale brown, few limy nodules, calcareous	118.0	134.0
Siltstone, slightly silty, light gray-white, some very fine-fine sandstone, limy 134-136 ft., some medium-very coarse sand below 148 ft., calcareous.	134.0	150.0
Sand and gravel, very fine sand to fine gravel, some thin interbedded fine to coarse sandstone beds	150.0	156.0
Siltstone, moderately silty and slightly clayey, very pale brown	156.0	175.0
Sandstone, very fine-medium, light brown, slightly calcareous	175.0	194.0
Siltstone, slightly silty and clayey, very pale brown to white, calcareous	194.0	218.0
Sand, very fine to coarse, slightly limy	218.0	224.0
Silt, moderately clayey, reddish brown to pale brown, some limy areas	224.0	237.0
Silt, slightly clayey, pale brown, some sandstone layers, limy in areas	237.0	269.0
Sand and gravel, fine sand to fine gravel, mostly very coarse sand, partly lime cemented	269.0	281.0
Siltstone and sandstone interbedded, very pale brown to light gray, some fine-medium sand to sandstone lenses 283-287, 292-294, and 298 ft.	281.0	308.0
Sandstone, very fine to medium coarse, light gray, moderately calcareous	308.0	312.0

Silt, slightly sandy, light gray-white, in part limy	312.0	318.0
Siltstone, light gray to white, very limy	318.0	322.0
Silt, moderately clayey, light olive gray, marly, trace volcanic ash, no sample 335-340 ft., and 345-355 ft	322.0	355.0
Silt, moderately sandy, light gray-olive, very calcareous (poor samples)	355.0	360.0
Sand and gravel interbedded with sandstone (poor samples)	360.0	390.0
Sand, fine to very coarse, trace of fine gravel, some reworked sandstone pebbles (poor samples) no samples 400-412 ft	390.0	412.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Shale, clayey, light gray to pale yellow	412.0	420.0

Test Hole #39A-F-77 (E-log)
(6-30-6bbbc)
Frontier County

Location: SW NW NW NW sec. 6, T. 6 N., R. 30 W., 395 ft. south of north section line and 48.5 ft. east of west section line, 71 ft. north of dirt road going east.
Ground elevation: 3,061 ft. (t) (Camp Hayes Lake SE 7.5 minute quadrangle)
Depth to water: 202 ft. (est.) (12-12-77)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, moderately sandy, very fine to medium some coarse, brown to tan.....	0.0	5.0
Sand very fine-fine, silty, yellow-brown, coarser below 45 ft.....	5.0	50.0
Silt, very sandy, very fine with some very coarse sand to 60 ft., finer 75-80 ft., light yellow brown.....	50.0	80.0
Silt to very fine sand, some very coarse sand, slightly clayey 85-90 ft., light yellow brown.....	80.0	155.0
Silt, moderately sandy, slightly clayey, sand is very fine, light yellow brown.....	155.0	186.0
Silt, clayey, light yellow brown, note that circulation was lost at 185-195 ft. and 200-220 ft., very poor sample, hole abandoned at 220 ft...	186.0	220.0

Test Hole #49-B-48 (No e-log)
(7-24-1adda)
Frontier County

Location: NE SE SE NE sec. 1, T. 7 N., R. 24 W., 2,040 ft. south and 95 ft. west of northeast corner.
Ground elevation: 2,684 ft. (i) (Elwood SW 7.5 minute quadrangle)
Depth to water: 257.5 ft. (11-9-48)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, dark brownish-gray.....	0.0	1.5
Silt, light brownish-gray with buff tint, moderately calcareous with some snail shells 2 to 10 ft.....	1.5	10.0
Silt, light-gray, slightly darker with depth; contains a few limonitic flecks and snail shells 10-17 ft. slightly to moderately calcareous 25 to 30 ft.....	10.0	35.0
Silt, light brownish-tan with gray tint.....	35.0	37.0
Soil, silt, dark reddish-brown.....	37.0	41.0
Silt, buff-gray with slight tan tint.....	41.0	44.0
Silt, light buff-gray, moderately to very calcareous with a few limy nodules from 48 to 50 ft.....	44.0	50.0
Silt, slightly clayey, moderately calcareous, light-buff to tannish gray, in part very fine sand.....	50.0	56.0
Silt to sand, slightly to moderately calcareous, light brownish-buff with gray tint; slightly coarser 80 to 81.5 ft.....	56.0	81.5
Silt, slightly to moderately calcareous, light brownish-buff to buff-gray; texture grades from fine to coarse; contains some very fine sand and nodular fragments 83 to 85 ft.....	81.5	85.0
Silt, sandy, tannish-gray; texture grades from coarse silt to very fine sand.....	85.0	87.0
Silt, slightly to moderately calcareous, buff-gray with brown tint; contains limy nodules 87 to 90 ft., very to moderately calcareous with some sand grains 100 to 106 ft.....	87.0	106.0
Silt, slightly to moderately calcareous, light brownish-tan with gray tint; texture grades very fine to coarse.....	106.0	110.0
Silt, slightly to moderately calcareous, buff-gray to brown; texture grades fine to very coarse; contains very fine sand and intermittent hard thin calcareous zones, slightly clayey 145 to 150 ft...	110.0	150.0
Silt, moderately calcareous, light buff-gray.....	150.0	160.0
Silt to sand, slightly calcareous, light tannish-gray; texture grades from coarse silt to very fine sand, hard zone at 166 ft.....	160.0	172.0

Silt, moderately calcareous, buff-gray; texture grades from slightly to moderately clayey; contains a hard limy layer at 173.5 ft.....	172.0	175.0
Silt, slightly sandy, slightly to moderately calcareous, light brownish-gray to buff; contains very fine sand with traces of fine and medium sand, some thin white calcareous layers, less gray and principally silt 200 to 230 ft.....	175.0	230.0
Silt, slightly sandy, slightly to moderately calcareous, light brownish-gray; contains very fine to fine sand with some medium to coarse sand, light-gray and very calcareous 239 to 240 ft.....	230.0	241.5
Silt, light brownish-gray with slight tan tint; contains some calcareous spots.....	241.5	246.0
Silt, moderately clayey, light gray.....	246.0	251.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, very slightly sandy, moderately calcareous, white; contains fine to medium sand, more sandy from 255 to 260 ft.....	251.0	260.0
Silt, slightly clayey to very sandy, light gray to brownish-gray.....	260.0	266.0
Sand and gravel, brownish-gray to pink; texture grades from fine sand to medium gravel, finer and some calcareous cementation from 276 to 279.5 ft.....	266.0	279.5
Silt, moderately calcareous, white.....	279.5	279.9
Silt, sandy to gravelly, white to tan.....	279.9	285.0
Silt, slightly clayey to sandy, reddish-tan, in part very sandy; contains fine to coarse sand.....	285.0	291.0
Silt, very sandy, very calcareous, light gray; contains fine to coarse sand; darker and noncalcareous 294 to 297 ft.....	291.0	300.0
Sand, brownish-gray with pink tint; texture grades fine to coarse sand with some fine and medium gravel.....	300.0	303.0
Silt, very sandy, very slightly calcareous, light brownish-gray; contains very fine to fine sand....	303.0	308.0
Sand, brownish-gray with pink tint, texture grades fine to coarse sand with some fine to medium gravel.....	308.0	315.0
Sand, silty, very slightly calcareous, light brownish-gray; texture grades very fine to medium sand.	315.0	318.5
Silt to marl, moderately calcareous, white to tannish-gray; contains clayey silt from 319 to 319.5 ft.....	318.5	320.0
Marl, moderately calcareous, light gray.....	320.0	320.5
Silt, sandy, to sand, silty, light brownish-tan with gray tint; texture of sand grades very fine to fine.....	320.5	323.5
Silt, sandy, moderately calcareous, white; contains very fine to fine sand.....	323.5	326.0

Siltstone, clayey, reddish-tan, blocky; contains a few pink marl fragments	326.0	328.5
Silt, clayey to sandy, light brownish-gray; contains very fine sand	328.5	332.0
Silt, sandy, moderately calcareous, white; contains very fine to fine sand	332.0	333.0
Silt, slightly clayey to sandy, reddish-tan; contains very fine to fine sand; slightly to moderately calcareous 335 to 340 ft, moderately to very calcareous 340 to 345 ft	333.0	345.0
Silt, sandy, moderately calcareous, white	345.0	346.5
Sand, silty, to silt, sandy, light-gray with slight green tint; texture grades very fine to fine with some medium sand	346.5	352.0
Silt, clayey to slightly sandy, light gray with slight green tint	352.0	355.0
Sand, silty, to silt, sandy, moderately calcareous, light gray with slight green tint	355.0	360.0
Sand, silty, light gray to light brownish-gray; texture grades very fine to medium sand	360.0	373.0
Sand, light brownish-gray; texture grades from fine to medium with some coarse sand	373.0	381.0
Silt, slightly sandy, moderately calcareous, white, more sandy 382.5 to 384.5 ft	381.0	384.5
Sand, slightly silty, light brownish-gray	384.5	391.0
Sand, silty, light gray, calcareous 391 to 393 ft	391.0	395.0
Sand, slightly silty, light brownish-gray; texture grades from very fine to medium sand	395.0	401.5
Silt and sandstone, moderately calcareous, white	401.5	403.5
Silt, sandy, to sand, silty, slightly to moderately calcareous, light brownish-gray, very calcareous from 406 to 417 ft	403.5	417.0
Silt, clayey, to marl, moderately calcareous, white.	417.0	420.5
Sand, light brownish-gray; texture grades from fine to medium with some coarse sand	420.5	427.0
Silt, sandy, slightly to very calcareous, light gray; contains very fine to fine sand	427.0	429.5
Sand, very light brownish-gray; texture grades very fine to medium, slightly coarser 435 to 448.5 ft.	429.5	448.5
Silt, very sandy, light greenish-gray	448.5	449.5
Silt, clayey, light greenish-gray; contains thin slightly to moderately calcareous zones	449.5	461.0
Sand, very light brownish-gray; texture grades from fine to medium sand	461.0	468.5
Silt, sandy, very light greenish-gray; contains very fine sand	468.5	470.1
Sand, silty, very light brownish-gray with slight green tint; texture grades from fine to medium and some coarse; contains a sandstone layer 470.1 to 470.5 ft, more sandy, consolidated and in part calcareous 475 to 480 ft	470.1	480.0
Silt, clayey to sandy, light greenish-gray	480.0	482.0

Sand, slightly silty, very light brownish-gray; texture grades fine to medium with some coarse, and from coarse sand with some fine gravel 485 to 490 ft	482.0	490.0
Sand, silty, to sandstone, slightly to moderately calcareous, very light brownish-gray with some green tint; texture grades from fine to coarse with trace of fine gravel, slightly more silty 495 to 500 ft	490.0	500.0
Sand, light brownish-gray with slight green tint	500.0	504.5
Sand, silty, light gray with slight green tint; contains very fine sand	504.5	507.0
Clay, silty, to silt, clayey, moderately to very calcareous, light gray; contains some greenish-gray blocky layers	507.0	513.0
Silt, sandy, to sand, silty, slightly to moderately calcareous, very light brownish-gray with green tint; texture grades from very fine to medium	513.0	522.0
Silt to marl, moderately calcareous, white	522.0	527.0
Sand, brownish-gray with green tint; texture grades from fine to coarse with some fine to medium gravel; contains limy fragments	527.0	533.0
Sand, slightly silty, very light brownish-gray with green tint; texture grades from fine to medium	533.0	537.5
Silt, sandy, moderately to very calcareous, light gray; contains very fine to fine sand and occasional limonitic flecks	537.5	544.0
Silt, slightly to moderately sandy, moderately to very calcareous, light gray	544.0	558.0
Silt, slightly clayey to sandy, very calcareous, light brownish-gray; contains very fine sand and occasional limonitic flecks	558.0	560.5
Silt, moderately clayey, very calcareous, light gray; contains occasional limonitic flecks	560.5	565.0
Silt, slightly clayey to very slightly sandy, very calcareous, light gray; contains some reworked Chadron Formation fragments	565.0	575.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Chalk, light yellow to white; contains rounded fragments	575.0	577.0
Chalk, yellow to white	577.0	578.0
Shale, chalky, silty, yellow to buff	578.0	580.0
Shale, chalky, white with some yellowish-buff; contains some ironstone 590 to 595 ft	580.0	600.0

Test Hole #52-B-48 (No e-log)
(7-25-9bbbb)
Frontier County

Location: NW NW NW NW sec. 9, T. 7 N., R. 25 W., 98 ft. south and 118 ft. east of northwest corner.
Ground elevation: 2,537 ft. (i) (Eustis SW 7.5 minute quadrangle)
Depth to water: 58.7 ft. (11-20-48)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil: silt, dark brownish-gray; coarse texture, darker from 1 to 2 ft	0.0	2.0
Silt, moderately calcareous, brownish-buff with gray tint, darker and slightly less calcareous with occasional gravel from 5 to 11.5 ft., dark brownish-gray from 11.5 to 12 ft	2.0	12.0
Silt, clayey, slightly to moderately calcareous, buff-gray with brown tint	12.0	23.0
Silt, brownish-buff mottled with medium gray	23.0	23.5
Silt, slightly calcareous; texture grades fine to coarse with some very fine sand grains; contains a few snail shells	23.5	25.0
Silt, very slightly clayey, slightly calcareous, buff-gray; contains few limy nodules and snail shells	25.0	30.5
Gravel, consists of limestone and sandstone grains; contains some fine to coarse sand	30.5	31.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, brownish-tan; texture grades from fine to coarse	31.0	34.5
Sand and gravel, tan-gray; texture grades from fine sand to fine gravel with some medium gravel, in part consolidated	34.5	39.0
Sand, silty, to sandstone, slightly calcareous, very light tan-gray; texture grades from fine to medium with some coarse sand and trace of gravel; contains clayey silt, reddish-tan from 40.5 to 41 ft., limy silt from 41 to 42 ft	39.0	42.5
Silt, slightly clayey to slightly sandy, light gray with slight green tint; contains fine to coarse sand, reddish-tan and more sandy 45.5 to 48 ft., moderately to very calcareous 46.5 to 49.5 ft., light tan-gray 48 to 49.5 ft	42.5	49.5
Marl, slightly sandy, white	49.5	51.5
Silt, clayey to slightly sandy, moderately calcareous, white	51.5	53.0
Silt, very slightly clayey to moderately sandy, reddish-tan; contains fine to coarse sand and a trace of gravel	53.0	56.5

Silt, very sandy, tan-gray with brown tint; contains fine to coarse sand and a trace of gravel.....	56.5	60.0
Silt and sandstone, moderately calcareous, light gray with slight tan tint.....	60.0	63.0
Sand and gravel, tan-gray to pink; texture grades fine sand to medium gravel, and some coarse gravel with some consolidation.....	63.0	74.5
Silt, sandy, and sandstone, gray to light gray, intermittently calcareous.....	74.5	78.5
Sandstone, very light brownish-gray; texture grades from fine to coarse with a trace of gravel, calcareous in part.....	78.5	84.5
Sand and gravel, brownish-gray with pink grains; texture grades from fine sand to fine gravel with some medium and a trace of coarse gravel, cemented in part.....	84.5	90.0
Silt, sandy, to sand, silty, very light tan-gray; texture grades from very fine to fine sand; contains some interbedded light gray clayey silt and very fine sandy silt.....	90.0	93.5
Silt, very slightly clayey to moderately sandy, reddish-tan; contains fine to coarse sand.....	93.5	96.0
Sandstone, brownish-tan; texture grades fine to medium with some coarse sand and trace of fine gravel.....	96.0	101.0
Sand and gravel, tan-gray; texture grades from medium sand to coarse gravel; contains few dark minerals, slightly consolidated.....	101.0	117.0
Silt, very slightly clayey to sandy, brownish-tan; contains very fine to fine sand, some limy nodules.....	117.0	120.0
Silt, moderately sandy, light reddish-tan with gray tint; contains fine to medium sand, some limy nodules and limy layer.....	120.0	124.5
Sandstone, moderately calcareous, light brownish-gray; texture grades fine to medium with some coarse; contains light gray silt layer at 128.5 ft.....	124.5	130.0
Silt to marl, moderately calcareous.....	130.0	132.5
Sandstone, light brownish-gray; texture grades fine to coarse; contains some limy material, unconsolidated 142 to 153.5 ft.....	132.5	194.5
Sandstone and silty sand, tan-gray and light gray; texture grades fine to medium with a trace of coarse.....	194.5	210.0
Sand, light brownish-gray; texture grades from fine to medium, slightly consolidated, more consolidated and silty from 223 to 225 ft.; contains light gray silt at 230.5 ft.....	210.0	236.0
Silt, slightly clayey to sandy, light gray with slight brown tint.....	236.0	236.5

Silt, reddish-tan; contains marl from 237.5 to 238.0 ft	236.5	238.0
Sand, light brownish-gray; texture grades from fine to coarse sand; contains silt and a trace of fine gravel 240 to 244.5 ft	238.0	244.5
Silt, clayey, brownish-tan; very sandy silt 245 to 247.5 ft	244.5	249.0
Sand and gravel, brownish-gray to green; texture grades from fine sand to medium gravel, some coarse gravel 260 to 265 ft	249.0	267.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Chalk, white, with interbedded yellow and orange layers	267.0	300.0

Test Hole #10-F-78 (E-log)
(7-25-12aaaa)
Frontier County

Location: NE NE NE NE sec. 12, T. 7 N., R. 25 W., 38.5 ft. south of north section line and 18.5 ft. west of the east section line.
Ground elevation: 2,604 ft. (t) (Eustis SE 7.5 minute quadrangle)
Depth to water: 140 ft. (7-10-78)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly sandy and clayey, grayish brown.....	0.0	5.0
Silt, slightly sandy, light yellowish brown, occasional snail shells, slightly calcareous, yellowish brown between 47-59 ft., very fine sand.	5.0	59.0
Silt, slightly sandy, very pale brown, sand is very fine to fine, calcareous, limy areas.....	59.0	97.0
Silt, slightly clayey and sandy, very pale brown, sand is very fine, few limy areas, calcareous.....	97.0	138.0
Silt, clayey and sandy, white to very pale brown, very limy.....	138.0	141.0
Sand, gravelly, fine sand to very coarse gravel.....	141.0	152.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, moderately clayey, slightly sandy, light gray, very calcareous, sand is very fine.....	152.0	156.0
Sand-sandstone, silty, very fine to fine grained, limy and partly lime cemented 158-161 ft.....	156.0	161.0
Silt, slightly clayey and sandy, light gray, some limestone layers, calcareous.....	161.0	168.0
Sand, fine to medium, some interbedded sandy silts and fine grained sandstone.....	168.0	176.0
Silt, moderately clayey, light gray and pink, very calcareous.....	176.0	190.0
Sand and gravel, fine sand to fine gravel.....	190.0	199.0
Silt, slightly clayey and sandy, white, very limy, sand is very fine.....	199.0	203.0
Sand, fine to very coarse, some fine gravel grains, partly lime cemented 203-208 ft.....	203.0	211.0
Silt, moderately clayey, pink, some very fine to fine sandstone layers.....	211.0	231.0
Sandstone, very fine to fine, light gray, partly silty.....	231.0	240.0
Silt, clayey, pink, some interbedded siltstone layers, calcareous.....	240.0	252.0
Sand, fine to very coarse, trace of fine gravel, few lenses of clayey silt, moderately calcareous with some silicious rootlets.....	252.0	280.0
Silt, slightly clayey and sandy, pink, moderately calcareous, sand is very fine, limy areas.....	280.0	287.0

Sandstone, very fine to fine grained, pale olive, slightly calcareous, much silicious cementation, silty and ashy below 305 ft.....	287.0	315.0
Silt, clayey, pale olive, moderately calcareous, ashy.....	315.0	324.0
Silt, very clayey, pale olive, moderately calcareous, some ash, some siltstone and claystone layers.....	324.0	345.0
Sand, very fine to medium coarse, some coarse grains, possibly very silty, clayey silt-siltstone layers 352-353 ft. and 357-362 ft.....	345.0	364.0
Silt, very clayey, pale olive, moderately calcareous, few light gray siltstone lenses.....	364.0	372.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Chalk, clayey, white to yellow and light gray.....	372.0	395.0

Test Hole #40-A-49 (No e-log)
(7-25-28bbbb)
Frontier County

Location: NW NW NW NW sec. 28, T. 7 N., R. 25 W., 98 ft. south and 118 ft. east of northwest corner.
Ground elevation: 2,586 ft. (i) (Eustis SW 7.5 minute quadrangle)
Depth to water: 133.6 ft. (8-20-49).

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, sandy, dark brown	0.0	2.0
Silt, sandy, brownish-tan	2.0	3.5
Silt, slightly sandy to slightly clayey, slightly calcareous, light brownish-buff; contains some gastropod shells	3.5	5.0
Silt, sandy, light brownish-tan; contains very fine sand	5.0	10.0
Silt, slightly sandy, grayish-brown; contains very fine sand, limonite stain and limonitic nodules at 20 ft	10.0	38.0
Silt, slightly clayey, slightly calcareous, dark brown with a red tint	38.0	40.0
Silt, slightly clayey, dark brown	40.0	45.0
Silt, slightly clayey, slightly calcareous, light brownish-tan	45.0	48.5
Silt, clayey, slightly calcareous, light brownish-buff	48.5	50.0
Silt, slightly clayey, calcareous, light brownish-buff, slight red tint at 55 ft., slightly sandy 75 to 80 ft	50.0	80.0
Silt, clayey to slightly sandy, brown with red tint, moderately calcareous below 95 ft	80.0	100.0
Silt, slightly sandy, slightly calcareous, light brownish-buff; contains very fine sand; some limy zones	100.0	110.0
Silt, sandy, brown	110.0	115.0
Silt, sandy, brown; contains some limy nodules	115.0	125.0
Sand and silt, sandy, interbedded, brown; texture of sand grades very fine to very coarse	125.0	130.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand, brown to pinkish tan; texture grades very fine to very coarse; contains some interbedded silt zones and limy nodules	130.0	140.0
Sand, brown to pinkish-tan; texture grades very fine to very coarse; contains limy fragments and hard zones from 150 to 160 ft	140.0	160.0
Sand to sandstone, slightly calcareous; texture grades very fine to medium; contains interbedded silt and limy zones 165 to 170 ft	160.0	170.0

Sandstone, very calcareous; very fine texture; contains interbedded sandy silt, very calcareous, whitish-brown	170.0	175.0
Siltstone, very calcareous, brown; contains interbedded sandy silt, white	175.0	180.0
Sand to sandstone, brownish-tan; texture grades very fine to coarse; contains limy layers	180.0	200.0
Sand to sandstone, tannish-brown; texture grades very fine to medium; contains limy rootlets	200.0	210.0
Sand, brownish-tan; texture grades very fine to medium; contains limy fragments and fine sandstone 240 to 247 ft	210.0	247.0
Marl, very calcareous, light gray; contains interbedded sandstone	247.0	249.0
Sand to sandstone, very calcareous, brownish-gray; contains some siltstone	249.0	255.0
Sand, yellow, red, pink, and brown; texture grades from fine to very coarse; contains some yellow clay fragments	255.0	260.0
Sand, brown and pinkish-tan; texture grades very fine to coarse	260.0	270.0
Sand and clay, interbedded; texture of sand grades fine to very coarse, clay is yellowish-white, brown and pinkish-tan	270.0	284.5
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Chalk, very calcareous, whitish-yellow	284.5	290.0
Shale, chalky, slightly silty, moderately calcareous, dark brown to dark gray	290.0	310.0

Test Hole #11-F-78 (E-log)
(7-27-36aaaa)
Frontier County

Location: NE NE NE NE sec. 36, T. 7 N., R. 27 W., 27.5 ft. south of center of highway 23-S, 11 ft. west of center of gravel road going north; 27 ft. east-north-east of telephone pole and 41 ft. west-north-west of "Old Trail Marker".
Ground elevation: 2,641 ft. (t) (Stockville SE 7.5 minute quadrangle)
Depth to water: 210 ft. (7-12-78)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, moderately sandy, slightly clayey, dark grayish brown	0.0	1.0
Silt, slightly sandy and clayey, very pale brown, sand is very fine, calcareous	1.0	45.0
Silt, slightly sandy and clayey, brown, sand is very fine, calcareous	45.0	53.0
Silt, slightly clayey and sandy, very pale brown, sand is very fine, moderately calcareous, few limy areas	53.0	97.0
Silt, moderately clayey, very pale brown, some very fine sand, calcareous	97.0	103.0
Silt, moderately sandy, light yellowish brown, some limy areas, sand is very fine to fine, light gray with fine to medium fine sand below 120 ft., calcareous	103.0	124.0
Sand and gravel, fine sand to fine gravel, mostly fine sand to fine gravel, mostly medium to coarse sand	124.0	131.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, clayey, pink, very calcareous	131.0	135.0
Sandstone, very fine grained, pink, some lime cementation and few clayey silt layers	135.0	160.0
Silt, clayey, pink, some very fine grained sandstone between 164-166 ft	160.0	169.0
Sandstone, very fine-medium grained, light gray, some limy areas	169.0	181.0
Sand and gravel, very fine sand to fine gravel	181.0	197.0
Silt, very clayey, light gray to 200 ft. then pink, calcareous, few limy layers	197.0	215.0
Siltstone, clayey, pink, some very fine grained sandstone, calcareous	215.0	228.0
Sand, very fine to fine, some very fine grained limy sandstone layers	228.0	246.0
Sandstone, very fine grained, light gray, some interbedded very fine-fine sand layers, slightly calcareous	246.0	263.0

Silt, sandy, pink, some siltstone lenses, slightly calcareous	263.0	266.0
Sand, very fine to medium coarse, trace coarse-very coarse sand	266.0	274.0
Silt, slightly sandy, light gray, sand is very fine, calcareous	274.0	283.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Flint, strong brown, silicious and very hard	283.0	287.0

Test Hole #33-A-60 (E-log)
(7-28-1caaa)
Frontier County

Location: NE NE NE SW sec. 1, T. 7 N., R. 28 W., 3 ft. south of and 27 ft. west of center of section line.
Ground elevation: 2508 ft. (t) (Stockville 7.5 minute quadrangle)
Depth to water: 10.38 ft. (8-10-60)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly-moderately clayey, grayish brown.....	0.0	7.0
Clay, moderately-very silty, grayish brown.....	7.0	16.0
Gravel, fine-medium gravel, some very coarse sand...	16.0	26.0
Sand, very fine, very silty, moderately clayey.....	26.0	28.0
Sand and gravel, very fine-very coarse sand and fine gravel.....	28.0	37.0
Sand, very fine-coarse.....	37.0	50.0
Sand and gravel, fine-very coarse sand and fine-medium gravel.....	50.0	62.0
Tertiary System - Miocene Series - Ogallala Group:		
Siltstone, pale olive.....	62.0	67.0
Sand-sandstone, very fine-medium, trace coarse.....	67.0	91.0
Silt, moderately-very clayey, slightly sandy, limy lenses.....	91.0	100.0
Sand-sandstone, very fine-coarse sand, trace fine gravel, some rootlets, limy.....	100.0	110.0
Sand and gravel, medium-very coarse sand and fine gravel.....	110.0	121.0
Sand-sandstone, very fine-coarse sand, trace fine gravel and some rootlets, limy.....	121.0	126.0
Silt, very sandy, very fine-medium sand, very limy..	126.0	130.0
Sand and gravel, fine-very coarse sand and fine gravel.....	130.0	134.0
Sand-sandstone, very fine-medium, some coarse-very coarse, in part very silty, rootlets, in part limy, pale yellow-pale olive.....	134.0	148.0
Silt, moderately-very clayey, slightly-sandy, very fine-medium, moderately limy, light gray-very pale brown.....	148.0	155.0
Sandstone, very fine-medium, slightly clayey, rootlets, very limy, much lime cement, light yellow brown-white.....	155.0	180.0
Sand-sandstone, very fine-medium, in part lime cemented, rootlets, light yellow brown and white..	180.0	187.0
Silt, very clayey, very limy, slightly sandy, white.	187.0	190.0
Sand-sandstone, very fine-coarse, limy, lime cemented lenses, pale olive and white.....	190.0	200.0

Sand, very fine-medium, trace coarse-very coarse and fine gravel, slightly-very silty, slightly clayey, rootlets, light gray.....	200.0	218.0
Silt, very clayey, moderately sandy, very fine-coarse, light gray.....	218.0	220.0
Sand-sandstone, very fine-coarse, trace very coarse sand and fine gravel, very silty, slightly-moderately clayey, light gray and light yellow brown...	220.0	230.0
Sand and gravel, fine-very coarse sand and fine gravel, trace silt lenses, rootlets, bone fragments, reworked shale.....	230.0	248.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay-shale, yellow and white, much iron stain and iron stone.....	248.0	251.0
Clay-shale, gray black.....	251.0	280.0

Test Hole #32-A-60 (E-log)
(7-28-24bbbb)
Frontier County

Location: NW NW NW NW sec. 24, T. 7 N., R. 28 W., 144 ft. south of north section line and 7 ft. east of west section line.
Ground elevation: 2,691 ft. (t) (Stockville 7.5 minute quadrangle)
Depth to water: 184.34 ft. (8-9-60)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, dark brown-brown.....	0.0	10.0
Silt, slightly-moderately clayey, iron staining, trace snail shells, trace very fine-fine sand, grayish brown-brown-pale brown.....	10.0	60.0
Silt, slightly-moderately clayey, moderately-very sandy, very fine-fine, in part marly, very pale brown.....	60.0	75.0
Silt, slightly clayey, slightly-very sandy, very fine siltstone seams, in part marly and lime cemented, brown-very pale brown.....	75.0	110.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, very fine-fine, very silty, lime cemented with some rootlets.....	110.0	139.0
Sand and gravel, very fine-very coarse sand, fine medium gravel, trace sandstone, in part silty.....	139.0	160.0
Silt-siltstone, moderately clayey, very sandy, very fine-medium, marly, lime cemented with limestone seams, very pale brown-pale brown.....	160.0	205.0
Sand-sandstone, very fine-very coarse, trace fine gravel, in part lime cemented, slightly silty, brown-white.....	205.0	231.0
Silt-siltstone, moderately clayey, slightly sandy, very fine-fine, siltstone is limy, pale brown-very pale brown.....	231.0	236.0
Sand, very fine-medium, trace coarse, occasional sandstone and siltstone seams, rootlets, in part lime cemented, brown-very pale brown.....	236.0	282.0
Sand-sandstone, very fine-coarse, trace very coarse, very silty, marly, in part lime cemented, rootlets pale brown.....	282.0	301.0
Sand, very fine-coarse, trace sandstone, slightly silty, marly, in part lime cemented, rootlets, pale brown.....	301.0	309.0
Silt, very clayey, very limy, very pale brown.....	309.0	311.0
Sand-sandstone, very fine-very coarse, trace fine gravel, in part lime cemented, pale brown.....	311.0	328.0

Silt-siltstone, moderately clayey, moderately-very sandy, very fine-medium, interbedded sandstone seams, marly-lime cemented, yellow brown-pale brown-white	328.0	345.0
Limestone, in part sandy, very pale brown-white	345.0	350.0
Sand-sandstone, very fine-coarse, slightly clayey, marly, pale brown	350.0	362.0
Silt, slightly-moderately clayey, very sandy, very fine-medium, trace coarse-very coarse, pale yellow	362.0	369.0
Sand, very fine-coarse, rootlets, siltstone fragments, very pale brown	369.0	374.0
Silt-siltstone, slightly-moderately clayey, slightly to very sandy, very fine-medium, rootlets, shale fragments, pale olive-yellow and light gray	374.0	378.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay-shale, mottled pale olive-white-yellow-gray, bentonitic	378.0	390.0
Clay-shale, light gray-dark gray, some light gray to white 390-395 ft., bentonitic	390.0	420.0

Test Hole #13-F-78 (E-log)
(7-29-36adaa)
Frontier County

Location: NE NE SE NE sec. 36, T. 7 N., R. 29 W., 22.5 ft. west of gravel road, 154 ft. south of center of wood bridge, 1391 ft. south of power lines running east-west, at south edge of terrace abutting outcrop of loess approximately 30 ft. of open cut, 27 ft. north of edge of loess outcrop.
Ground elevation: 2,700 ft. (t) (Curtis SE 7.5 minute quadrangle)
Depth to water: 110 ft. (7-18-78)

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Silt, sandy and slightly clayey, light brownish, gray, sand is very fine.....	0.0	4.0
Silt, sandy and slightly clayey, light gray, sand is very fine-fine, slightly calcareous.....	4.0	12.0
Silt, slightly sandy and clayey, light yellowish brown, moderately calcareous, sand is very fine-fine, light gray and very calcareous below 20 ft..	12.0	26.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, clayey and slightly sandy, light gray, sand is very fine-fine, limy, pink below 32 ft.....	26.0	41.0
Sand and gravel, fine sand to fine gravel, mostly coarse sand.....	41.0	51.0
Silt, moderately clayey, slightly sandy, pale olive to pink, calcareous.....	51.0	67.0
Sand, very fine to medium, silty.....	67.0	72.0
Silt, sandy and clayey, pink, sand is very fine to medium, calcareous.....	72.0	77.0
Sand, very fine to medium coarse, very silty.....	77.0	81.0
Silt, slightly clayey and sandy, pink to light gray, some fine-medium sand layers and partly limy, ashy 115-117 ft.....	81.0	123.0
Sand and gravel, fine sand to medium-fine gravel mostly coarse sand.....	123.0	134.0
Silt, slightly clayey and sandy, pink-light gray, some siltstone layers, limy areas.....	134.0	171.0
Sand, fine to medium, silty and partly limy.....	171.0	181.0
Sandstone, very fine-fine grained, light pink, slightly calcareous with some silicious rootlets..	181.0	211.0
Silt, clayey, pinkish white, calcareous, some siltstone below 217 ft.....	211.0	224.0
Sand, fine-very coarse, trace fine gravel.....	224.0	230.0
Silt, slightly clayey and sandy, light gray, limy, sand is very fine-medium.....	230.0	233.0
Sand, gravelly, fine sand to fine gravel.....	233.0	240.0
Sandstone and sand, very fine-medium, pinkish gray, moderately calcareous.....	240.0	246.0

Sand and gravel, fine sand to medium fine gravel, mostly coarse and very coarse sand.....	246.0	253.0
Silt, clayey, light gray to white, some siltstone, calcareous.....	253.0	262.0
Sandstone, very fine to medium grained, pinkish white to light gray, moderately calcareous, some pale olive clayey silt layers, few siltstone lenses.....	262.0	311.0
Silt, slightly clayey, sandy, pale yellow, sand is very fine-fine, partly lime cemented.....	311.0	319.0
Sand, very fine to medium.....	319.0	321.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, shaly, pale yellow-light greenish gray, some iron staining, possibly reworked to 345 ft., light gray to black below 360 ft.....	321.0	377.0

Test Hole #13-H-78 (E-log)
(7-30-36dddc)
Frontier County

Location: SW SE SE SE sec. 36, T. 7 N., R. 30 W., 270 ft. west of center line at north-south power line and 50 ft. west of center line of north-south trail road. 91 ft. north of east-west fence on east side of road and 72 ft. west of that fence corner on east side of dirt road.
Ground elevation: 2,960 ft. (t) (Curtis SW 7.5 minute quadrangle)
Depth to water: 310 ft.(est.) (8-9-78)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, sandy, dark grayish brown, humic.....	0.0	6.0
Silt, coarse to very coarse, slightly sandy, very pale brown, calcareous, few snail shells.....	6.0	56.0
Silt, slightly sandy, yellowish brown, calcareous, few limy streaks, some iron stains.....	56.0	61.0
Silt, coarse, slightly clayey and sandy, light yellowish brown, calcareous, sand is very fine, clayey below 67 ft.....	61.0	86.0
Silt, slightly clayey, pale brown, calcareous, blocky with some lime, paleosol.....	86.0	91.0
Silt, coarse, sandy, light yellowish brown, few limy streaks and nodular areas, sand is very fine.	91.0	101.0
Silt, slightly clayey and sandy, light yellowish brown, pink cast below 120-132 ft., calcareous, some iron stains.....	101.0	144.0
Silt, coarse, slightly clayey, light yellowish brown, calcareous, limy nodules.....	144.0	153.0
Silt, coarse, slightly clayey, light yellowish brown, calcareous, sand is very fine to fine, some limy nodules, blocky with few iron stains, pinkish below 229 ft.....	153.0	244.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, very fine to fine, pinkish white, calcareous, slightly silty and clayey in areas, sandy in lower part.....	244.0	262.0
Sand and gravel, fine sand to medium gravel.....	262.0	277.0
Silt, slightly clayey, pink, calcareous.....	277.0	289.0
Sand and gravel, fine sand to fine gravel, trace medium gravel.....	289.0	297.0
Silt, slightly clayey and sandy, pink-pinkish white, calcareous, fine-medium sand 308-312 ft., few limy areas.....	297.0	337.0
Sandstone, very fine to medium grained, white, calcareous, some limestone.....	337.0	342.0
Silt, slightly clayey and sandy, pinkish, white, limy, sand is fine to medium, some siltstone.....	342.0	371.0

Siltstone, clayey, pink	371.0	378.0
Sandstone, very fine grained, pink, some claystone, manganese stains	378.0	387.0
Silt, slightly clayey, white, very limy	387.0	394.0
Sandstone, very fine grained, silty, light gray to white, very calcareous, some siltstone layers	394.0	426.0
Sand, very fine to medium, very silty, pinkish white to white	426.0	438.0
Silt, slightly clayey and sandy, pinkish white, some very fine sand	438.0	442.0
Sandstone, very fine to fine, interbedded with siltstone, light gray to pinkish white, some limy areas	442.0	485.0
Sandstone, very fine to medium, clayey and silty, white, some siltstone and reworked shale	485.0	490.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Shale, clayey, pale yellow-yellow-pink and light gray, some iron and manganese staining, dark gray below 524 ft	490.0	530.0

Test Hole #55-A-48 (No e-log)
(8-24-1babb)
Frontier County

Location: NW NW NE NW sec. 1, T. 8 N., R. 24 W., 10 ft. south and 1,500 ft. east of northwest corner.
Ground elevation: 2,693 ft. (i) (Elwood NW 7.5 minute quadrangle)
Depth to water: 203.6 ft. (11-11-48)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Road fill: silt, dark brownish-gray	0.0	0.6
Soil: silt, dark brownish-gray	0.6	2.0
Silt, medium brownish-gray	2.0	3.0
Silt, medium buff-gray, lighter 5 to 10 ft	3.0	10.0
Silt, light buff-gray; contains gastropod shells and limy rootlets and limonite-stain 10 to 30 ft	10.0	56.0
Silt, dark reddish-brown	56.0	60.0
Silt, medium reddish-buff, slightly clayey 90 to 95 ft	60.0	108.0
Silt, clayey, light buff-gray	108.0	111.0
Silt, slightly clayey, medium buff-gray	111.0	120.0
Silt, slightly clayey, light brownish-gray	120.0	125.0
Silt, slightly clayey, light reddish-brown, slightly less red and less clayey 140 to 150 ft	125.0	150.0
Sand, silty, light reddish-brown; texture grades from fine to coarse	150.0	175.0
Silt, sandy, light brownish-gray; contains very fine to medium sand, less sand 185 to 190 ft., coarse sand to fine gravel 224 to 235 ft., hard limy layer 234 to 235 ft	175.0	235.0
Sand and gravel, varicolored; texture grades from medium sand to coarse gravel, fine gravel 255 to 260 ft	235.0	301.0
Sand and gravel, fine sand to medium gravel, slightly cemented	301.0	302.0
Silt, medium-gray to brown, very calcareous 316 to 316.5 ft	302.0	320.0
Sand and gravel, gray to reddish-brown; texture grades from coarse sand to medium gravel; contains intermittent hard cemented zones	320.0	347.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand, slightly silty, light brownish-gray; texture grades from fine to coarse, contains rootlet fragments	347.0	360.0
Silt, slightly calcareous, gray-white	360.0	363.5
Silt and siltstone, interbedded, moderately calcareous, light reddish-tan	363.5	369.0

Sand, silty, medium reddish-brown; texture grades fine to coarse, light brownish-gray 380 to 392 ft.; contains calcareous layer 384.5 to 385.5 ft.	369.0	392.0
Sand, light grayish-tan; texture grades from fine to very coarse.	392.0	395.0
Sand, silty, moderately calcareous; texture grades from fine to medium with some fine gravel.	395.0	400.0
Silt, dark brownish-gray; contains a very calcareous zone 404 to 404.3 ft.	400.0	405.0
Silt, clayey, medium reddish-brown; contains a very calcareous zone 409 to 409.5 ft.	405.0	410.0
Clay, light yellowish-gray.	410.0	417.0
Silt, sandy, moderately calcareous, grayish-white, more gray with depth; contains very fine to fine sand; slightly clayey 445 to 450 ft.	417.0	450.0
Sandstone to sand, silty, light gray; texture grades very fine to fine and some medium.	450.0	455.0
Sand, slightly silty, very light brownish-gray; texture grades from very fine to fine and some medium sand.	455.0	465.0
Sand, silty, to silt, sandy, moderately calcareous, very light gray; texture grades very fine to fine and some medium, in part clayey 467 to 470 ft.; contains some embedded gravel 470 to 473 ft.	465.0	473.0
Silt, sandy, to sand, silty, very light greenish-gray; contains fine to medium sand.	473.0	485.0
Sand, slightly silty, very light brownish-gray; texture grades fine to medium, slightly coarser 490 to 510 ft.	485.0	510.0
Silt, sandy, light gray; contains fine to medium sand; less sandy 523 to 530 ft.	510.0	530.0
Sand, silty, light brownish-gray; texture grades fine to medium.	530.0	539.0
Sandstone, silty, light gray; texture grades fine to medium.	539.0	542.0
Silt, very sandy, very light brownish-gray; contains very fine to medium sand, limy zone 544.5 to 544.7 ft.	542.0	545.0
Sandstone, silty, moderately calcareous, white to light gray; texture finer and very calcareous 554 to 555 ft.	545.0	555.0
Silt, sandy, to sandstone, moderately to very calcareous, light gray; contains hard zone 559.7 to 560 ft.	555.0	560.0
Silt, slightly clayey to sandy, moderately calcareous, light gray.	560.0	562.0
Silt, slightly sandy, moderately calcareous, white.	562.0	562.5
Silt, slightly clayey to sandy, light gray with brown tint; contains thin hard zones at 563 and 564.5 ft.	562.5	565.0

Silt, sandy, moderately calcareous, very light brownish-gray; contains thin hard zones.....	565.0	575.0
Sand, slightly silty, slightly to moderately calcareous, light gray, slight green tint 583.5 to 593 ft.; texture grades fine to medium.....	575.0	593.0
Silt to marl, moderately calcareous, white.....	593.0	594.5
Silt, sandy, moderately to very calcareous, very light gray with very slight green tint; contains very fine to fine sand.....	594.5	602.5
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, chalky, yellow to white, darker with depth...	602.5	610.0

Test Hole #22-H-78 (E-log)
(8-24-6bbbb)
Frontier County

Location: NW NW NW NW sec. 6, T. 8 N., R. 24 W., 194 ft. south and 222 ft. east of northwest corner.
Ground elevation: 2,700 ft. (t) (Eustis 7.5 minute quadrangle)
Depth to water: 175 ft. (est.) (9-8-78)

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Sand, moderately-very silty, possibly old road fill, brown	0.0	5.0
Silt, slightly-moderately clayey, gray brown-dark gray brown	5.0	20.0
Silt, slightly clayey, very coarse silt, sandier 32-38 ft., limy streaks, trace manganese staining, yellow brown-pale yellow brown, light gray paleosol 24-26 ft	20.0	86.0
Silt, slightly clayey, trace very fine sand, reddish brown	86.0	90.0
Silt, slightly clayey, fine-very coarse silt, trace very fine sand, limy streaks, trace lime concentrations, yellow-brown-pale yellow brown	90.0	160.0
Silt, moderately-very clayey, yellow brown	160.0	164.0
Silt, slightly clayey, fine-coarse silt, yellow brown	164.0	174.0
Silt, very coarse silt, trace very fine sand, manganese and iron stains, light grayish brown-light gray	174.0	198.0
Silt, very coarse silt, trace very fine sand, manganese and iron stains, light grayish brown-light gray	198.0	201.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, coarse-very coarse silt, trace very fine sand, moderately limy, light gray-pale brown	201.0	232.0
Silt, slightly clayey, some very fine sand, slightly to moderately limy, light gray-pale brown-white with some dark greenish brown silts	232.0	246.0
Sand-sandstone, very fine-fine, trace medium-very coarse, moderately limy, moderately silty, light gray-light green-pale brown	246.0	268.0
Sand, very fine-fine, slightly silty, pale brown	268.0	276.0
Silt, slightly clayey, moderately-very sandy, very fine-fine sand, green gray	276.0	281.0
Silt, trace very fine sand, trace siltstone, very limy-lime cemented, very pale brown-grayish white.	281.0	286.0
Sand, very fine-medium, some coarse-very coarse, trace fine gravel, lime cemented, light grayish brown	286.0	290.0

Sand, very fine sand, trace sandstone, moderately-very silty, very limy, light gray-pale brown.....	290.0	294.0
Sand, fine-very coarse, trace fine gravel, trace lime cement, pale brown.....	294.0	301.0
Silt, very sandy, very fine-fine sand, limy, light gray-pale brown.....	301.0	306.0
Sand, very sandy, very fine-fine sand, limy, light gray green.....	306.0	309.0
Silt, moderately-very clayey, trace very fine sand..	309.0	324.0
Sand and gravel, fine sand-fine gravel, much very coarse sand-fine gravel.....	324.0	339.0
Silt, very coarse, some very fine sand, yellow brown	339.0	341.0
Sand, fine-medium, trace coarse sand-fine gravel, slightly limy in streaks, trace iron and manganese staining, yellow brown.....	341.0	349.0
Silt, some sandstone and siltstone seams, moderately to very clayey, slightly sandy, very fine-fine sand, moderately-very limy, grayish brown-white...	349.0	368.0
Sand-sandstone, very fine-medium, rootlets, slightly limy in streaks, trace iron and manganese stains, yellow brown.....	368.0	395.0
Silt, moderately-very sandy, very fine sand, limy, light grayish white.....	395.0	404.0
Silt, moderately-very sandy, slightly limy, gray green.....	404.0	414.0
Sand and sandstone, very fine-fine sand, slightly to moderately silty, slightly limy, rootlets, light gray green.....	414.0	430.0
Silt-siltstone, moderately sandy, very fine-medium sand, very limy, light green white.....	430.0	433.0
Sand, very fine-fine, trace medium-coarse sand, trace rootlets, light gray green, very silty at 464 ft.....	433.0	466.0
Limestone-siltstone, manganese stains, very hard, very limy, white.....	466.0	474.0
Sand-sandstone, interbedded with silty, clayey-claystone seams, sand is very fine-medium, moderately-very silty, slightly moderately limy, light greenish gray.....	474.0	512.0
Sand and gravel, very fine sand-medium gravel, much coarse sand-fine gravel.....	512.0	521.0
Silt, very sandy with limy siltstone, light gray....	521.0	524.0
Sand, very fine-very coarse, much medium, slightly silty.....	524.0	530.0
Silt, very limy, slightly sandy, very fine medium sand, very clayey at 543 ft., light gray.....	530.0	564.0
Sand-sandstone, very fine-medium, slightly-moderate silty and limy, trace rootlets, light gray.....	564.0	578.0
Silt, moderately-very clayey, slightly-moderately silty, slightly limy, light gray, green pale brown.....	578.0	607.0
Sand, very fine-coarse, much fine-medium.....	607.0	610.0

Silt, moderately clayey, slightly sandy, light gray-pale brown.....	610.0	616.0
Sand and gravel, very fine-very coarse sand, some fine gravel.....	616.0	638.0
Silt, moderately-very clayey, gray white, sandy at 640-642 ft. and 645-649 ft., traces of reworked weathered clay and flint.....	638.0	651.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Chalk, very calcareous white to 660 ft., iron staining and white-light yellow 660-678 ft.....	651.0	678.0
Chalky, shale, light gray-tan with iron stains.....	678.0	680.0

Test Hole #41-A-49 (No e-log)
(8-25-6dddc)
Frontier County

Location: SW SE SE SE sec. 6, T. 8 N., R. 25 W., 141 ft. north and 400 ft. west of southeast corner.
Ground elevation: 2,822 ft. (a) (Farnum 7.5 minute quadrangle)
Depth to water: Unknown; test hole caved at 196.5 feet (8-27-49).

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Road fill: silt, slightly sandy, grayish-brown.....	0.0	1.0
Silt, slightly sandy, brown.....	1.0	2.0
Silt, slightly calcareous, light brownish-tan, iron-stain 5 to 20 ft.....	2.0	20.0
Silt, grayish-brown; contains limy nodules, lighter at 35 ft.....	20.0	40.0
Silt, light brownish-buff.....	40.0	55.0
Silt, slightly clayey, black to dark brown, in part light tan.....	55.0	60.0
Silt, brown to dark brown.....	60.0	63.0
Silt, light brown with red tint.....	63.0	66.5
Silt, moderately calcareous, light brown with red tint; contains limy zones.....	66.5	70.0
Silt, slightly calcareous, light brownish-tan with slight red tint.....	70.0	75.0
Silt, slightly sandy, slightly calcareous, light brownish-buff.....	75.0	88.0
Clay, slightly silty to sandy, light brown to red-dish-buff.....	88.0	90.0
Silt, slightly clayey, light brownish-buff; contains limy nodules at 95 ft.....	90.0	100.0
Silt, slightly sandy, slightly calcareous, light brown to buff; contains very fine sand.....	100.0	110.0
Silt, slightly sandy, moderately calcareous, light brown to buff.....	110.0	125.0
Silt, slightly clayey to slightly sandy, moderately calcareous, light brown to tan.....	125.0	130.0
Clay, light brownish-tan.....	130.0	135.0
Silt, slightly clayey, slightly calcareous, buff; contains limy nodules.....	135.0	140.0
Silt, clayey to slightly sandy, light brownish-buff; contains very fine sand, limy nodules at 145 ft., slightly calcareous 150 to 155 ft., and 160 to 180 ft.....	140.0	185.0
Silt, sandy, moderately calcareous, brown, inter-bedded with grayish-white silt; contains limy nodules.....	185.0	190.0
Silt, clayey, slightly sandy, slightly calcareous, contains limy nodules 190 to 195 ft.....	190.0	200.0

Silt, sandy, slightly clayey, slightly calcareous, light-brown to buff; contains limy nodules; lost circulation at 210 ft., abandoned hole.....	200.0	210.0

Test Hole #42-A-49 (No e-log)
(8-25-7aabb)
Frontier County

Location: NW NW NE NE sec. 7, T. 8 N., R. 25 W., 7 ft. south and 1,200 ft. west of northeast corner.
Ground elevation: 2,755 ft. (i) (Farnum 7.5 minute quadrangle)
Depth to water: Unknown; test hole caved at 218 ft. (8-27-49).

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Road fill: silt, slightly sandy, brownish-gray.....	0.0	1.5
Soil: silt, slightly clayey, dark brownish-black...	1.5	4.0
Silt, slightly clayey to very slightly sandy, brown to dark-brown.....	4.0	5.5
Silt, slightly sandy, slightly calcareous, light brownish-tan; contains very fine sand, a few gastropod shells below 20 feet, some limonite-stain below 30 ft.....	5.5	50.0
Silt, slightly calcareous, grayish-brown; contains some limonite-stain.....	50.0	60.0
Silt, slightly calcareous, brownish-tan with red tint; contains calcareous nodules below 65 ft.....	60.0	77.5
Silt, moderately calcareous, grayish-brown to white; contains a few calcareous zones.....	77.5	80.0
Silt, moderately calcareous, light brownish-buff with red tint; contains calcareous nodules.....	80.0	95.0
Silt, slightly clayey, moderately calcareous, light-brown to reddish-tan.....	95.0	104.0
Silt, slightly clayey, very calcareous, tan to light green; contains limy zones.....	104.0	106.0
Silt, slightly clayey, moderately to slightly calcareous, light brownish-tan; contains limy nodules, more consolidated 110 to 115 ft.....	106.0	115.0
Silt, slightly clayey, moderately calcareous, very light brownish-tan; contains limy nodules.....	115.0	120.0
Silt, moderately calcareous, gray to light brown; contains limy nodules.....	120.0	130.0
Silt, slightly clayey, slightly calcareous, light brown to reddish-buff; contains limy nodules.....	130.0	140.0
Silt, slightly calcareous, tan to light brown; contains limy fragments.....	140.0	146.0
Silt, moderately calcareous, light buff to whitish-brown; contains limy zones.....	146.0	150.0
Silt, slightly to moderately calcareous, light brownish-tan; contains limy nodules.....	150.0	164.5
Siltstone, very calcareous, light grayish-brown.....	164.5	166.0
Silt, moderately to slightly calcareous, reddish-tan to light brown; contains limy nodules.....	166.0	188.0
Silt, clayey, reddish-tan to light-brown.....	188.0	190.0

Clay, light brownish-buff; contains limy nodules 190 to 195 ft	190.0	200.0
Clay, silty, light reddish-brown; contains limy zones	200.0	205.0
Clay, silty, light brown to reddish-buff	205.0	215.0
Clay, silty, slightly sandy, light brown to reddish-buff	215.0	220.0
Silt, sandy, dark reddish-brown; contains very fine to medium sand	220.0	225.0
Clay, silty, slightly calcareous, light reddish-brown; contains limy fragments	225.0	230.0
Clay, silty, slightly sandy, pink to light tan	230.0	236.0
Tertiary System - Miocene Series - Ogallala Group:		
Clay, very slightly silty, light olive-green to grayish-white; contains limy layers	236.0	240.0
Clay, sandy, grayish-green; contains sand grains, yellow and very fine to coarse, some limy fragments	240.0	250.0
Clay, sandy, reddish-tan; contains very fine to coarse sand, limy fragments	250.0	260.0
Clay, sandy, moderately calcareous, whitish to reddish-brown; contains limy layers 261 to 261.5 ft. and 264.5 to 265 ft	260.0	265.0
Clay, sandy, slightly calcareous, grayish to reddish-brown; contains very fine to coarse sand	265.0	270.0
Sand and silt, interbedded, very calcareous, reddish-brown; texture grades very fine to coarse sand	270.0	277.5
Silt, sandy, very calcareous, reddish-brown to grayish-white	277.5	280.0
Silt, sandy, light red, interbedded with clay, moderately calcareous, white	280.0	286.0
Clay, very calcareous, white, sandy 289 to 290 ft	286.0	290.0
Sand, green to light brown; texture grades very fine to coarse	290.0	295.0
Silt, sandy, reddish-brown, interbedded with clay, very calcareous, white	295.0	296.0
Sand, slightly calcareous, greenish-brown; texture grades very fine to medium	296.0	308.5
Silt, slightly sandy, moderately calcareous, grayish-green to grayish-white	308.5	310.0
Sand and silt, interbedded, green to light-brown; texture grades very fine to very coarse sand	310.0	315.0
Sand, brown to pinkish-tan; texture grades very fine to very coarse	315.0	317.5
Silt, slightly sandy, slightly calcareous, greenish-white	317.5	319.0
Sand, light olive-green; texture grades very fine to medium	319.0	320.0
Silt, sandy, light olive-green to brown; contains very fine to medium sand	320.0	325.0

Sand to sandstone, slightly calcareous, tannish-brown to light gray; texture grades very fine to coarse	325.0	331.5
Silt, sandy, light reddish-brown to grayish-brown	331.5	333.5
Silt, sandy, moderately calcareous, reddish-brown, interbedded with sandstone; contains very fine to medium sand	333.5	340.0
Silt and sandstone, interbedded, very calcareous, whitish-brown; contains very fine to medium sand	340.0	345.0
Sandstone, light brown to brown; texture grades very fine to medium	345.0	348.0
Silt, sandy, gray, and sandstone, reddish-brown, interbedded, moderately calcareous; contains very fine to medium sand	348.0	350.0
Siltstone, very calcareous, grayish-white with green tint; contains very fine sandstone	350.0	355.0
Silt to siltstone, very calcareous; contains green sandstone	355.0	360.0
Silt, sandy, and sand, interbedded; contains very fine to coarse sand	360.0	370.0
Silt, sandy to clayey, moderately calcareous, dark gray-brown, lighter 375 to 380 ft	370.0	380.0
Sand, varicolored; texture grades very fine to very coarse, some fine gravel 385 to 390 ft	380.0	390.0
Silt, sandy, moderately calcareous, brown and pinkish-tan; contains very fine to very coarse sand	390.0	395.0
Sand, slightly calcareous, tan to yellow; texture grades very fine to coarse	395.0	400.0
Silt, sandy, to sandstone, slightly calcareous, grayish-tan	400.0	410.0
Sand, tannish-pink to yellow; texture grades very fine to coarse; contains some small limy fragments	410.0	420.0
Silt, sandy, very calcareous, grayish-white; contains very fine to medium sand	420.0	430.0
Silt, slightly sandy to slightly clayey, very calcareous, grayish-white; contains very fine to medium sand	430.0	435.0
Silt, sandy, very calcareous, light grayish-green; contains very fine to coarse sand	435.0	440.0
Silt, very sandy, slightly calcareous, light olive-green; contains very fine sand	440.0	450.0
Clay, slightly calcareous, brownish-tan; contains limy fragments	450.0	460.0
Sand, tannish-gray; texture grades very fine to fine; contains limy nodules	460.0	490.0
Sand, moderately calcareous; texture grades very fine to medium; contains some interbedded limy zones	490.0	493.0
Marl, sandy, very calcareous, light gray	493.0	497.0
Sand, very calcareous; texture grades very fine to medium; contains some marl zones	497.0	500.0

Clay, sandy, slightly calcareous, greenish-gray; more sandy 505 to 510 ft.....	500.0	510.0
Sand; texture grades very fine to medium; contains some interbedded silt, light grayish-green.....	510.0	526.0
Sand, brown, red, pink, yellow and green; texture grades very fine to medium.....	526.0	538.0
Clay, sandy, light gray.....	538.0	540.0
Sand; texture grades very fine to fine; contains limy nodules.....	540.0	550.0
Sand; texture grades very fine to medium; contains interbedded silty clay, reddish-tan.....	550.0	560.0
Sand, tan; texture grades very fine to medium; contains interbedded sandy clay layers, slightly calcareous, white.....	560.0	570.0
Sand, brownish-tan; texture grades very fine to medium; contains limy nodules.....	570.0	580.0
Sand, very light green; texture grades very fine to medium; contains sandy clay.....	580.0	590.0
Sand, to sandstone, light brownish-tan; texture grades very fine to medium; contains some sandy clay.....	590.0	600.0
Clay, sandy, light green; darker at 605 ft.; contains yellowish-orange clay fragments at 610 ft...	600.0	620.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Chalk, very calcareous, grayish-white; contains yellowish-orange clay fragments.....	620.0	630.0

Test Hole #53-B-48 (No e-log)
(8-25-20dccd)
Frontier County

Location: SE SW SW SE sec. 20, T. 8 N., R. 25 W., 20 ft. north and 2,265 ft. west of southeast corner.
Ground elevation: 2,737 ft. (i) (Farnum 7.5 minute quadrangle)
Depth to water: 233.7 ft. (11-11-48)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, dark brownish-gray	0.0	1.0
Silt, very slightly clayey, buff to brownish-gray, buff-gray and slightly calcareous 2.5 to 5 ft.	1.0	5.0
Silt, moderately calcareous, buff-gray with slight brown tint; contains a few snail shells and limonitic flecks 9 to 10 ft	5.0	10.0
Silt, sandy, light brownish-gray; contains very fine sand, a few snail shells, and a few limonitic flecks	10.0	20.5
Silt, light brown-gray, slightly calcareous below 30 ft	20.5	45.5
Silt, very slightly clayey to very slightly sandy, medium to dark reddish-brown; contains very fine sand	45.5	50.0
Silt, sandy, tan-gray; contains very fine sand, calcareous 56 to 60 ft., slightly to moderately calcareous 60 to 70 ft., slightly clayey 65 to 70 ft	50.0	70.0
Silt, slightly to moderately calcareous, light brown to gray, light gray 89.5 to 91 ft.; texture grades from fine to coarse, slightly sandy 114 to 127.5 ft., slightly clayey 188 to 190 ft.; contains few calcareous nodules 130 to 140 ft	70.0	207.5
Tertiary System - Miocene Series - Ogallala Group:		
Silt, clayey to sandy, moderately calcareous, white; contains fine to very coarse sand	207.5	215.0
Silt, sandy, moderately calcareous; slightly granular; contains fine to coarse sand	215.0	218.0
Silt, very slightly clayey to sandy, light tannish-gray; contains fine to very coarse sand	218.0	220.0
Silt, sandy to pebbly, mottled light gray and reddish-brown; contains fine sand	220.0	230.0
Sand, silty, and gravel; texture grades coarse sand to medium gravel	230.0	240.0
Silt, light brown with red tint; contains sand and gravel	240.0	242.0
Sand, silty, and gravel; texture grades from coarse sand to medium gravel	242.0	248.0

Silt, medium brownish-gray; contains sand and gravel	248.0	250.0
Sand and gravel, light grayish-yellow to brownish-red; texture grades from coarse sand to coarse gravel; contains some calcareous particles from 265 to 270 ft., silty from 280 to 288 ft	250.0	288.0
Silt, sandy to gravelly, light brownish-gray	288.0	300.0
Sand and gravel, grayish-yellow to reddish-brown; texture grades from medium sand to coarse gravel, silty from 300 to 305 ft., intermittent hard and soft layers 305 to 310 ft	300.0	318.0
Marl, light grayish-white	318.0	328.0
Sand and gravel; texture grades from medium sand to medium gravel	328.0	332.0
Marl, light grayish-white; contains some consolidated sand and gravel	332.0	339.5
Sand, light brownish-gray to pinkish-brown; texture grades from fine to coarse with some fine gravel	339.5	341.5
Silt, slightly to moderately calcareous, light tan-gray, slightly clayey 342 to 346 ft., noncalcareous from 342 to 344 ft	341.5	346.0
Sandstone, brownish-tan; texture grades from fine to coarse; contains a few rootlets	346.0	350.0
Silt, sandy, to sandstone, moderately calcareous, light tan-gray	350.0	351.5
Sand and gravel, brown; contains claystone with some marl and quartz grains, more quartz sand 360 to 365 ft	351.5	365.0
Sandstone, slightly to moderately calcareous, light brownish-gray; texture grades from fine to medium.	365.0	373.5
Silt, sandy, moderately calcareous, grayish-white; contains thin interbedded green silt layers	373.5	375.5
Silt, very slightly clayey, moderately calcareous, light gray with green tint	375.5	380.0
Sand, silty, moderately calcareous, light gray; texture grades fine to medium	380.0	387.0
Sandstone, moderately to very calcareous, light tannish-gray; texture grades from fine to medium, less consolidated and coarser 390 to 397 ft.; contains silt and small seeds 400 to 405 ft	387.0	405.0
Sandstone to sand, silty, light gray	405.0	410.0
Sand, silty, to sand, light tan-gray; texture grades from fine to medium and some coarse	410.0	427.5
Sand, silty, light gray; texture grades fine to coarse	427.5	457.0
Silt and sandstone, moderately calcareous, white	457.0	459.5
Silt, sandy to clayey, and sand, silty, interbedded light gray with slight green tint; contains fine sand	459.5	465.0

Silt, sandy, to sand, silty, light gray with slight green tint; contains fine to coarse sand with traces of gravel, a few silty clay granules from 470 to 472 ft	465.0	472.0
Sand, silty, light brownish-gray; texture grades fine to coarse with a trace of fine to medium gravel	472.0	475.0
Sand and gravel, light brownish-gray; texture grades from fine sand to medium gravel	475.0	483.5
Sand, silty, to silt, sandy, light gray with a slight green tint; contains fine to coarse sand and limy fragments	483.5	486.5
Silt and sandstone, moderately calcareous, white	486.5	488.5
Sand, light brownish-gray; texture grades from fine to coarse, some consolidation	488.5	490.0
Silt and sandstone, moderately calcareous, light gray with slight brown tint; texture grades from very fine to medium sand	490.0	510.0
Silt, moderately calcareous, white	510.0	513.5
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, chalky, very calcareous, bright yellow to light gray, lighter with depth	513.5	530.0

Test Hole #87-33 (No e-log) (No samples)
(8-26-5bacd)
Frontier County

Location: SE SW NE NW sec. 5, T. 8 N., R. 26 W., approximately 1,200 ft. south of north section line and 1,900 ft. east of west section line.
Ground elevation: 2,640 ft. (t) (Stockville NE 7.5 minute quadrangle)
Depth to water: Not recorded.

	Depth, in feet	
	From	To
Quaternary System, undifferentiated:		
Clay, silty, yellowish-gray.....	0.0	30.0
Soil, black.....	30.0	34.0
Clay, silty, yellowish-gray.....	34.0	53.0
Clay and silt, calcareous.....	53.0	67.0
Clay, silty, pink.....	67.0	85.0

Test Hole #31-F-77 (E-log)
(8-27-34ccbb)
Frontier County

Location: NW NW SW SW sec. 34, T. 8 N., T. 27 W., 1,036 ft. north 38 ft. east of southwest corner.
Ground elevation: 2,692 ft. (t) (Stockville 7.5 minute quadrangle)
Depth to water: 181 ft. (10-21-77)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Soil, silty, dark grayish-brown	0.0	1.0
Silt, slightly clayey, grayish-brown; in part limy; below 5 feet principally pale brown	1.0	88.0
Tertiary System - Miocene Series - Ogallala Group:		
Sandstone, very fine-fine grained, some medium, silty; in places lime cemented	88.0	95.0
Silt, very sandy, slightly clayey, pale brown, sand is very fine	95.0	100.0
Sandstone, very fine-fine grained some medium, rare coarse sand; rootlets; some volcanic ash	100.0	113.5
Sand, very fine-very coarse, little fine gravel; sample missing below 115 ft. probably as above	113.5	120.0
Sand, very fine-very coarse, little very coarse sand to fine gravel	120.0	124.0
Silt, very sandy, slightly clayey, reddish-brown, very calcareous; in places limy	124.0	132.0
Sand, gravelly; very fine sand-fine gravel	132.0	142.0
Sand, very silty, slightly clayey; sand is very fine to coarse some coarser grains	142.0	144.0
Sand, very silty, slightly clayey; sand is very fine to coarse with some coarser grains 152-153 ft., contains some silt lenses	144.0	157.0
Silt, very sandy, slightly clayey, pale brown, very calcareous; sand is very fine-fine	157.0	161.0
Sand, gravelly; fine sand-fine gravel with some medium gravel	161.0	165.0
Silty sand-sandy silt, slightly clayey, light gray, very calcareous; sand is very fine, some lime cemented sandstone	165.0	188.0
Silt, very sandy, slightly clayey, brown to light gray, very calcareous; sand is very fine-medium; some sandstone	188.0	208.0
Sand, moderately silty, very fine-fine, little medium to coarse; from 214-216 ft. silt lens	208.0	224.0
Silt, slightly clayey, slightly sandy, white, very calcareous; sand is very fine-fine; some volcanic ash	224.0	230.0
Sand, silty, very fine-fine	230.0	234.0

Silt, very sandy, slightly clayey, white, very calcareous; sand is very fine	234.0	241.0
Siltstone, clayey, reddish-brown	241.0	255.0
Sandstone, very fine-medium grained	255.0	265.0
Sandstone, very fine-very coarse grained, little fine gravel; from 208-281 ft. no sample; below 281 ft. sand is very fine-medium, some coarse, little very coarse	265.0	300.0
Silt, moderately clayey, light gray with olive tint.	300.0	312.0
Sandstone, very fine-fine grained, silty; below 324 ft. sand is very fine-medium with few coarser grains	312.0	338.0
Siltstone, clayey, brown	338.0	347.0
Sand, very fine-very coarse, little fine gravel	347.0	375.0
Sand, gravelly; very fine sand-fine gravel	375.0	380.0
Tertiary System - Oligocene Series - White River Group:		
Brule Formation:		
Siltstone, clayey, pinkish-white	380.0	415.0
Tertiary System - Eocene Series - White River Group:		
Chadron Formation:		
Clay, olive-gray, in places maroon, some bentonite..	415.0	435.0
Sandstone, very fine-fine grained, silty; some volcanic ash; some lithic gravels	435.0	440.0
Clay, silty, olive-gray, moderately calcareous	440.0	445.0
Cretaceous System - Upper Cretaceous Series - Colorado Group:		
Niobrara Formation:		
Shale, clay, dark-gray, very calcareous; some bentonite, some pyrite	445.0	450.0

Test Hole #35-A-60 (E-log)
(8-28-1baaa)
Frontier County

Location: NE NE NE NW sec. 1, T. 8 N., R. 28 W., 8 ft. south of north section line and 2,411 ft. east of west section line.
Ground elevation: 2,754 ft. (t) (Moorefield 7.5 minute quadrangle)
Depth to water: Unknown. (8-16-60)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly-moderately clayey, very slightly sandy, very fine sand, dark gray brown.....	0.0	4.0
Silt, slightly-moderately clayey, trace iron stain, light brownish gray-pale brown.....	4.0	63.0
Silt, moderately-very clayey, trace siltstone, slightly-moderately sandy, very fine sand, limy lenses, pale brown-very pale brown.....	63.0	118.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand, very fine-medium, trace coarse-very coarse, very silty, slightly clayey, light gray-white.....	118.0	135.0
Silt, slightly clayey, very sandy, very fine-fine, trace rootlets, pale olive-pale brown.....	135.0	140.0
Sand, very fine-very coarse sand, very silty, pale brown.....	140.0	148.0
Sand and gravel, medium-very coarse sand and fine gravel.....	148.0	149.0
Clay, slightly sandy, very fine sand, pale yellow-pale brown.....	149.0	154.0
Silt, moderately-very clayey, moderately-very sandy, very fine-fine, yellow brown-pale brown.....	154.0	166.0
Sand and gravel, fine-very coarse sand and fine gravel, rootlets.....	166.0	178.0
Silt, slightly-moderately clayey, very sandy, fine-coarse, in part limy, pale brown.....	178.0	189.0
Sand and gravel, medium-very coarse sand, and fine-medium gravel.....	189.0	210.0
Sand, very fine-fine, moderately-very silty.....	210.0	223.0
Sand and gravel, fine-very coarse sand and fine gravel.....	223.0	236.0
Sand-sandstone, very fine-very coarse, trace fine gravel, very silty, in part lime cemented, light gray-white.....	236.0	255.0
Silt, slightly clayey, very sandy, very fine-fine, in part very marly, limy zones, pink-reddish yellow.....	255.0	266.0
Sand-sandstone, very fine-fine, rootlets, in part very limy.....	266.0	276.0
Sand, fine-very coarse sand with trace fine gravel..	276.0	294.0

Silt, very sandy, very fine-medium, slightly clayey, marly with lime cement, light gray-white.....	294.0	300.0
Sand-sandstone, very fine-medium, slightly clayey, very silty, in part lime cemented, very pale brown and white.....	300.0	320.0
Silt, moderately-very sandy, very fine-medium, moderately clayey, trace limy siltstone, light yellow brown.....	320.0	322.0
Sand-sandstone, very fine-coarse, trace coarse, moderately very silty, in part limy, very pale brown.....	322.0	343.0
Silt, moderately-very clayey, slightly sandy, very fine-medium, rare limestone lens, brown-pale brown	343.0	350.0
Sand, very fine-coarse, interbedded sandstone lenses, very silty, slightly clayey, marly, light brownish gray-light reddish brown-light olive gray	350.0	378.0
Sand, very fine-coarse, trace very coarse, in part very silty.....	378.0	384.0
Silt, very sandy, very fine-medium, slightly clayey pale olive.....	384.0	394.0
Sand-sand and gravel, very fine-very coarse sand and fine gravel, trace silty clay lenses.....	394.0	405.0
Silt, slightly-very sandy, very fine-coarse, slightly-moderately clayey, trace siltstone, in part limy, yellow brown-light reddish brown.....	405.0	430.0
Sand, very fine-medium, trace coarse, slightly-moderately silty, brown-gray.....	430.0	438.0
Silt, slightly clayey, very sandy, moderately limy, pinkish gray-reddish brown.....	438.0	450.0
Sand-sandstone, very fine-fine, slightly-very silty, rootlets, light gray.....	450.0	473.0
Silt, moderately clayey, slightly sandy, very fine-fine, in part limy, light gray.....	473.0	490.0
Sand, very fine-medium, trace coarse-very coarse and fine gravel, trace weathered shale, in part limy..	490.0	510.0
Sand and gravel, medium-very coarse sand and fine gravel, weathered shale fragments and silt lenses.	510.0	519.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay-shale, black.....	519.0	530.0

Test Hole #34-A-60 (E-log)
(8-28-13cccc)
Frontier County

Location: SW SW SW SW sec. 13, T. 8 N., R. 28 W., 48 ft. north of south section line and 43 ft. east of west section line.
Ground elevation: 2,714 ft. (t) (Moorefield 7.5 minute quadrangle)
Depth to water: Not recorded. (8-11-60)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, dark grayish brown	0.0	3.5
Silt, slightly-moderately sandy, very fine-fine, slightly clayey, iron staining, trace snail shells, pale olive-grayish brown	3.5	45.0
Silt, moderately-very sandy, very fine, slightly moderately clayey, slightly limy, brown	45.0	64.0
Silt, very sandy, very fine-fine, very limy with lime cement, very pale brown	64.0	68.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand-sandstone, very fine-coarse, rootlets, limy areas	68.0	85.0
Sand and gravel, medium-very coarse sand and fine-medium gravel	85.0	97.0
Silt, slightly clayey, very sandy, very fine-medium, light brown	97.0	106.0
Sand and gravel, fine-very coarse sand and fine gravel, sandstone lenses	106.0	121.0
Sand-sandstone, very fine-fine, moderately clayey with interbedded silt lenses, sandy at 130, 139, and 150 ft	121.0	158.0
Sand, very fine-medium	158.0	164.0
Sand-sandstone, very fine-fine, slightly clayey and silty	164.0	171.0
Sand and gravel, very fine-very coarse sand and fine gravel	171.0	176.0
Sand-sandstone, very fine-fine, very silty, in part marly	176.0	196.0
Sand, very fine-medium, slightly silty	196.0	212.0
Silt-siltstone, moderately clayey, moderately sandy, very fine-medium, limy lenses, light brown	212.0	220.0
Sand-sandstone, very fine-medium, siltstone lenses, in part marly and lime cemented, rootlets	220.0	275.0
Sand, very fine-medium, trace coarse, silt lenses, light yellow brown	275.0	300.0
Silt, slightly clayey, moderately sandy, very fine-fine, olive silt lens, brown	300.0	302.0
Sand, very fine-coarse, very silty, slightly-moderately clayey, rootlets, limy lenses, light yellow brown-light gray	302.0	345.0

Silt-siltstone, moderately clayey, in part limy, light reddish brown-brown-very pale brown-white...	345.0	356.0
Sand-sandstone, very fine-coarse, in part very silty and lime cemented, interbedded thin siltstone.....	356.0	420.0
Silt, very sandy, very fine-fine, thin limestone lenses.....	420.0	448.0
Sand, fine-very coarse, trace fine gravel, trace yellow silt lenses, reworked yellow shale fragments below 450 ft.....	448.0	472.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay-shale, very pale brown and grayish to 475 ft. then black.....	472.0	490.0

Test Hole #8-F-78 (E-log)
(8-28-32ccaa)
Frontier County

Location: NE NE SW SW sec. 32, T. 8 N., R. 28 W., 23 ft. south of gravel road, 15 ft. north of barbed wire fence, 1015.5 ft. west of bend in road to east, 931 ft. east of bend in road to west; approximately 1250 ft. east of west section line and 1250 ft. north of south section line.
Ground elevation: 2,698 ft. (t) (Curtis SE 7.5 minute quadrangle)
Depth to water: 160 ft. (7-13-78)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, pale brown, topsoil.....	0.0	2.0
Silt, slightly clayey and sandy, light yellowish brown, sand is very fine to fine, moderately calcareous.....	2.0	55.0
Silt, slightly sandy and clayey, brownish yellow, sand is very fine, moderately calcareous, very limy below 68 ft.....	55.0	92.0
Sand, very silty, fine to medium some coarse sand...	92.0	95.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, slightly clayey and sandy, pink, sand is very very fine, calcareous, very limy below 104 ft.....	95.0	106.0
Silt, slightly clayey, pink, limy at 110 and 112-121 ft., some very fine to fine sand between 112-121 ft. and 124-130 ft., calcareous.....	106.0	130.0
Sand and gravel, fine sand to medium fine gravel....	130.0	136.0
Silt, sandy, light gray, sand is very fine-fine, partly lime cemented 141-143 ft.....	136.0	145.0
Sandstone, very fine to medium fine, pinkish gray, some siltstone and limestone layers, calcareous...	145.0	152.0
Silt, slightly clayey, light gray, some siltstone seams, slightly calcareous.....	152.0	159.0
Silt, pink calcareous some siltstone.....	159.0	165.0
Silt, slightly clayey, light gray, calcareous, fine-coarse sandstone layers 174-176 ft.....	165.0	182.0
Sandstone, very fine-coarse grained, light greenish gray, lime cemented 192-195 ft., many rootlets....	182.0	195.0
Sand, silty, very fine to medium, limy.....	195.0	200.0
Limestone and sandstone, white, sand very fine to fine.....	200.0	207.0
Sandstone, very sandy, light gray, very fine-fine grained, calcareous.....	207.0	217.0
Sand, very fine-medium, slightly silty, ashy, some limy areas.....	217.0	223.0
Silt, sandy, light gray, sand very fine-fine, ashy between 223-231 ft., very sandy and light greenish gray below 231 ft.....	223.0	248.0

Sand, very silty, light gray, some very fine-fine sandstone layers, with limy areas throughout.....	248.0	271.0
Silt, moderately clayey, light gray, calcareous.....	271.0	279.0
Sandstone, sandy, very fine-fine grained, light gray, moderately calcareous, some silicious cementation, moderately silty below 286 ft.....	279.0	292.0
Sand and sandstone, very fine-medium, light greenish gray, silty 302-305 ft., 313-315 ft. and 319-324 ft., calcareous.....	292.0	346.0
Silt, slightly-moderately clayey, light gray to pink very calcareous.....	346.0	363.0
Silt, sandy, pink, sand is very fine to fine, some fine to coarse grained sandstone layers, moderate to very calcareous.....	363.0	392.0
Sand to sandstone, fine to coarse, some lime cementation slightly silty in parts.....	392.0	400.0
Sand, gravelly, fine to coarse sand, some fine gravel.....	400.0	423.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Shale, clayey, light gray-pale yellow, iron stained, black below 425 ft.....	423.0	450.0

Test Hole #37-F-77 (E-log)
(8-29-12bbba)
Frontier County

Location: NE NW NW NW sec. 12, T. 8 N., R. 29 W., 590 ft. east and 55 ft. south of northwest corner.
Ground elevation: 2,815 ft. (t) (Curtis 7.5 minute quadrangle)
Depth to water: 201 ft. (11-14-77)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey, slightly sandy, dark brown to black; sand is very fine.....	0.0	3.0
Silt, slightly clayey slightly sandy, yellowish-brown, slightly calcareous; sand is very fine; below 15 ft. trace of snail shells.....	3.0	20.0
Silt, slightly clayey, slightly sandy, light gray, slightly calcareous; sand is very fine.....	20.0	45.0
Silt, slightly clayey, slightly sandy, pale-brown; from 55-60 ft. rare shell fragments.....	45.0	72.0
Silt, moderately clayey, light yellowish-brown, slightly calcareous; some very fine sand.....	72.0	80.0
Silt, very sandy, slightly clayey, pale-brown, moderately calcareous; sand is very fine-fine; in places limy areas.....	80.0	108.0
Silt, moderately sandy, slightly clayey, yellowish-brown, some limy nodules.....	108.0	148.0
Tertiary System - Miocene Series - Ogallala Group:		
Sand, very fine-very coarse, some fine-medium gravel and very silty; some limestone fragments.....	148.0	161.0
Sand, gravelly; very fine sand-medium gravel, trace of coarse gravel; from 137-167 ft. silty.....	161.0	182.0
Siltstone, clayey, sandy reddish-brown, moderately calcareous; sand is very fine-medium.....	182.0	193.0
Sand, very fine-medium, very silty, slightly clayey.	193.0	196.0
Sandstone, very fine-coarse grained, very silty, slightly clayey; below 219 ft. limy layer.....	196.0	220.0
Silt, very sandy, slightly clayey, reddish-brown, moderately calcareous; sand is very fine-medium...	220.0	226.0
Sandstone, very fine-very coarse grained, very silty; below 232 ft. some fine gravel.....	226.0	244.0
Silt, moderately sandy, light gray, very calcareous; sand is very fine-fine.....	244.0	247.0
Sand, very fine-very coarse, some fine gravel.....	247.0	258.0
Sandstone, very fine-medium grained with some coarse and very silty; below 269 ft. sand is very fine-fine.....	258.0	270.0
Sand, very fine-very coarse.....	270.0	279.0
Silt, very sandy, in part sand, very silty; sand is very fine-coarse; many limy areas.....	279.0	297.0

Sandstone, very fine-medium grained, very silty; some volcanic ash	297.0	306.0
Silt, moderately clayey, slightly sandy, gray; sand is very fine-medium; some volcanic ash; below 310 ft. limy areas	306.0	316.0
Silt, slightly clayey, slightly sandy, reddish-brown and slightly calcareous; sand is very fine-medium.	316.0	321.0
Sand, very fine-medium, very silty; some siltstone fragments; below 321 ft. sand is very fine-medium.	321.0	348.0
Silt, slightly clayey, pinkish-gray, moderately calcareous	348.0	352.0
Sandstone, very fine-medium grained; below 368 ft. lime cemented	352.0	371.0
Clay, silty, bentonitic, olive-gray	371.0	380.0
Silt, slightly clayey, slightly sandy, pale olive-gray, moderately calcareous; sand is very fine-medium	380.0	384.0
Sand, very fine-medium, very silty	384.0	390.0
Sand, gravelly; very fine sand-fine gravel; below 404 ft. silty	390.0	408.0
Sandstone, very fine-medium grained, silty; in places lime cemented; below 460 ft. sand is very fine-coarse	408.0	476.0
Silt, very sandy, slightly clayey, pale-olive, sand is very fine-medium	476.0	484.0
Sand, very fine-coarse	484.0	492.0
Sandstone, very fine-medium grained, slightly silty.	492.0	500.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Shale, clay, light gray some yellow; below 515 ft. black	500.0	520.0

Test Hole #14-H-78 (E-log)
(8-30-36dddd)
Frontier County

Location: SE SE SE SE sec. 35, T. 8 N., R. 30 W., 47 ft. north of east-west road and 177 ft. west of north-south high power line; 150 ft. east and 30 ft. south of 3 storage bins and 200 ft. north and 200 ft. east of abandoned house.
Ground elevation: 2,840 ft. (t) (Curtis SW 7.5 minute quadrangle)
Depth to water: 140 ft. (8-10-78)

	Depth, in feet From	To
Quaternary System, undifferentiated:		
Silt, slightly clayey and sandy, dark grayish brown, some humic material	0.0	6.0
Silt, coarse, slightly sandy, very pale brown, some iron staining	6.0	71.0
Silt, clayey and slightly sandy, brown, slightly calcareous, some lime streaks, paleosol	71.0	75.0
Silt, sandy, light yellowish brown, calcareous, sand is very fine to fine, limy areas	75.0	94.0
Silt, sandy, light yellowish brown, limy, sand is very fine to fine	94.0	106.0
Tertiary System - Miocene Series - Ogallala Group:		
Silt, very sandy, pinkish white, very limy, sand is very fine to medium becoming medium to very coarse below 113 ft	106.0	118.0
Sand and gravel, medium sand to fine gravel, trace medium to coarse gravel	118.0	128.0
Silt, slightly clayey and sandy, pink to light gray, few limy areas, much very fine-medium sand below 150 ft	128.0	153.0
Sand, very fine to medium, trace very coarse, silty 156-158 ft., medium sand to coarse gravel below 158 ft	153.0	169.0
Silt, slightly clayey, pink to pinkish white, limy, some very fine-fine sand layers	169.0	204.0
Sand and gravel, fine sand to medium gravel, much medium coarse sand	204.0	216.0
Silt, slightly clayey, pinkish white, calcareous, very limy 222-226 ft	216.0	233.0
Sandstone, very fine to medium, pink, some siliceous rootlets	233.0	252.0
Silt, slightly clayey and sandy, pinkish white, calcareous, some limy areas and siltstone layers	252.0	278.0
Silt, clayey, pink, calcareous, manganese stains, light gray and very limy below 289 ft	278.0	293.0
Sand, very fine to medium, silty, some very fine to fine grained pink to light gray sandstone, very limy areas	293.0	329.0

Sandstone, very fine to medium grained, pink, much very fine to medium sand, some siltstone.....	329.0	341.0
Sandstone, very fine to fine grained, light grayish white, calcareous, fine to medium sand layers.....	341.0	361.0
Sand, very fine to very coarse, trace fine gravel, much coarse to very coarse sand.....	361.0	374.0
Sandstone, very fine to medium, light gray, calcareous, fine to medium coarse sand layers, some pinkish sandy silt layers.....	374.0	392.0
Silt, sandy, white, some lime cemented areas, sand is very fine to medium.....	392.0	398.0
Sandstone, very fine to medium grained, light green to gray, calcareous, some light brown and pink silt and siltstone layers.....	398.0	416.0
Silt, slightly clayey, white to light greenish gray, some very fine-fine sand.....	416.0	422.0
Sandstone, very fine to medium, light greenish gray and white, calcareous, some siltstone.....	422.0	427.0
Silt, clayey, pale yellow to pink, some siltstone lenses and manganese stains.....	427.0	441.0
Sand, very fine to medium coarse, some fine to medium coarse grained sandstone, few silty layers, pale olive siltstone layers below 467 ft. and lime cemented 462-464 ft.....	441.0	484.0
Cretaceous System - Upper Cretaceous Series - Montana Group:		
Pierre Formation:		
Clay, shaly, light green to pink and pale yellow, pyritic, dark gray below 486 ft.....	484.0	500.0