UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY

LIGNITE DRILLING DURING 1977 IN WESTERN NORTH DAKOTA: ADAMS, BILLINGS, BOWMAN, DUNN, GOLDEN VALLEY, GRANT, HETTINGER, MERCER, OLIVER, SLOPE, STARK, AND WILLIAMS COUNTIES

by
U.S. Geological Survey
and
North Dakota Geological Survey

Open-File Report 78-888
1978

This report has not been edited
for conformity with Geological
Survey editorial standards or
stratigraphic nomenclature.

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1978 DRILLING OF LIGNITES
IN WESTERN NORTH DAKOTA: ADAMS, BILLINGS, BOWMAN, DUNN, GRANT, GOLDEN VALLEY, HETTINGER, MERCER, OLIVER, SLOPE,
STARK, AND WILLIAMS COUNTIES

by

U.S. Geological Survey and
North Dakota Geological Survey Introduction and Acknowledgments
A drilling program was conducted in western North Dakota by the North Dakota Geological Survey (NDGS) under Grant No. 14-08-0001-G-440 from the U.S. Geological Survey. The drilling was done as part of the U.S. Geolog-local Survey's program to evaluate and classify mineral lands in the public domain. The purpose of the program was to gather data on the thickness, quality, extent, and recoverability of lignite beds and the lithologic characteristics of the coal-bearing unit, the Fort Union Formation (Paleo-cene), in western North Dakota.
This preliminary report includes geophysical logs, descriptions of samples, lists of lignite beds, and locations of the testholes. The lists of lignite beds include most of the beds more than 2 feet thick and were generally made from the density logs, but where there were depth discrep-ancies between the gamma and density logs, sample depths were consulted to decide which log to use.
Testholes were drilled in five general areas between June 25, 1977,
and October 20, 1977, with the first hole in Williams County (Area A)
and the last hole in Billings County (Area E). For convenience of refer-ence, the areas are designated A through E, with the general locations

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Figure 1. Index map showing area of drilling activity: (A) Williams County, (B) Mercer and Oliver Comties, (C) Slope, Golden Valley, Bowman, Billings, and Adams Counties, (D) Adams, Grant, and Hettinger Counties, (E) Billings, Dunn, and Stark Counties.

shown on figure 1. Testhole locations are shown on the area maps (figs. 2-
6) and specific locations are on the log headings using the system of
land survey in use by the U.S. Bureau of Land Management. The distances from section lines are approximate distances. Elevations are also approximations taken from the topographic quadrangle sheets or, where topographic coverage was lacking, from altimeter surveys.
The total number of testholes and the area in which they were drilled
are as follows: Area A, Williams County, 12 holes; Area 3, Mercer and Oliver Counties, 74 holes; Area C, which extends from the Golva area of Golden Valley County to the Scranton area of Bowman County, 89 holes; Area D, Grant and Hettinger Counties, 54 holes; and Area E, southern Dunn County to Stark County, 6 holes. Total drilling was 62,562 ft plus core. Nine core holes were drilled during the 1977 drilling program. The procedure was to move a few feet from a testhole and core the interval
or intervals .indicated on the log of the adjaceut hole (e.g. P1A, PlAC). In the Mercer and Oliver area core holes were PlAC, P3AC, P6AC, P1GC, and P3GC. In the Grant and Hettinger area core holes were H16C, H30C, H33C, and H43C. The core was split and one-half was sent for analyses to the U.S. Geological Survey, Lakewood, Colo. The remainder of the core is in the NDGS storage facilities in Grand Forks, North Dakota. Analyses are shown on page 10 of this report.
Fieldwork was carried out by the following NDGS personnel: Clarence G. Carlson, Randall Reichert, Michael Camara, Richard Scattolini, and David Lechner. U.S. Geological Survey personnel included Hal Owen, Robert
Lewis, and Susan Cook. Coordination and technical guidance were provided by Clarence G. Carlson (NDGS) and Elmer M. Schell, U.S. Geological Survey.

R97V/

EXPLANATION

Tc*t Hole No. W-l
Stotc Highwoy G9
Federal Highway £*3
Area A

T
155

T 154

Figure 2. Drill-hole locations in Area A, Williams County. Drill-hole data on pages 11 ti 42.

T
147
N

T
146
N

r
145
N

EXPLANATION

Test Hole No. PIA

State Highway 0
Area B

R85W R84W R83W

Figure 3. Drill-hole locations in Area B, Mercer and Oliver Counties. Drill-hole data on pages 43 to

T
144
N

T

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186.

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fltf«r«l
AIM C

EXPLANATION I ,\
T»»l H»lt N» L-l I "

Figure 4. Drill-hole locations in Area C, Slope, Golden Valley, Bowman, Billings, and Adams Counties Drill-hole data on pages 315-541.

T
141
N

R35W

R94W

RS2W

3iLLllN_GS_£OUNTY_
T--T - STARKJCOUNIY

DUNN

T
140

f*

B-5

R9GW

R95W

EXPLANATION

Test Hole Ko. B-l

Slate Highboy ©
Area E

T
143
N

R99W

Figure 5. Drill-hole locations in Area E, Billings, Dunn, and Stark Counties. Drill-hole data on pages 291 to 314

R90W M9W

CO

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M-5?

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H-9t

R91W -- --

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EXPLANATION

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M-54 i H '*r 1 M-2S

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M-59 » ..

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M-3

M 9
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H-4)
LEIPZIG
H-44

tH-.3

H-31

H-lt

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H-:»"

tH-20
H-2S

H-40

R-i.

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1)4
N

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Figure 6. Drill-hole locations in Area D, Adams, Grant, and Hettinger Counties. Drill-hole data on pages T87 to 290,,

A forward rotary drill was used with water as the drilling fluid, and continuous 5-ft (1.5-m) samples were collected except where circulation was. difficult to maintain. In that case an air-mist drilling medium was used and no samples were collected. Samples were logged by the geologist in the field and then bagged and placed in the storage facilities of the NDGS, Grand Forks, North Dakota. A driller's log for each testhole was obtained and these logs are on open file at the NDGS Grand Forks office. The logging procedure was to run the gamma-ray, self-potential (SP),
and resistivity probes, followed by the density probe, unless there were problems with the logging devices. A backup probe with the 4 channels on one device was used during periods when the separate probes -needed re-pairs. The log printouts were photographically reduced and both the orig-inals and negatives are on open file at the NDGS office in Grand Forks. Testholes were given letter and number designations prior to the
drilling season. A few sites were later deleted, but to avoid the con-fusion of renumbering subsequent holes the original designations were retained. This results in a few missing numbers (e.g. W-5, H-4, etc.); in these cases no hole was drilled.

Table Core analyses on an as-received basis from U.S. Bureau of Mines laboratory.

USBM No.

PROXIMATE
ANALYSIS

w

MOISTUR

D 194029 33.1
D 194030 34.4
D 194031 30.8
D 194032 35.7
D 194033 35.7
D 194034 29.8
D 194035 33.6
D 194036 33.3 .
D 194037 29.3
D 194038 34.3
D 194039 36.8
D 194040 41.4
D 194041 29.5
D 194042 35.5
D 194043 35.4

u
HvOLATIL
1 WATER

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29.2
28.1
28.2
26.2
27.7
20.5
29.3
29.3
22.0
26.3
24.7
25.5
26.7
27.0
27.6

FIXED CARBON

30.6
30.0
29.4
29.2
30.7
19.0
30.1
31.9
18.0
30.1
20.1
26.2
24.7
24,0
28.5

as</5
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HEATING

VALUE BTU/lb.

ULTIMATE
ANALYSIS

SULFUR

7.1 6965 .6
7.5 6803 .6
11.6 6647 .9
8.9 6495 1.4
5.9 6840 1.1
30.7 4398 .6
7.0 6990 .6
5.5 7093 .4
30.7 4486 1.3
9.3 6731 1.1
18.4 4880 1.2
6.9 6163 1.1
19.1 5848 2.4
13.5 6042 1.0
8.5 6742 1.5

Z
03

HYDROG]

6.7
6.6
6.2
6.6
6.8
5.3
6.7
6.7
5.3
6.5
6.3
7.2
5.8
6.6
6.7

CARBON

41.9
40.9
39.8
39.6
41.0
26.9
41.6
42.9
26.7
40.3
30.1
36.6
35.0
36.0
39.9

Z

NITROGE

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OXYGEN

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43.0 18.3
43.7 21.6
40.8 14.6
42.8 21.8
44.7 18.9
35.9 19.4
43.5 18.0
43.7 19.8
35.6 17.7
42.4 19.2
43.4 18.4
47.7 29.7
37.2 14.1
42.3 21.7
42.5 19.9

Sample No. Well No. Depth Sample No. Well No. Depth

D 194029
D 194030
D 194031
D194032
D 194033
D 194034
D 194035
D 194036

P-3GC
P-3GC
P-3GC
P-1AC
P-1AC
P-1GC
P-1GC
P-1GC

103-107.3
168-178
198-204.3
133-142
142-149
45- 50.2
77- 83.2
133-139

D 194037
D194038
D194039
D194040
D 194041
D194042
D 194043

P-6AC
P-3AC
H-33C
H-33C
H-30C
H-16C
H-43C

78- 81.3
110-119
43- 50.6
56- 66
61- 71
65- 72
48- 58.2

10

NORTH DAKOTA CKOl.OOICAL SUKVF.Y

Hole No: _ W-JL _...... . Map: _ Ray .l.SE..
Elcv.:-J,2Qi_ft_ Location: T...15.6£, R. 96 .w, Sec. 18 ..Tract: Measured :_6pjQ_£t_ FSL, 60 ft
Surface ownership:_______.
T.; gnite Ws-. 90-94; 101-110: 157-160; 414-424; 468-474 ft Remarks: ________..._..... ____._._ .._.______ Lithology
Recorded by? Randall Reichert

On te: 6-30-77 State: ND ... County: Williams
ddda Drilled depth: 500ft
Hole sizc:_4f4in,.._ _ Air [..] Water &<] Cored: Yes M Ni» [^ __.__. .._ ._ __ ____,_Coal ownership: _____.___

Geologist

Geophysical logs
recorded by: __ Lechner

Lithology

Gamma

T.C.._2_ Range !QQcps_
Recording speed 20 "Vniin
Logged depth _5_PP_.ft.___

Density
T.C. _2.. Range .100 cps
Recording speed 2Q/ t/min
Logged depth _5.PP ft__

Depth

*- o

u,

__ 0-10 Sand, yellowish-gray, pebbly, limey
_ 10- 11 Clay, white, limey
11- 20 Till, yellow, pebbly, limey
20-51 Claystone, yellow, silty

_ 51-57 Siltstone, greenish-gray, sandy
57- 63 Gaystone, greenish-gray, silty
63- 75 Gaystone, gray
__ 75- 80 No samples
80- 83 Claystone, gray
83- 88 Lignite, black
"" 88-100 Qaystone, gray
100-110 Lignite, black
110-133 Gaystone, gray, silty

133-134 Lignite, black
134-141 Claystone, gray, silty
"141-142 Lignite, black
_ 142-157 Siltstone, green, sandy
157-160 Lignite, black
160-162 Claystone, gray, silty
162-186 Siltstone, green, sandy, clayey

186-200 Claystone, gray, silty

200-218 Siltstone, green, clayey
218-236 Siltstone, green, sandy

236-260 Siltstone, green, clayey

- 260-2R4 Claystone, light-green, silty

2H4-300 Siltstone, light-green, sandy, limey

300-306 Claystone, light-green, silty, limey
_ 306-307 Lignite, black
307-318 Silt.ronc, gray, clayey, limey
318-333 Claystone, gray, silty, limey
~ 335-341 Lignite, black
~ 341-347 Siltslonc, uray, clayey
_ 347-349 Ctayslonc, gray, silty
-UQ.^T li.-nitc hl-U-k

- 0-0

r-50

- 20

- 100

-40

150

-20Q"60

250
~ -80

- 300

^=re^~ _ 100

=r -350

11

Hole number continued
W-l

Lithology

403-418 Lignite, black
418-459 Claystone, gray, silty, limey

459-467 Lignite, black
467-470 Claystone, gray, silty, limey
470-500 Noiamoles

Gamma

T.C.. 2 Range ..LQQ cps_ Recording speed -2P_jt/rnin Logged depth 500 ft

Density
T.C._2_Range JHQ_cps Recording speed2Q_wrnin Logged depth 500 ft

Depth

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- 600

h650 -?.00

- 700

- - 220
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Hole number W-l

SP

Sens, setting 50 MV ^- 5 _
Recording speed _20. :t/min
Loosed deoth _ $00 ft

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Resistivity
Sens, setting . 50
Recording speed.2Q.ft/min
Lo^ecd depth 500 ft DO

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- 350 '

13

SP

Hole number continued
W-l

Resistivity
Sens, setting_5.0..MY.__ jScns. setting___J>Q. _____ Recording speed J51L.fr/mmjRecording spccd2Qft/min Logged depth ....500 ft ._ Logged depth .500 ft .

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Depth!

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- 550

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-600 '

r-650 ;
; -200

j. !

1-700

j- -220.

j

r-750 I

14

NORTH DAKOTA Gl'.OLOGICAL SURVF.Y

Hole No: _ W:2 _______ Map:... Ray. 1_SE. ..Onto: 6-28-77 State: ND .County: Williams Elcv.: _2,2_55 Jft __ Location : T. 15.6.2 , R. 97 !$, Sec. 14 , Tract: abba Prilled depth: 500 ft Measured: _J>3jt JL2 Hol
Surface ownership: .. . . -_ _ _
Lignite 1 d«: 136-139; 153-155: 210-224: 306-309: 343=3.45-
Remarks: ________-__. . - _ -_ --___- ______

Lithology

3Ain,. Air G Water (£] Cored: Yes ["]
_ - __ .__.. Coal ownership: ____ '~_ _ _ _

No [XJ

Recorded by Randall Reichert

Geophysical logs
Geologist NX recorded by: .___ JUfi.ch.net .._.__._ _._

Lithology

Gamma

T.C.._?__. Range .100 cps_.
Recording speed ?.0 't/tnin
Logged depth _437._ft _ ._

Density
T.C. 2.. Range 100 cps
Recording speed20.'
Logged depth ..489 ft_ ..

Depth

£ s

0- 8 Sand, yellow, medium-grained to coarse-grained, stlty, limey
8- 52 Till, yellow, pebbly, limey, sandy

_ 52-75 Till, yellowish-gray, pebbly, sandy

75- 83 Till, yellowish-gray, pebbly, silty
83- 92 Till, yellowish-gray, sandy
92-120 Sand, yellowish-gray, medium-grained to coarse-grained

120-129 Gravel, yellow, fine-grained to coarse-grained 129-134 Till, yellowish-gray, pebbly
134-135 Lignite, black
135-154 Till, yellowish-green, pebbly

154-159 Lignite, black
159-172 Siltstone, olive, clayey

172-176 Sandstone, white, limey
176-181 Siltstone, olive, sandy
181-193 Claystone, green, silty
193-212 Siltstone, green, sandy

-212-232 Lignite, bbck

~~ 232-300 Siltstone, greenish-gray, sandy

- r-0 -0

300-306 Siltstone, brownish-gray, sandy
306-314 Siltstone, gray-green, sandy
314-320 Lignite, black
320-395 Claystone, olive, silty

-20

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Hole number continued
W-2

Lithology

295-396 Lignite, black
396-472 Siltstonc, gray, clayey

472-475 Lignite, black
475-500 Sihstonc, gray, clayey

Gamma

T.C. 2 Range _lPO.cps_ Recording speed J-Q_A Logged depth 487 ft
_ _ ^ L M*_l'"~ T TTT'

Density
T.C. .2_ Range 100 cps Recording speed 2Q_ft/rn j n depth 489 ft__

Depth

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- 550

. -180
-600

-650 -200

- 700

(- -220

- 750

Hole number W-2

SP

Sens, setting__50MY_ Recording speed_20_ ft/min Rec Logged depth 48_7jt

Resistivity
Sens, setting DU
ording speed 20. "/min
Logged depth ._1.87_ft. .__

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^300
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_ -1001

- 350

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17

Hole number continued
W-2
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SP j Resistivity Depthj
Sens, setting _._. 50_MV__ iScns. setting__50 __ I % Recording speed .^0_wminiRccording spccd?P/c/min o £
T ~,-~,.J J n _<.U 4R7 ft \r ~, J J^ *U 4R7 ft LL "5

Kecoraing speea._fl!_ l|-/min;KccorQmg spccaty.'vm Logged depth ...487 ft __ JLoggcd depth 487 ft

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.__, ", T "1 ^^

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~"~' J ' ~ **" ,^-l~^~lm~~L J -LJ - ^ ^ -m.
I.Zr^.Tri*. -"-- ^. TTX .T.. A - X^Ir-n- ZTT \

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j-400 ;

[-450 :
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(-500 j

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f- ~!60;

r I
f-550 i

i

1

J

U -180,

r-SOO i

^650 ! L ~ 200i
i -

- 700

r -220,

NORTH DAKOTA CKOLOGICAL StUlVKY

Hole No:._._. W-3._......._ Map: Red Mike Hill . Date-: 6-28-77 Elcv.:-2A45_ft__ Location: T. 15 5. If, R.96_.w.Soc. .29., Tract:
FNL KBK

State: ND . County: Williams

bcba Drilled depth: 340 ft

Measured: ^570 _

Surface ownership:

530 FWL, Hole size: n.

Lignite beds; 303-316 _____

Remarks: _______ _.__.....

Lithology
Recorded by: ___ Randall Reichert

Air G Water H Cored: Yes ["]

__ ._ Coal ownership: _______ .__ _

No

Geophysical logs
Geologist sac recorded by: __..Lechoer__.

Lithology

Gamma

T.C...2.-. Range _1QO cps..

Recording speed ?_0 't/min

Logged depth __337_.ft _.._

Density

T.C. .2... Range .1QO cps

Recording speed 20."/min

Logged depth _336 ft

Depth

0-21 Sandstone, yellow, medium-grained to coarse-grained

~ 21-25 Sandstone, yellowish-gray, fine-grained to
_ medium-grained, pebbly
25- 30 Sandstone, yellow, medium .grained to coarse-grained
30>- 38 Sandstone, yellow, medium-grained to coarse-
~~ grained, pebbly
__ 38- 53 Siltstone, olive, sandy, clayey
53- 68 Sandstone, yellow, fine-grained to coarsa-grained
_ 68-73 Lignite, black
73- 75 Siltstone, olive, clayey, limey
~~ 75- 85 Claystone, olive, silty, limey
85- 88 Sandstone, green, fine-grained, silty
88- 90 Lignite, black
~ 90-100 Claystone, olive^reen, silty, limey
_ 100-105 Claystone, olive-green, silty
105-110 Claystone, olive-green, silty, sandy, limey "110-115 Claystone, green, silty
_ 115-120 No samples
120-139 Gaystone, srayish-?reen, silty, limey
139-147 Sandstone, grayish-green, silty, limey
_ 147-150 Sandstone, brownish-gray, limey
~ 150-153 Sandstone, gray, silty, limey
153-154 Lignite, black
154-156 Sandstone, brownish-gray, silty, limey, finc-grained
__ 156-166 Siltstone, olive-gray, sandy, limey
166-167 Lignite, black
167-173 Claystone, olive-ray, limey
173-189 Sandstone, olive-green, limey
~~ 189-196 Siltston^, olive-green, sandy, limey
_ 196-198 Shale, brown, limey
198-202 Sandstone, olive-green, limey, silty
202-213 Siltstone, olive-green, limey
213-220 Sandstone,olive-green, finegrained
~ 220-237 Siltstone, olive-green limey
_ 237-241 Lignite, black
241-262 Siitstoiw, olive-green, limey

262-267 Sandstone, olive-green, fine-grained, silty, limey 267-309 Siltstone, olive-green, limey, clayey

309-316 Lignite, black

316-335 Siltstone, olive-green, limey

335-340 Siltstone, brownish-gray, limey

- 0-0

- 20

- 100

^350

19

Hole number W-3

SP Resistivity
Sens, setting 20.MY Sens, setting 50 Recording speed 20 fym'm Recording speed20 fymin Logged depth . 337jt Logged depth ._J37_j[t__

J

1

1

i

Depth;

hO-i

r

50
-20'

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1-100
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L

-40;

r'50

r

200"60

250 :
- -80

r300

^ -iOO;

- 350

Hole No:_. Wr4__.__Map:_Ray_lSE___._ Da cc:JL2<8:ZZ State: ._ND_County:_Wjjjianis..____ Elcv.: __J2450..fc__ Location: T. 155. S , R.36_w , Sec. .. ?.._., Tract:. cccd.._ Drilled depth: _460 .&_.. ._ _..._ Measu-rcd:_2Q.fr._l^f 633.tjFWL. Hole size: __4 34jn.._ Air D Water (x) Cored: Yes ["j No g] Lignite beds: 90.-91LJJ.Q-349; 375-386; 424-428 . . . ... ._..._.... .. ____...__._ .. ._._

Remarks:

Lithology
Recorded by:^MchaeLCarnara.

Y< Geophysical logs
Geologist scat recorded l>y: _____I-echner_._ ____

Lithology

Gam ma

T.C._2_ Range 19P_cp.s_

Recording speed 2Q* c/min

Logged depth _460 Jt_

T.C.

Density

Range lPQ_cps.

Recording speed 20.'Vmin

Logged depth _ 460 ft

Depth

fc

_ 0-5 Sand, dark-yellowish-brown, fine-grained, silty,
lignitic
-" 5- 17 Sand, brown, fine-grained, silty, lignitic
__] 7- 34 Sand, brown, medium-grained

34- 58 Gravel, orangish-brown, very small to small pebbles

_ 58- 75 Siltstone, olive-brown, clayey limey

- 75- 83 Qaystone, light-gray, silty

- 83-90 Siltstone, light-gray, clayey

_ 90-.93 Liiinite
93- 94 Claystone, liyht-gwen
~ 94-103 Siltstons, gray, clayey, limey
_ 103-104 Lignite
104-105 Claystonc, green
~ 105-118 Siltstone, olive-gray, clayey, limey
_ 118-120 Lignite
120-133 Siltstone, light-fray
- 133-15S Claystone, light-gray, limey, silty

- 153-172 Siltstolie, light-gray, clayey, limey

172-182 Siltstone, olive

132-193 Claystone, liglit-gray, limey

193-194 Sandstone, light-gray, very fine grnined, silty 194-213 Siltstone, gray, limey

213-215 Sandstone, light-gray, silty
215-218 Lisnite

218-222 Claystone, light-gray
222-224 Siltstone, light-gray
224-225 Sandstone, light-gray, very fine grained, silty 225-231 Siltstone, dark-gray
231-234 Sandstone, light-gray, very fine grained, silty 23-1-235 Siltstonc, lif.ht-gray
235-241 Sand-it jno, light-gray, very tine grained, silty 241-24* Siltstuno, lyht-gray
244-243 Claystone, dark-riray
245-250 Lignite
250-263 Siltstoiic, olive-gray
263-205 I i-tiite
2^>5-273 Clayitone, tight-gray
.17">-275 Lignite
27."-3uO Sitlstone, liju-^ray, clayey
?''^-J()3 Clayvtonc, olivc-i-.ray, clayey
3UJ-306 Ligniic
306-313 Qjystoivj, gruy
313-315 Lignite
315-323 Chystoni;, otive-yray
323-330 Li::T!itc

33O-337 Siit>loiio, lij'ht-j'ray, clayey
337-357 Li':ui:c

-0-0

- 20

- 100

21

Hole number continued
W-4

Lithology

.163-370 LifiiiUc
370-379 Gaystonc, lUiht-grcen
379-3y3 Lignite
393-3v>5 Claystone, olive-^ray
395-410 Lignite
410-413 Gaystone, very dark-olive-wra*
113-135 Lignite

435437 Siltstone, UglU-rray
437-445 Lignite
445460 Siltstone, li-;lit-olive-gray

Gamm.i

T.C.J __ Rane
Recording speed JlJL/t/rnLn Logged dep:h 460 ft

Density
T.C_L_Ran<re 100 cps o ' Recording speedSiL Logged depch 460 ft

Depth

!_. O

-500

- - ISO

-550

- - ISO
- 600

«50 -200

- 700

- -220

- 750

22

Hole number W-4

SP

Sens, setting. 50 MV.
Recording speed_2Q. ft/min Recording speed 28. ^/m in Logged depth 46QJt Logged depth _460 ft.

Resistivity
Sens, setting

_--r--- V~

_ ^

" ^."71^1 2J1 *. . H . , 1 ~
.... J

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^ -_- rrrrj
.". j.'^r^i' j^r*j

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Depth

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- 0-0 !

- 50 I

- - 20|

- 100
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- 40!

- 200-60'

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300

- 1001

- 350
I

23

SP

Hole number continued
W-4

Resistivity
Sens, setting _.5.Q.-MY__ Sens, setting ____J>JL __ Recording speed J20_ ft/minJRccording spcedlP/t/ min Logged depth .. 460 ft

i

Logged depth .460 ft

Depth!

;- -120.
-400

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^ *-^

s° J'o
$/> :.- . '?+*--

.... _. . . . . ._. ;_

-450 '
- 140,

_ i i
i

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J

-500

i
p -160:

r]

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- iso

h600 ;

r-650 I
i -200,

1-

'^-700

r -220:

H750

NORTH DAKOTA GKOLOC.ICAL SURVKY

Hole No:_ _W-6. .Map:... Charlspn NW ..Date: 6-30-77 State: ND County: Williams Elev.:.. ?,Q65 ft . Location: T. .155* , R..95 .w , Sec. 32 , Tract: bdbb Drilled depth: 220ft Measured: li370JL pjfe lAQOjtnv?, Hole size: _4_&m..__ Air [j Water [XJ Cored: Yes ["] No (Xj Surface ownership:________...._.__...__ . ._..._
Lignite W*; 140-148; 157-163; 184-189; 201-204 _

Lithology
Recorded by:

._____..... Coal ownership:

Randall Reichert

Yes Ccophysical logs
Geologist ^i* recorded by : ___ Lgchiier,

Lithology

Gamma Density
T.C.._2... Range JOG cps_ T.C. .2. Rangc.lOO.eps Recording speed ?0 ^ c/min Recording speed 20."/min Logged depth _220 ft _ Logged depth ,220ft

Depth

0- 2 Silt, olive, clayey, sandy
2- 8 Gravel, yellowish-gray, fine grained to coarse-uiained, sandy
8- 48 Till, yellowish-gray, pebbly

- 48-70 Till, gray, pebbly

~ 70- 80 Claystone, gray
~~ 80- 83 Lignite, black
83-108 Siltstone, gray, sandy

~ 108-110 Siltstone, yellow, sandy
~~ 110-120 Siltstone, gray, sandy
~~ 120-137 Siltstone, gray, clayey
"" 137-148 Lignite, black
" 148-156 Claystone, olive, silty
~ 156-157 Lignite, black
_ 157-160 Claystone olive, silty
160-163 Lignite, black
163-183 Clay stone, gray, silty

~~ 183-190 Lignite, black
~ 190-712 Clay stone, gray, silty

212-216 Lignite, black
216-220 Claystone, olive, silty

- 0-0

- - - 50

- 20

- 300

_ -100

-350

25

Hole number W-6

_ , . . . - - - . ,

SP Resistivity Depth;
Sens, setting 50_MV ISens. setting -J?-2 ^ { Recording speed^Q_ fr/miniRecording speed2ilfr/min « « Logged depth __220jt. iLoggcd depth ._2?0jt... £ ^

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r
-40!

i-150

250 !
- -80

j-300

L -100;

- 350 I

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NORTH DAKOTA OF.OLOCICAL SURVEY

HolcNo:_. ....W-7 . ._._Map:_..Np.Topq. . ....Date: 6-27-77 State: ND County: Williams Elcv.: __ _Location: T..J.54*, R. 10.0 w. Sec. .35 , Tract: aaaa Drilled depth: 320ft Measured: FNL _ r. PEL ... ^^ 4^^ Air f"| \va ter [xj Cored: Yes [.].78 ft Surface ownership:.

33ft Hole _4j&.in..___ Air U Water [Xj

_________.. Cool ownership:

No

Lignite W*; 28-31; 104-106; 110-114; 195-204; 23.1-23.6; 25.2^254

Remarks:____.___- _..-_..... . _.__ ..._.._._.____ ._._

Lithology
Recorded by: Michael Camara

Geophysical logs
Geologist^* recorded by: __._Lechner

Lithology

Gamma

T.C..-2-. Range ..1Q9 C PS-

Recording speed 20*t/mj n

Logged depth __32Q .ft__...

Density

T.C. 2 _ Range .100 cps

Recording speed 20.' t/inin

Logged depth _318 ft_

Depth

u, 2

0- 4 Sand, yellowish-brown, pebbly, lignitic
4- 11 Sand, brown, medium-grained to fine-grained, pebbly, lignitic
11- 16 Sand, brown, fine-grained, siity, lignitic
16- 25 Qaystone, very light gray, slightly calcareous 25- 30 Siltstone, yellowish-brown, clayey
30- 33 Lignite
33- 35 Claystone, light-gray, silty, limey
35- 37 Lignite
37- 43 Qaystone, vrry light green, limey
43- 45 Lignite
45- 48 Qaystone, very light green, limey
48-51 Lignite
51-53 Qaystone, dark-brown
53- 55 Claystone, light-gray
55- 64 Siltstone, olive-green, sandy
64- 68 Siltstone, light-olive-brown, sandy
68- 70 Qaystone, olive-brown, silty, limey 70- 72 Lignite
72- 80 Siltstone, olive-brown
80- 84 Gaystone, light-gray
84- 93 Lignite, black and brown
93- 95 Siltstone, light-gray, limey
95-100 Lignite; poor sample
100-110 Qaystone, dark-olive-green, silty
110-120 Lignite; poor sample
120-125 Lignite
125-131 Qaystone, light-olive-gray, silty
131-145 No samples
145-160 Claystone, light-gray, limey
160-168 Siltstone, gray, limey, clayey
168-191 Sandstone, gray, limsy, silty
191-198 Siltstone, gray, limey
198-203 Lignite
203-205 Sandstone, gray, silty, limey
205-207 SUtstone, gray, clayey
207-215 Qaystone, olive-gray, clayey
215-220 Siltstone, olive, sandy, limey
220-222 Siltstone, olive-brown, clayey
222-232 SUtstone, olive-gray, clayey, limey 232-236 Sandstone, olive-gray, silty, limey 236-238 Lignite
238-240 Qaystone, olive
240-252 Sandstone, olive, silty, limuy
252-253 Siltstone, olive-brown
253-257 Lignite
257-267 Siltstone, olive-brown, clayey
267-275 Claystoitc, olive-brown, sitly
275-278 Claystone, olive-green
278-2S2 Sandstone, olive-gray, silty, limey
282-290 Siltstone, olive-gray
290-297 Siltslone, olive-brown
297-300 Sandstone, gray
300-302 Siltstone, olive-gray
302-304 Shale, calcareous, tight
304-315 Siltstcnc, olive-gray, limey
315-320 Clavstone, olivo-irr:iv

80

- 100

27

Hole number W-7

SP I Resistivity Depth
Sens, setting 20_MV [Sens, setting ._£2 Recording speed _20_ ft/miniRecording speed20.it/min % £
Logged depth 320 ft Logged depth .__320_ft ^ ^ j

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1-150

f-200-60;

-250 i
- - 80.

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L -100;

h !
1-350 '

Hole No:__W^____,__Map:_.Eay_3J^W._^ _ Date:._6-26£77_ State: ND County: Williams.........__ Elcv.:_..2,24Q_ft__ Location: T. l-SlJ , R._lPPw, Sec. __1_3__, Tract: _ddcd _ Drilled depth: __380_ft__.__. _ _ Measured: _92 £t__ FSL, _190lt_l\&. Hole size: 4 X in. Air [j Water [X] Cored: Yes G No S Lignite beds: .3A-3.£_65.-.6.9.l 71-78; 96-99; 116-119; 220-224; 233:238;_3!7-327; 355-363__ __ _____

Remarks:

Lithology
Recorded by: Randall Rcichert. _ . . Yes Gcologistxj*

Geophysical logs
recorded bv: .I

Lithology

Ganima

T.C. _2_ Range JLQQjC.ps_

Recording speed 2D^/

Logged depth3&Q-£t

Density

T.C. _2_ Range iPQ^ps_

Recording speed2.0-"/min

Logged depth _3_8pjt__

Depth

2:,

0-13 Till, yellowish-brown, pebbly

13-18 Siltstone, gray, clayey
18-21 Lignite, black
~" 21- 32 Claystone, yellowish-gray, silty, sandy 32- 37 Claystone, gray
37- 40 Lignite, black
~ 40-63 Claystone, gray, silty

63- 68 Lignite, black
68- 70 Claystone, gray, silty
70- 77 Lignite, black
77- 96 Clay-stone, gray, silty

96-100 Lignite, black

100-114 Claystone, gray, silty

114-120 Lignite, black

120-146 Claystone, gray, silty

146-147 Lignite, black
147-173 Siltstone, dark-gray, clayey

173-175 Lignite, black
175-182 Siltstone, dark-gray, clayey
182-187 Claystone, dark-grayish-brown
187-212 Chystoiie, gray, silty

212-213 Lignite, black
218-220 Clay stone, dark-gray, silty
220-222 Lignite, black
222-233 Claystonu, dark-gray, silty
233-240 Lignite, black
240-274 CLystone, dark-gray, silty

~ 274-295 Siltstont:, dark-gray, clayey

- 295-300 No samples

~ 300-312 Siitstone, dark-»;ray, clayey

~ 312-318 Lignite, black
_ 318-320 Siltstone, gray, clayey
320-325 Lioiite, black
325-353 Cluystone, gray, silty

353-355 Lignite, black
355-358 Claystone, gray, silty
358-360 Lignite, bhick

- 0-0

-20

~'~"~~~~"'-«r :

~~rr:"v-^j£^EE= -40

350

Hole number continued
W-8

Lithology

360-380 Claystons, gray, silty

Gamma
Tr 2 Range _IOO_ces__ Recording speed 20 ft/min Logged depth 380 ft

Density
T.C._2__ Railge 100 cps Recording spped 20 ft/min Logged depth 380 ft

" ~" ~ "'

*> o
o -

o 4i

- 120
400

450
- 140

500

- 160

h550

- 180
600

- 700

* -220

- 750

Hole number W-8

-

SPkjl Resistivity IVWJJU^kl* J-b Y
Sens, setting 5.0 MV Sens, setting $J) Recording speed 2Q ft/minRecording speedlilft/- Logged depth 380ft [Logged depth 380ft

Depth

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--,_n^_,_7.. ~~^_ ~t"__ ._ _i " £. i __ ~rr*~'" * "" j~ '\r _"~~ ~~* '.' ' "' ^^- -" "".

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L.37>._.-.._ _ _....__ >f&T

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H-250

j-300
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r-
u

j-350
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31

NORTH DAKOTA GEOLOGICAL SURVEY

Holer

Elev.:.

Measured:_

Lignite beds:

Map; Ray 3SW Date; 6-26-77 State: ND County: Williams

.Location: T. 151 * , R..22-W , Sec.__13_ , Tract: _£.«£__ Drilled depth: 300ft

125 ft F5L , 30 ft Hole size :

104-109: 170-180; 245-247 ...

JRs-. Air Cj Water Cored: Yes Q No

Remarks: .

Lithoiogy
Recorded by: Randall Reichert

Geophysical logs
___ Geologist JK recorded by: Lechner_

Lithology

Gamma

T.C. _2_ Range 100 cps_

Recording speed 2Q"/min

Logged depth . 3QQ ft

Density

T.C. _2_ Range IPO cps

Recording speed 2Q"/mii C» *

Logged depth 300ft

Depth

5 S
£ 2

0-10 Oaystone, olive, sflty

10-22 Oaystone, olive, silty

22- 25 Oaystone, brownish-gray, silty
25- 27 Lignite, black
~" 27- 30 Oaystone, light-gray
_ 30-34 Clay stone, dark-gray, silty
34- 35 Qaystone, brownish-gray, silty
~ 35- 36 Lignite, dark-brown
36- 50 Siltstone, gray, clayey
"" 50-54 Qaystone, white
_ 54- 61 Claystone, green, sflty
61-68 Gay stone, gray, silty
68- 70 Claystone, brownish-gray
_ 70- 85 Siltstone, green, clayey
~ 85- 97 Shale, white
97-98 Siltstone, green, clayey
_ 98-105 Lignite, black
105-107 Claystone, brownish-gray, sflty
107-122 Claystone, grayish-green, silty
122-123 Lignite, black
123-173 Claystone, grayish-green, silty

173-181 Lignite, black

181-193 Claystone, grayish-green, silty

193-194 Shale, white
194-200 Claystone, grayish-green, silty
200-215 Sandstone, green, fine grained, sflty, clayey 215-240 Siltstone, green, sandy

240-245 Siltstone, brownish-green, sandy
245-250 Siltstone, green, sandy
250-254 Lignite, black
254-262 Siltstone. green
262-265 Lignite, black
265-287 Siltstone, green, sandy

287-291 Shale, greenish-white

291 -300 Siltstone, green, clayey

- 0-0

r

4C

-350

Hole number W-9

SP

Sens, setting__2Q_MV.
Recording speed.2CL ft/min Recording speed.2Q.rt/ j Logged depth _2PO-iL

1

J

Resistivity
Sens, setting 5.Q.
2-Q.it/mm
Logged depth-1QQ ft ..

Depth j

i-o-o !

r

50

- 100

- 40!

,-150

-200-60:

I

250 !

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p-350 i

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Hole No:.... .NY-10 ..Map: . .Charlsgn.NW ..Date: 7-1-77 State: ND County: Williams I-lcv.: . 2.275-ft .._ Location: T. 15.4.5 , R. 95 _\v , Sec. 9 , Tract: cccc Prilled depth: 400 ft Measured :-310.Cc-_ PsT, ,._6Q..(L FWL,

Surface ownership:

Hole size: __4_&in. _. Air [J Water |X] Cored: Yes ["{ No [XJ

_ _ _ _ _ ._.._......___Coal ownership:
- 137:.176:17.9; .3^.3Q_^3J9:337i360:366_

Remarks: __._. . -

Lichology
Recorded by: RandaJl Reichert Geologist ^S recorded by: ___kechner_.______

Lithology

Gaiuina

T.C...2.. Range .100.cps_

Density
T.C. J2_... Range.100 cps.

- - - - - - --£i * c

Recording speed2Qjc/min j Recording speed20_«/ mj n

Logged depth _374 ft._... Logged depth _367_ft_

Depth

r-rrxf^rt 100 £==£ ' ~T^"Jji^fr:..- .--^100

'.' "73"200

0- 10 Sand, yellow, clayey, silty

10- 36 Till, yellow, pebbly

36- 37 Lignite, black
37- 50 Claystone, olive, silty

50- 61 Lignite, black

61-102 Clay ..tone, gray, silty

102-105 Lignite, black
105-133 Claystone, gray, silty

133-136 Lignite, black
136-145 Claystonc, gray, silty
145-155 Claystonc, yrcen, silty
155-16.'' Clay<tono. gray, silty

163-165 Siltstnne, gray, clayey
165-173 Claystone, gray, silty
173-174 Lignite, black
3 74-1 US Claystone, green, silty
188-193 Siltstone, green, clayey, sandy
193-202 Claystone, green, silty
202-204 Siltulone, green, clayey, sandy
204-218 Clay stone, gray, silty
218-237 Claystoiitf, green, silly

237-245 ChysUme, green, silty, limey
245-253 Claystonc, gray, silry

253-300 Claystonc, green, silty

- 300-307 Lignite, black
_ 307-319 Cb> stone, gray, silty
319-323 Claystone, green, silty
323-331 lignite black
~ 331-340 Claystone, gray, sihy
" 340-345 Lignite
345-358 CLiy>to»;, eray, silty
358-365 Lignite, bhtek
~ 365-400 Ku vunyks

Hole number continued
W-10

Lithology

Gamma

T.C. 2 Range _1QQ cps_ Recording speed 20_ft/mjn Logged depth 374 Ft

^^ - - - -i i **" *\ £ /) ' '-"-

Density
T.C. _2_ Range JLQdcps Recording specd2iL"/min

Depth

h450
- 140

- 500

- - 160

- 550

. -180
-600

-650 -200

- 700

- -220

- 750

3&

Hole number W-10

SP

Sen*, getting 5.0.MV

* * _ _ **

Recoi

Logged depth 3Z4..&.

jrding speed 2$L ft/min Recording

Resistivity
Sens, setting .

Logged depth _37.4 .ft..

Depth

- 0-0

- 50

-20;

^-100

-40:

rl50

-200-60

^250
!- -80

300

- 100!

^-350

i

36

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No- W-ll ,Map: MarmonSE Date: 6-76-77 State: ND County: Williams __ Elev.: _2JL65.1L Location: T. JL55.S , R.1Q&W, Sec. _1L, Tract:. Jccc _ Drilled depth: 320ft Measured: _21QJEtJi^U&Lft m. Hole size: 4 % jn^. Air D Water H Cored: Yes Q No Q Lignite beds: .H6-152L121-194; 255-254 ....__.._.._...._._... ... ______.___ .....

Remarks: . Note poor samples 194-320

Lithology
Recorded by Michael Carnara ._,

Ye.

Geophysical logs
_____Geologist^ recorded by: .__techner_ . _.__

Lithology

Gamma

T.C. _2_ Range 1QQ cps
Recording speed 20

Logged depth

Density

T.C. JL_ Range A
Recording speed 2flL"/min

Logged depth 320 ft

Depth

«_. a

II

0- 4 No samples
4- 18 Till, yellowish-brown, silty, lignitic
18- 26 Clay, yellowish-brown, silty
26- 29 Till, dark-yellowish-brown, sandy
29- 54 Till, dark-gray to black; with lenses of coarse-grained sand

- 54- 56 Clay, dark-gray to black, silty
56- 70 Sand, dark-yellowish-brown, mcdium.grained to coarse-grained; lignite fragments common

70- 82 Gravel, dark-yellowish-brown; with lignitic
coarse grained sand, boulder at 70*
"" 82-100 Sand, dark-yellowish-brown, medium-grained
_ to coarse-grained, lignitic, pebbly

- 100-140 No samples

140-145 Siltstone, olive-brown, sandy
]45-155 Lignite
155-191 Claystone, light-gray, silty

191-194 Lignite
194-223 Siltstone, light-gray, clayey

- 223-225 Lignite
225-243 Claystone, light-gray

243-263 Siltstone, light-gray, sandy

- 263-266 Lignite
266-277 Claystone, light-gray
~~ 277-279 Siltstone, olive, clayey
_ 279-292 Claystone, light-gray

292-317 Siltstone, light-gray, sandy

317-320 Claystone, light-gray

, u ?-- - -0-0

- 20

37

_ -tOO

-350

Hole number W-ll

SP

Sens, setting_1Q.MV
Recording speed 2Q ft/min Logged depth __31S.ft.__

_J
!

i

i

-1

Resistivity Depth;
Sens, settine £0 .. ^

/" I W

Recording speed2H"/min I « <i Logged depth _^3.19_ft.

LO-O

r i

r :

h50 i

r -20

r

HOO

- 40

H50

-zoo"60

- 250
- 80

^300

L -100;

-350

38

Hole No:

Elev

Measured

W-12 Map: MarmonSE Date: 6-25-77 State-. ND County: Williams
360ft

V l^ VJ« -| ,_ .j_- _L«- - -^-f^r ' - -i± - -i *»l«*fc-J _.n *'**-* -*-^T-* - _ m ^/«fc%W TJ_ ----- W*«fe«V ~~ ...__ -IT- ~Vi*X* * »%» __,

'.:_226QJL- Location: T.I55.X, R.1QQ.W, Sec._2_ , Tract:_jaba__ Drilled depth: ________ sured: 57 ft m. _665jt_ Si, Hole size: 4 % in. Air D Water 3 Cored: Yes Q No Lignite beds: ..194-199; 25.0-254;.322-331_ .._ . ..._. _..__. ._._ ._ ___________ ..

Remarks:

Lithoiogy
Recorded by; Reichert

1 Geophysical U^pi
_ Geologist x£ recorded by: Lechner

Lithology

Gamma

T.C. _2_ Range 1QO

Recording speed 20/Vmin

Logged depth 359ft

Density

T.C 2 Range 100 cps

Recording speed 2£L"/min

Logged depth 353 ft

Depth

Iu,

0- 62 Till, yellowish-brown, pebbly -0-0

62-103 Till, grayish-brown, pebbly

103-105 Gravel, grayish-brown, clayey, silty
105-108 Sand, yellowish-brown, clayey, silty
~" 108-115 Till, yellowish-brown, pebbly
115-133 Gravel, yellow to gray, medium grained to
coarse-grained
"~ 133-138 Gravel, yellow-brown, medium grained to _ coarse-grained, silty
138-140 Gravel, yellow to gray, medium grained to coarse-grained
140-160 Till, yellowish-brown, pebbly
~~ 160-165 Till, yellowish-brown, pebbly, sandy
_ 165-175 Gravel, yellow to gray, medium grained to
coarse-grained, sandy
175-180 Gravel, yellow to dark-gray, medium grained to _ coarse-grained
"" 180-190 Sand, yellowish-brown, medium grained
190-195 Gravel, gray, medium grained to coarse-grained 195-202 Lignite, black
202-237 Siltstone, olive, clayey

237-244 Lignite, black

244-253 Siltstone, gray, clayey

253-265 Siltstone, gray and yellow, clayey

265-309 Siltstone, gray, clayey

- 309-325 Lignite, black

325-350 Siltstone, gray, clayey

~ 350-360 No samples

-20

-100

Hole number W-12

SP i Resistivity
Sens, setting 2.Q.-MV Sens, setting

Depth

Recording speed^fiL ft/minJRecordingspeed20.ft/min j £ « Logged depth 359 ft iLoggcd depth _._35JLft . ; u, 2
i

r -

- 0-0

- 50

20

- 100

- 40

- 150

-ZOO"60

-250

- - 80

-300

- 1
lOOi

-350

40

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:

Elev.:_

Measured:50JI

W-13 __ Map- Marmon SE Date: 6-25-77 State: ND County: Williams ___ Location: T. Ills , R.1QQLW , Sec. J_, Tract:. aaaa -_ Drilled depth: _260_fL

FNL _8.Q JL*wL Hole size: 4 % in. Air D Water B Cored: Yes D No
Lignite beds:. _13^38.;JL87496.;253_-26Q_ ...

Remarks:

Lithology
Recorded by: _Randall Reichert

Geophysical logs
.__Geologists* recorded by: __ Lechncr

Lithology

Gamma

T.C. _2__ Range 100 cps
Recording speed 20. Wmin

Logged depth -26tQ_ft

T.C.

Density
-2_ Range 100 cps
Recording speed

Logged depth 260 ft

Depth

s

0- 6 Till, brown, pebbly
6- 10 Sand, light-brown, fine-grained, silty
10- 20 Sand, light-brown, fine-grained to medium-grained, coarsening downward
20- 33 Sand, light-brown, medium-grained to coarse-grained, slightly pebbly towards bottom
33- 36 Sand, very light-yellowish-brown, medium-
grained
36 43 Gravel, light-yellowish-brown, small
43- 95 Gravel, yellowish-brown, medium-grained to coarse-grained

- 95-132 Claystone, light-gray

- 132-137 Lignite
_ 137-140 Siitstone, tan
"~ 140-145 Ctaystone, light-fray
- 145-164 Siitstone, light-gray, clayey

- 164-175 Silt-stone, light-gray, sandy

- 175-176 Lignite
_ 176-182 Sandstone, light-gray, silty
182-184 Claystone, olive-gray
- 184-193 Lignite
193-227 Claystone, olive-gray

~ 227-243 Siitstone, light-gray

243-250 Claystone, light-gray, silty

~ 250-260 Lignite

- 0-0

- 50

-20

4.0 ... . gt.v/T* s»+,syi.Tf..

-300

. -too

-350

41

Hole number W-13

SP I Resistivity
Sens, setting_2Q.MV Sens, setting _.._5Q_._ Recording speed_2.Q. ft/minlRccording speed20.ft/... Logged depth _2AQ.fL__ Logged depth .__?60jt .

mm

Depth

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h-150

-200"60

- 250 i
!- -80

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i

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i

42

NORTH DAKOTA GEOLOGICAL SURVEY

Hnl* No; PIG Map: Hannover NE pate. 7-22-77 State. __

Elev.: -2M2Jt__ Location: T. HIX, R.81__W , Sec. _A_ , Tract: .?kb>_._ Drilled depth: _

County: Mercer

Measured: __Z£fL 2,620 ft Hole size: 4% in. Air E3 Wacer D Cored: Yes G No (29 Lignite beds: .-14-47; lf>-%2\. 132,139; 165-168

Remarks: .

Lithology
Recorded by? Geologist^?

Geophysical logs
recorded by: __:chner_.

Lithology

Gamma

T.C. _2_ Range 100 cps
Recording speed ZQ/Vmin

Logged depth _2QOjt__

Density

T.C. JL. Range 100 cps

Recording speed ^0^/

Logged depth 200ft

Depth

0- 5 Till, yellowish-brown, sandy, pebbly 5-13 Siltstone, yellowish-brown
13-17 Sandstone, white
17-20 Siltstone, brown
20- 22 Sandstone, dark-yellowish-brown
22- 25 daystone, dark-yellowish-brown, silty 25- 26 daystone, gray
26- 30 Qaystone, black to very dark-gray
30- 45 No samples
45- 50 Lignite
50- 59 daystone, dark-gray
59- 73 Siltstone, dark-gray, sandy
73- 80 Sandstone, gray, very fine grained to fine-grained

80- 84 Lignite
84- 95 Siltstone, dark-gray
95-125 Sandrtooc, light-gray, very fu» grained
125-200

- 0-0

- 20

aoff60

250

r -so

-300

_ -100

43

Hole number PIG

SP Resistivity
Sens, setting -20_MY jSens. setting ~5JL Recording speed_2£.fc/min[Recording speed-2&w Logged depth _ 7.00 ft [Logged depth _ 2QCLft
i

t

J

1

J

Depth

£ 2

- o-o

L i
i

1-50 !
i I

-

^100

-40!

-i50

-ZOO"60'

- 250 !

- 80!

1

r300

- 100!

^-350

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_.P2_G.____Map: Hannover NW patg: .7-21-77 State: __ND__County:.. Oliver.......... Elcv.:_2,Q7J..£t_Location: T.141*. R.-S4_W, Sec. .A__, Tract: ..__bbbb_ Drilled depth:__?5?A_... Measurcd: __.2Q_fL_ RS& 60.ft_ Fvv?, Hole size: 4 % in. Air B Water Q Cored: Yes D No Lignite beds:. _l6Q_162Ll 170-172; 200-202;. 204-207; 232-240 __.._._ .. ... __________... .

Remarks:
Lithology
Recorded by:

Geophysical logs
Geologist NO* recorded by: -.._.._ Lcc.hlicr.

Lithology

Gamma

T.C._2_ Range .lQO_cps_
Recording speed 20^ r/niin
Logged depth __.25.Q_ft_

Density
T.C. _2_ Range JL
Recording speed
Logged depth 250 ft

Depth

No samples -0-0

- 50

-ao

- 100

"-. - :- <-=: .,

^ » A f\ i_i*_:_-. _. .':__' ' ' " ^

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45

- 300

_ -iOO

^-350

Hole number P 2 G

SP

Sens, setting . 2DJVI.Y Recording speed 2£L ^/mi Logged depth __ -25.0 £L._

1 i

. .1

J

Resistivity
Sens, setting 50_____ min Recording speed_2Q&/min Logged depth 25.) A...._

Depth

ll
~!

-0-0

- 20

MOO
L_

- 40

- 150

=__=__! -2CO"60

r-250 '

- - 80

-300

_ -100

--35C

Hole. No:

Elcv.:

Map:. Stanton Date:__7_rl3iZ7State: ND County! Mercer
Location: T.l4lSc, R.85_w, Sec. _.22_.,Tract:..^4.4.._Drilled depth: 600ft

Measured: 2.600 ft §£, _20QJL Hi, Hole size: 4 34 in. Air D Water (x) Cored: Yes [XJ Lignite beds: IJU-lflfiUJ&ilSQ;. 196-20.0; 261-264; 273-277: 342-344: 400-402; 405-409; 471-473

No

o L.. Core hole P 3 GC was located 75 feet north of P 3 G; cored intervals were 98 to 103, 168 to 178, rxcntarKs: . i^^»-» /»«/»/> *r\ c ... ._

. ,' and 198 to 202 feet; recovery was 19 feet. , ...

Lithofogy Ycs C.cophysical logs Recorded by:_-MicJiaeLCamaca____'. Geologist N* recorded by: Lechner

Lithology

Gamma

T.C. 2_ Range JHQLrps_

Recording speed 2Q' r/min

Logged depth 600 ft

Density

T.C. _2_ Range .1QO cps

Recording speed 2.0."/min

Logged depth 600 ft

Depth

01ll
«j <U

8 I
U, 2

- 0-7 Sand, yellowish-brown, very fine grained to
' fine-grained
~~ 7-17 Till, yellowish-brown, sandy
_ 17-22 Sandstone, yellowish-brown, very fine grained
to fine-grained
- 22- 25 Silt stone, olive-brown
25- 27 Siltstone, light-gray
~ 27- 39 Oaystone, light-gray
- 39- 43 Lignite
43- 46 Sandstone, dark-olive-brown, fine-grained
- 46- 50 Claystone, light-gray
50- 55 Sandstone, dark-olive-gray
~- 55. 56 Claystone, white
^ 56- 67 Claystone, dark-gray
67- 68 Limestone, dark-gray
"* 68-73 Qaystone, gray
-, 73-83 Sandstone, dark-gray, very fine grained to
fine-grained
"* 83-84 Lignite
- 84- 85 Siltstone, dark-olive-gray
85- 90 Sandstone, dark-gray, very fine grained to
- ' fine-grained
_ 90- 93 Siltstone, dark-gray
93- 98 Claystone, gray
- 98- 99 SDtstone, very dark brown
99-100 Lignite
"" 100-102 Siltstone, light-gray
102-105 Lignite
"" 105-109 Claystone, gray
- 109-110 Claystone, very light jray
110-115 Siltstone, gray, sandy
"" 115-116 Limestone

_ 116-132 Sandstone, gray, very fine grained to
fine-grained
- 132-147 Siitstone, gray, sandy
_ 147-152 Siltstone, olive-gray, clayey
152-153 Claystone, dark-brown
.. 153-154 Lignite, brown
154-159 Claystone, olive-green
~ 159-162 Claystone, dark-olive-gray
162-164 Claystone, dark-olive-brown
"" 164-167 Lignite
- 167-168 Qaystone, light-olive-gray
168-172 Lignite
172-178 Claystone, iight-olive-gray
- 178-180 Siltstone, Iight-olive-gray
180-190 Sandstone, greenish-gray, very fine grained to
~ , fine-grained
_ 190-192 Lignite
192-198 Claystone, green
~ 198-200 Siltstone, green
_ 200-201 Sandstone, green
201-205 Siltstone, olive-gray
205-207 Claystone, dark-brown
207-216 Claystonc, light-gray
~ 216-220 Siltstone, light-gray
- 220-221 Limestone

221-230 Siltstone, light-gray
- 230-250 Siltstone, greenish-gray

-0-0

- 20

300

......_ _'. _; ; ' T^TTyr".

= _ -100

47

Hole number continued

P3G

250-254
' 254-256
256-262
m 261-265

.265-267
257-270

270-275
"275-233
. 283-294
294-295
'295-299
. 299-303
303-304
304-309
309 315
315-327
. 327-330
330-334
334-335
335-347
' 347-350
.350-353
353-357
357-369
369-371
371-380
380-381
381-382
" 382-385
. 385-387
387-392
392403
403-407
407415
415416
.416417
417-445
445-454
454-455
"455462
.462463
463466
466-600

Lithology

Sandstone, green, silty, very fine grained
Lignite
Siltstone, olive-gray, sandy
Sandstone, greenish-gray, very fine grained to fine-grained
Lignite
Sandstone, greenish-gray, very fine grained to fine-grained
Siltstone, gray, clayey
Qaystonc, dark-olive-gray
Qaystone, very light gray
Lignite
No samples
Claystone, very light-olive-gray
Sandstone, light-olive-gray, very fine grained Siltstone, light-olive-gray, sandy
Sandstone, greenish-gray, very fine grained
Siltstone, light-olive-gray, sandy
Lignite
Siltstone. light-olive-gray
Siltstone, light-brown
Siltstone, light-olive-gray, sandy
Sandstone, light-olive-gray, very fine grained Gay stone, light-greenish-gray
Lignite
Gaystone, dark-olive
Lignite
Siltstone olive-gray, sandy
Claystone, dark-olivc-gray
Lignite
Qaystone, dark-olive-gray
Siltstone, very dark brown
Lignite
Claystone, dark-olive-gray
Claystone, dark-brown
Sandstone, light-greenish-gray, very fine grained Siltstone, very dark brown
Lignite
Sandstone, olive-green, very fine grained, silty Qaystone, very dark brown
Lignite
Sandstone, olive-green, very fine grained
Claystone, very dark brown
Luiinte

Sandstone, olive-green, very fine grained to tine-grained

T.C..

Gamma

- Range 100

Recording speed _2£L/Vmin

Logged depth 600 ft

Density Depth

T.C. J2_ Range 100 cps

Recording speed _20ft/min

Logged dgprfi 600 ft

w O

- -"''' - " " - * ' * u^. ''T*-^iv - 'V?^i(£_«^Jr>nj^£!r~ *£*£"'"' *** *"*zzi

-200

h-700

- -220

i

1-750

Hole number P 3 G

SP

Sens, setting_2.0.M.V_ Recording speed 2£L-fym'm Logged depth ._.6Q_0 ft _

Resistivity
Sens, setting 50 Recording speed2Qifymin Logged depth _-6Q_0_A.._

Depth

Ji

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i

-1

- 0-0

1-50

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ZOO'60

r

-250
- 80

r

[--300

_ -100:

-350

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49

Hole number continued
P3G

1

SP

Sens* setting .., ^ 2.0 MV
Recording speed. ,.,20. ft/min

O i

Logged depth _ 6.0.0 £t _

- - - 5^.-

_....... _..-._._ ^...

i £ f-** -

Resistivity
Sens, setting ___ JjQ._
Recording speed 20^^ n
Logged depth .600 f

-^ .... .-i

!=-?
i .. .. v ... . j ....
- -:.:- .. ^_. .__) =

._m.i:..- . ._. .^7..-.~~~.

., ... , , .. -,._Jrr: r

j : r -:_-:-:_- :. . .^. _-_ . =:=:.

i ".; '. .7 -Z ": T~"~-' " ~-"-
I . _. .-._..J_ _. _. _.
i f~ ~" ~ ~ ~ "~"^Q' ~ .'J'.l r.-'^;

^j~» in 1" ."""! j

.^= j

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~rDi.-._-^Z-^j

^><I^:i^H

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Depth!
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-400 ;
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|- -160!
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i

-esc ;
: -200,

f

J
I

i

700

-220.

\-750

50

Hole No:__JLi G___Map:. Stanton Date: _2z20_-.7I_ State: ND County:__ Merger.... Elcv.: _ZQfi5J&_Location: 7.144-*, R.84-W. Sec. _30_ , Tract: bcbb. .__ Drilled depth: _._24_OJft__ , _ _

KNL KRT^ I I Measured:L.5_84_ft_ RSJ.. _I_48 £t_ FWL, Hole size: __i%.ini___ Air U Water [3 Cored: Yes D No Q3
Lignite beds:.._80-81;JJ6I178i 195-19_9;23>238 _...__._. .. _. .__________ ._

Remarks:

Lithology
Recorded by: _MicIiaelCamara. .., . . Yc» Geologist NX

Geophysical logs
recorded by: . __ .Ji "

Lithology

Gamma

T.C.-2_ Range JLOiLep.s_

Recording speed ZQ/

Logged depth _24_Q_ft

Density

T.C. _2_ Range !PP_cpA

Recording speed 20_"/ mjn

Logged depth 240 ft

Depth

0-6 Sandstone, yellow-brown, silty, pebbly 6 - 10 Lignite
10 - 17 Sandstone, light-grayish-brown, very fine grained
17 - 19 Siltstone, grayish-brown
19 - 19.5 Ironstone, concretion
19.5- 20 Claystone, orangish-brown
20-21 Lignite
21 - 24 Siltstone, browish-gray
24 - 26 Siltstone, olive-gray, clayey
26 - 30 Claystone, light-gray
30 - 44 Claystone, light-gray
44 - 47 Lignite
47 - 48 Claystone, dark-gray
48 - 50 Siltstone, green
50 - 51 Sandstone, green, very fine grained to fine-grained
51 - 56 Siltstone, greenish-gray, clayey
56 - 57 Claystone, gray
57 -58 Claystone, dark-olive-gray
58-59 Lignite
59 - 65 Siltstone, green, clayey
65 - 70 Claystone, light-gray, green
70-71 Lignite
71 - 76 Sandstone, dark-greenish-gray, very fine grained
76 - 77 Claystone, dark-gray
77 - 78 Lignite
78 81 Claystone, dark-gray
81 - 82 Lignite
82 - 83 Claystone, dark-gray
83 - 84 Lignite
84 - 93 Claystone, dark-gray
93 - 98 Sandstone, greenish-gray, very fine grained 98 -110 Siltstone, gray
110 -125 Sandstone, greenish-gray, very fine grained 125 -149 Siltstone, gray, clayey
149 -150 Lignite
150-154 Claystone, grayish-brown
154 -155 Lignite
155 -157 Claystone. dark-brown
157 -160 Sandstone, brownish-gray, very fine grained 160 163 Sandstone, greenish-gray, very fine grained 163 -165 Claystone, greenish-gray
165 -166 Siltstone, ulive-gruy
166 -168 Sandstone, greenish-gray
168 -170 Lignite
170 -172 Claystone, olive-gray
172- -191 Sandstone, greenish-gray, very fine grained, silty
191 -193 Claystone, olive-gray
193 -197 Lignite
197 -204 Claystune, greenish-gray
204 -228 Claystone, gray, silty
228 -230 Sandstone, light-greenish-jjray, very fine grained
230 -233 Chystono, olive-gray, silty
233 -236 Li-nite

, 236 -240 Clay, dnrk-tiray

V-0-0

- 20

-300

. -100

-350

51

Hole number P4G

SP I Resistivity
Sens, setting .. .20 M.V JSens. setting ... -±H._ Recording speed -2£L fc/miniRecording speed2Q_tt/min Logged depth __ 240 ft._ Logged depth _.24Q_ft_

g*
J

Depth

- 0-0

h50
L

t

HOO

-40'

j-200-60

I i

- 80

r300

-100:

,^350

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NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_ P5G __Vbp: Hannover NW Date :.JZii?iZ7_ State: ND__County :__QUyer._...._. Elcv.: ..-2,lD5_ft_ Location: T. JL43.Sc, R.-84-W , Sec. _!8_ , Tract:. .bbbb.__ Drilled depth:

Measured:_.33_£t._f*k, -42 _ft_ FWL, Hole

Lignite beds: ..56-^063=168;. 181-188 ....

size: %-irk_ Air D Water H Cored: Yes Q No

Remarks:

Lithology
Recorded by: Michael Camara

Cicophysical logs

Vcs *

....__Geologists** recorded by: .

Lithology

Gamma

T.C. _J2_ Range 100 Cp.SL.

Recording speed -ZOtymin

Logged depth __24QJL

Density

T.C. _2_ Range JLQQ_cps

Recording speed 20.^/mi

Logged depth 240 ft

Depth

0- 6 Sandstone, yellowish-brown, very fine grained to medium-grained
6- 8 Sandstone, brownish-gray, silty, very fine grained to medium-grained
8-11 Sandstone, yellowish-brown, very fine grained 11-13 Siltstone, olive-brown, sandy
13- 24 Siltstone, olive-gray, sandy
24- 27 Claystone, yellowish-brown, silty
27- 29 Claystone, light-gray
29- 30 Sandstone, brown, very fine grained
30- 39 Siltstone, olive-brown, clayey
39- 40 Limestone, gray
40- 62 Siltstone, olive-brown, sandy
62- 67 Siltstone, olive-gray, sandy
67- 79 Siltstone, gray, sandy
79- 86 Sandstone, light-gray, very fine grained to fine-grained
86- 88 Lignite
88- 90 Siltstone, very dark brown
90- 93 Claystone. greenish-gray
93- 95 Sandstone, greenish-gray, very fine grained to fine-grained
95- 97 Claystone, olive-green
97- 98 Siltstone, dark-brown, clayey
98-100 Lignite
100-107 Sandstone, light-gray, very fine grained to fine-grained
107-127 Sandstone, light-gray, very fine grained to fine-grained
127-159 Claystone, olive-gray, silty
159-163 Gaystone, dark-gray
163-170 Lignite
170-175 Siltstone, dark-gray, clayey
175-180 Sandstone, light-gray, very fine grained to fine-grained
180-181 Siltstone, dark-gray, sandy
181-190 Lignite
. 190-240 Sandstone, olive-green, very fine grained to fine-grained

- 20

- 300

_ -100

-350

Hole number P 5 G

ar Resistivity
Sens, setting _.2Q_MV.. Sens, setting _.. 50 Recording speed _2Q. fyminjRecording speed 20. "/m in Logged depth _ .240. ft__ Logged depth __24Q.1L

1

H

J

J

Depth

u O
4> *
C> O

u-

hO-O

! 50

-20

MOO

-40

pi50

-200-60

r250 l

s- -so'

- 300

U

-35C

54

. Map: Hannover NE Date:._^23;77_ State: ND._ County: _Oliver

Elev.:~2,UQ-ft_._. Location: T.111.X, R._84_fCt Sec.. A_., Tract:. cc.cb_..__ Drilled depth: _?20jt_ Measured: J19.SJL_ FSlf, ±1 ft _ FWL, Hole size: 4 % in. Air D Water S Cored: Yes Q No Lignite beds:._$.7-^JL4Zr.l51j. 178-186 .__.. . .... _.__ ..._._.... .. ________ .. .

Remarks:

Lithology
Recorded by; -Mighael Camara_

Yw Geophysical logs
Geologist XK recorded by: ._...Lechner

Lithology

Ganima

T.C. ...,,.2.,,.. Range lQQ_cps__

Recording speed 20.^/min

Logged depth 220 ft

T.C.

Density

2 Range !QO_C£S_

Recording speed 20- 'Vmin

Logged depth _220 ft

Depth

O 5 Siltstone, grayish-brown, sandy
5-17 Till, dark-yellowish-brown, silty
17- 18 Siltstone, orangish-brown
IB- 21 Siltstone, grayish-brown, clayey
21- 25 Claystone, dark-grayish-brown
25- 29 Siltstone, white
29- 33 Claystone, olive-gray
33- 46 Claystone, light-gray
46- 47 Lignite
47- 50 Siltstone, dark-brown
50- 55 Siltstone, grayish-green
55- 64 Siltstone, gray, sandy
64- 73 Claystone, gray
73- 74 Lignite
74- 77 Siltstone, light-gray
77- 80 Claystone, gray
80- 89 Claystone, grayish-green
89- 90 Lignite
90- 95 Claystone, gray
95- 97 Sandstone, grayish-green, very fine grained to fine-grained
97-100 Siltstone, gray
100-103 No samples
103-106 Siltstone, dark-gray, clayey
106-116 Sandstone, greenish-gray, very fine grained to fine-grained
116-124 Siltstone, gray, clayey
124-125 Sandstone, greenish-gray, very fine grained to fine-grained
125-147 Claystone, gray
147-150 Claystone, dark-gray
150-154 Lignite
154-162 Siltstone, grayish-green
162-166 Sandstone, greenish-gray, very fine grained 166-175 Claystone, gray
175-177 Siltstone, dark-brown
177-180 Sandstone, light-gray, very fine grained 180-181 Lignite
181-183 Siltstone, very dark brown
183-185 Siltstone, gray, sandy
185-190 Claystone, gray
190-193 Lignite
193-195 Clay stone, dark-olive-gray
195-197 Lignite
197-200 Oaystone, dark-olive-gray
200-204 Claystone, gray
204-21)5 Lignite
205 220 Sandstone, gray, very fine grained to fine-grained

- 20

:, _-.- _ - y^T- ZOO "" ~^=^

~ .:_ / .- -^. ~:~-~ '-. »

-300

-350

55

Hole number P 6 G

SP Resistivity
Sens, setting_ .2.0.MV_ JSens. setting 50_ Recording speed .20 fymin Recording speed20.fr/min Logged depth _..Z2.Q Jt _ Logged depth -220. ft.._._
.... -- -j-- -"- - --

Depth

J

J

1

1

- 0-0

50

-20!

- 40'

150

-200"60

- 250 !
- - - 80

-300

- 100!

-350

f-

56

HoleNo:__PJZ

Elcv.:_ 1,89.0. ft

Measured: _320iL

Map:_ Stanton SE Dare: 8-3-77 State: _J5£___ County:. ...Mercer.,. . __

Location: T. Hlsc, R.S.lw, Sec. 32. , Tract: .__?aab_ Drilled depth: __?5J.... KSJx ±20 Hole size: 4 K in. Air [j Water [x] Cored: Yes D No LiBiite beds: 107-109; 136-138; 207-210; 238-242; 310-313
o

Remarks:

Lithology
Recorded by Michael Camara

Ctcophysical Iocs
- , Ye, ill ^
._._ Geologists** recorded by: _._ Lechner

Lithology

Gamma

T.C.-1-Range 1Q2JEE?-

Recording speed 2Sr Vmin

Logged depth _5-QQ.ft_

Density

T.C. _2_ Range 1°_°_£EI

Recording speed 2H'r/min

Logged depth __500jt__

Depth

0-7 Sand, yellowish-brown, very fine grained,
pebbly
7-18 Till, yellowish-brown, sandy, pebbly
_ 18-20 Till, yellowish-brown, silty
20- 40 No samples

40- 45 Siltstone, light-olive-brown
45- 50 Sandstone, light-olive-brown, very fine grained
~ 50-51 Lignite
__ 51-60 Sandstone, light-olive-brown, very fine grained
60- 65 Claystone, light-gray; poor samples
_ 65- 67 Lignite
67- 70 Siltstone, light-gray, sandy
70- 76 Sandstone, light-gray, very fine grained to
_. fine-grained
76- 83 Gaystone, light-gray
83- 84 Siltstone, gray
_ 84- 94 Sandstone, gray, very fine grained to fine-grained
94-97 Siltstone, green, sandy
97-101 Sandstone, grayish-green, very fine grained to fine-grained
~~ 101-106 Claystone, olive-gray
106-109 Lignite
109-110 Siltstone, olive-gray, sandy
~ 110-118 Sandstone, light-greenish-gray, very fine grained
_ to fine-grained
"" 118-125 Siltstone, light-brownish-gray
125-134 Sandstone, grayish-white, very fine grained 134-135 Lignite
~~ 135-14 3 Sandstone, gray, very fine grained
_ 143-148 Siltstone, gray
148-150 Claystcne, grayish-white
"* 150-154 Claystone, gray
__ 154-155 Sandstone, gray, very fine grained, si'Uy
155-159 Claystone, gray
159-160 Lignite
160-164 Siltstone, gray
164-201 Sandstone, gray, very fine grained
_ 201-202 Claystone, grayish-white
202-203 Lignite
~ 203-206 Sandstone, light-greenish-gray, very fine grained,
_ silty
~~ 206-210 Siltstone, light-brownish-gray
210-215 Claystone, light-greenish-gray
215-220 Claystone, light-greenish-gray
~ 220-227 Siltstone, greenish-gray
_ 227-229 Siltstoiic, brownish-gray
229-230 Sandstone, greenish-gray, very fine grained to fine-grained
_ 230-232 Lignite
232-239 Sandstone, green, very fine grained, silty
_ 239-240 Lignite
240-245 Cluystone, light-grayish-brown
"~ 245-246 Sandstone, grayish-brown, very fine grained
_ 246-247 Siltstone, dark-gray
247-253 Sandstone, light-greenish-gray, very fine grained
to fine-grained
253-254 Siltstone, dark-gray
~ 254-255 Lignite

- 0-0

- 20

£f=S^E3 160 £^E^

3 HO r-- __- .I..._ -- ..

-'-"- -' ~:^»r::: 3

ErEl ZOO Lrrrrrt^rr- -~^:=.:r~--

Hole number continued

P7G

Lichology

_ 255-263 Claystone, dark-olive-brown
263-266 Sandstone, "rayish-wreen, very
- fine-grained
266-278 Claystone, green
~* 278-280 Chystone, dark-gray
_ 2SO-284 Sandstone, greenish-gray, very
silty
- 284-286 Claystone, dark-olive-gruy

2S6-295 Sandstone, light-greenish-gray, "" silty
_ 295-296 Siltstone, dark-gray
296-299 Claystone, dark-olive-brown
- 299-300 Lignite
_ 300-340 Sandstone, grayish-green, very
fine-grained
- 340-345 Siltstone, grayish-brown
345-364 Sandstone, grayish-green, very
~ fine-grained
__ 364-407 Sandstone, greenish-gray, very
silty
- 407-409 Sandstone, grayish-green, very
__ fine-grained
409-420 Claystone, grayish-brown
- 420-429 Siltstone, gray, sandy
429-432 Sandstone, light-greenish-gray,
"" 432-440 Siltstone, light-gray
_ 440-490 Claystone, grayish-brown
490-497 Limestone, black
"~ 497-500 Claystone, grayish-brown

fine grained to

fine grained,

very fine grained,

fine grained to

fine grained to

fine grained,

fine grained to

silty

Gamma

T.C. 2_ Range 100 rps Recording speed 20

Logged depth __iQQJ:L

Density

T.C _2_ Range 100 cps

Depth

Recording speed 2Qj^lm\ Logged depth 500 ft

-550

. -ISO

-600

- 700

- -220

- 750

Hob number P7G

SP
Sens, setting
Recording speed_20. ft/min Recording speed-20ft/ Logged depth _

Resistivity
Sens, setting 50-

i orvil.
mm

Logged depth 00ft

!

i

Depth

- 0-0

-50

- 20!

i

HOO

. "T .VvjiEl^ I <

- 250 I
i i
u.. _ 80

r

300

r - 100

L.

"-35C '

59

SP

Hole number continued
P7G

Resistivity
Sens, setting ___Ji<LMY_ Sens, setting . $9 » Recording speed _2Q_ fy mini Recording speed 2j?t/min I Logged depth __5DQ.ft _

J
-i

Logged depth . 500 ft

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1

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'" T"~ ~"^ .,. '"".TIT""]

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Depth!

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-450 .
- 140;

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500

I- -160.
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(-550
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h-600

H

j ~i

- 200

-j

j

j

700

r- -220

- 750

60

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: __ P 9 __ Map:__Stanton _____ Date :_Z-24^TZ_ State: _ ED. __ County: _ Mercer Elcv.:_J,225J&L_ Location: T.lMJfc, R.S5-W. Sec.. ?4__ , Tract: ._bcb.b__._ Drilled depth: _120.ft __ .... . Measured: _U32(Lfc-|gfc, _4a.&_ Fm.. Hole size: __£34 Jn,_ Air [x] Water D Cored: Yes Q No £ Lignite beds: -J.5r3aa6r.85; 113,1 16. .. . ._........ .. ____ . __ ._. ._

Remarks:
Lithology
Recorded by:

Cioophysicral lops
.__Geologist NO recorded by: ...____ Lechner . .. _

Lithology

Ganima

T.C..^_ Range _10_Q_cpjL
Recording speed 20
Logged depth _12_Q_£t

Density
T.C. _2_ Range J..QO_cpi
Recording speed ZQ.'Vmin
Logged depth _120 ft

Depth

No simples -0-0

- 50

- 20

- 3-100

- 40

- 250
~ -80

- 300

_ -100

-350
61

Hole number P 9 G

SP Resistivity Depth j
Sens, setting ..J2.0. .MY_ Sens, setting _.-... 50.___ Recording speed_2£L Wmin Recording speed20. wmin Logged depth __ .I20.ft. Logged depth _120_ft_ .._

J

-j

t

- 0-0

- 50

HOO

- 40

ri50

r

-200"60

.-250 :
- -80

.^-300

- IOO,

350

62

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:.__1 C __Map:__Sianrou____Date:_Zzi4rZ7_State: __ML_County:_Mercer _

Elev.:_J.,845_ft_. Location: T. 144.S, R.._85_w, Sec. _8_., Tract: __.dddd_ Drilled depth: _...JLOQ_£t_... . ..._ Measured: _58jt__:FSL, _86 fL.Hk Hole size: 4 % in. Air D Water E Cored: Yes G No 0 Lignite-beds; 3.3-37; 75-79 .... _ _ . ... ._..... ._. .. ________._.....__

Remarks:

Lithology
Recorded by Michael Camara

Geophysical logs
Geologist NX recorded by: ___.JLechner.......

Lithology

Gainma

T.C._2

Recording speed 20"/min

Logged depth _IQSih

Density

T.C. _2_ Range J_0(Lcps.

Recording speed 2D."/min

Logged depth 97 ft__

Depth

4_» <U

I I

0-10 Sandstone, dark-brown, fine-grained

10-20 Sandstone, dark-brown, fine-grained, pebbly

20-32 Sandstone, light-gray, fine-grained to very
__ flne.grained
"~ 32- 33 Qaystone, light-gray
33- 34 Claystone, white
34- 36 Lignite
~ 36- 55 Claystone, light-gray
55- 58 SUtstone, light-gray
58- 59 Limestone, gray
_ 59- 60 Claystone, light-gray
~ 60- 63 Lignite
63- 65 Siltstone, dark-brown
65- 67 Siltstone, olive-gray
"* 67* 76 Sandstone, light-gray, very fine grained to
fine-grained
76- 77 Oaystone, olive
~~ 77- 80 Lignite
80- 90 Claystone, greenish-gray
90-100 Siltstone, olive

- 0-0

-50

- 20

- 100

- 40

1-150

-250

~ -80

- 300

_ -100

1-350

Hole number

SP
Sens, setting_5Q_MV__ Sens. __ . __ .__ Recording speed .20. fym in (Recording speed 20ft/ Logged depth .... 100..ft_

mm

[Logged depth __100_ft__

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i

OJ CJ

tt. 2

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hO-0

50

I- -20;

'-100

-401

HI 50

H
- i
i
L200 60

r250 i
^ -80;

,-300

-too,

64

Hole No:__2_G_

NORTH DAKOTA GEOLOGICAL SURVEY

Hoe No: __ _ ___ . __ Map:_Stanton ______ Date: 7-19-77 State: ND County: Mercer Eicv.:_l,M5jt_ Location: T.l4l2, R. 85 _w, Sec.. _28_, Tract: ccdd...
Measured: JUBJ&

______ ate: -- tate: ounty: _ __
R. 85 _w, Sec.. _28_, Tract: ccdd... .. Drilled depth: _._240JL-.- __
__ Hole size: 4 K in. Air [3 Water Q Cored: Yes Q No H
Lignite beds: ._1.16illli 224-230 ....__..._.... _______ .__...._

Remarks:

Lithology
Recorded by:_

Geophysical logs
.___ Geologist NO recorded by: ..___Lechner

Lithology

Gamma

T.C. -2_ Range JLQOLcps_
Recording speed 20 Wmin
Logged depth _24Q_&_

Range

Density
T.C.

Recording speed
Logged depth 240ft

Depth

No samples -0-0

rt ^

- 300

_ -100

-350

Hole number 2 G

SP Resistivity
Sens, setting _.. .-20-MY Sens, setting . 5.0 Recording speed_2Q.ft/min[Recording speedHLfymin Logged depth _...24Q ft_ Logged depth _24D.ft

1

-j
-J

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i

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i i
H

Depth

- 0-0

-50

-20:

'-100

- 40-

L200~ 6(

r-250

- - 80

-300

- 100,

- 530

66

Hole No:__3_CL __ Man: Fort Clark Date:_J-=9z<ZZ.
N _ no K

. State: ND County: Oliver.

Elev.:-J,240_ft_ Location: T.lili, R.-83.W , Sec. _JL_, Tract: .addd ._ Drilled depth: __.60_(l_ft__ Measured: JJillJL jgfe .50-fLJSfc. Hole size: 4 %im._ Air G Water Q Cored: Yes Q No Lignite beds: .-_47-_${k£5_-.3_8; 158-160;J86-_188; 242-244; 317:324 ..__. ...... ______..__ _.

Remarks:

Lithology
Recorded by; Michael Cam ara

_ . . Yes Geologist Nac

Geophysical logs

recorded by: . _ Lechner

Lithology T.C..

Gamma

2 Range l_OP_cp_s_

Recording speed 2Q«c/min

Logged depth _5i9 ft__

T.C.

Density

2 Range JOOcgs

Recording speed 2D.'Vmin

Logged depth 594ft

Pepth

II
0- 10 Siltstone, yellowish-brown, sandy, pebbly 10- 21 Till, dark-yellowish-browi>, sandy
21-22 Claystone, dark-yellowish-brown
22- 23 Lignite, brown, soft
23- 24 Claystone, grayish-olive
24- 25 Lignite, brown, soft
25- 28 Clay stone, olive
28- 29 Sandstone, olive-gray, very fine grained, stlty 29- 40 Silts tone, olive-brown, clayey
40- 45 Claystone, light-olive-brown
45- 47 Claystoiie, gray
47- 50 Lignite
50- 65 Siltstone, light-gray; poor samples
65- 71 Sandstone, light-gray, very fine grained to fine-grained; poor samples
71- 78 Claystone, light-gray
78- 84 Claystone, light-green
84- 88 Lignite
88- 93 Claystone, light-green
93- 94 Siltstone, light-gray
94- 95 Lignite
95- 98 Claystone, dark-brown
98-103 Siltstone, light-gray, clayey
103-109 Sandstone, light-gray, very fine grained to fine-grained
109-121 Siltstone, light-gray, clayey
121-122 Siltstone, light-green
122-132 Claystone, gray
132-135 Siltstone, gray, sandy
135-137 Claystone, gray
137-142 Claystone, dark-gray
142-145 Claystone, olive-gray
145-150 Claystone, very dark-grayish-green 150-153 Siltstone, gray, sandy
153-155 Sandstone, light-gray, very fine grained to fine-grained
155-157 Siltstone, olive-gray
157-159 Lignite
159-163 Siltstone, light-greenish-gray
163-166 Lignite
166-170 Siltstone, dark-olive, sandy
170-177 Sandstone, light-gray, very fine grained to fine-grained
177-182 Gaystone, gray
182-186 Claystone. dark-olivc-j:ruy
186-189 Lignite
189-192 Siltstone, very dark brown
192-197 Siltstone, green, clayey
197-205 Siltstone, dark-gray
205-216 Siltstone, olive-gray
216-217 Claystone, very dark brown
217-21S Claystone, white
218-223 Claystone, very dark brown
223-225 Liirnite

225-227 Sittstone, light-olivc-gray
227-232 Gaystone, green
232-240 Sandstone, light-brownish-gray, stlty, very fine grained
240-242 Sandstone, dark-brown
242-244 Siltstone, djrk-brown

- 0-0

- 50

- 20

~"_r~ _ *._"^-m_~_- -.7 " _ ^ ^~~^-~" _" ^_."_~"-~""~' ^y^V^T'CZ

67

_ -100

350

Hole number continued

3G

Lichology

244-246 Lignite
246-247 Clay stone, dark-gray
~ 247-248 Lignite
. 248-251 Sandstone, light-gray, silty, very fine grained
251-256 Oaystone, white
256-282 Gaystone, very dark-grayish-brown
282-288 Sandstone, light-gray, fine-grained to very
~ fine-grained
_ 288-291 Oaystone, dark-brown
291-292 Claystone, green
292-300 Qaystone, olive-green
_ 300-312 Siltstone, olive-gray, sandy
312-315 Sandstone, olive-brown
315-318 Qaystone, dark-olive-gray, silty
318-321 Lignite
321-325 Siltstone, olive-gray, sandy
_ 325-328 Lignite
328-342 Sandstone, light-green, fine-grained to very fine gra'iud
__ 342-344 Qaystone, dark-brown
344-374 Sandstone, light-green, fine-grained to very finegrained
374-378 Siltstone, dark-brown
378-400 Sandstone, light-green, fine-grained to very _ fine grained
400-428 Siltstone, gray
423-464 Sandstone, light-green, fine-grained to very fine grained
464-508 Qaystone, olive-brown, silty
508-520 Sandstone, olive-green, very finegrained to fine-drained
520-600 Siltstone, dark-gray, clayey

Gamma

T.C._L- Rsnf* 100 cps

Recording speed 20 fo/mi

Logged depth ^QQ ft

Density

T.C._2 _ Range 100 cps

Recording speed 2Sl/c/m in

Logged depth ^04 f»

Depth

« o

=E5*IZZ

~-~'-~ ~" : ^^IHrj

- 500

- - 160

- 700

- - 220

- 750

Hole number 3 C

SP

Sen*, setting _2CLMV , Recording speed 20 fymin
Logged depth __ 55.9 .ft_

Resistivity
Sens, setting 50 Recording speed 2.0 ft/min Logged depth ._599_ft__

_ _:_^.~r-~~ -TrrrVy: J> 2722:

I

_j ZZZZES

Depth

-0-0

-50

- 20.'

i-ioo

L

r -

!-!50

r
;_

r

401

250

- - 80

- 300

- 100

- 350

r

r
SP

Hole number continued
3G

Resistivity
Sens, setting_2£LMV. iScns. setting_. Recording speed __2£L ft/min Recording speed.2(fc/nun Logged depth __599.ft _

J

j
1

"1

- H

i

Logged depth . . 599 ft .

f - /

^ - . ' T

.... _ ., c^r_- -..)_ 7__- -=r=;

Depth!

1-iOO ,

L450
- 140:

r

500

- 160:

-550

1-

L- -180^

r-600 ,

'-650 j
i_ -200|

i

f

L '

i-700

- - 220

1-750

70

j/t LJ iJO IV T

ND County : _^i
160ft

Hole No: _ . .IG__. __ Mnp: Fort Clark __ Date: 7-10-77 State:

Elcv.: _J1QlQ_ft_ Location: T. -li^X , R. 83..W , Sec. _!JL , Tract: . _ abbb_ Drilled depth:

Measured: _lQOjft__ KM* AMf'Sk Hole size: 4 % in. Air D Water B Cored: Yes G No Lignite beds: 3.P-MJ.OQ^102; 133-135 .._ . . .._._... .. __________ ......

Remarks:

Lithology
Recorded by: .Camara . ___ Geologist Yc« Cioophysical logs

recorded by: ..._ Lechner

Lithology

Gamma

T.C...-2_ Range _lQO_cps_
Recording speed ^Ortymin

Logged depth __16Jl£t_

Density
T.C. _2_ Range 100 cps
Recording speed 2.Q.' t/rnin
Logged depth 159 ft

Pepth

0-10 Sandstone, yellowish-brown, very fine grained to coarse-grained
10-17 Sandstone, dark-yellowish-brown, silty
17- 20 Sandbtone, olive-brown, very fine grained to fine-grained
20- 21 Claystone, orange-brown
21-25 Siltstone, dark-olive-brown
25- 26 Siltstone, olive-gray
26- 27 Lignite
27- 30 Claystone, olive-gray
30-160 No samples, lost circulation

- 0-0

- 20

hr:-V±r2rr--.:rr-r^r:<fr r b .rrirv^trrfErr^f-

71

-EOC) 60

H250
- 80

- 300

_ -100

- 350

Hole number 4 G

SP | ' Resistivity
Sens, setting _5Q_MV__ !$ ens. setting ___5P _ Recording speed _2& "/niinfRecording speed_2Dfr/min Logged depth _ .16Q ft._ Logged depth _.__.!6Q_£t_

;

- - :£^~
""7",". . " !^

Depth

8 o

o-o

r

- 100

- 40'

- 150

-ZOO' 50

- 250 !
L- -80

- 300

- 100'

- 35C

72.

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:___5JL __Map:.

Elev.: _23OQ4_ft_. Location: T. J

Measured: _168_&L_ ML. 20 ft__ FWX.

Lignite beds: .._48^55^.92,94; 123-126 .

Fort Clark ___ Date: 7-7-77 State:
N _ K

ND County:_Qliyer____ __

R._83_w . Sec. __22_. , Tract: _bbbb. _ Drilled depth: __18Qjft___ _._

Hole size: __i_3^Ja-_ Air D Water H Cored: Yes [1 No H

Remarks:

Lithology
Recorded by:

Yw Geophysical logs
.___ Geologist Jfc* recorded by: ._._Lechner_.... . _.. _

Lithology

Gamma

T.C. _2_ Range JUHLfips.

Recording speed 2£L"/min

Logged depth _18.Q.£t_

Density

T.C. _2_ Range lP.Q_cp.§.

Recording speed 20- "/min

Logged depth _180 ft

Depth

0- 5 Sand, yellowish-gray silty, limey
5- 28 Till, yellowish-gray, pebbly, limey
28- 36 Siltstone, gray, sandy, limey
36- 38 Qaystone, gray, silty, limey
38- 40 Sandstone, green, silty, limey
40- 43 Qaystone, gray, silty, limey
43- 46 Claystone, brown, silty, limey
46- 55 Lignite, black
55- 57 Qaystone, gray, silty
57- 58 Lignite, black
58- 64 Qaystone, gray, silty
64- 67 Siltstone, green, sandy
67- 70 Li-nite, black
70- 73 Qaystone, gray, silty
73- 75 Sandstone, green, silty, limey
75-78 Siltstone, green, sandy
78- 89 Qaystone, gray, silty, limey
89- 91 Lignite, black
91-115 Qaystone, gray, silty
115-117 Siltstone, green, sandy
117-124 Claystone, green, silty
124-128 Lignite, black
128-138 Qaystone, gray, silty, limey
138-144 Qaystone, brown, silty
144-157 Sandstone, gray, silty, limey
157-160 Qaystone, gray, silty
160-168 Sandstone, greenish-gray, silty, limey 168-173 Limestone, gray
173-180 Qaystone, green, silty

- 0-0

-20

^±Z^_..-Jl_I_^'l -200~ 60

250

r -so

-300

_ -100

-350

73

Hole number 5 G

SP Resistivity Sens, setting - -50 M\L_ Sens, setting 50___ Recording speed_2Q- "/min Recording speed 2.Q.ft/m in Logged depth .... .18.0 ft._ Logged depth __18Q ft...__

1
_!

- .-."- : 'ci_j?==

Depth

<-» c
flj «-

£ 2

- 0-0

50

r -20

I 00

- 40'

r-150

r

r

- 250 '
'- -80

- 300

_ -iOO

-35C

-7A

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: __ 6.G __ Mnp: Fort Clark ____ Date :._7i§:_7Z__ State: ND County: __ Oliver ____ _ Elcv.: _2,OJlft_ Location: T. Hi £ , R. 83_w , Sec. __20_. , Tract: ..__ cbbb_ Drilled depth: _220.ft __ _ ._

Measured: ^MJ^SL*, _3.6_&_ FWL. Hole size: 4 % in. __ Air D Water H Cored: Yes D No

Lignite beds: 67-72: 99-106: 110-112; 127-129; 157-159; 1?4:1_96_ ._ .... ____ ____ ._.

Remarks:

Lithology
Recorded by:_Ran.dall Esichert_. Geologist prac

Geophysical logs
recorded by: ..._ Lechner

Lithology

Gamma

T.C. _2_ Range _lQQ_cps_

Recording speed 2H'Vmin

Logged depth 220 ft

Density

T.C. _?_ Range !QO_£ES

Recording speed 2.Q"/min

Logged depth 214 ft

Depth

u,

0-10 Sand, yellow, fine-grained to medium-grained, pebbly
10- 47 Till, yellow, pebbly

47- 57 Clays tone, yellow, silty, limey

57- 67 Sandstone, gray, silty, limey

67- 72 Lignite, black

72- 88 Gaystone, gray, silty

~ 88- 93 Claystone, gray, silty, limey

~ 93- 95 Limestone, gray
_ 95-97 SHtstone, gray, clayey, limey
97-108 Lignite, black
108-113 Claystone, olive, silty
_ 113-115 Lignite, black
115-117 Siltstone, olive, clayey
117-130 Sandstone, gray, silty
130-132 Sandstone, gray, silty, limey
132-134 Lignite, black
__ 134-137 Siltstone, gray, sandy
137-140 Claystone, green, silty
140-153 Claystone, gray, silty, limey
153-156 Limestone, gray
156-159 Claystune, gray, silty
_ 159-160 Lignite, black
160-186 Claystone, gray, silty
~ 186-187 Limestone, gray
_ 187-196 Gaystone, gray, silty, limey
196-197 Lignite, black
197-202 Claystone, gray, silty
202-207 Qaystone, green, silty, limey
~~ 207-215 Gaystone, brown, silty
_ 215-220 Sandstone, green, sil ty

- 0-0

-20

" "" -- ^^ ^- . . -

'"~"~'_~ " ~^~7",'7~^'^"7'L~'-^"^"J"r '"-'TVT-'^' .'_!_-' ^~,f"~T^21

- 250

- 80

-300

- 100

Hole number 6 G

SP Resistivity
Sens, setting _.20MV Sens, setting _5Q.__ Recording speed ?,0 fo/min Recording speed .2£lft/m in Logged depth _

Depth

J

_.

i

-J

Logged depth _^.2p-.^_

- 0 t-
h

-20:

-40!

1-150

- 200-60

-so

,-300

._ -100

u.

- 330

"76

DAKOTA GEOLOGICAL SURVEY

Hole No:__7jCL Mnn: Stanton

I . . Date:._ZrIiILState: ND County:__^Mercer
Elev.:-JU9-45.it_Location: T.-144&, R.8.5_w , Sec.. _2_0_._, Tract: .._aaad_ Drilled depth: __22?/I_ Measured: _4i8_£t_ jffix. _3.2.ft_^ML. Hole size: _ 4 %,"k. Air [j Water H Cored: Yes D Lignite beds: ..-i68Jji_L L7 6-180 _ _._ .... ._.. .. _..._.. . ... _____. _.__

No

Remarks:

Lithology
Recorded by: __MicliaeLCaniar.a_ _ , . Yes Gcologistxso

Geophysical logs

recorded by: .._ Lechner

Lithology

T.C..

Gamma

2__ Range _100_ces

Recording speed 20. "/min

Logged depth _20Q_ft.._

Density

T.C. _^_ Range

Recording speed 2H'Vrnin

Logged depth _20?JL_

Depth

0- 6 Sand, yellowish-brown, fine-grained
6- 21 Till, dark-yellowish-brown, sandy

21-30 Till, dark-olive-brown, sandy, lignitic

30- 63 Till, very dark gray, sandy, lignitic

63- 70 Till, very dark gray, sandy, lignitic; lenses of coarse gravel
70- 81 Gravel, dark-gray, coarse, sandy

81-84 Lignite
"" 84- 95 Sandstone, gray, very fine grained
_ 95-105 Siltstone, gray
105-108 Claystone, gray
~ 108-115 Siltstone, dark-olive-green
_ 115-124 Siltstone, dark-gray
124-132 Sandstone, olive-gray, very fine grained to fine-grained
_ 132-140 Siltstone, dark-gray
140-156 Sandstone, gray, silty, very fine grained

156-162 Sandstone, gray, very fine grained

162-165 Siltstone, gray
~~ 165-167 Sandstone, gray, very fine grained
_ 167-170 Lignite
170-174 Claystone, olive-gray
174-1 SI Lignite
181-191 Siltstone, olive, clayey
~~ 191-200 Siltstone, olive-gray

_____._^_^ _0 -0

^^=-::-^=^~_ -^^== -100

^ ___ . _ / Q ' ____.____

-50

-20

40

- 150

-20CT60

-250
i
- - 80

-300

_ -100

-350

77

Hole number 7

SP

Sens, setting __20_My Recording speed ._2£L ^ Logged depth _20.CL£t-

Resistivity
Sens, setting -50_____ Recording speed-2jQ.fr/min Logged depth ... 2flO ft.._

Depth

-» o

s s

J

\

r-0-0

Lh°
r -20

^-100
L

- 40

r-i50

200-60

-250 :
i i
L -80'

-300

- 100:

-350

73

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__ .8jG____ Map; Stanton_____ Date: __Zr 2_Q:_7Z_State: _ND County: Mercer Elcv.: _.l,91Lft_.. Location: T. 144.*, R 8£-W, Sec. 1.8 _ , Tract: ._._«« ... Drilled depth: ___20Q_fj:_...... Measured: _5JJi.__ FS?. J53jt_ F\YX, Hole size: 4 % in. Air D Water H Cored: Yes Q No | Lignite beds: .-34-3203=78; 125-132; J.50-J54 . .._.. ...._..._ . .. ____.____... ..

Remarks:
Lithology
Recorded by:

C.eophysica
Geologist HOC recorded by: ___ Lechner

Lithology

Gamma

T.C._2_ Range 10P_cp.s_
Recording speed ZQWmi
Logged depth __

Density
T.C. 2 Range .LQO^p.s.
Recording speed ICL'Vmin
Logged depth _200__ft__

Depth

No samples -0-0

- 20

12.0 er=--l~-"l'--'.-L~'..'-'---T~

?£==, 1*0 ~

-^^="~-

250
f~ -80

-300

_ -100

79

1-350

Hole number g G

SP

Sens, setting.

Resistivity
..2.0 M.V__ Sens, setting __.50._.._
Recording speed J2Q.fymin(Recording speed2Q.rt/min i Logged depth ._ .200.ft_ JLogged depth J200.£n._

ii

J

Depth

-4 O

Si 5

- o-o

r50

- 20'

HQO

- 40

r-!50

-200"60

- 250 I
i- -8o'

-300

- ICO

80

n v/ixi n L//MVW i /v s U ft V

Hole No: __ 9
Elcv.:._-2,g_65_ft

Measured: _78 ft

Mnp: Hannover NW Date: 7-12-77 State: ND County: Oliver .._.. _ Location: T.l41_s[, R.85_w . Sec. __11. , Tract: .baaa. _ Drilled depth: _220 £t_ __ _

-tSL&i&SJL FWL, Hole
Lignite beds: .J13M4Q; 164-173; 208-217.

sze: 4 % in. Air D Water [X] Cored: Yes D No

Remarks:

Lithology
Recorded by: Randall Reichert . . Yen

.___ Geologist 3D»

Geophysical logs
recorded by: ....._

Lithology

Gamma

T.C..-1_ Range .J,P.O_£ps
Recording speed ZQ'V

Logged depth ...22Qit

Density

T.C. _2_ Range J,QO_cps
Recording speed 2.Q'r/min

Logged depth 220ft

Depth
wk4
4-. O

0- 10 Sand, yellow, pebbly

10-15 Till, yellow, pebbly
15- 16 Lignite, black
"~ 16-23 Siltstone, white, clayey
_ 23- 32 Claystone, green, silty
32- 35 Gaystone, orange, silty
35-37 Claystone, olive, silty
__ 37- 40 Claystone, gray
40- 45 Claystone, dark-gray
_ 45-50 Siltstone, gray, clayey
50- 77 Sandstone, gray, silty, fine-grained to medium-grained
77- 78 Sandstone, white, limey
~ 78- 95 Sandstone, gray-green, silty
95-108 Claystone, gray
108-112 Siltstone, pray, clayey, sandy
112-132 Claystone, gray, silty

- 132-133 Claystone, brown, sitty
_ 133-139 Claystone, gray, sitty
139-142 Lignite, black
_ 142-167 Claystone, gray, silty

- 167-172 Lignite

~ 172-177 Claystone, yellowish-gray, silty
_ 177-180 Claystone, gray
180-184 Sandstone, gray, silty, fine-grained
- 184-202 Siltstone, gray, silty

~ 202-211 Claystone, gray, silty

- 211-217 Lignite, black
__ 217-220 Gaystone, gray, silty

- 0-0

- 300

_ -IOO

-350

SP

Sens, setting 1Q.MV
Recording speed 20 fr
Logged depth __22(L£t._

Hole number 9

Resistivity

o . 7

Sens, setting

1

1

Recording speed 20.it/min
Logged depth _22_0 ft ..

Depth

4_> O

o ^

(-0-0

r50 i

r -20:

i-100

- 40'

150

- 200-60

,-250 I
I- -80

i -300

-3 50

82

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__11LG_.__Mnp: Hannover NW Date: 7-12-77 State: _Jffi__County: Oliver ....__ Elev.: _2>03Q__. Location: T. 142.$, R.-84.W, Sec. __18., Tract:..cddc___ Drilled depth: 180ft Measured: 24ft gf. 2J9LfiRfc Hole size: 4 % in. Air D Water H Cored: Yes Q No

Lignite beds:

Remarks:

Lithology
Recorded by: Randall Reichert

Geophysical logs
___ Geologist sx recorded by: . ~_ Lechner

Lithology

T.C.

Gamma

-2_ Range 100 cps
Recording speed 20"/min
Logged depth _lHft__

Density
T.C. _2_ Range lQQ_crjs
Recording speed 2Q_' c/ min
Logged depth 174 ft_

Depth

~ 0- 5 Sand, yellow, fine-grained to coarse-grained, _ pebbly
5- 10 Till, yellow, pebbly
10-12 Gravel, yellow, fine-grained to coarse-grained
12- 15 Sand, yellow, fine-grained to medium-grained,
~~ silty
_ 15-30 Gravel, yellowish-gray, medium-grained to
coarse-grained
30- 40 Gravel, gray, sandy, fine-grained to coarse-grainec 40- 46 Sand, gray, pebbly
"~ 46-115 Sand, gray, silty

~ 115-138 Gravel, gray, finegrained to coarse-grained

~ 138-141 Lignite, black
"" 141-180 Sandstone, gray, fine-grained to coarse-grained,
pebbly

.. -==:-0-0

h-50

- 20

250

r -so

-300

- - 100

-350
83

Hole number 10 G

SP

Sens, setting _2tt

Resistivity
Sens, setting 5Q_
Recording speed 2Q ft/ miniRecording speed_.2Cft/min Logged depth ___ _J74.ft.._ Logged depth -_.lZ4.ft..___

- - -_ .~-.T.r II

1

Depth

- 0-0

- 50

-20i

L

hi 00
L

- 40

1-150

-200-60

.-250
1- -80

1-300

-!00

- 350

84

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:

Elcv.:._2,01

11 Map: __Hiyinpver_NE__ oate: _T^]1__ State: ND County:__Oliver
tX_Location: T. ill. x, R..M.W. Sec. __21, Tract:.._daaa _ Drilled depth: __160jt__ _._ Measured:^JjOjt- FS1L, ^.O.ft__ ^ Hole size: __lI4kL_ Air D Water H Cored: Yes D No [X] Lignite beds:. J?7-34i.70-.72; 95-97; 12_8-131

Remarks:

Lithology
Recorded by- Michael Camara Ye: Geophysical logs

._ _ ..___ Geologist MJC recorded by: ___ .Leclinex.... .._.._...

Lithology

Gamma

T.C._2_. Range _IQQ

Recording speed 20.'Vmin

Logged depth _JL60_ft__

T.C.

Density

2 Range i_QP_£E!

Recording speed 2Q."/min

Logged depth 160 ft

Depth

_ 0-10 Silt, olive-brown, sandy

10-12 Silt, olive-brown, pebbly, sandy
12-17 Siltstone, olive-brown
~" 17-22. Sandstone, dark-olive-brown, fine-grained
_ 22- 27 Claystonc, dark-brown
27- 33 Lignite
33-41 Day stone, dark-gray, silt y
_ 41- 42 Lignite
42-51 Siltstone, dark-gray, clayey
_ 51-71 Sandstone, light-gray, fine-grained to very fine
grained
71-73 Lignite
73- 76 Claystone, dark-gray, silty
~~ 76- 85 Sandstone, light-gray, fine-grained to very fine
grained
__ 85- 90 Sandstone, green, silty
90- 93 Siltstone, green, clayey
93- 97 Claystone, olive-gray
_ 97- 98 Lignite
98-100 Siltbtone, dark-green, clayey
_ 100-107 Claystone, dark-gray
107-113 Siltstone, dark-gray
~~ 113-114 Sandstone, light-gray, fine-grained to very fine
_ grained
114-129 Siltstone, dark-gray
129-131 Chystone, dark-brown
131-134 Lignite
134-138 Siltstone, olive-gray
_ 138-140 Lignite
140-146 Sandstone, dark-olive-brown
146-149 Sandstone, gray, silty
_ 149-156 Siltstone, gray
156-160 Siltstone, gray, sandy

.- -0 -0

-20

85

- 250

~ -80

-300

_ -100

Hole number 11 G

SP

.«._.. _

Resistivity
V_ Sens, setting 50

£ ' £

* c/min Recording speed2Q."/min

b

* ^*W«*fc«# fc * » Ate T
ens. setting 5Q_

Recording speed ?-fl "/min Recording speed 2.Q. &/' Logged depth . JL6Q fc..._ Logged depth -_1.4n

JL/wOUil

1.4P ft _ £

<u

ho-o

- 20:

- 100

- 150

-200"60

r250

i
- 300

_ -100

- 350

86

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__12 G.__ Map:_^ Fort.Clark_____ Date: 7-8-7 L_ State: __ND___ County:__.Oliver ._..._. Elcv.:-_U937_ft_. Location: T.lilsc, R.83_w , Sec. __1Q._, Tract:. __ahcb _ Drilled depth: _J40_ft__....._
ITWf FEL _ _

Measured: ^ijfL-KSl^^SOjt^ML. Hole size: 4 3A in. Air M Water [Xj Cored: Yes G No £ Lignite beds:. .. ..-.. .-

Remarks:

Lichoiogy
Recorded by: Randall Reichert________.

Cioophysica! logs
._.__ Geologist ?« recorded by: .__ Lechner

Lithology

Gamma

T.C. _2_ Range lQ.Q_cps
Recording speed
Logged depth _ I40.

Density
T.C. A .^* _2_ a Range rvdiigc .LQOcgs. .i_v.^_i: D
Recording speed 2Q.* t/min
Logged depth 140 ft _

:pth

(X,

<L> M
o

2

0-12 Sand, yellow, fine-grained to coarse-grained, pebbly, silty
12-17 Till, yellow, pebbly
17- 30 Sand, yellow, fine-grained to medium-grained, siity
30- 37 Gravel, yellow, fine-grained to coarse-grained 37- 40 Sand, yellow, fine-grained to coarse-grained, pebbly
40- 61 Gaystone, green, silty

61-62 Lninite, black
62- 83 Gaystone, olive, silty, limey

83- 90 Gaystone, green, sitly
90-140 No samples

- 0-0

. "^».,. ' ' "L-i
. . ^^^ ___.^mJ^ - - - "^
"-_ «I. ^<^ . " ^. ^|

-_- _ nzj r__^i____..._!.

IJT:£-_- «»»- ---^r.-^\ p£^i:_:._. :_.j:..._. .^c.^z^
- 50

- 20

~: - V "^ ' ^

- 100

.. - .-V

- f^r^HHso

- 40

-250

~ -80

-300

- 100

-350
87

Hole number 12 G

.. ._ T..
SP
Sens, setting -._ . -5_Q MY. _ Recording speed 20
Logged depth _. 140. ft._

Resistivity
Sens, setting -pP______ fr/min Recording speed,2Qfr/min Logged depth ... 14Q.ft_

j

H __i

i
1

w~_r_!- ri "_rT,"!, _, ^. j^_» _ t. r T _,, _j»-^ *. _.* I^T-._TTV

Depth

*^ o
CJ **

- 0-0

- 50

-20'

HOO

L

150

-200-60

r

- 250 j
*- -80-

,-300

L -ice

88

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: __ ..ia_Q_._. __ Map:_HimnovejJiE __ Date: 7-22-77 State: ND County: Oliver. Elcv.:.- lAQOJft Location: T.143.&, R.84_w, Sec. __?_._.., Tract: _Jddd_ Drilled depth: __ <? Measured: 150 ft ??£ 150_ft__ gift, Hole size: 4 % in. Air [X] Water D Cored: Yes Q No Lignite beds: . . - - - ...._. _.-.__......_ . .. . :: __ ... .

Rcm.irks:
Lithoiogy
Recorded by: -

Ye, tJcophysical lop
Geologist NO recorded by: ._ Lcchner

Lithology

Gamma

T.C..JL. Range 100 cps
Recording speed 2.0.
Logged depth _6Qj-t

Density
T.C. _3_ Range SOO^.
Recording speed -2D"/rnin
Logged depth 60 ft

Depth

u, CJ

21

No samples -0-0

- 50

- 20

- 100

-40

H50

-EOS60

250
- 80

-300

_ -lOO

Hole number 13 G

SP

Sens, setting . -2Q.MV_ Recording speed _20 ft/rnir Logged depth ._. .60 .ft .._

Resistivity
Sens, setting -0 [Recording speed20_wmin Logged depth .6.0 ft.__

1

H

-i

1

_i

j

H

i
1
J

Depth

- 0-0

H-50

L
i-

-20

MOO
L

L

r -40'

r-iso ;

-200-60

p250 !
- - SO1

_ -100.

- 350

90

NORTH DAKOTA GEOLOGICAL SURVEY

Hole Nn: 14 G Mnp: Hannover NW Date:_J>12-_77_ State: ND. County :_Oliver_____ Elcv.: .. 2,lQ5jt___ Location: T.llsL*, R. 85_w, Sec. __!i_, Tract: ._c<*Ad__ Drilled depth: __260_fL...... _... Measured: _54Jk__ flS ^.6JL6ftFWL, Hnlc sizcr 4 3/4 in._ Air D Water B Cored: Yes G No Q Lignite beds: ._163zl6I; 172-174; 176-184 L 227-234 . . ...___......_.... _ _________ . ..._

Remarks:

Litliology
Recorded by: Ran<ialLRekherL

Geophysical logs
.___ Geologist NW recorded by: ___Lecjiner

Lithology

Gamma

T.C._2_ Range 100 cps_

Recording speed 20"/min

Logged depth ___260JL

Density

T.C. _1_ Range iP-jc

Recording speed -2jQ'Vmin

Logged depth _260 ft

tr*w L ._

Depth

0- 20 Sand, yellowish-gray, fine-grained to medium- grained, pebbly

20- 38 No samples

38- 40 Sand, white, silty, pebbly, fine-grained to medium-grained
40- 45 No samples
45- 50 Sand, white, silty, pebbly, fine-grained
50- 65 Sandstone, yellow, silty, fine-grained
65- 75 No samples

75- 83 Sandstone, yellow, silty, fine-grained

83- 85 Sandstone, gray, limey, fine-grained to medium- grained
85- 92 Sandstone, yellow, silty, fine-grained to medium- grained
92-100 Sandstone, gray, fine-grained
100-103 No samples
] 0 3-105 Sandstone, gray, limey
105-110 Claystone, gray, silty
110-131 Siltstone, gray, sandy
131-151 Sandstone, gray, silty

151-164 Sandstone, white, silty

164-170 Lignite, black

170-175 Claystone, gray, sandy, silty
175-176 Lignite, black
176-178 Sandstone, gray, silty
178-187 Lignite, black
187-193 Claystone, gray, sandy, silty
193-204 Siltstone, gray, sandy
204-217 Claystone, gray, silty
217-232 Siltstone, gray, clayey, sandy

"~ 232-236 Lignite, black
_ 236-252 Claystone, olive, silty

~ 252-260 Siltstone, olive, sandy

- O-O

- 20

^t rt'^-.tT'JJ"jfr~ : ^"~l vIJ 1~7Z~"" "~ ". * ~~.'~T ~.~~ -/-^T.^Z r_^_^ t^C?".

|~~i* '^^-"^/^^^."^.T, " '~.j

p-^rur-^..-.;.. ^.-^i-|

~~: ~f ' i: "nz 2.^0 !c~.i.mtrrr^:rrm: "v"r"

- 300

- - 100

-350

91

Hole number 14 G

SP

Sens, setting .. ..20 MV_ Recording speed J2SL &/ mi Logged depth _. 260. ft__

min Rec

Resistivity
Sens, setting
ording speed-2Qfr/min Logged depth _2&0.&.

^" ' L!T*-i**'ii*-' ""*""" "1_T -

J
i
I
1
- i

-i

Depth

M O

- 0-0

-50

MOO I

L i

r -40!

[-150

r
u

."-250 i i
!- -80'

L_

1-300

^350

92

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__._L5_G- __Map:, Hannover N£__ Date:._Z-.2.1r77_State: __ND__County:_ Elev.:-2O5QJEt_-. Location: T.143.S, R&4.-W, Scc._2_Q_., Tract: .__b.cac .. Drilled depth: _J80jt___ __ Measured: L8Q.Q. ft_ &L, _S65 It. Fwl Hole size: 4 34.in^_ Air [E Water Q Cored: Yes G No H Lignite beds: .Jl55=lfi2l 116-180; 182-188;.244-248

Remarks:

Lithology
Recorded by:

Cifophysical logs
Geologist NO" re-corded by: .Lecliner... . . ._.

Lithology

Gamma

T.C..-2_ Range lQQ.cps_
Recording speed jiP'
Logged depth __280_ft

Density
T.C. ^_ Range 100_cjps_ Depth
Recording speed
Logged depth 280 ft

No samples -0-0

-z-Jt-rr.:^ ^_t-'T.:I .-rrr'.rr. f;-,-
^1 ----- ^r-r:-."^^^^:

- <H~^ ^^^'^^l^

hso
-20

h!00

-40

r-150

- 200"60

zXo _-"

:^-6-

250
-80

- -300

_ -100

93

Hole number 15 G

SP Resistivity
Sens, setting _ _5.Q.MV__ Sens, setting .50___ Recording speed _2Q &/ m in Recording speed 20. ft/ Logged depth _ ..280 £r

. m n

Logged depth _.2.8Q..tt._

I

i

-I

f ... . . __ . ._ ^X____ m,. n. .___ - »i . . ii i ... , - -. ...-.-..»<

Depth

I

hO-0

-20

100

-40

:50

- - 80'

.^-300

-ICO,

-350

94

Hole No:__ .X6_C

NORTH DAKOTA GEOLOGICAL SURVEY

Fort Cjark _ Date: ..Zl^lZZ_ State: __. _[01iver.County:.
Elcv.:_-2,0^i£t_.. Location: T.iils, R.83_w. Sec. __2_P__, Tract: aaaa_ __ Drilled depth: __2_2?lL._....

Measured: 7.6Jt__ RSix _2P_.£t_ K^c Hole size: ___4J£.'«? _._ Air C]

Lignite beds: .6.

Water [X] Cored: Yes D No H

Rernr.rks:

Lithology
Recorded by: _MicJiaeLCamara.

Geophysical logs
Geologist swc recorded by: .__Lcchner_

Lithology

Gamma

T.C._2_ Range _LQQ_cgs_

Recording speed 20.'t/rnin

Logged depth __200. Jl_

Density

T.C. 2__ Range

Recording speed 20.it/min

Logged depth 200ft

Depth

II

0- 5 Silt, light-yellowish-brown, sandy, pebbly
5- 12 Till, dark-yellowish-brown, sandy
12- 16 Till, olive-brown, sandy
16- 29 Till, olive-brown, sandy, lignitic
29- 54 Till, dark-gray, sandy, shaley

~ 54- 69 Gay stone, dark-gray, limey

- 69- 74 Lignite

- 74- 78 Claystone, light-gray
_ 78- SO Sandstone, light-gray finegrained to very
fine grained
- 80- 83 Ctaystone, dark-brown
_ 83- 86 Sandstone, light-gray, fine-grained to very fine
grained
- 86- 88 Siltstone gray, clayey, limey
_ 88- 90 Sandstone, light-gray, fine-grained to very fine
grained
- 90- 93 Siltstone, gray, clayey
_ 93- 97 Oaystonc, gray
97-104 Sandstone, light-gray
_ 104-105 Limestone, light-gray
105-113 Siltstone, light-gray, clayey, limey
- 113-114 Lignite
114-115 Claystone, dark-brown
~ 115-120 Sandstone, light-gray, fine.grained to very
_ fine grained
120-127 SiUstone, dark-gray, limey
- 127-134 Cluystone, gray
_ 134-135 Sandstone, light-gray, fine-grained to very fine
grained
- 135-139 Claystone, dark-gray
139-141 Siltstone, dark-olive-gray, sandy
~ 141 -14 3 Sil tstone, dark-olive-brovvn
._ 143-145 Lignite
145-150 Siltstone, dark-olive-gray, limey
- 150-154 Siltstone, olive-gray, sandy
154-157 Claystone, light-gray
157-160 Claystone, dark-brown
- 160-177 SiUstone, light-gray, Hayey
177-178 Sandstone, lidu-gray, fine.grained to very finr ~ grained
178-1R5 Claystonc, light-gray, silty
1S5-2M Claystonc, li-lil-gray
- 214-2 15 SnuKtotie, light-gray, lltio-graitied to very fine
grained
215-220 Claystonc, dark-gray

- o-o

^-50

- 20

^ "JT^TTTJL ' *-C.' ~^",~~.~~' ----- - _- - - -- ^- ^.- ,.

^,_. . j^ ._ ~"" " . ~, "T r ~n j ^~*nT '~*

_ -iOO

95

Hole number 16 G

SP Resistivity Depth i
Sens, setting . -2.Q MY_. Sons, setting __.->9___ , I Recording speed JZHwmin Recording speed .2^ ^/min % £ j Logged depth _.. 230. ft._ Logged depth ._20Q_ft.......

J
i 4

f-o-o !

i-
F

L

r
- 100

- 40

-ZOO"60

- 250 :
- -80'

r-300

96

Hole No:__17_G_.._ __Map:_ZpJ3_Clark____- Date:.

Elev.: _.2,18Q_ft_. Location: T. .143.& , R._8.3_w , Sec. ...20_., Tract:. .dddd __ Drilled depth: _32Q_fj; Measured: ___5_Qlt_ rsf, ^P ft__ RWK Hole size: __4_3/Liru_ Air [j

Lignite beds: ._J-9M27j 217-223; 226-228-243-245; 277-279; 301-304

ate: ___fcUD__County:__.Dlkcx ...._

d_._ Drilled depth: _.320_k_ . ....._

Water C3 Cored: Yes [j No Q

Remarks:

Lithology
Recorded by: -Mch.aeJL.Camsra. Y09

Geophysical logs

- - . _ Geologist:*** recorded by: ...___Lechner ....

Lithology

Gamma

T.C. ._2__ Range lPO_cp_s_

Recording speed21L* t/min

Logged depth _31 6.ft__

Density

T.C. _2_ Range 10Q_c_p_s_

Recording speed 2Q.*Vmin

Logged depth __314_ft__

Depth

0- 7 Till, olive-brown, sandy, lignitic
7- 8 Till, dark-yelknv-brown, silty
8- 11 Cliiystonc, olive-brown
11-12 Lignite
12- 15 Claystone, olive-brown
15- 18 Siltstone, olive-brown
18- 19 Sandstone, olive-brown, fine-grained 19-21 Claystone, orange-brown
21- 25 Claystone, olive-brown
25- 28 Sandstone, olive-brown
28- 30 Claystone, olive-brown
39- 35 Claystone, olive-gray
35- 37 Claystone, brisht-orangish-brown
37- 40 Claystone, dark-gray
40- 41 Claystone, olive-brown
41-46 Lignite
46- 55 Claystone, olive-gray; poor samples
55- 57 Cby^tone, brownish-gray, limey
57- 60 Siltstone, green, clayey
60- 62 Sandstone, olive-brown, silty
62- 70 Siltstone, green, clayey
70- 72 Sandstone, olive-brown, medium-grained to fine-grained
72- 76 Sandstone, olive-gray, medium-grained to fine-grained
76- 80 Siitstone, lisht-gray
80- 83 Siltstone, preen, clayey
83- 87 Lignite
87- 90 Siltstone, green, clayey
90-100 No samples
100-113 Siltstone, light-green, clayey
113-119 Claystone, light-olive-brown
119-120 Claystone, dark-brown
120-124 C'laystone, dark-olive-gray
124-127 Cljystoue, brown
127-133 Cliystone, olive-jray
133-154 Siltslonc, olive-^ray, clayey, limey 154-155 Siltstone, dark-gray, sandy
155-157 Sandstone, dark-gray, siity
157-358 Sandstone, white, fine-grained to very fine grained
158-162 Sandstone, light-gray, fine-grauied 162-180 Claystone, gray ~
ISO-190 SandNtonc. li«;ht-gray, very finegrained to tinc-gj-jined
190-19 1 Sandstone, liglit-^ray, silty
191-196 Lignite
l'J6-2Ui) Cb>stone, dark-brown
200-202 Cl.-iysronc, li»lil-ray
2()2-203 Sandstone, light-gray, silty
203-216 Siltstone, dark-gray, limc\
216-222 Lignite
222-225 CLiysione, olive-gray, si!t\
225-231 Silts'.nne, olivc-cray, clayey, limey 231-24! Sandstone, light-gray
241-242 Claystone. light-urav
242-243 Lifiiiilo
243-2^5 Cljystoue, olivo-gray
245-253 SiltMonc, light-yray

-0-0

-20

r~ r~.irr.".' ' i ~. crirr. ~i 1 --

~^^: 160 \,

_^ r ~ _~ ~ T " r * ~^ r ^"_n_j^~^

h"TUT*;.._.""*!' ~^T^ .~-*^^"""J / 3 O * __

97

Hole number continued

Lithology

261-265 Cluystone, light-gray
7.65-271 Sandstone, light-gray
271-274 Sihstone, light-gray
274-276 Ciaystone, very light gray
276-277 Lignite
277-286 Ciaystone, gray
286-292 Sandstone, light-gray, very fine grained to fine- grained
292-305 Siltstone, olive-gray, limey
305-307 Lignite
307-310 Ciaystone, olivc-eray, silty, limey
310-320 No samples

Gamma

T.C. Range-

Recording speed.

Logged depth _

Density

___Ra; o

Recording speed _"/min

Logged depth

Depth

[-120

h400

M O

450
- 140

500

- 160

1-550

- 180

600

- 650 -200

700

- 220

r-750

98

SP
Sens, setting 50_MV
Recording speed _2d ft/mi Logged depth -316 ft__

Hole number 17 G

Resistivity
Sens, setting 50... Recording speed 2Qfym in Logged depth ..3.16: ft ..._

- I
J

-i
;

I

- -" < " "^ * -"---

Depth

fcrf O
<u *-

-0-0

-50

- 20

MOO

-40

,-150

-ZOO"60

r250 I
- - 60

-350

h

99

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_.J.&.G__. __Mnp:_Fo_rt.Clar]c_____._Date:._Z-Zi?I__State: ND County: Oliver _ Elcv.: _2,030__fc...... Location: T. _H3* , R. 83._w , Sec. _.22_., Tract:. _bccc._ Drilled depth: ___22_0lt___

FNL Measured: 2*315JL KSK. 264.1$- FWL, Hole size:
Lignite beds: ._8-10L9£,lQ2; 131,134 . .._

4 K in. Air U Water Cored: Yes D No

Remarks:

Lithology
Recorded by: -Michael.Camara

Geophysical logs
.._ Geologist**" recorded by: .. -_L?fnner_.

Lithology

Gamma

T.C. J2_ Range

Recording speed 20.'Vmin

Logged depth 220 ft._

Density

T.C. JL. Range 1PJL2I

Recording speed 2Q_rt/r

Logged depth _220 ft

Depth
c/i

S 1
£ 2

0- 4 Sand, dark-yellowish-brown, silty, pebbly 4- 5 Sand, dark-yellowish-brown, pebbly, lignitic 5- 8 Sand, dark-brown, silty, pebbly
8- 10 Sand, yellowish-brown, pebbly
10- 19 Till, yellowish-brown, sandy
19- 24 Till, dark-ycllowish-brown, sandy
24- 30 Till, olive-brown, sandy, pebbly
30- 33 Gravel, dark-yellowish-brown, sandy, lignitic 33- 44 Till, olive-brown, sandy
44- 50 Till, dark-gray, pebbly
50- 52 Gravel, dark-pray, sandy, lignitic
52- 58 Till, dark-olive-brown, lignitic
58- 63 Till, dark-olive-brown, pebbly, very lignitic 63- 70 Till, dark-olive-brown, silty, lignitic
70- 79 Siltstone, light-gray, limey
79- 83 Sandstone, light-gray, fine-grained
83- 89 Claystone, light-gray, limey
89- 93 Sandstone, light-gray, fine-grained
93- 98 Claystone, light-gray, limey
98-102 Gaystone, dark-olive-brown
102-103 Lignite
103-119 Claystone, dark-olive-brown
119-123 Siltstone, dark-olive-brown, clayey, limey 123-127 Sandstone, light-olive-gray, fine-grained 127-129 Claystone Ii{iht-j;reen
129-136 Lignite
136-140 Sandstone, light-gray, very fine grained 140-147 Ciaystone, olive-brown
147-J50 Cluystone, dark-brown
150-156 Sandstone, light-gray, very fine grained 156-160 Siltstone, olive-brown
160-172 Sandstone, lis;lu-gray, very fine grained 172-174 Claystone, green
174-] 84 Sandstone, light-gray, very fine grained 184-205 Claystone, gray
205-207 Lignite
207-213 Siltstone, very light gray
213-216 Lignite
216-220 Claystone, dark-green

- - - - - 20 ---

lE-frf {-JI>i-;r:_ TT r~-tzr^^=rrjr:rr-|ri-7 :r^r.

r250
i
- - 80

-300

_ -lOO

100

Hole number 18 G

SP
Sens, setting . -5QM_y__
Recording speed _2Q. fymin
Logged depth 220. ft.._

H;
~i

1

j

-I

r...

Resistivity
Sens, setting _50____
Recording speed 2Q_^/m in
Logged depth .120 ft__

^^V__rL:q

-... ++.. V--,:;-::^;
'^^j?^'

";; ^_...._.._-z^

Depth

- 0-0

-50

-zo;

[-100

-

-40'

- 200
L

r60

r 250 |
- - 60

J -300

-

- 100'

- 33C

101

Hole No:_ 12_G._ . __ Map:_llinn.oy_cr N t_ ._ Date: J^QiLL. State: _ i__ County :_Q]iver Elcv.:_2,Q2Q.ft__. Location: T. JL41s , R.«4 w , Sec. .22..., Tract: ...aaaa .._ Drilled depth: __.180JL..... Measured: 245.ft.._ JcsS. .S0/t__l»*. Hole size: 4 %J£-_ Air D Water [Xj Cored: Yes [j No Lignite beds: JL24JL2&. 164-166 .

Remarks:

Ltthology
Recorded by: -Randall Reichcrt

lo
. . Geologist3K* recorded by: . __.

Litholog)'

Gamma

T.C...Z-. Range _10.Q.cp.s_
Recording speed20_"/min

Logged depth _JL28_£t__

Density

T.C. -1_ Range JLOCLcgs.
Recording speed ?5- *V min
Logged depth 178 ft

Depth

u O

II

- 0-12 Sand, yellowish-gray, fine-grained to medium-
grained, pebbly
~ 12-18 Gravel, yellow, fine-grained to coarse-grained,
_ sandy
18- 36 Till, yellow, pebbly
- 36- 37 Lignite, black
37- 46 Claystone, gray, silly, limey
~ 46- 50 Siltstone, gray, clayey
- 50- 57 No samples
57- 60 Lignite, black
- 60- 68 Clnystone, gray, silty
68- 76 Qaystone, olive, silty
~ 76- 77 Lignite, black
_ 77- 80 Chystone, olive, silly
80-100 No samples

- 100-124 No samples

124-127 Lignite, black
127-160 No sample's

- 0-0

- 50

-20

100

-40

M50

-200-60

-250

- - 80

-300

_ -100

-350

102

- I_1_J_I. J.__L__1.-_L-._1.--.L_ L_1__1 -i-_L. .!__L__L.

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ro °

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Mole ».w.t..<.w._.--. No:_.21.G. ..-__....- ._ Mnp:_.Sianco.n__._. -___ ___- __Date:._Z-20-77_State: __-._.__ _._ -_ County :_Mcrcer_______ Elcv.: _ 1,95.5. ft__ Location: T. .lili, R.SlJf, Sec. _.28__ , Tract: .^aaa ._ Drilled depth: _l^Q.ft_ Measured: J,aJt.__*$£, j69.ft__ Hat Hole size: 4 3/4.in._ Air D V/atcr H Cored: Yes C
Lignite beds: .-!46JuiQ; 1.53-155i 159-162.. ... ._...._.. .. ___ ____

NO

Remarks:

Lithology
Recorded by: _

Clcophysical logs
.... _ Geologist ntK recorded by: .._Lechner___.. ._

Lithology

Gamma

T.C._-2_ Range JM.cj?s_
Recording speed 2fft/min
Logged depth 168 ft__

Density
T.C. _2_ Range lPQ_crj^

c Recording speed2.Q_' c/min
Logged depth 164 ft _

Depth

_ No samples L-o-0

- 20

104

- 250
i

h -eo

-300

_ 100

-350

Hole number 21 G

SP Resistivity
Sens, setting _ ..20 MV__ Sens, setting _..._.5Q___.._ Recording speed _2Jlft/min Recording speed .2Qft/min Logged depth __. lJ?8_ft__ Logged depth ___1.68.£t_

l

" '- '" ""^"' ' ''" " jy- ' -"-' ' J -^~^~- ___ , _, T~ r . IIT^____Ti '

Depth

0-0

t-50

- 20'

- IOO

- 40

r-i50

-?00 60

,-250 '
1 -SO'

,-300

- 350

105

Hole No:__.4.4jyL__ __ tvinpt otauuun____...Date:, 7-19-_77_State: ND County:_ Mercer ....___ Eiev.: U35..ft_ Location: T.l41fe, R.S.5..W. Sec. -JL__, Tract:, cccd. _ Drilled depth: _160Jt__._ ._ ^ _ / RKfcC /»'? /\ r. yEt ,, i . /< 3/ :_ A fvl

Hole No:_.22j£.__ __ Mnp:

W?V"f^ / ifV-'T

Measured: __62_fr.._.._ FSL, JL^.QJL FWL,
Lignite beds: ._42-.44_:.2.0:5)4 .

sze: £ip4... Air Cored: Yes D No

Remarks:
Lithology
Recorded by: .

Cioophysicnl loirs
Yes Geologist NO recorded by:

Lichology

Ganmu

T.C._2_ Range _l.QO..cps_
Recording speed 2^"/min
Logged depth ..-.160JLE__

Density
T.C. _2. Range IfiOcps.
Recording speed 2£L*Vmin
Logged depth _160 ft

Depth

- Nro samples _._.____=^:' -0-0

- 20

-eoo-60

250
' -80

-300

. -100

- 350

106

Hole number 22 G

SP Resistivity Sens, setting _ J2_Q>LY__ Sens, setting ~--.-.->V_-. 50

C C

Recording speed 2_Q_"/min Recording speed2Q-Wmin
Logged depth _.. ..160 It.. Logged depth _.._JL60.ft._

J

Depth

)-> U
a *-

£ 2

h-o-o

50
- 20:

- 100

L

- 40'

150

- 200~ 60

-so

- 300

107

Hole No:__22_C_.. . _ __Map:-f2Tt_Clark______ Date:.23.ll.!._State: ^L[L__ County :_^liver__..._.__ Elev.:_-L.93.0 ft _.. Location: T.lil.* , R.83.J?, Sec..!._., Tract: ..dc>d _ Drilled depth: __120 ft Measured: _&6Il£L l;SL, 2i2QP_£?:BKL, Hole size: __U£jyi:_ Air LJ Water H Cored: Yes [j No Lignite beds: ._. ... ._... .._... .. ____..____

Remarks:

Lithology
Recorded by: -Mi.chacl.Camara,

tioophysicn oes

r- I Ye" lit b T 1. _ ..._ Geologist*» recorded by: .._ __ Lechner

Lithology

Gamma

T.C...2_ Range lQO_£p.s_

Recording speed2jQ.' c/min

Logged depth 120 ft

Density

T.C. 2 Ranee & .1Q.Q^£? . Depth

Recording speed 2Q*

Logged depth 120 ft
u,

0- 3 No samples
3- 17 Till, dark-ycUowish-brown, silly
~~ 17-20 Till, clark-olive-brown, cbyey

~ 20- 26 Till, dark-yellowish-bro\vn, silty
_ 26-33 Till, dark-yellowish-brown, sandy, stony
33- 34 Lignite
34- 38 Claystone, yellowish-brown
_ 38- 42 Claystone, brownish-gray
42-43 Claystone, light-gray
__ 43-44 Lignite
44- 54 Claystone, light-gray
54- 59 Siltstone, light-gray, clayey
59- 83 Sandstone, dark-yellowish-broxvn, very fine ~~ grained to fine-j-rained, silty
_ 83- 86 Siltstone, light-gray, clayey
86-100 No samples
~ 100-1 tU Claystone, lij-ht-gray

~ 110-120 Siltstone, light-gray, clayey

- 0-0

-20

-ZOO"60

h250
i
- - 80

- 300

_ -100

- 350

108

Hole number 23 G

SP

Sens, setting -5Q MY__ Recording speed 20 fymin Logged depth .__ ..J20. ft_

J

1

Resistivity
Sens, setting _5Q_ __ Recording speed .20 win in Logged depth - J2Q ft...._

Depth

I

u

(-50

--20'

-i oo

M50

-200 60'

250 :
-80

,-300

- 100'

109

Hole No: __24_G_. _ _ . Mnp:_f QirjCJitk______ Date: ._L.l d-ZZState: _ED__ County:.._Silver. ..___ Elc v.:...!, 9_10fr_ Location: T.141&, R. 53 _w , Sec. __6.__, Tract: ..._ddcc_ Drilled depth: _8Q.ft___ _ _
JCkttx

Measured: _2.40 .£:..._ FSL ,

Lignite beds: ._.. ..

FEL Hole size: __!% in, _ Air D Water [XJ Cored: Yes [j No

Remarks:

Luhology
Recorded by: Michaej Camara.

Cioophysicul log
Geologist sea recorded by: .....Lechner

Lithology

Gamma

T.C. _ 2_ l^ange 10.Q.cp_s_

Recording speed 2.£rr/min

Logged depth __80..ft__

Density

T.C. _2_ Range JP.O_cps

Recording speed 2P.fc/ min

Logged depth 80 ft

[Depth

0-3 Sandstone, dnrk-ycllowisli-brown, fine-yrained
to very fine grained
"" 3- 5 Claystone, ycllowish-lirown
_ 5- 8 Qay.sione, olive-brown
8- 15 Claystonc, light-olivc-pray, silty
~ 15- 16 Claystone, very lignt-yeliowish-brown
16- 17 Lignite
~ 17- 21 Cbystone, very light-ycllowish-brown
21- 22 Claytloiic, orangish-brown
22- 25 Gay stone, very light-olive-gray
25- 29 Sandstone, yellowish-brown, very fine grained 29- 31 Siltstoiic, very light-yollowish-brown
"" 31- 32 Claystone, dark-brown, silty
_ 32- 34 Siltstonc, dark-ycllowi.sh-brown, sandy, shell
fragments
34- 36 Shale, dark-gray, limey
_ 36- 40 Claystone, liglit-gray
40- 44 Siltstonc, dark-;:ray, clayey
44- 50 Claystone,-;rcen
_ 50- 52 S-indsrunc, dark-jirayiih-green, very finegrained
to fine-grained
52- 55 Claystone, dark-iiray
55- 56 Sandstone, white, tight, very fine yrained
~ 56- 60 Sandstuiie, dark-pray, very fine grained
_ 60- SO Sandstone, green, very fine grained to fine-
grained, tight streak at 66

h-0-0

-20CT60

110

h-250

h -eo

h300

L -too

r-350

SP

Sens, setting-20 MV.. _ __ Recording speed _2£L "/min Logged depth _.. ._8Q. ft__

Hole number 24 G

Resistivity
Sens, setting .... 5.CL-Recording speed 2.Q' c/min Logged depth _80 ft..__

Depth

HO-0 !

u

- 20

- 100

- 40

--'50

- 200,-60

- 80'

- 300

iOO-

111

HoicNo:___.25J-L... ..._.M.ip:__Han.iiaver.NE. _ Date:.JM°.:IL State: _J&Q__County:__.Oliver........__ Elev.: - -1,9.60 ft_.. Location: T. JL41* , R.84 _J , Sec. _JU__, Tract: .deed. ._ Drilled depth: __!?0?_£L_..._..... Measured: JIQL &..._. FSL,2J)00_ft g&; Hole size: _JJ4 in- ._ Air D Water H Cored: Yes [j No B Lignite beds:..39-61;-9>.95 ... ...

Remarks:

Litholo^y
Recorded

Coophysica! logs
Geologist fli? recorded by: .._.__.. Lecl1£e.r

Lithology

Gamma

T.C... 2__ Range. IQO cp.s_

Recording speed 2Qit/min

Logged depth __I2P_£t___

Density

T.C. _2_ Range

Recording speed ?£L "/ min

Logged depth 120 ft ff i -~ - - -

Depth

0-3 Till, very light-olive-brown, sandy, pebbly
3- 21 Sandstone, Ihht-olive-brown. medium.graincd to
~~ fine-jiraincd, pebbly

21- 22 Sandstone, reddish-orange, fine-grained
_ 22- 23 Oaystone, Ikht-bruwnisli-oranjre
~" 23- 26 Oaystone, lijilit-olivo-yray
- 26- 32 Oayvtone, lisiht-olivtr-brown
32- 37 Claystone, yray
~ 37-38 Lignite
_ 38- 40 Claystone,ureenish-juay
40- 45 Siltstone, gray, clayey
_ 45- 46 Claystone, dark-brown
46- 50 Siltstone. 5ray
- 50- 5{J Sandstone, li«ht-greenish-gray, fineuiraiucd to
_ very finv. grained
58- 60 Lignite
"" CO- 65 Sihstonc, olive-preen, clayey
_ 65-75 Sanclstrne, greenisli-jray, fine-grained to very-
fine- ^raiiK-d
~ 75- 90 Siitstonc, dark-gray, clayey
__ 90- 92 Claystone, li^ht-gray
92- 96 Lk'tiif?
-- 96- 97 Sand.'.toru', olive, silty
97-100 Silthtone, olivo
100-107 C-'laystone, ligiit-crny, silty
__ 107-i 12 Ssndstonc, lijiht-olive-.;ruy, finegrained to very
fine grained
_ 112-J20 Gaystouc, liyhl-sray

fo r - -^v ~_

0-0

^ ' - *~ ' ~ ^ ~ "^ ^

50

- 20

/^/^'^--:::^^

- 250

- - 80

- 300

_ -100

-350

i-

112

Hole number 25 G

SP

Sens, setting _20 _MV_._

Resistivity | Depth
Sens, setting __.5Q_... j

Logged depth JL2.Q ft . ._

_l

-t
J

Recording speed _25_ ft/ min Recording speed20.it/min « « Logged depth .._..._! 20 ft., u!

a «J

J 1'_._- Qlr ^_" r _ ,_ z -.". jl..." " _'r \ . . _ -

ho-o I

U
50

- 20.

- 40!

r

- 200

,-60

250 '
- 80

- 300

- 100

- 350

113

Hole No:_._2£_C_ __Map:_fcLannoyci_N_£.__Date:._Z-24^Z2_State: _..ND__County:_M.ercci__._...__ Elcv.: _i,a20 ft . Location: T.14L *, R.-S^J?, Sec.. 34_., Tract: ..._dddd_ Drilled depth: _60jt________ ..__ Measured: _60lt___*;sL, .213 ft_ H*. Hole size: ___4.;^.in, Air H? Water Q Cored: Yes D No K] Lignite beds: ..... . - . - ... - - - -.-.- .._....- . ...__

Remarks:
Lithology
Rerordt-d by:

(icophysical lops
Geologist NO recorded by: . ___._Lechner

Lithology

Gamma

T.C. ~2_ Range lQO_fc__
Recording speed 2QL' c/min
Logged depth _60 ft

Density
T.C. _3- Range .500_ft__
Recording speed 2Q"/min
Logged depth 60 ft

Depth

II

No Samples 1-0-0

- 50

-20

" 1 r - -. . ~ .- - - -- _ .- j
. v^ -~~ ~ _ i" ^ . 7. ""CS* F-*>tfyTf* ^fr~' f^ i

- IOO

- 40

- ISO

u

250
|- -80

- 300

_ -lOO

i-350

114

Hole number 26 G

SP
Sens, setting _. 51LMV.__ Recording speed .20.
Logged depth _ 6_0_ft_____

Resistivity
Sens, setting 50 __ &/min Recording speed J20 ft/m in Logged depth _._6Q ft____

- i

Depth
V)
u.

i-t O <J <->
4) t)
fe Z

hO-0 !

- 100

150

-200 60

250 '
- 80

- 350

115

Hole No: __ 2Z-G._ __ Map :_Jd2J}I12veL.N.E___ Date :_Z^2;.77_ State: _ ND __ County: Oliver Elev.:_l, 950 ft.... Location: T.Mlx, R. 84 J^ Sec... Ai, Tract:. bead. _ Drilled depth: _._14.QlC-- __. Measured: 1,800. &_. ijsfe. Hole size: ___ i&in. Air &J Water Q Cored: Yes Q No Lignite beds:. -90-22 -. _

Remarks:
Lithotogy
Recorded by: .

C'.oophysicnl ID^S
Geologist D NO* recorded by: J ___.__ Lechner '

_ -

Lithology

Gamma XJ-......»«. Density
T.C._2_ Range 10Q_cps_ T.C. _1_ Range JL°JL£E!.
Recording speed 2^' c/min Recording speed 20rt/mjn
Logged depth -__JL4JLft_ Logged depth _140 ft

Depth

i_ U

II

_ No samples 0-0

-200-60

j-250
j
~ -80

- 300

-

. -100

-350

116

Hole number 27 C

SP

Sens, setting -SO MV_ Recording speed 20. ft/mi Logged depth __ -140 ft_

Resistivity
Sens, setting . 50 _ Recording speed20.ft/min Logged depth _.._ JL4Q.ft__

Depth

- o-o

- 50

i:
HOO

! -40

r

- 200' 60

r-250 :
'- -80-

[-300

~ 100

L_

117

Hole No:. __..29G. . ._ Mnp:_Hannover_N^_.__ Date:.7^2-77__Stare: _ND__ County :__Qliyer____ ___ Elcv.: _.2,0.5Q ft.. .. Location: T. J.13JS , R.84 _w , Sec. __22_ , Tract: .cccc . ._ Drilled depth: _ _.16j}_ft_ . . _ Measured: _2.6_ft..._ FSL. J52..&- FWL, Hole size: __Ulilk _ Air [5 Water Q Cored: Yes [H No Lignite beds: .35-60I.09-7J; 155-157 . . . . ____

Remarks:
Lithology
Recorded by: -

C.oophysicai loirs

^ t Yes i j t Geologist NO recorded by: ...._. Lcchner

Lithology

Gamma
T.C.-2.- Range i_QQ^.s_
Recording speed 2H"/rnin
Logged depth _ _16fi..£^

Density
T.C. _1_ Range L°_9_£P.S.
Recording speed 2H*£/min
Logged depth _l^ft__

Depth

k- 0

_ No samples 0-0

-40

.. .. - .-. ... ..^^^..tso

-200-60

250
i
- - 80

- 300

_ -100

f-350

118

Hole number 29 G

SP Resistivity Sens, setting_.. 20 MV _ Sens, setting _ __5Q_ Recording speed_20. ft/min Recording speed_?.~ft/min Logged depth ... .150.ft _ Logged depth .--. 160 ft

Depth j

t_. O
o> *-

hO-0 I

L

L

HOO

- 40'

- 150

200- 60

- 300

- 100

119

Hole No:__3£LG_. - Map: Hannover N\V.. ^ Date: 7-21-77 State: __ND__County: jDliver _ ____ Elcv.:--2,080.ft_. Location: T.l£La, R.85. _w , Sec. 24_., Tract: .bccb. ._ Drilled depth: _220_ft____ __ Measured: .2,000,(t_ KS&, _10_fL FWL. Hole size: 4 3/d in. Air K \Vater Q Cored: Yes [j No 0 Lignite beds: ...?l-84j 86-88; 90-98; 17.5-1.83; 207-211 ... ... _... . . .. ____ ____

Remarks:
Lithology
Recorded by: _

Geophysical logs
. Geologist NO recorded by: .__

Lit ho logy

Gamma

T.C. _!_ Range 1QQ. cps_
Recording speed 2.0-"/min
Logged depth .

Density
T.C. _..2_ Range lQQ_CRi
Recording speed lH
Logged depth 211 ft

Depth

S I
u. 2

No samples

- 20

100

:L_l^L.'j^-l50

- 80

120

Hole number 30 G

^ ~; _ *-j -ig» TTT^~T i ."jminn "rrt~~ t

SP Resistivity Depth Sens, setting_50JMY Sens, setting 1....5Q... _
f* f ^* Recording speed J^Q-tt/minRecording speed 2_0.tt/min *j «
Logged depth ._.. .215 ft._ Logged depth 2.15 ft. __ EL, 2>

_ _ ^-.--- rTr--:^ hO - 0

1

J ~i- 1 ''1'^^"L~_~ ~r^ -T-^r^~T-i~"~^" - -"-' -" L " "* *'""* *~~i L- j r~~^ _ ^Tn^T~^^r^-rT.7^ r'_i_T_ "^'~"^'*~T-'^irr ' _'-i~~d

tz^^-1 i
~~^^j '

L i ,'
; ^*^-- . . i ... . ~-- L_-- ~-T - <^~'J '

200~ 60

r 250 i
: - -30

- 300

- 100.

121

Hole No:.... 31..G._. . . .Map:_$Aan.tgn.S _£___._ _ Date:._JZ-.24.-.7Z.State: ___ND_ County:._Mei.cer._ .___ Elcv.:..l,90Q.ft. Location: T.144_£, R.84._w, Sec. ..?0_. , Tract: .._dbdd__ Drilled depth: __lQ.QJL-_._ . _ Measured: _1,350 ft. ?su .L356.ft^ Hole size: __43d.in._. Air SJ Water [j Cored: Yes Q No H Lignite beds: ...43-4^. 57-60; 84-87 . ... ____..- _

Remarks: .... Lithology
Recorded by: _.. _ .. - .__.._. . ...

ops

._.._ Geologist NO recorded by: ..__. iechncj:_.. ._. ..

Lithology

Gamma

T.C. 2. Range 100_.cps_
Recording speed 20.' c/min
Logged depth _lHO.il_

Density
T.C. _3_. Range 5_0_() j:p_s_
Recording speed 20_' c/min
Logged depth __100_Jt__

Depth

II

No Samples -0-0

-50

- 20

250
r -so

-300

_ -100

-350

122

Hole number 31 G

SP

Sens, setting_2Q.MV

Resistivity
Sens, setting _ __
Recording speed 2SL ft/min Recording speed 2Q.it/min ! Logged depth .... _!PQ.ft__

50

Depth

Logged depth -!QPA..__

ho-o

-20'

- 40!

'50

,- 250
L - -80

- 300

- 100

123

Hole No:... {> V.A .Map: Hazcn NW .Dare: 7-26-77 State-: ND County: Mercer Elcv.:. ?,1 23 ft ...Location: T. 145 fe, R. 87 \v. Sec. 2 . . Tr:u-t: badd Prilled depth: 400ft Measured:JL125 ft. iSfe^Sft FWL, Hole size: _4J6.in,... Air [. j Water fXJ Cored: Yes Ixi

Surface ownership:. Coal ownership:
Lignite beds: JJ2,J49jJ.9Q-19_2L238,244; 284-288; 349:35.].

Remarks: jQ°I<Lh°L(t.P 1 AC was located 40. feet_sputjl of £_1A_ core.interyaLwasl33 to 149 feet; recovery 15 feet Lithology 9 inches' Ye, Geophysical logs
Recorded by: Randall Reichcrt____ ___.____ Geologist*.1** recorded by: __ _ _. Leclmer. ____

Lithology

Gamma Density

T.C..-?._ Rane JOOcps.jT.C. .2 Rane 100 cps. Depth

Recording speed 2Q_»c/mm

Logged depth __400 ft_ .

Recording speed 20. »t/ n

Logged depth _.400 ft_ .' _^ ix 2

0- 10 Sand, yellowish-brown, pebbly

JO- 57 Till, yellowish-brown, pebbly

57- 58 Siitstonc, tan, clayey
58- 65 Sandstone, gray, silty, fine-grained
65- 77 Sandstone, yellowish-gray, silty, tine-grained

77- 78 Sandstone, white, fine-grained to medium-grained 78- 98 Sandstone, yellow, fine-prained to medium-jirained
98-1 17 Sandstone, green, fine.j;rnined to mcdium-grainod
117-121 Sandstone, white, fine-grained

121-133 Sandstone, green, fine-grained

133-142 Lignite, black

142-144 Siltstone, «ray
144-151 I icniie, black
15J-157 Clay.stone, pray-green, siity
157-168 Siltstone, gray, sandy
168-182 Sandstone, jrecn, silty

182-196 Siltstone, grayish-}?rcen, sandy

196-200 Claystune, yrecn, silty

20U-230 Gjystonc, gray, silty

230-239 Siltstone, p.ruy, clayey
239-240 Livtaitc, blnck
24(t-245 Siftstone, gr:iy
245-247 Licnitc. black
247-250 CLiystone, pr.-iy, silty
250-260 Sandstone, grayish-ijreen, silty
260-262 Claystone, gray, silty
262-265 Lynitc. black
265-267 S.tndsionc, jiray, silty
267-276 Siitstonc. i'ra>, clayey
276-2S7 Claystonc, jiray, silty
287-2S8 Lk'iiiu'. black
288-292 Siltstonir, irray, clayey
292-295 LiiMiiic, black
295-3 I C Silistnnc, gray, elayey
316-322 Siltstone, green, sandy
322-345 Siltsionc, gray, clayey
345-347 C'laystone, green, silty
347-348 I.i::nite, black
3-1S-.<55 Siiistuiie, irrayish-grccn, sandy
355-371 C' 1 ij'sionc, gray, silty
371 -372 CLiystOiic, white, litney

- 50

" :.=4-~V-1- 30 tr~---- ------ - - -: ----- ' -^ ~

-20

. __. --;_-_ >.- -

| _ _ .-- __;--_.: _. .:-._. -_--_ - V^, - -'-

'

Hole number continued
P 1 A

Lithology

372-380 Ckiystone, gray, silty
330-381 Lignite, bbck
381 -390 Clay stone, gray, silty
390-392 Cbystone, white, limey
392-400 Claystone, gray, silty

Gamma

T.C l- Range o _1QO cps_ x ~ Recording speed _2£L/c/min Logged depth 4QQ.it__

Density
T.C._2__ Range _l_QO_cp_s Recording speed 2Q_fr/min Logged depth _40Qft_.

Deptli

- 120

- 500

160

- 550

. -180
- 600

-650 -200

- 700

.

-220

- 750

125

Hole number P 1 A

>QJMV_ SP

Sens, setting.
Recording speed _2& ^/min Recording speed_20rt/min Logged depth _4QO .ft.

1

1

Resistivity
Sens, setting _.._JLQ

Depch

* n-w^ir « *n **f^^"^ * * i - £j ^f

Logged depth _1Q<L&._ £ |

r= .. :."_;
.....: ..u.u .'-.^
.. . . :J

~r .-.__ ..-.'..: Tatrm

J^i-pl^

^ ^^-.^-"""v?- ^£^.^^:% ^ ^^^^^^^.--.^

LO-

h

- 50 ,
-20'

-100

-40

r-150

-250
-- -60

- 500
i

U

- 100:

-350

126

NORTH DAKOTA C.KOLOC.ICAI, SUHVF.Y

HolcNo:__ P. 2 A. .- Map:... Beulah . . .Dare: 8-4-77 State: ND County: Mercer Eiev.: ..?>OQ5 ft _.... Location: T. 145$, R. 88 .w. Sec. 14 ,Tr.u-t: dcdb Drilled depth: 90 ft Measured:J300fL._R5L. L850_ft{&. Hole size: __4J&m...__ Air [x] Water [J Cored: Yes ("j No [; Surface ownership:_______.... _.._-_.. __._._.__ - __...___....... Coal ownership: ___ _____ .. _ Lignite beds! 52-70 __..._.
Remarks: __
Lithology
Recorded by:.

Geophysical logs
_ , . Yes iii & T 1 Geologist NO recorded by: ____ _ L.ecnner.__

Gamma Density
T.C..-2... Range ..100 cps_ T.C. .3... Range 500 cps. Depth Recording speed 20' c/min Recording speed20 .' c/min
Logged depth _ 90 ft .. Logged depth _ 90 ft._ % t>

»__F . _ .. -i-T a

Q

w

- Qw
T~*~~_-^ - £

z_r_-,> ! 2O :--:...-. -~ , ^"^_ i s-*\j , ...

3-50

. r ...._. .. .___. -20 rra t ..... r.

- -.----.- ^, -_ ~~^ <?/\ i __ _. -- - ___; _.-..r.rrru.
..... . ;-»_---._ .I aU \---_ . "- ".rr _ . _. ,.:___._.... .-...yr -3

E-I^L ;,;-:^_£:^_p fa 4 [.rjEj^^^^^jl^^e-1^^ -10 0 t-~~ -""- -" r_*-!i .7r___r,. -^'V^'_ii I_"n." j_^i ~i_i *~~77'^^r~'^n~i-T_~""'~''-"-""--~ t-.*i ~!~~~~~

- 40

- 150

Lithology

_ No samples

-200"60

- 350
- - 00

L300

_ -100

- 350

127

Hole number P2 A

SP Resistivity Depth;

r

or i rs-CMiLiviiy

Sens, setting 20 MV Sens, setting JiQ . Recording speed _20_ ft/minlRccording speed 2Hit/min £ £ Logged depth _90Jl.__. pegged depth __iPA_ | £ |

1

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_. . ~i

ro-o i

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i

r i

h° ! i

r -20

. -100

L :
i

"~ 40

-200rSO

-250
' -80

^-300

u. -100;

- 350

128

NORTH DAKOTA Cl'.OLOCICAI, SIWVKY

Hole No:.. .. p 3 A .. . Map: Zap . .. . . .Dan-: 7-27-77 State: ND County: Mercer
Elev.:- 2 » 06 5 ft__. Location: T. 144*, R. 88 _w . Sec. 6 , Tract: baab Drilled depth: 140 ft Measured: _60_(t.__ £s£c L.9_97_ftFWL, Hole size: _1J4 in. ... Air [XJ Water [".] Cored: Yes [XJ No Surface ownership:. _.... ._._. ._..._ Coal ownership:
; 107-118; 133-138 ..... _ __...___._. .... _ . _. .. __ ....._.. _____ ___. _.__ ..
Remarks: Core hole P 3AC was located.4Q feet south. gf_P_3A; cored interval ^.wa,s. Jl^io lj.9__feejti_recoyery_... __. Lithology 9 feet* Ycs Geophysical logs
Pvecorded by: ______________________ ____ Geologist NO recorded by: __ . Lcch.ner

Lithology

Gamma
T.C.._?-. Range . 100 cps.
Recording speed ?0»t/j T1 in
Logged depth __ 140 ft ....

Density
T.C. _2... R.,ngc 100 cps
Recording speed20 _»ty m j n
F.ogged depth ...140 ft.

Depth

No samples .-0-0

iL j\ ri-"r~rv'_ - 9-O f .. . ., ..

. " * * "_zr zz. in]

- ~y_w....... _._. . -. i

zoo" so

- 250
- - 80

- 300

L

_ -ioo

- 350

129

Hole number P 3 A

SP Resistivity Sens, setting 20 MV Sens, setting _.. £0 . Recording speed.2.0.'VminiRecording speed 20. rt/mi i Logged depth ._!!<>.-ft._ (togged depth ....lAQ.ft ..

i

Depth

£

1

H
1

h>-o !

t i

1-50 !

- 20

rlOO

- 40'

ri50

-200"60

- 250 !
- - 80

r300

- 35

130

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l

Hole number P4A

SP Resistivity __ j Depth
Sens, setting 2.Q.MV Sens, setting 50._._ i M Recording speed _.2Q ft/min Recording speed-2Q.ft/min j *j S Logged depth __22Q.ft .__ JLoggcd depth .220. ft __ £ j:

j

i ~i _j -\

i

i
i

1

r-0-0
i

h-

r

50
- 20'

rlOO

- 40

rt50

- 200-60

-250

- - 80

,-300

i_ 100

- 350

132

NORTH DAKOTA CKOLOOICAL SURVKY

Hole No:.-..P 5 A.. . ._ Map: . Hazen.NW . .Date: 7-26-77 State: ND County: Mercer
Elev.:.. 2,1.58_ft_ Location: T.145.§, R. 86 w, Sec. 6 .Tract: bbbb Drilled depth: 200 ft Measured: 123-.&_IsK, _30_ft._ RVL. Hole size: _ji34in, __ Air iXj Water LJ Cored: Yes |. j No JX] Surface ownership:_____.._......____ ..._.._..._...... ._.______. Co;»l ownership:_
T.ignifp liefis; 171-185 ...._.... _ ._. ..._.__.... ._. .....__..__.___.... Remarks:_______._......____. .. . _ _._... .__._....-.._... ._ ...... __.. _ .__..
Lithology Ye Geophysical logs
Recorded by:___________________________ Geologist NO recorded by: __ Lechner

Lithology

Gamma
T.C. ._? . Range .100 cps ,.

C

Recording speed 20't/m j n
Logged depth __2QQ ft .. _

Densit)
T.C. .3. Range 5 00 cps.
Recording speed 20. ' c/min
Logged depth _ 20Q_ft_

Depth
f,
«, 4-1
'> * ->

u. 5

No samples __. .._. -0-0

- 50

- 20

100

40

- 150

t___T J!zr_r "" "__r ' ~ '"f*^ ' ' vrTyj
._,_.- -.,_ _^'_ _.. _"___ ">".!._ _" -" .T"__IJTl-Trj

;-ao^ 60

-350

133

Hole numberP5A
SP
Sen*, setting 50.M_y.
Reco:
Logged depth ._2p.Qjfe
rding speed .,20. fr/min Recording
Resistivity
Sens, setting --J.Q.
speed2.Q.ft/rnin
Logged depth -J.Qfi.ft._.
Depth
 ' ' -
_l
~j
 *
!
-so
-20:
-100
i-206"60'
-250 '
- -80
-300
-350
134

[SOUTH DAKOTA (il-.OLOOICALSUKVF.Y

Hole No:.. .. P6.A ..Map: Beiijah NW ..Date: 8-7-77 State: ND County: Mercer Etev.: 2j 11 Ojt.._ Location: T. 1.45. £, R. 88 w. Sec. 10 , Tract: bccc Drilled depth: 180ft Measured: .2^5 5 JL Ps, 250_ft._ FWL. Hole size: _4.&in,.__ Air [XJ Water f..| Cored: Yes |x '] No [Surface ownership:. Coal ownersship:
Lignite hcds:_82-^4i_9_4-96jl63:166___ ...._. . ._ ._... ..... .___..... . . .__.__.__ Remarks: £.QIfi..h.Q.l.e_P. 6AC_.was located 40 fe_et_SQuth.ofJ).6A.; coredjnterval was 78 to 85; recovery 7 feet. Lithok>gy
Recorded by:.

Yes

Geophysical logs
____.__... .__. Geologist NO* recorded by: ___ ._ Leclijier

Lithology

Gamma

T.C...?-- Range .? 00. cps
Recording speed 20
Logged depth _18Q ft

Densiry
T.C. _2 . Range .lOOcps
Recording specd20.^/iniTi
Logged depth _ 180 ft

Depth

No sain plus

t" .__ i_.__

^r~r_-^q
" ~ " ~ T^ , 1 _._.....

" * "
. . ._. . ... _

_. _ . _ j _ :_ __ ; _ . _ _ . ._ ; ' '" ~~ _

100

-350

135

Hole number P 6 A

SP j Resistivity Depth: Sens, setting 5P_MV. Sens, setting - 50...__ w Recording speed.^-fyminiRccording speedl0.ft/min j *j 2 Logged depth _180.ft_ togged depth _i?0 ft _ j £ | ..__._ _._._j.._. ...._...._.. 4

(-0-0 ! L ;

I

r j

r50

-20

HOO

-40.

,-150

-200"60

250 ;
- - 80

^300

- 350

136

NORTH DAKOTA CKOLOOICAI, SUK VF.Y

Hole No:.__ .P7 A . . Map:.. Beulah NE Date: 7-27-77 State: ND County: Mercer
Elev.:_ 1 - 9?P.ft __ Location: T. A4.6$, R.87 .w . Sec. 28 ,Tr;K-r: cccc Drilled depth: 40ft

KKJX Measured: Jilt.._ FSL, .116It. FWL, Hole size: _4j% in. Air [X Water f." j Cored: Yes [ ] No [Xj
Surface ownership:.
Lignite beds:____
Remarks: _._ ... _.
Lithology
Recorded by:

__ __ Cool ownership: ____

Geophysical logs
Geologist NO* recorded by: ___._._?.'.?.<:ilJle.r

Lithology

Gamma

T.C.._2_. Range ...100 cps
Recording speed 2Qf r '
Logged depth _40 ft.

Density
T.C. -3. Range 500.eps
Recording speed 20.'t/ Tn j n
Logged depth _ 40 ft__

Depth

No samples

r -50

- 0-0

-2C

- 100

h

-4O

150

-200" SO

- 250
- - 80

-300

_ -lOC

i-350

137

Hole number P 7 A

SP Resistivity Depth;
Sens, setting 20.MY Sens, setting _. 50 ^
Recording speed _2Q.fr/minRecording speed2Q.rt/min % *J 1 Logged depth _iP.lE.._..._. Logged depth _10.ft... .__ £ 2 !

J

-o-o

h

r50

- 20

- 100

1

!_ -40-

r-150

-ZOO'60

- 250 i
- - 80

H

j

_i

300

- -:CO!

-350

138

[NORTH DAKOTA CKOI.OCICAL SURVEY

Hole No:.__ P 8.A . .. Map:. : 7-27-77 State: County: Mercer Elev.:.J,920jt__ Location: T. 144$, R. 88_w, Sc-c. 4 , Tract: cede Drilled depth: 200ft
KSDC

Measured: _. 27 ft__FSL, 7.98 ft.. FWL, Hole size: __4/Jlin. _ Air [.Xl Water LJ Cored: Yes ["] No [xj Surface ownership:
Lignite heds: 74-77; 167-172; 180-182; 188-191 _
Remarks: _ .. ___ __..._._._.. . . _ ._. ..
Lithology
Recorded by: ________

Coal ownership:..

Geophysical logs
._____________Geologist NO recorded by: __ Lechner

Lithology

Gamma
T.C.._2_. Range J-OP cps_
Recording speed ?0't/min
Logged depth _ 200 ft _._

Density
T.C. _2... Range JLOO.cps

c Recording speed 20.'tymin
Logged depth _200.ft_ .__

Depth

No samples -0-0

r-50

-20

no --:=r

r -BO

- 300

L
-iOO

-350

139

Hole number P 8 A

SP | Resistivity
Sens, setting _20_MY.. Sens, setting £0. Recording speed_20. ft/minjRecording speed-2Q.fr/min Logged depth _J£PO_ft__ (Logged depth -20.0 ft..._

Depth j

II!

i

I

i

"I
H

i

hO-0-

r50 !
!
f -20.

i

jH
HOO
i

L

r -40

i-150

- 200-60

J i
i

-i

-250 :
- - 80

- 300 ';
i
\ '

-100;i

|
- 350 '

140

NORTH DAKOTA (I! ',()LOGICAL SUKVF.Y

Hole No: .._ ?9A . ..Map:... Beulah . .. Date: 8-4-77 State: ND County: Mercer Elev.:-.1.970. ft _ Location: T.145._«\ R. 87.\v. Sec. 20 .Tract: baaa Drilled depth: 40ft Measured:_20_fL_$m,2^56Q..ft:FwL, Hole size: _4_% in. _. Air iXJ Water G Cored: Yes ["] No [xj

f

Surface ownership:
Lignite beds:_
Remarks: __
Lithology
Recorded by:

Coal ownersrship:

YCS Geophysical logs
Geologist NO recorded by: ___.__ Lcchner____

Lithology

Gamma

T.C..J?-. Range _10Q cps
Recording speed ?Q.'t/niin
Logged depth _ 37 ft. . .

Density
T.C. -2_. Range _100_cps
Recording speed20.'Vinin
Logged depth _ 39 ft _

Depth

o o

ix 2

- No samples ------o-o

-20

- 100

r -40

KI50

i

200-60

[-250
~ -80

- 300

_ -lOC

-350
141

Hole number P9 A

i

Resistivity Depth
^rrrina 50

I or

Sens, setting ._?0_MV Sens, setting .,.=.- Recording speed_2Q_fc/min Recording speed_20^c/rnin j % « I Logged depth _JlJt___. Logged depth _3ZJt_.._ { £ ^

_i

- l

- i

~1

J

- 50

-20

- 100

- 40'

S-150

^-250 I
''- -50'

!-300

-350

142

NORTH DAKOTA C.KOLOC.ICAI, SURVK.Y

HoleNo:__...P_!Q.A __ Map: ..Hazen NW ..Date: 7-26-77 State: ND County: Mercer
FJcv.: -J-.' 9- 7.?^.- Location: T. .I4_5^ t R. 87. w. Sec. .14 , Tract: adcla Drilled depth: 60ft
Measured: AUIJL fc&k liiL- PWK Hole she: 4 K in. .. Air ixj Water [".'] Cored: Yes ['] No [XJ Surface ownership: _______ .___._. __ ... __ _.._.___ ____._ __ .. .Coal ownership: _____ _ ___ _____ Lignite beds: _Z2l^±___ - ___ _ __ .... --_... _ . _ ...... _ ___ .... ____ . __ . .... ___ . _____ ....._. Remarks: ____ ~- ._._...... .. .. - . ._...... ._.. ... .. ._.. ... _ .. _. .._.. ..._. _________ Lithology
Recorded by:

Geophysical logs
______ Geologist NO recorded by: __ Lechner

Lithology

Gamma

T.C..-2L. Range JQQ cps_

Density
T.C. _3._ Range _500.cps
Recording speed20_'t/m m Recording speed 20."/min
Logged depth _60_.ft_. ..... Logged depth _..60 ft._.

Depth

No samples -0-0

-2C

- 100

r

}-
-150

- 4C

r-250

1-300 1-
- 10'

-350

143

Hole number P10 A

SP Resistivity Depth] Sens, setting .50.MV Sens, setting ._!Q-
i Recording speed_20_ ft/minjRecording speed 20.ft/mm j £ % \ Logged depth 60 ft __ [Logged depth __«6.d.£t_._ £ "2. ' j_ ... . - . -.-_,.... . -. ... -.-. -.-t- ----- .

i

=rE:..- " SO ".'

ho-o

- 20;

r-IOO

I

J

40'

. -150

J!

I

]

J

250

- -SO

^300
I :

u :
L. -'CO;

p35C

f

U i

144

NORTH DAKOTA (IKOI.OGICAI, SURVEY

Hole No: _. P.I 1. A _.._ Map:. ..Beulali. _ . ..Date: 8-3-77 State: ND .County: Mercer
Elcv.:.. \»?60_ft ._ Location: T. . 1.4.4 y, R. 88. w, Sec. 22 .Tract: bccd Drilled depth: 40ft
Measured: _21 620jt.'FSK. 392. ft.. FWL, Hole size: _A^.in..__ Air LX Water [."'] Cored: Yes [1 No [X] Surface ownership: ______ ..__._ .._......._.. __ .... _._..... ____ .....Coal ownership: ______ _ __ Lignite beds: _____ - _ .. . ____ __.._.._........_._. _ _.__..... _ .._. __....._. _ .. _ . ___ . ___ ________ .___

Lithology
Recorded by:

Ye Geophysical logs
Geologist NO recorded by: .... Lechner

Lithology

Gamma

T.C..JL Ranee JOQ cps_ f Recording speed20_ rt/min
Logged depth _4_0_ft.. _ _.

Density
T.C. _3... Range . 500 cps
Recording speed^.Q.^/Jnin
Logged depth _40 jt.._...

Depth

No samples -0-0

- 100

r

h
- 150

-4C

-200"6C

-250

- 300

- 10

- 350

145

HolcNo:__.l A .. . ..._Map:-Hazcn..NW . . ^

Eiev.: _JLl4Q.ft ... Location: T. 146.* , R. 86 _w. Sec. 30 , Tract:

Measured :_2J?_23_ft_ scsi* 3J>. fL_ FWL. Hole sue: _4.34 in.^.. Air LJ

Surface ownership:

.Date: 7-26-77 State: ND County: Mercer

bccc Drilled depth: 300 ft

Hole size: _l.3Ain.^. Air ["_] Water [3 Cored: Yes ["") No [xj . Coal ownership:__

; 233-237; 252-254^280-282..

Remarks: _._

Lithology
Recorded by:. Michael Camara

Geophysical logs
.____ Geologist *# recorded by: __._ LecJxner_____

Lithology

T.C.

Density

2 100.cps Depth

Gamma

T.C..JL. Range .- .. ..*. ivangc ._^vv>f?

Recording speed 20«t/,n j n Recording speed20.' c/inir

Logged depth _.3-O.O.ft_ Logged depth _ 3QO_ft_ _

0- 8 Sand, yellowish-brown, very fine grained, silty 8- 20 Till, grayish-brown, sandy, very pebbly

20- 40 Till, yellowish-brown, sandy

40- 66 Till, grayish-brown, sandy, pebbly, lignitic

66-120 Till, dark-gray, sandy, lignitic

- 0-0

' "

-20

120-130 No samples

130-150 Till, dark-gray, very sandy, lignitic

150-160 No samples

160-176 Till, dark-gray, sandy, lignitic

176-177 Limestone

177-186 Siltsto:ie, gray, sandy
186-188 Sikstone, jrray
188-190 Gaystone, gray
190-192 Lignite j 192-193 Gaystone, liaht-grayish-green
193 -19S Sandstone, light-grayish-green, very fine grained | tc fine-grained
198-209 Gaystone, gray
209-210 Siltstonc, dark-brown
210-212 Sandstone, light-yrayish-green, silty, very fine grained to fine-grained
212-219 Gaystonc, light-gray
219-222 Siltstonc, light-grayish-green, sandy
722-233 Gaystonc, light-grayish-grecn
233-236 Lignite
236-252 Sandstone, iight-grayish-p;°cn, very fine trainee! to fine-prained
252-253 Gaystonc, light-gray
253-255 Lignite
255-262 SiUstone, gray, sandy
262-276 Sandstone, grayish-green, very fine grained 276-277 riaystonc, light-greenish-gray
277-279 Lignite
279-283 Gaystonc, green, silty
283-28X Sandstone, lipht-grcenish-cray, very fine grained
2H8-290 S;mdstonc, gray, very fine grained, silty 290-292 Lignite
2(>''.-300 G:;ystonc, gray

- 40

_ -iOO

- 350

146

Hole number 1 A

SP I Resistivity
Sens, setting 50.MY Sens, setting _...5P.. . Recording speed 20 ft/min'Rccording speed-2_Q/r/m in Logged depth .__3PP.ft._ fogged depth _ 300 ft .._

Depth ',

"--."."'"...' r '-" _ r - ..; r. "^ I

J

-.--r--i

1

J

- 0-0

- 50

-20

r-100

- 40'

;-2ocT60

- 250

- - 80

- 500

-350

147

Hole No:__. 2 A __Map:.. IJcuian Nb . . .. n.ite: I-'LI-II State: N1J County: Mercer Liicv.:--l>954 fc ... Location: T. 1463:, R. 87 w. Sec. 30 .Tract: bbab Drilled depth: 60ft Measured: JL2_ ft.... W JMJlfc fw?. Hole si^c: __.4.%.in. ... Air [k] Water '".] Cored: Yes ["] No [Xj Surface ownership:. Coal owners ship:
Lignite beds:.
Remarks: _Np ji.P.jor. Resistivity
Lithology'
Recorded by:

Geophysical logs
Geologist NO recorded by: _____Lcj:JTner______

Lithology

Gamma
T.C..-2. Range _100 cps.
Recording speed ^O'tymin
Logged depth _60_ft_._

Density
T.C. ..2... Range _100.eps
Recording speed 20."/rntn
Logged depth _6Q_ft__ _

Depth

No samples -0-0

-50

- 2

i_

-100

- 4

1-150

-200"6'

- 250
~ -8s

[-300

L
_ -10-

-350

NORTH DAKOTA (IKOLOGICAI, SURVKY

Hole Nc;: _ ...3 A , _ _ ..Map:. ..Zap . . .. Dati*: 8-4-77. State: ND County: Mercer
Elcv.:.. 1,203 jt__ Location: T.l45_g:, R.. 88_\v , Sec. 20 , Tract: cddd Drilled depth: 240ft Measured: Jilt. __ FSL.^S^Jt FWL, Hole size: _ 4 _%jn.__ Air ["# Water [_"J Cored: Yes [" j No [Xj Surface ownership:
Lignite bcds:_202^04_.
Remarks: ____ .__-..
Lithology
Recorded by:_

__._Coal ownership:

Geophysical logs
. Geologist NO recorded by: ._._ Lechner

Lithology

Gamma

T.C.._!_ Range _1.00.cps_
Recording speed 20«t/tn j n
Logged depth _J*0_ft__

Density
T.C. JL. Range ..l.QO_cps
Recording speed20.
Logged depth _^OjL

Depth

t^ O

u,

No Samples t=r^r -racr -0-0

- 300

-350

149

Hole number 3 A

SP Resistivity Depth; ^ Sens, setting .20.MV_ Sens, setting /_- §P Recording speed .20. ft/ min Recording speed 20. ft/m in j % § Logged depth _24Q_ft.__. Logged dcpch _24Q..ft__ | £ 5 i

_j

i

^4

hO-O !
i :

r ;

r50

-20

:-ioo

-40:

i-150

-ZOO"60

,-250 i
'- -80

! I

-5oo :

- 350

150

NORTH DAKOTA (WOKOGICAI. SURVEY

Hole No:_.fA. _.._ ._Map:.. Hazen. NW . .Date: 7-25-77 State: ND .County: Mercer Elcv.:-!^.9-^_Location: T.145&, R.86._w. Sec. 20 , Tract: cbcc Drilled depth: 60ft
Measured: _iA26jt_ ^ _12jt_. HVJU Hole size: ___4ilm.._._ Air [X] Water L".i Cored: Yes ["] No [X] Surface ownership:_______ _._-. _. _.. ___. ._._._....______... Cool ownership: ________ _ ._ Lignite beds:_______..._ __._.._ .... .-. _.._...__ __._...__.._. ... _ _._ _..___. _________ Remarks: _No_SJP..or.Resistivity logs run. ._ _ __._._..._._.__ _. .__._________________ Lithology Ye3 Geophysical logs
Recorded by:_____________________-____ Geologist NO recorded by: ___ Lechner

Lithology

Gamma
T.C..-2 Range ..IPP cps.
Recording speed 2Qit/m i n
Logged depth _ 60. ft

Density
T.C. _2 Range .IpP.cps
Recording speed 20. /min
Logged depth _^0ft__

Depth

No samples -0-0

-50

- 2

- 100

I-

h!50

- 250

- 300

_ -10

151

Hole No:__5A __Map: __Jdaz.CD>NW_____ Date :Ii26.-77_ State: ND County: Mercer __ Elev.: 2,lfi2.ft_. Location: T. HSJii , R..86_w, Sec. 1__., Tract: .._i!?bb_ Drilled depth: _JL?PjL_____ ___ Measured: _1Q2JJL_ KSfe -JAfL. FWU Hole size: __JL&m.._ Air [E Water Q Cored: Yes D No H Lignite beds:. - - - - -- ...._.... . _....._._

Remarks:

Lithology
Recorded by:

(Geophysical lops
Geologist NO' recorded by: ___ .^echner_ _

Litholog}'

Ganima
T.C._2_ Range J,<HLcp&_
Recording speed 20^/min
Logged depth

Density
T.C. JL Range lQO_cgs
Recording speed 2.Q_
Logged depth 130ft

Depth

<_, o

No samples 0-0

F-4W81 f°
iili ===-50
-20

152

250
r -eo

- 300

. -100

- 350

Hole number 5 A

SP

Sens, setting 5.Q.MV
Recording speed _20. ft/ mm
Logged depth 130 ft

Resistivity j Depth
Sens, setting _.. 5Q___ 1 ^ Recording speed -2flft/m in £ £

T 11 i 1 in £« o ,5j Logged depth A JVL". PX j>

...I-. _._._..___.:-..- -T_

z= -- ... _._.-_ .- . . -.:_ --. *"
l.~'-^~.' . : ..'' : ~ ~ ~.--~.T^r

-:- : " '"-" ^i. 1:

:v-_:r __ :::--:- -' - - ' " -_-=^.
H--.T,,---.- : "--^

^.^;^;---,.^-.^J

_ _ .. ... . _. ._._ _ .. _ _.,_ _ . f^ . .... __

, L _.. .V _^ , i . -.^ 1 E^^J-" f=^==- ~: \ ^7:----:=!=
^r^^^r-^^.--^ -^-^^--

1 ^_::.... -.._-:vt:. ^_;_-.---.rr ~'^~^j^~ ~,* j." _"*^ ' ' ' " ^_ _" j* "*\ ' *" .'. ." , ,7"--_- _ I-

!
i

i

t
rso

"" -20

- 100

1

-40

- 150

1

i
-200-60

- 250 ;
- - 80

- 300

_ -too,

- 350

153

Hole No:_.6.^___ __ Map: .Hazen NW___._ Date:.7^1'IL. State: Elev.:_2,Q2a£t_. Location: T..li5s:, R..86_$\ Sec. _JL8 , Tract:_da Measured: JL37_3.£t_ FSL, _l64j't g^j., Hole size: OLin. Air S Lignite beds: ._4.9-55 ._ . . .. - ... ._..- .-

Remarks: No S.P. or Resistivity logs run.

Date :.7^S-77_ State: NP County: Mcrcer ec. _JL8 , Tract: .__.4add_ _0^1^ depth: __ ^Ojj Air Q Water D Cored: Yes

Liehology
Recorded by: Geologist

Geophysical logs
recorded by: ..

Lithology

Gamma
T.C._2__ Range
Recording speed -ZOWmi
Logged depth

Density
T.C. JL Range _500_cp£ Depth
Recording speed ^.'
Logged depth 60 ft

trf O

_ No samples

"T"I*-" ~"^^T7 ~"C?" ' ~_*F ^.'^ -0-0

_V^ ", ". ' . "'**"" , ^7^

-50

-EO

- 100

- 40

f-150

-200-60

250
r -so

- 300

_ -100

-350

154

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: __ 1 A __ ..___ Map: _ Buulaii __ . _ __ Datc:.JL3j:L7 _ State: _ ND __ County :__Mcrcer_ Elev.:_l,9_40_£t _ Location: T.144.S, R._SS_W , Sec. _2Q__ , Tract :.._aaba __ Drilled depth: ___60jt __ .. Measured: _5.0it _ Jisac. 1332.&EW*. Hole size: 4 3/4 in. Air |XJ Water D Cored: Yes Lignite beds: .. - - .._...._.._. . . .. ._

No

Remarks: No S.P. or Resistivity logs run
Lithology
Recorded by:

Cioophysteal li>gs
_._.._..______._._... .._ ..._ Geologist NO recorded by: ..._Lechner.

Lithology

Gamma
T.C. -2_ Range JLO_0_cp_s_
Recording speed 2£L* tfr~;n
Logged depth _j6D.ft

Density
T.C. _3_ Range S
Recording speed 20.
Logged depth 60 ft

Depth

«_, O

No samples

i - -- -^ ^

^^ -

- 0-0

h50

-20

100

- 40

r-150

U

-200"60

-250
- 80

- 300

_ -100

155

County: Mercer ttoie No:__tt-a__ __ Map:-*ap-_________ Date :___£±L/jL State: __^._County:_£lej Elev.:_2.QSift.... Location: T.lils:, R..88.^, Sec. ...32., Tract: _£ccc. __ Drilled depth:__]

80 ft

Measured: JS2J&. F$L. J4jt
Lignice beds: -131^140; 153-158 _. ...

Remarks:
Lichology
Recorded by: -_._ .

Hole size: 4 K in. Air H Water C Cored: Yes Q No [X|

Cioophysical logs
_._ . .Geologist NO recorded by: ._ Ladiner. .._....

Lithology

Gamma

T.C. J2._ Range lQO.cgs_
Recording speed 20. 'Vmin
Logged depth _J£2-£t__

Density
T.C. _JL Range ^_.._,_
Recording speed 20L'Vmin
Logged

C*w

depth

£

180 jt__

Depth

8 I
u, 2

_ No samples

._.... ..v...... ri /ZO """

- 300

- 100

-350

156

Hole number 8 A

SP
Sens, setting _.. 5.0 MV Recording speed _20. ft Logged depth _ J..62_ft

Resistivity
Sens, setting 50
ft/ min Recording speed 2Q. "/min Logged depth 162ft..

J

"1

-j

1

Depth

K>-<

- 50

r
U
-20Q-60

.-250
- 80;

- 300

- 100'

l~

157

Hole No:__9_A_._.._ __Map:_Ha?en_NW.____ Dace:..J^LIZ.State: NP _County: Mercer __ Eicv.: __2,.188.ft__ Location: T. 14fi.Sc, R. 8<Lw , Sec. _._!? , Tract:. .aabb _ Drilled depth: __. 2^2JL... Measured: ..24 ft.. . jgfc, -J>.9jL/J RKfc Hole size: 4 % *** Air H Water Q Cored: Yes Q No Q3 Lignite beds: .-169JL7.d; 137-192. . ...__...._.._.___. ... _________ _ ...._

Remarks: .
Lithology
Recorded by:

Cloophysicjil loirs
_ . . Ye« jit T 1 Geologist NO recorded by: ..____ Le.clin.cr ....._

Lithology

Gamma

T.C.. 2L_ Range lOQjcgs^
Recording speed 20't/mjn
Logged depth ?-fin ff

Density
T.C. -1. Range _19£fPs.
Recording speed 20-"/min
Logged depth _2.60_fc__

Depth

II

~ No samples -0-0

;tZ^ i--^-.f = 10

40

: r <li, -:r3

30

r^=±lCO

£3
^^O

^-50

- 20

*-E.~EE~^

- 100

i£fiEiEr-l50 -....

-40

= -250
80

-300

_ -100

-350

158

Hole number 9 A

SP

Sens, setting -2D,MY__
Recording speed ?.D fymi
Logged depth __ _260jt

Recording speed ?.D fymin Recording speed _2D"/ Logged depth __ 26_Q ft._

-1
J

-1

H

-J

Resistivity
Sens, setting 50 _____
m in

Depth

_

- o-o

- 50

i

-20;

'-100

-40!

f-150

r

h
k
r*
L

-200~60

^-250 |
^ -80

- 35C

159

Hole oe No: o: __ __ .J.Q .. A . . __ Map?_ R.Milnh MW : ft-4-77 State: __ ND __ County: _ Me£cet. . __ a_ . -- __ __ _ £cet_ - ___ Elcv.:~ 2,260. ft__. Location: T.Hijfc, R.SS-*, Sec. §_, Tract:.. b.aaa.,.._ Drilled depth: __3PO_£t; __ ... __ Measured: 20_ft.... _ ^ 24.7.11: &L, Hole size: 4 ^.jn^ Air S V/ater Q Cored: Yes D No H Lignite beds: _34,2£_222z231_; 247-250 ... . . .__. _.._.....__...._. . . _________ ... .

Remarks:

Lithology
Recorded by:.

"

___.___......___Geologist NO" recorded by: .___Lechner..

Lithology

Gamma
T.C.._1_ Range .J.Q.Q_cps_
Recording speed 2Q"/min
Logged depth __2J^.iP.._

Density
T.C. _2_ Range .IQCLcps.
Recording speed 2D_f£/min
Logged depth 296 ft

Depth

II

No samples -0-0

- 20

- 100

r-150

. - .- - 1 -.

-EOO"60

_ -I
r

ir-;.: -: -. V1:E^3 f'^ 1 "-

- 80

300

_ 100

-350

160

Hole number 10 A

SP Resistivity
Sens, setting 5.Q_MV Sens, setting. 5<L_. Recording speed _2Q_ "/min Recording speed20 fy Logged depth _ 288.ft Logged depth -28

-\

-I-i
-i

i

-i

Depth

- o-o

-50

"

L

HOO i

L I

r -40!

r
L

-zoo"60

k '

f-250 I
:~ -so

h !

300
r

'- i

'--350 '

161

Hole No:.__11 A.____Map:_BsyialLNi____Dace:._.M:71.State: ND County: Mercer __ Elcv.:_l£7_Q/t__ Location: T.1.1L.X, R.88_w, Sec. _12_ , Tract:. W?J>4-_ Drilled depth: ___8°JL.____. _.._ Measured: jt4SJJL_ g!u. 448_ft_ FWL. Hole size: 4 34 in. Air Q Water 0 Cored: Yes D No [3
Lignite beds: _52r2Q _ ... . - ... - .. ..._....-._.. ..-. . ._....._._

Remarks:
Ltthology
Recorded by:

Geophysical logs
._ Geologist NO recorded by: .___.Lechncr._.. .___.__

Litholog)'

Gamma

T.C.-_2_ Range
Recording speed 20. "/min
Logged depth _

Density
T.C. 2 Range IPASEi
Recording speed 2Q_"/min
Logged depth 80 ft__ C'C* I ^

Depth

II
~ No samples -0-0

I . ' ' ; jC' 'i

- 50

- 20

h!00

Hole number 11 A

SP

Sens, setting ..5.QjMV.

i . i

Resistivity Depth

iSens. setting 5.Q | w ° £ I ° _ I k-
Recording speed _2H."/min Recording speed2D>t/min I « «

Logged depth _ JSILft _ Logged depth . _ 8.0 &...__ I w «

J

i i

ro-o

I

-so

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No; 12 A __Map:_Beiilah______Date:^2=2A-2L State: ND__County: Mercer Elev.:_JL,940.ft_Location: T.-lMse, R._88_w, Sec. ._1P__, Tract:. __cdab_ Drilled depth: _60jt_
I-^lJt fcvP^. ; I (I

Measured:JLQ5IL£L_FSL, ^250_£tFWL, Hole size: 4 % in. Air (X| Water U Cored: Yes U Lignite beds: . - - - ...._.-._.

No0

Remarks: No S.P. or Resistivity logs run.
Lithology
Recorded by: -

Geophysical Joes

_, . . Yes lit

__.._. Geologist NO recorded by: ..._ Lechncr

Lithology

Gamma

T.C. _2._ Range ._lQQ_cps_
Recording speed Z^rt
Logged depth _.60.ft

Density
T.C. 2 Range 100 cps
Recording speed ±£"
Logged depth _60 ft c*f i -

Depth

No samples -0-0

- 50

- 20

- 100

-40

h!50

-EOS60

- 250
~ -80

-300

_ -100

163

Hole No:__U_A____ Map! Beulah_____ ._ Date: .22&ZL. State: ND County: Mercer Elcv.: l,.950.ft_Location: T.lilJt, R.88_w, Sec. J___, Tract: _M4<L Drilled depth: _JPjt___ Measured: 26.20jt._ £&& 159_3_£t nSfc, Hole size: 4 3A in. Air (Xj Water Q Cored: Yes Q No Lignite beds:. .. .._.. .._. . .... . ._ ..

Remarks: No Density, S.P. or Resistivity, logs run.
Lithology
Recorded by: . -

Geophysical logs
_ Geologist NO recorded by: ____Lechner

Lithology

Gamma
T.C.-2.- Range .100 crjs_
Recording speed 2J2.' c/min
Logged depth _4£_£t____

Density
T.C. __ Range _.__
Recording speed "/min
Logged depth _______

Depth

No samples irsr: 3

164

- 0-0

-20

Hoo

-40

-ZOO"60

250
f- -80

-300

_ -100

-350

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: __ Mercer 14 A __ Mnp: Beulah NW __ _ Date:. _JL7:Z7__ State: ND County: Elcv.:_JU98Lft _ Location: T.L46.X, R.&8-.W, Sec. ..28.. , Tract:. _dccc_ Drilled depth: __ I Measured: _J23_fr__ FSL^S^ASjt ^ Hole size: __li4.m,__ Air [XJ Water Q Cored: Yes [j No Lignite beds: 97-l£>O._ _ .. _ ... . _... .._.. . .. _____ ._._.__... .

Remarks: No S.P. or Resistivity logs run.
Lithology
Recorded by: .

Geophysical logs
... .._._ Geologist NO" recorded by: _____ Lechner. __.

Litholog\r

Gamma
T.C.._ 1_ Range 1QO.C£S_
Recording speed2fi'r/niin
Logged depth _12.(L£t_

Density
T.C. _3_ Range 19.0 JEEi
Recording speed ZflL
Logged depth 120 ft

Depth

II

No Samples

- 20

-200-60

250
- 80

-300

_ -100

165

Hole No:_..15.A.____Mnp:^ejJah_____ _Date: JL&7.Z_State: ND County: Mercer Elcv.: _JU9j8CLflL_ Location: T.141.S , R3B._w , Sec...22.., Tract: ....dcbb _ Drilled depth: _60_ft____.. . Measured: L3.QQ.fL FSL%620jt_ Hi. Hole size: 4 % in. Air [Xj Water Q Cored: Yes D No i Lignite beds:. . - .... _.. .._.._.... ._ ... .

Remarks: No S.P. or Resistivity logs run.
Lithology
Recorded by: ... . - ...._._. _

Geophysical logs
____ Geologist NO recorded by: ...___Lcchner.

Litholog)'

Gamma
T.C.._2_ Range !QO_?RS

^o Recording speed z-Si
Logged depth _, 60 ft

Density
T.C. _!__ Range 1P_Q_£E1
Recording speed 20-
Logged depth 60 ft

Depth

No samples r=rrrr^--=.-=:.-- -. -0 -0

J-50

- 20

- 100

-40

r-150

-EOS60

-250

-300

_ -100

-350

166

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__L6_A_____Mnpt Beulah Date: 7-26-77 State: ND County: Mercer ____
Elev.: _JL980_ft__ Location: T. M!&, R.-8Z.W, Sec. _32_ , Tract: ._aada.__ Drilled depth: 36 ft __
Measured: 805ft KSB, _84f__§&. Hole size: __4J_Jn__ Air B Water Q Cored: Yes Q No Q Lignite beds:. - - - - - - - - --- ....._..-. . _........

Remarks: . Clinker 0-36; no logs run
Lithology
Recorded by: -

Geophysical logs
Geologist NO recorded by: . Lechner_.. .

Lithology

No samples

T.C..

Gamma
Range
Recording speed "/min
Logged depth _________

Density
T.C. __ Range ______
Recording speed *c/min
Logged depth _______

Depth

tu _>

- 0-0

1-50

-20

- 100

-40

M50

-250
- - 80

-300

_ -100

167

Hole No:__L7.A.... _ Map:IloiicnLVa|ley_NE_.Date:_M-Zl_State: _.2!2__County:__Mcrccr Eicv.:_2,24Qlt_._ Location: T. 14£Jk f R. -SSL*, Sec. .12.., Tract: Jbbcc __ Drilled depth: __300ft Measured: JJL6Zfc Ji». -i4.£L. IWL. Hole size: __l^iilL. Air E Water D Cored: Yes [j Lignite beds: ._2p-22j_57-_6p; 114-116; 240-244; 265-267 , _ _ ______ __

Remarks:
Lithology
Recorded by:.

Cloopliysical loirs

_ . . Yc« i 7 i i ^

.. . Geologist NO recorded by: __

Lithology

Gamma

T.C. .I Range 1P_C
Recording speed 20.'V
Logged depth 298 ft

Density
T.C. JL Range
Recording speed ^fiL
Logged depth 296ft

3JL Depth

_ u. ->

No samples

:rr-.r__4-::__=;=: -3QO

_ -100

- 350

168

Hole number 17 A

SP
Sens, setting 5Q_MV._
Recording speed _2d &/ min Recording speed .20 &/ Logged depth __ 2S8..ft._

1
- I

1

Resistivity
Sens, setting 5Q__
i / % f\ C*. i
mm

Logged depth __298.ft__

Depth

4J O

II

- 0-0

- 50

~

i

-4C

,-!50

I :
L-200- 60'

250 !
i
- 80*

:-300

- 100:

-35C '

169

Hole No:__liLA-...- __Mnp: Zap______ Date:_J3dL-27__State: ND County; Mercer £lcv.:_J,9 LQjt__ Location: T 144 £, R. 89_^ . Sec. _24._ , Tract: ._b.cdc _ Drilled depth: __40ft Measured: 2,63Q.fL*Sfc, J.Q.O.IL W., Hole size: 4%K_ Air g] Water Q Cored: Yes D No S3 Lignite beds: . 14=2J ..._ .. .. - ....-.._.. ..._...... ... ._

Remarks: No S.P. or Resistivity logs run.
Lithology
Recorded by:

Geophysical logs
._.__ Geologist NO recorded by: .._.Lechner. .

Lithology

Gamma
T.C._1_ Range
Recording speed 2Q' c/min
Logged depth _ 4Q ft .

Density
T.C. _3_ Range _5QO_cps
Recording speed 20."/min
Logged depth 40 ft__

Depth

No samples

t"~._.~:. : . .«- -* r- *

- o-o

1-50

- 20

- 100

-40

f-150

-200-60

-250
- - 80

- 300

. -100

- 350

170

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__Jki_A____ Map:__Be_uJah_NE^.___ Date:.Jt§:ZZ_State: ND County:__ Mercer Elcv.;_2,.Q30lt_. Location: T.l45.fe, R.-8S.W . Sec. _10__, Tract:. _.add<L Drilled depth: _J.40jt_

Measured: 2A626_Lt._^', J3 ft__ ^, Hole size: ___i. 3AJ^ Air D Water H Cored: Yes T

Lignite beds:.-_90-92;.9_9:1_19 . _ ... ._.. __._._.. _. ________..

No

Remarks:

Lithology
Recorded by Michael Camara

Geophysical logs

Geologist sac recorded by:

Lithology

Gamma

T.C._2_ Range ,IOO_cp.s_

Recording speed _?P"/min

Logged depth _.140.ft_

Density

T.C. 2 Range l_00.eps

c Recording speed 2:Q_"/ min
Logged depth _HQ J£__

Depth

u. CJ

II

0- 10 Sandstone, yellowish-brown, silty

_ 10- 14 Claystone, light-grayish-brown, silty
14-15 Lignite
15-21 Claystone, light-grayish-brown, silty
21-29 Claystone, gray, silty
29- 34 Siltstone, gray
34- 47 Sandstone, light-gray, very fine grained to fine-grained
47- 49 Sandstone, grayish-white, very fine grained 49- 61 Sandstone, light-greenish-gray, very fine
~ grained to fine-grained
_ 61- 88 Claystone, dark-brownish-giay

_ 88-89 Lignite
89- 93 Siltstone, brown
~ 93- 95 Claystone, dark-brown
_ 95- 98 Claystone, dark-gray
98-117 Lignite
117-135 Claystone, gray

135-138 Claystone, light-green
138-139 Sandstone, light-gray, silty
139-140 Claystone, green

- 0-0

- 50

- 20

- 100

-40

1-150

-EOS60

- 250

- 80

-300

_ -lOO

-350

171

Hole number 19 A

SP

Sens, setting - ._5.0.MV__ Recording speed _2
Logged depth _._ JL40 ft

Resistivity
Sens, setting- -5.0

1

- I
J

1

A 20 ft/min Recording speed_2Qwmin Logged depth __14.0 ft._

Depth

&

- 0-0

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L
h°
-

iOO

-40.

r-150

-2CO~ 60

J

- 250

- - 80

-300

- 100

-35C

172

NORTH DAKOTA U'.OLOGICAI, SUKVKY

Hole No:... AG _1_. _ .Map:... Bculah NW. .Date: 8-5-77 State: ND County: Mercer Elcv.:.-2jl81.ft__ Location: T. 1.46s, R. 89 w.Soc. 26 , Tract: addd Drilled depth: 300 ft Mcasurcd:2^LfL-«K» _3.3 ft.Si. Hole size: __4_&in, ... Air [X Water Q] Cored: Yes L'l No [x] Surface ownership:_______ ..__ _..._..__ ___...._____..__._____. Coal ownership:____ _..___ . . .._ T.i gnifft hed«: 150-153; 230-237; 275-279 .. _ .. .. .___.._. .._. ._ ._ . ____.__....____.___..__ Remarks:__- ._...__.._ . ._. _ . ._ ..._._. .... . .___.. .... ._ ._______ Lithology
Recorded by:.

Yeg Geophysical logs
_ , . Yes r i i i & T 1. Geologist No recorded by: __._Lggh.nef _

Lithology

Gamma
T.C..-2 Range 100 cps .
Recording speed 20rt/m jn
Logged depth _3QQ ft . ..

Density
T.C. __2. Range 100 cps
Recording speed 20. "/min
Logged depth .300..ft _ _

Depth

No samples -0-0

-20

_ -100

-350

173

. i._.L_.J.__l_J.

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Hole number AG2

SP Resistivity Depth
Sens, setting 2_0_MV Sens, setting 50_____ w
Recording speed^Q_^/min Recording speed20.ft/min j g 2 Logged depth J,60 Jt_._ (Logged depth _J.6p.ft __ £ £

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J

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r50

- 20

- 100

- 40:

j-200"60

,^250

- - 80

^300

-350

176

NORTH DAKOTA (.I'.OI.OCir.AI. SURVF.Y

Hole No:_ ..AG 3 ..__._Ma p: Beulah.NW . n.,rc: 8-5-77 St.m-: ND County: Mercer Elcv.:-I,l36jt__ Location: T. 146 §:, R. 88.w.Soc. 30, Tract: cdcd Drilled di-ptli: 280ft Mcasurcd:_^6JL._ FSL* IxZOOlfJWL. Hole size: _A?A in. ._ Air 1% Water [J Cored: Yes L'l No [XJ Surface ownership:________._ ..._......_._._..... __._.___. .._ Coal ownership: _____.___ rignii-P hp.rU! 112-115; 182-192; 225-229 _.. . _____ _ ____....__.______.- __.________._.__ Remarks:_______. .. _ .. ..__... .__._. ._.._ .. ._...__. .._. __._ - ..... ._. . ._______ Lithology
Recorded by:

Geophysical logs
Geologist NO recorded by: ______Lechner.

Lithology

Gamma

T.C..-2.. Range .100 cps_
Recording speed 2Q'Vmin
Logged depth _28Q ft .....

Density
T.C. _2 Range 100 cps.
Recording speed 20. "/min
Logged depth, 280 ft .

Depth

No samples 0-0

- 50

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ri"^

177

-20D" 6(

250
-8C

-300

Hole number AG 3

Resistivity j Depth
Sens, setting -J.._i<L_ I
Recording speed JLQ_ ft/min Recording speed-20ft/min ' - *> Logged depth 280 ft_. Loggc<

SP
Sens, setting.

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- 100

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-250 !
'- -80

rsoo -;

- !00:

-350

178

IN'ORTH DAKOTA (il'.OLOCICAL SUKVF,Y

HolcNo: . . AG4.___Map:.Beulah_NW . ..Hate: 8-5-77 State: ND .County: Mercer Elev.: _.2,170_ft_ Location: T. 1.46.§: t R. 89 .w , Sec. 34 .Tract: daaa Drilled depth: 320ft Measured: JL434JLFSL, _20_ft_ *w& Hole size: __4%Jn.
Surface ^nrfo/-o r»\jrr>prcMifT ownership:_______...._. _...._.
Lignite br^>- 143-145:182-184:223-230
Remarks:______._.-__.... ..
Lithology
Recorded by:

Air [XJ Water U Cored: Yes ["] No [Xj
Coal ownership:_______.__ ___

ye Geophysical logs
____ Geologist NO recorded by: _____Lech_njr_

Lithology

Gamma

T.C..-2-. Range JLQO cps.
Recording speed ?Q' c/niin
Logged depth _320.ft ...

Density
T.C. _2. Range 100 cps.
Recording speed 20. *V
Logged depth _ 320 ft

min

Depth

No samples -0-0
- i-^-".- ~',^f r ..~~TJ P"^^ i ' "i ~ "T - -, ~~'. ~' I ~. '.._L 1 _;

-

^ -_

179

Hole number AG 4

SP
Sens, scttin01 50 MV_____
Recording speed _2Q. ^/mir
Logged depth _32_Q_ft__

Recording speed_^0, ft/min Recording speed^O.^/ Logged depth 320 _ft

Resistivity
Sens, setting 50
min

-m

j j

Depth

g
2 I

r-O-O

r

- 100
i
I I

L i
!_ -40

- 150

r !

-200~60'

- 250

- -80

- 500

- 350

NORTH DAKOTA GEOLOGICAL SURVKY

Hole No:_.AG.5.. . Map: .Golden Valley NE. Date: 8-6-77 State: ND . County: Mercer Elcv.:__2.4 4JLft __ Location: T.14<L§ , R. 89 .£, Sec. 34 . Tract: bccc Drilled depth: 300 ft Measured:2,613.ft_ m* _35.ft_3m., Hole size: _A&in...__ Air L& Water [J Cored: Yes [ ] No Surface ownership:_______.__.._ ...._.._____._ ...____.. _._._. Coal ownership: _____...___.. . .... Lignite beds: JZZii83jJ97-199_. ._ ... ._.. . _ ...__._...__._ .._..__.._ _. ____.__......____.__ Remarks: _______ ... ... -. ._. .- _._
Lithology
Recorded by;

Yes Geophysical logs
. Geologist NO recorded by: ___Le_clmfir_.

Lithology

Gamma

T.C..-2 Range JOO cps..
Recording speed 20>t/min
Logged depth _296. ft ..._

Density
T.C. _.2... Range 100_cps
Recording speed 20.' t/min
Logged depth _ 295 ft_ ._..

Depth

No Samples -0-0

- 50

-2C

- 100

-40

. :r. _:: -^7- .. -.--r
. i I , r-,-

350

181

Hole number ACS

SP

Sens setting 50 MV S Recording speed 2SL fyminP Logged depth _226_ ft. _ I

RCSJ
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recording
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stivity Depth ;
n? ^" ... 01

; speedlOfc/min « 2 pch._296.ft.__ £ | :

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NORTH DAKOTA (iKOLOGICAI, SURVKY

HolcNo:._. AG.6 ._ Map: Golden Valley NE Dan-: 8-7-77 State: ND County: Mercer Elcv.:_.L990_ft._ LocaCion: T. 146^, R. 89 .\v. Sec. .22 , Tract: caaa Prilled dquh: 80ft Mcasurcd:_21 482_fL FS?;2,62_Q ft FWL Hole size: __4_3Ain...._ Air [Xj Water L.J Cored: Yes [j No [XJ Surface ownership:_______ .... _.__...__. ._ .....__ ._._ _. Coal ownership:______ ... __ T.ignirp beds:...30-36 ___.__..._... ._.._. . ..._.... ....____..._.._.________._.___._

Lithology
Recorded by:

Yes Geophysical logs
Geologist NO recorded by: , . Lechncr

Lithology

Gamma VJilllllliU. Density X^^IIOiL\
T.C...2._. Ranee 100 cps. T.C. .2. Ranee _100.eps

r f Recording speed 20 'Vmin j Recording speed 2Q tc/iTiin
Logged depth __ 80 ft .... Logged depth _ 80 ft

Depth

No samples -.-..-=-0-0

. "" -2C

r -:

r__._" _ -

-4C

1-150

-20D" 6C

-250
- - 8C

-300

_ -IOC

183

-350

Hole number AC 6

SP

Sens, setting__2Q_MV_

Resistivity
Sens, setting . 2.0 _.

Logged depth .JO. ft;..

l
j

j

i

Depth

Recording speed _2Q."/min Recording speed -2Qrt/m in i o "

Logged depth.__&<!.&._ -_ \£! w o

ho-o
L

r50

rlOO

-40:

riso

- 200-60

250 i
- 80

- 300

_ -iOO:

- 350

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:..._..AQ.7. _Map:..Bculah__NW ..Dare: 8-5-77 State: ND County: Mercer
Elev.:. J2>290_ft__ Location: T. 145 §:, R. 88 _w . See. 6 .Tract: cbbc Drilled depth: 360 ft Measured: liQ20_(L FSL* _2fi_fjL_ FWL, Hole size: __434_in.__ Air [XJ Water [..] Cored: Yes ["] No [Xj Surface ownership: . . . -.
Lignite ^^-- 84-86; 296-298; 349-351 _..... _
Remarks:________._._ ._..- .. ._.. -
Lithology
Recorded by:

- Coal ownership:

Geophysical logs
. Geologist NO recorded by:

Lithology

Gamma
T.C..-2... Range JL.QQ cps_
Recording speed 20't
Logged depth _ 356 ft

Density
T.C. .2_ Range 100 cps^
Recording speed 2Q' t/min
Logged depth _. 356 ft

Depth
Cfl
Ui

*J CJ y "
-' £
U. 5

No samples 1-0-0

- 'f--^ [Tl". -'.T -^

- - - * _^r*--^ * « "j-j f*\^~ ~ T- --'- "' " -i'i'^^T_;^-" _'^_ _* "--,- / ^.^"J "

*- -..^350

185

Hole number AC 7

SP

Sens, setting 50.MV..
Recording speed -20. ^/min
Lo2»ed depth .,.33.6 ft

Resistivity
Sfns <;(*fnrn» 50
Recording speed 2jQ.ft/min
"Looped ^^06^ %| dcoth "^y*"., ,356 ft

Depth

*- 0

II
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1
n_o

_J

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J

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-20:

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r-100
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-4o;

r200-60

r250 .

-80.
r-

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J-300 ,

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-100:

^-350

r
r

186

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__HJ _______ Map:... . Leipzig 2 NE Date: 10-4-77 State: _ND_ .County: Grant

~ \\ o _ ~ l -

Elcv.:..J2,3.0Z_f]t__ Location: T.JJla, R._89_w , Sec. __.2_ , Tract: .J?ccc __ Drilled depth: __2_2? JI___ ... .._

Measured: 2*61CLk_ rtfe. J?5_£t_ TO. Hole size: 4 3/£ in . Air D Water CEi Cored: Yes [j No g]

Lignite beds: 7.6-^^9.3,9.6; 1.71:173;. 196,199

Remarks:

Lit ho logy
Recorded by: _HaLQwen_

Yes

Geophysical lops

___. .._.___GeologistW recorded hy: ..___...Lechner

Litholog\'

Gamma Density

T.C.._2_ Range .10.0.cps_ T.C. JL. Range J,QQLcp.s

Recording speed ZQ"/min Recording speed -2Q*Vmin

Logged depth _22P_£t__ Logged depth 220 ft _

Depth

X

0-2 Siltstone, dark-brown
2-15 Claystone, medium-gray
~ 15- 37 Siltstone, medium-brown; traces of limonite at _ 19 and 32 ft

37- 74 Siltstone, medium-gray

74- 75 Lignite, black
75- 80 Siltstone, medium-gray
80- 84 Lignite, black
84- 93 Sandstone, medium-gray, muscovite 93- 95 Lignite, black
95-112 Claystone, medium-gray
112-114 Lignite, black
114-120 Claystone, medium-gray
120-152 Siltstone, medium-gray

152-155 Siltstone, dark-brown
155-158 Siltstone, medium-gray
158-170 Claystone, brown, carbonaceous

170-173 Lignite, black
173-175 SUtstone, medium-brown
175-188 Siltstone, medium-gray
188-189 Lignite, black
189-195 Siltstone, medium-gray
195-220 Sandstone, medium-gray

- o-o

- 50

- 20

- 100

^~"^1Z"T""*" ^---T-r 1^' ~ ' cr^* f~- J~'~*"^Z" IT _» ~"--;'A""- ,' *J" *"" "L^^

-2CS60

r-250

- - 80

-300

_ -lOO

187

Hole number H 1

SP
Sens, setting ..5<XMY_ Recording speed _2Q_ ft/ min Logged depth _. 22Q jft__

Resistivity
Sens, setting -5_Q Recording speed 20_tt/m in Logged depth ~ _.220 tt_

H

j
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j
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Depth

- 0-0

- 50

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-20;

-40:

pi 50
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r-250 ;

i- -so;

u ;

r r300

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L -loo

-350

188

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__ H 2._ .__Map:__LeipligJ2. NE_ .._ Datc:._l_0:5.-:22_State: ND County:_.. Grant.._.__ Elcv.:_2,39.5. ft__ Location: T.-134$, R..89-W, Sec.__1Q., Tract: _bbcc _ Drilled depth:__300_£t__.. Measured: J^QOJLfSfc, _12JL_fwl Hole size: __i_%m,__ Air G Water fx] Cored: Yes [j No Lignite beds: -24^24^32^5; 119.-121;.248-253 . ...._..._.. .. ____..___.__..

Remarks:

Lithology
Recorded by: HaLQw.en

Geophysical logs
Geologist:**1 recorded by: .____Lechner

Lithology

Gamma

T.C. _2_ Range JOQ cps_

Recording speed ZO't/

Logged depth _3QQft

Density

T.C. _J_ Range _5.0Q_c.p&

Recording speed 2Q.i

Logged depth __3_QP

Depth

0-10 Siltstone, medium-brown

10- 15 Siltstone, dark-brown
_ 15-23 Siltstone, medium-brown
23- 25 Lignite
25- 30 Claystone, medium-brown
30- 32 Claystone, medium-gray
~ 32- 33 Lignite
_ 33- 45 Qaystone, medium-gray
45- 53 Sandstone, medium-gray
53-55 Lignite
55- 68 Siltstone, medium-gray
68- 69 Lignite
_ 69- 75 Siltstone
75- 80 Claystone, light-blue
~ 80- 87 Qaystone, medium-gray
_ 87- 99 Siltstone, medium-gray
99-101 Lignite
101-115 Siltstone, medium-gray
_ 115-116 Lignite
116-140 Siltstone, medium-gray

- 140-200 Sandstone

200-210 Claystone, carbonaceous

210-217 Claystone, medium-gray
217-220 Claystone, dark-gray
220-225 Qaystone, medium-gray
225-228 Gay stone, dark-gray
228-248 Qaystone, medium-gray
248-252 Lignite
252-255 Siltstone, dark-gray
255-260 Sandstone, gray
260-300 No samples

- 0-0

- 20

-40

5H50

_ . __._. , ._ j~

IT-ji-ir'lii: " J?" ">?/>
.. _- .. .: ... '."^. " ^AU
",^~ ~_~~~', -^;*__ * 7 -^- ^** -- -c* - ^i'_~*'__i'""^j
.__. ^ _...._ _ __ J _ ^^'^"i~^~T.~v. "*^. . _ -- -_. -~

'~~--E~.>- 25O

£-:- _ ^<J ^^ '^^ ------f - - _ -1 ~ -80

:60

300

_. -"00

189

SP

Logged depth _.. 3£0..ft.._

H

-i

i

-I

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-I

Hole number H 2

Resistivity Depth
Sens, setting_ ..SQ-MY Sens, setting 1 1.PJ9 Recording speed 20- ^/rnin Recording speedlQL^/min ** « Logged depth _300.ft_..__

"".- ' ..Tl^." ^^' HZ.JZ .-T^ .

- - - - **^fj^" " ^>* " "" J^.t?

- o-n
i

C

20

i-iOO

- 40

200

- 80

- 300

- 100

- 35C

190

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_H3 __Map: Leipzig 2 NE Date: __WL4-72. State: __ND__County:_.__(? Elcv.: _Z3.25_ft_ Location: T. .Uls , R._8?_w , Sec. _ 2__., Tract: .__dddc_ Drilled depth: ___2Qfl_fL.... Measured: 20ft FSL. J>28_?t_fyi, Hole size: ___4_%jn. Air D Water H Cored: Yes D No Lignite beds: J4-18U43JL46j.158.160 ...

Remarks:
Lithology
Recorded by: JHalQwen__..___..________ _ , . Yen

___ Geologist *c&

Geophysical logs
recorded by: ..._ Lechner

Lithology

Gamma

T.C_2_ Range .l.QOjc£s_
Recording speed 20. "/min
Logged depth _ 2DJQJk_

Density
T.C. 2 Range _!QO_cgs.
Recording speed 20_"/min
Logged

C'C'

depth

I

_200 Jt_ _

Depth

w O

~~ 0-73 Sandstone, brown -0-0

- 20

73- 80 Lignite, black
80-105 Siltstone, medium-gray

105-110 Sandstone, gray
110-143 Siltstone, gray

143-J46 Lignite, black
146-153 Siltstone, gray
153-157 Siltstone, dark-gray
157-158 Lignite, black
158-175 Siitstone, medium-brown to gray
175-200 Sandstone, gray

~ -' . " ^,1 ^ /) -- - - -- - - - - _T^;

r" _ : \y ^^r

-20D-60

- 250
~ -80

- 300

-

_ -lOO

191

Hole number H 3

SP j Resistivity Sens, setting 5Q.MY [Sens, setting .5.Q_. Recording speed _J*Q. ft/min Recording speed _2P.ft/m in Logged depth _.. 2QD. ft_ Logged depth _._2_QQ.ft__

]

i

j
j

J

-* T~~ "HAZ" rjiv^ ITTI ~ T .'^ IT*" iJ? ^ * i*.ni-i.1 ""mrc^J
- j; * JTT ^- -«. JT1 *. rf7 . m_^IT r TTi _r f-. u.- . _ *._ v. _. .^^ --7.j..TT^

Depth j

rO-0

h50

- 20,

r

-40'

. -150

r

- 200-60

- 250 :
- - - 80

r300

_ -iCO

192

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__H_6__.__Map:.Leipzig.!NE_ _ Date:...JJhilZLState: ND County:__.Grant ..____ Elcv.: 2.325.J&L_Location: T.J34<5, R.-8?_.w . Sec. __2J2__, Tract: ..a.daa.._ Drilled depth: _.._240_ft._.... Measured: L5_84JL *Sk. JLQ_6._ RWk. Hole size: 4 % in. Air G Water B Cored: Yes G No KJ

Lignite beds: ..^7-99; 160=163. .... ____...____... .._

Remarks:

Lithology Yes

Geophysical logs
Lechner

Lithology

0-10 SUtstone, medium-brown

15- 17 Siltstone, medium-brown
17-23 Siltstone, dark-brown
23- 31 Sandstone, brown
31-35 Siltstone, dark-brown
35- 36 Claystone, light-gray
36- 37 Lignite
37- 45 Gaystone, light-gray
_ 45- 50 Siltstone, light-gray
50- 60 Sandstone, light-gray
- 60- 65 SUtstone, light-gray
65- 75 Siltstone, brown
75- 80 Claystone, medium-gray
- 80- 82 Siltstone, gray
82- 87 Gaystone, medium-gray
87- 90 Gaystone, carbonaceous
90-93 Lignite
93-102 Gaystone, medium-gray
102-105 Limestone, light-gray
- 105-120 Gaystone, light-gray
120-152 Siltstone, medium-gray

~ 152-160 Lignite, black

~ 160-240 Sandstone, medium-gray

-

_

Gamma

T.C._2__ Range JLQQ_cps_

Recording speed 20 'Vm in

Logged depth __240_ft__

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^ .Ljr^^ *° ; -

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prmnr-f^rrr^-^j \ -
|~rr-.-. -- -*-:. zS^ l IZQ 1

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Br:^^ 2M ^r:

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r; ::^^^^^77! ^

Density

T.C. .!_ Range 1°°^P1

Recording speed 20^/min

Logged depth 239 ft

C*v-7 L

Jr:: i'"""^.^^"-"-. ~:.'7-'j

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7': ?-..~-~::-- -. : "^5^

V^-----^::j.:.£^

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i^^..*!, /sat-s*/*^ O-^^^r ^]

Depth
i/i
u

w 0

»8 1
t"i* *2

- 0-0

K-

- 50

" -20

- 100

-40

- 150

"

~

-200-60

_

- 250

- - 80

- 300

_ -100

193

Hole number H 6

T'

SP Resistivity
Sens, setting 5.0.M.V ._ jSens. setting . 1.QQ-. Recording speed _2£Lft/min[Recording speed.2Qit/min Logged depth _.. .210. A_ [Logged depth _.240 ft _

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j

- I

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- 1

-j

d*r« "crl.T"rr _VTT r*. * ~ " r «. 71

Depth

- 0-0

i_50

r
- 100

L

-40;
i

-250 :
i i
L- -80

r-300

-too-

-35C

194

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:___tL7__.-_ Map:_Lp.iD.zig.2._NE_ __ Date:.JjMr7.7__State: _ND___County:_Grant__...... Elcv.:__2»335.ft_ Location: T._134*, R. 89 _w , Sec. __26.., Tract:..ibbb ._ Drilled depth: __...._16_0_ft__ Measured: l,5.5.Q_fL FSL, _38 A. FWL. Hole size: 4 K in. Air [j Water H Cored: Yes D No Lignite beds: .-2.3-_aiL.87-.S.9 ... .. _ ... ._..._.._._.. .. ____.___.__...

Remarks:

Lithology
Recorded by: Richard Scattolini

Geophysical logs
._._ Geologist NX recorded by: .___ .Lechner. Ye,

Lithology

Gamma

T.C._2_ Range ._lQQ_cps_

f Recording speed2Q_ rt/min
Logged depth _JL6.CL£t _

Density

T.C. _2_ Range J,QQ_crjs

Recording speed 20_'Vmin

Logged depth _16.Q JI_

bepth

II

0- 6 Siltstone, yellow
6- 11 Claystone, yellow, silty
11-16 Claystone, light-brown
16- 19 Claystone, yellowish-brown
19- 23 Claystone, dark-brown, carbonaceous 23- 26 Lignite, black
26- 27 Claystone, dark-brown, carbonaceous 27- 28 Claystone, medium-gray
28- 31 Claystone, very dark gray, carbonaceous 31- 35 Claystone, light-brown, silty
35- 40 Qaystone, light-greenish-gray
40- 42 Siltstone, pinkish-gray
42- 44 Claystone, light-gray
44- 51 Gaystone, brown, carbonaceous
51-56 Sandstone, very light-brown
56- 64 Sandstone, very light-gray, fine-grained 64 65 Lignite, black
65- 70 Claystone, dark-brown
70- 71 Claystone, medium-gray
71- 75 Sandstone, light-gray, fine-grained
75- 76 Lignite, black
76- 79 Sandstone, medium-gray, fine-grained
79- 80 Sandstone, grayish-brown, fine-grained
80- 85 Sandstone, medium-gray, fine-grained
85- 89 Siltstone, dark-grayish-brown
89- 91 Lignite, black
91- 92 Sandstone, brown, carbonaceous
92-150 Sandstone, grayish-green, marly, fine-grained 150-160 No samples

- 0-0

- 20

100

r" "\ r ~_^^r.^~~~^-~~T'~ _T" ~n.Z7 Zl-iT- - """""" -- -

-200- 60

-250

-80

- 300

_ -lOO

195

Hole number H7

SP
Sens, setting . ..50 MV_
Recording speed 20- "/min
Logged depth _.. 160.ft_

1

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H i
i

Resistivity
Sens, setting .122
Recording speedl2.wmin
Logged depth .-I^LfL. __

Depth

- """ ~" --» ^ ' ' "T" ~~ ~ ^ ' * '^~ ^

T:_ i._ z^T"/r«^ rr: :

I0-0

-20]

- 100

-40!

H50

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-ZOO"60-

r250 I
- - 80:

-1

J -300

1_ -100.

- 350 i

196

NORTH DAKOTA GEOLOGICAL SURVEY

Map:_ Lcigzig_2JtfE_ ._ Date:._.10-_4r7!_ State: __N.D _ County :_Gran|__.
« _ / * /* _i _ 1 _ .~*. .11 i * « O O ft ft*

Hole No:__JtfL-_ -
Elev.: _-2,325_ft._ Location: T. .134's , R._89_w . Sec. _26__ , Tract:

r 'Sf^J^C- /\ /* F"HL* A ~\/ f ^ Measured: !i7_00..«_ FSL, JL1Q «_ JcWJc, Hole size: 4 % in. Air L.J
Lignite beds: ..26-li;J.2:.a4; 99-101 . ...

_ Drilled depth:

Water [XJ Cored: Yes [~] No JX]

Remarks:

Lithology
Recorded by: _Esichard_Scajj;Q.iini. _.___... _...__. Geologistsa

Geophysical logs
recorded by: . ._. Lechner

Lithology

Gamma

T.C. _^__ Range 100_cps_
Recording speed 2D'Vmin

Logged depth _200. ft_

Density

T.C. JL Range lQQ_cp.s_
Recording speed 2Q.'Vmin

Logged depth 200 ft c*c? i - - i

bepth

0- 2 Siltstone, dark-brown, clayey
2-15 Siltstone, yellow, clayey
15- 23 Claystone, ycilowish-light-brown
23- 26 Claystone, very dark brown, carbonaceous 26- 27 Lignite, black
27- 31 Claystone, dark-brown, carbonaceous 31- 34 Lignite, black
34- 35 Claystone, light-brown
35- 49 Claystone, light-grayish-gieen
49- 65 Siltstone, medium-gray, clayey
65- 80 Sandstone, dark-brown, carbonaceous

80- 99 No samples
99-100 Lignite, black
100-105 Sandstone, brown
105-161 Sandstone, greenish-gray, fine-grained

161-168 Sandstone, well consolidated
168-200 Sandstone, greenish-gray, fine-grained

- 0-0

- 50

- 20

- 100

- 40

-^frnl-200"60

- 80

h-300

100

197

Hole number H 8

SP Resistivity
Sens, setting 50.MV. Sens, setting -10Q Recording speed_20fymin Recording speed-2-Qfymin Logged depth _.. -20.0 ft _ Logged depth 200 ft..

Depth

h-0-o

-50

i

HOO

L

-40'

|-!50

- 200"*°

_ i
-I

r250 I
7- -80

r ;

- 300

- 350

r

198

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_ H_9__ __Map:__Le]pzig.2_NE__Date:J^±ZZ_State: __NE>__County:__ Grant .._.__ Elev.: _2,22ijCt_. Location: T. .131s , R.§9 _w* Sec. _i4_., Tract: .._bbaa__ Drilled depth: _. 180jt_._ _.... Measured: __L8jt LQ56 ftFWL,

Lignite beds: . . JS^fii IQ7-1 10

Hole sze: &.ilU._ Air D Water Cored: Yes No

Remarks:

Lithology
Recorded by: _±(4-Qw_en. ^ i Geologist

Cleophysical logs
recorded by: ._ Lechner

Lithology

Gamma

T.C. J2_ Range lQO_cps_

Recording speed 20.'Vmin

Logged depth _JJKLft__

Density

T.C. _1_ Range l°.Q_c£s

Recording speed 2Q.'Vmin

Logged depth 180 ft

Depth

0- 4 Sandstone, medium-brown
4- 6 Sandstone, limonitic
6-17 Siltstone, medium-brown
17- 18 Claystone, limonitic
18- 37 Qaystone, medium-gray
37- 40 Lignite

40- 42 Claystone, carbonaceous
42- 45 Lignite
45- 50 Siltstone, light-brown to gray
50- 60 No samples
60- 75 Siltstone, medium-gray
75-105 Sandstone, gray

105-106 Claystone, medium-gray
106-112 Lignite
112-135 Sandstone, gray

135-138 Limestone, light-gray
138-175 Sandstone, medium-gray

175-177 Limestone, light-gray
177-180 Sandstone, medium-gray

- 0-0

.._
' ' " - ~

- 50

- 20

HOO

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5pl50

r250

- 80

-300

i 100

199

Hole number H9

SP Resistivity
Sens, setting __50.MV __ Sens, setting ___LOO__ Recording speed_20 ft/ min Recording speed20.ft/min Logged depth _.. JL8Q ft._

1

-j

t

Logged depth ... _ L$Q ft._

~i

Depth

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p250
- - 80

- 300

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35C

200

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__H_10_ ____ Map:__Lfiipzi&J2.NE_._ Date:._lMr.77_State: __NJ)__ County:__.?_"£!.. . Elcv.:-2,30Q.it_. Location: T. -134.2 , R. 88_J , Sec. . 3_0_ , Tract:. _bbbc _ Drilled depth: __... 180_ft_ Measured: __.633_£t_ £Sfc, _94 ft_ FWL, Hole size: 4 3A in. Air G Water 0 Cored: Yes G No

Lignite beds: .--3.2-35 . . ... _ .... ____.____..

Remarks:

Lithology
Recorded by Richard Scattolini I<*S T t_

._.._ Geologist c&x recorded by: Lechner

Lithologv'

Gamma

T.C. ._2_ Range ._UlQ_cps_
Recording speed 20. 'Vmin C* L
Logged depth _18D_fl__

Density
T.C. _1_ Range .100_cp.s_
Recording speed?5-"/min
Logged depth 180 ft__

Depth

0- 2 Siltstone, yellowish-brown
2- 6 Siltstone, yellow
6- 25 Qaystone, yellowish-brown
25- 33 Gaystone, brown, carbonaceous
33- 36 Lignite, black
36- 37 Gaystone, brown, carbonaceous
37- 38 Qaystone, yellowish-gray, silty
38- 39 Lignite, black
39- 42 Claystone, brown, carbonaceous
42- 61 Claystone light-gray
51- 86 Siltstone, dark-gray, sandy

86-180 Sandstone, medium-gray, fine-grained to medium- grained; no samples 90-145, 155-160ft

0-0

- 20

^rfj /50 r-. - ^-^

- !00

201

Hole number H 10

^P en ui> Resistivity
Sens, setting _. .50.MV__ kens, setting _.___ l.QO __ Recording speed __20 ft/min Recording speed 20 "ft/m in

i

Depth

Logged depth __. 180 ft._ Logged depth -. 180. &.._.«

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r-150

- 200-60

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- - 100

K35C

202

IS'ORTH DAKOTA GKOLOGICAL SURVEY

Hole No:_.HJLL __Map:_i£ipzigJLNE__Date:JLQ-3r.7.Z._State: _N_D_County:__Grant ._.,.._ Elcv.: JU92jt._. Location: T. JL24st, R.-8&.W. Sec.-13__, Tract: .._ .bhbb_ Drilled depth: ._. l£0jt........._
FNL

Measured: 1

Lignite beds: .__43-3£L23rl.01

Hole size: Air [j Water [X) Cored: Yes D No

Remarks:

Lithology
Recorded by: _Hal_Qwen_

Geophysical Iocs

Yos ' ' ^ T 1

...___._.____ Geologist sx recorded by: ...___*±ecnner

Lithology

Gamma

T.C. -2_ Range JQO ft__
Recording speed 2Q.**/m'm
Logged depth 140 ft

Density
T.C. 3 Range
Recording speed 20it/ mjn

Logged depth

Depth

i_. O

II

~ 0- 30 Sandstone, medium-brown; some liinonite

30- 40 Sandstone, gray
40- 47 Lignite
47- 50 Clay stone, light-brown
50- 60 Claystone, medium-gray, slightly silty
60- 64 Claystone, medium-gray
64- 65 Claystone, carbonaceous
65- 85 Claystone, medium-gray
85- 95 Claystone, dark-gray
95- 98 Lignite
98-104 Claystone, dark-gray
104-105 Lignite
105-108 Claystone, dark-gray
108-110 Lignite
110-111 Claystone, dark-gray, slightly silty 111-120 Siltstone, medium-gray
120-140 Sandstone, medium-gray

- 0-0

-50

- 20

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f-250
- 80

- 300

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203

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NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:. _ HJJ __ __ Map: _LeipzigJiNE___ Date:. _ID.-3.z7i_ State: __.NQ __ County: __ .Grant... _._._ Elcv.: _ 2,322.ft _ Location: T. .Ula , R..88_w , Sec. .28... , Tract: __.cddd_ Drilled depth: _.._.140_ft___ . Measured: _13jt __ PS?, 2^600_ft fwl Hole size: _JJ4.in^_ Air D Water [x] Cored: Yes [~J No [x|

beds:. -J7-20J.13-25 .. _ ....__.._._... .. ____ _.____.__..

Remarks:

Lithology
Recorded by: -J .___ ._ __ Geologist *aT

Geophysical logs
recorded by: _...___L?cnn.e£.

Lithology

Gamma

T.C..JL. Range lQO_cp_s_
Recording speed 20.'Vmin

Logged depth _ 140 ft

Density

T.C. 2 Range !QQ_cpj_
Recording speed 2

Logged depth 140 ft

Pepth

0 - 2 Siltstone, yellowish-brown
2 - 12 Siltstone, yellow, clayey
12 - 16 Claystone, brownish-yellow
16 - 18 Quystone, medium-gray
18-19 Lignite, black
19 - 22 Claystone, yellowish-brown
22 - 25 Lignite, black
25 - 36 Claystone, light-gray
36 - 40 Siltstone, yellowish-gray
40 - 61 Claystone, light-gray
61 - 72 Claystone, dark-brown, carbonaceous

72 - 83 Claystone, light-greenish-gray, silty
83 -109 Sandstone, grayish-green, very fine grained, to fine-grained

109 -115 Gaystone, dark-grayish-brown, carbonaceous

115 -121 Sandstone, medium-gray
121 -121.5 Lignite, black
121.5-125 Sandstone, dark-green, finegrained to medium-grained
125 -140 No samples

- 0-0

" '. H-~~ --

"' ~ ', ~ . r>- zrr4

- 50

- 20

- 40

ISO

-EOS60

- 250
!

~ -80

- 300

_ -100

205

Hole number H 13

SP j Resistivity
Sens, setting ..5Q.MY Sens, setting Recording speed .2,0. «/ min
Logged depth . JL40 ft_

7

Depth

1

Recording speed-2P«/rnin
Logged depth _.14.0..&__

- 100:

K35C

I-

206

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__H..I4__ __Map:_§lieepjCreeJ^parn_ Date:.J.Q^£77_State: ND__County:__.Grant _ Elcv.: _.2,4QQ_ft__ Location: T. iMs , R._88_w . Sec. __32__, Tract: ._cddc _ Drilled depth: __ _.180jt_.. .. ___ Measured: _.2QJi_ FS?, ^JOOLft^L, Hole size: ___A^Jlb Air D Water H Cored: Yes Q No fS Lignite beds:-_8.8-90_._._. .,. .... ____.__.___

Remarks:

Lithology
Recorded by- Richard Scattolini

(Icopliysical lo^s
....___ Geologist NO recorded by: . __.._Lechner.

Lithology

Ganima

T.C.-2_ Range _lQO_cps_
Recording speed2D_^Vrnin
Logged depth _18D_ft_

Density
T.C. _?__ Range 100 cps
Recording speed 20.'r/min
Logged depth _1ZZ__

Depth
</> L-
5 S

0- 10 SUtstone, yellow, clayey
10- 15 Sandstone, yellowish-brown, consolidated _ 15- 20 Siltstone, yellow
20- 25 Sandstone
25- 180 No samples

0-0

- 20

~ ~' ~-y^n: : '; »7O c~.~ " ' ' ", '"" ^ ' ~ _L.J.' ----- t "

' ^

250
-80

- 300

_ -ioo

207

Hole number H 14

SP

Sens, setting . .J-P. M_V._
Record i

Logged depth _18.Q.ft ._

1

1

j
_j
1

1

1

Resistivity
Sens, setting .. 1Q.Q
ding speed 2Q-fymin Recording speedZQ. rt/min Logged depth __l.8Q.{t...

Depth

2

- 0-0

L

r50
-20

HOO

- 40'

- 200-60

-250 |
~ -80-

- 300

- 100

i-350

208

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__..£L15____Map:__Lfiith___..___ Date:._lflb3J.Z_State: __.JUD__._County:_. Grant .... ___ Elcv.:__2,393JL_ Location: T.U3-S , R._8JLw, Sec... 2__, Tract: ._abab Drilled depth: __20Q_ft_..._. . . _ Measured: _2_5_£t___ 1st lx.85Q_£tfwfc. Hole size: 4 K in. Air [j Water [X] Cored: Yes [j No [x] Lignite beds: -_7.7-82.

Remarks:

Lithology
Recorded by: -rRandaIl Reichert Geologist m"

(.Geophysical logs

recorded by: ..

Lithology

Gamma

T.C. _2_ Range JLQ.Q_cps_

Recording speed 2D"/min

Logged depth _200.ft_

Density

T.C. _Z_ Range JLO.CLcps

Recording speed -20't/rnin

Logged depth _200_ft__

Pepth

t_» CJ
o trt

0-3 Claystone, brown, carbonaceous, silty 3-4 Lignite, black
4 - 6.5 Claystone, light-gray
6.5- 7 Siltstone, orange, clayey
7-16 Claystone, green
16 - 16.5 Sandstone, yellowish-gray, very fine grained 16.5- 18 Siltstone, medium-gray, clayey
18 - 20 Siltstone, brown, clayey, carbonaceous
20 - 25 Claystone, medium-gray, silty
25 - 27 Claystone, dark-brown, silty, carbonaceous 27 - 37 Sandstone, yellow, very fine grained
37 - 38 Sandstone, orange
38 - 42 Sandstone, yellowish-gray, very fine grained 42 - 45 Sandstone, orange, very fine grained
45 - 48 Sandstone, greenish-gray, very fine grained, cemented

48 - 77 Sandstone, yellowish-gray, very fine grained 77 - 82 Lignite, black
82 - 85 No samples
85 - 90 Siltstone, light-gray, clayey
90 -158 Sandstone, light-gray, very fine grained

158 -162 Sandstone, brownish-gray, very fine grained

162 -166 Sandstone, light-gray, very fine grained, carbonaceous

166 -176 Sandstone, greenish-gray, very fine grained, cemented

176 -190 Sandstone, greenish-gray, very fine grained 190 -191 Lignite, black
191 -200 Sandstone, light-gray, very fine grained

- 0-0

- 50

- 20

lOO

209

Hole number H 15

SP Resistivity
Sens, setting ... ..5£.MY_ [Sens, setting 50 Recording speed _2Q ft/min Recording speed 2Q_tt/min Logged depth _. .200 ft._ Logged depth __.200..£L_

Depth

o-o

i

~!

1

-i

°

OO
L

- 40

- 150

L-2CO"60'

[-250 i
~ -80;

1-300

- 100

H35C

i

210

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: __ HJL6 __ __ Map : _____ Leith ____ ._._ Date:. J_9;3:Z7_ State: ,.J^2 __ County: __ Grant __ _ Elcv.:_2,4QiIt_._Locirion: T.. 133.x, R.88Lw. Sec. ..12. , Tract: . _bbbb__ Drilled depth: ._ . ?20_ft__ __ Measured :_I30JL__ Bte, __60.£t_aKk. Hole size: _____L34Jni_ Air [j \Vater Cored: Yes H No f J Linite beds:. _19-22i_66-73

Remarks: Core hole H 16C was located 60 feet south of H 16; cored interval was 65 to 72 feet; recovery 7 feet. Lithology Yc Geophysical logs
Recorded by : Richard Scattqlini _ . ____ ___ .. __ __ Geologist NK recorded by: . . __ JL-echner ....

Lithology

Gamma

T.C. ._2_ Range 100.cp_s_
Recording speed 20 Wmin
Logged depth _._220.ft_

Density
T.C. 2 Range ,100_cp£
Recording speed20_'Vmin
Logged depth __ 220 ft

C1CF i " '

Depth

- 0- 15 Siltstone, yellowish-brown, clayey
15- 18 Qaystone, brown, carbonaceous
_ 18-20 Lignite, black
~ 20-23 Claystone, carbonaceous
_ 23- 38 Gaystone, dark-olive-brown, carbonaceous
38- 63 Claystone, medium-gray, silty

63- 64 Claystone, dark-brown, carbonaceous
64- 72 Lignite, black
72- 75 Claystone, dark-brown, carbonaceous
75- 85 Claystone, medium-gray
85-It 4 Clay stone, medium-gray, silty

114-220 Sandstone, greenish-gray; no samples 124-135, 200-205 ft

- 0-0

- 50

-20

100

- 40

80 L-~-^^~-

' " """ ~~ < "' - i i / f\ r - _ ~~_ ~ ~*_*" *_"* ' *

- - - - ::- JDJVtz

L -ioo

211

Hole number H 16

SP

Sens, setting. -5£ My_ Recording speed 20 tt/ mji Logged depth _. .220 ft._

- I

1

J

Resistivity
Sens, setting 50
n Recording speed2Q_ft/min Logged depth _ 2.20.ft__

Depth

h-o-o

50

L

- 20

r
r
f-100

L

L
I I
i -40:

h150 :

r !

- 200-60

,-250 i
L -so'

i-300

- 100

-350

212

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: __ H_1.6_-A __ Map: ___ Leith _ _____ Date:. _lQ:l_5£77State: ___NP__ County :__. ..Grant. . ..._. Elcv.: __2,46Q ft__ Location: T. .133s , R._88j/X Sec. ..12.. , Tract: . _bbaa _ Drilled depth: _. .. 14-Q &_._. Measured: _12_£t __ IS. L250.&FW?. L250.&FW?. Hole size:ze __ iiUn, _ Air D Water KJ Cored: Yes f] No (X] Lignite beds:. -JB-13i89-93; 129-136 . ...

Remarks:
Lithology
Recorded by:

Cieophysica! lo^
Geologist f*X recorded by: .... Lechner

Lithology

Gamma

T.C.._2._ Range .10.0 cps
Recording speed 20^
Logged depth _l_40.ft

Density
T.C. _1_ Range A
Recording speed 20* c/min
Logged depth

Depth

~ No samples -0-0

- 20

-eoo" 60

250
' -80

- 300

_ -100

213

Hole number H16 A

SP

Sens, setting 50 MV. _ Recording speed-20. ft/min Logged depth _ 140. ft

j

i

1

Resistivity
Sens, setting _. .50 Recording speed J^P^/m in Logged depth .- 11Q .(i.

Depth

tt. 2
"1

hO-0

r-50

-20

HGO

-40

L200"60

J

-i H'

-250 !
- - 80

- 300

^. -100

- 350

214

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: __ H_17_. _ ,_._Map: _____Date: lQ3-77_ State: . Co unty :__... Grant Elev.:__2,418_(t_. Location: T. Jlls , R. 87 _* , Sec. _.1.8_. , Tract: . .ccc.c ._ Drilled depth: _ _.220_ft._...

Measured: _ 18_ft_ FSL, .38 ft__ FWL, Hole size: __ 4_^in._ Air G Water S! Cored: Yes fl No &J

Lignite beds :-.-40-4Z.__._. - .. .. ____ ... __ . _

Remarks:

Lithology
Recorded by; Richard. Scattolini ^ j Yes

..._._ Geologist306

Geophysical logs

recorded by: ..._ Lechner

Lithology

Gamma

T.C.._2_ Range 100,c£S_

Recording speed 20.^/

Logged depth __22_0_ft

Density

T.C. _2_ Range

Recording speed ?_Q_"/niin

Logged depth 220ft

Depth

0 - 1 Siltstone, reddish-brown
1 - 12 Oaystone, yellowish-brown, silty 12 -13 Qaystone, reddish-brown
13 - 21 Qaystone, light-brown
21 - 21.5 Lignite, brown
21.5- 31 Qaystone, light-brown
31 - 36 Qaystone, medium-gray
36 - 39 Qaystone, dark-gray, carbonaceous 39 - 40 Lignite, black, woody
40 - 41 Qaystone, yellowish-brown
41 - 47 Lignite, black
47 - 49 Qaystone, brown, carbonaceous
49 - 56 Qaystone, light-gray
56 - 64 Qaystone, dark-gray, carbonaceous
64 - 71 Siltstone, medium-gray
71 - 78 Siltstone, green, clayey
78 - 92 Siltstone, dark-gray, carbonaceous, clayey 92 - 95 Qaystone, light-green, silty
95 - 97 Siltstone, reddish-brown
97 -103 Qaystone, medium-gray
103 -105 Siltstone, grayish-brown
105 -110 No samples
110 -171 Qaystone, dark-gray

171 -185 Sandstone, dark-gray

185 -210 Siltstone, dark-gray

"" 210 -220 Qaystone, medium-gray

- 0-0

-50

- 20

(5J-7J ~- v .-»*.«'».*-)u-> tf < ___________ _____

215

Hole number H 17

i

SP i Resistivity
Sens, setting .3.0.MY_ jSens. setting - .v4_ Recording speed2Q_ »t/min Recording speed-^Pft/ Logged depth _. .220. ft._ Logged depth ..220.ft

Depth

-i

- I

-I

1

- i

- 0-0

*j O
o <-

£ 2
'1

- 50

- 20:

h
i-100

-40:

[-150

r

r-300

- 100.

216

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No; HIS Map; Sheep Creek Dam Date: 10-1-77 State: ND County: Grant

Elev.: 2r455 ft Location: T. 132.* , R. 33jf, Sec. _IQ_, Tract: .___.cbbc_ Drilled depth: __280jt__ __

Measured: _2,UAft §)?, _IDJt HVL, Hole size: 4 3/4 in. Air D Water H Cored: Yes D No E

Lignite beds:.

Remarks:

Lithology
Recorded by! Rand?H

Geophysical logs
Geologist«S recorded by: Lechner

Lithology

Gamma

T.C. _2_ Range -lQO_crjs T.C.

Density
2 Range 100 ci

Recording speed 20.ft/min j Recording speed 20. "/min

Logged depth 280ft__ Logged depth 280ft

Depth

0-4 Gravel, yeUowish-gray, sandy
4- 8 Sandstone, yellowish-gray, very fine grained 8-10 Sandstone, orange, very fine grained
10-17 Siltstone, brown, clayey
17-20 Oaystone, very light-gray
20- 34 Qaystone, medium-gray
34-41 Lignite, black
41-46 Siltstone, white, clayey
46- 47 Siltstone, brown, clayey, carbonaceous 47- 50 Sfltstone, white
50-70 Sandstone, very light-gray, very fine grained

70- 75 Siltstone, dark-gray, clayey
75- 81 Oaystone, dark-gray
81- 83 daystone, dark-brown, silty, carbonaceous
83- 91 daystone, dark-gray, silty
91- 95 Claystone, light-greenish-gray
95-165 Sandstone, light-green, very fine grained

... _o -0

- 20

_ 165-188 Sandstone, grayish-green, very fine grained, silty

188-190 Claystone, dark-brown, silty, carbonaceous

- 190-244 Siltstone, dark-gray, clayey

244-250 Claystone, medium-gray, silty

250-280 No samples

f ^r-----=r-? rf^
i: -- - q-:ir_:--.:y^ 77 -300

- 100

217

Hole number H 18

1 Resistivity
Sens.

SP

Sens, setting _2yJBJ£ piens. setting Recording speed 2SL ft/minIRe cording I Logged depth _ 39,0 ft JL

Depth

28°

n

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- - S

F-0-0

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MOO
L

r

- 200-60'

- 250

- -80;

{-300

r- -I00|

^-350

218

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__fcU2_ __ Map:PrfiH.)LRQckBiirte_. Date:.JLH-JL3-Z7_State: __JSID_._ County:_..
Elcv.: 2A7Lft_Location: T..132*, R.~S9_w , Sec.-2CL , Tract: .bbcc. ._ Drilled depth: _ _280_ftL........... Measured: JL3.QO_ft_ SSL, _25. £t_ FWL. Hole size: ___4 Ait D Water S Cored: Yes [j No H Lignite beds: 9-19^59:64 ... . _.. .

Remarks:

Lithology Y
Recorded by: Richard Scattolini______...._. ___ Geologist NX

Geophysical logs
recorded by: . .. Lechnej .

Litholog}'

Gamma

T.C._2_ Range .lOQ_cp.s_
Recording speed 2-Q.' c/min
Logged depth _._280it_

Density
T.C. _JL Range l.QQ_cp.s_
Recording speed 20.' t/min
Logged depth __^.80 ft_

Depth

II

0-6 Siltstone, yellow
6- 16 Lignite, black
~ 16- 22 Claystone, brownish-gray
22- 35 Siltstone, yellowish-brown
35- 60 Sandstone, yellowish-brown

60- 67 Qaystone, light-gray
67- 72 Lignite, black
~~ 72- 75 Claystone, light-brown, silty
_ 75- 80 Siltstone, pale-green
80- 85 Claystone, light-gray
"~ 85-101 Claystone, pale-green
101-115 Qaystone, brown, silty
~ 115-121 Claystone, dark-brown, carbonaceous
121-142 Claystone, dark-brown; carbonatized plant fragments

142-219 Sandstone, dark-greenish-gray, very fine grained

=^-0-0

- 50

- 20

219-224 Siltstone, dark-greenish-gray, sandy
224-270 Claystone, dark-gray silty

~ 270-280 Qaystone, medium-gray, silty

220 _____- __.__.__ S-- _^=^:

_ 100

219

Hole number H 19

SP
Sens, setting _ 3.Q .MY._ Recording speed 20 ft/ mjn Recording Logged depth _. 2BO..ft.._

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1

Resistivity
Sens, setting 100 speed-ZQw min
Logged depth _._. 28Q ft _

Depth

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L

- 50

-20;

40:

150

r

-200-60-

,-250 i
; i
~ -80

f-300

- 100:

-35C

220

NORTH DAKOTA GEOLOGICAL SURVEY

Hole Nn: H20 __ __Map:New.L.dptig^oj»dl- Date :.__1M.?.-Z7 State: ._ND__ County: __ .Grant,.. ....

__ 260_ft__

Cored: Yes [~] No

__ __ . . - .__.. .___

Elcv.:-.2,46CLft__ Location: T. 121*. R._9.0_w , Sec. ..1A. , Tract: .bcbb _ Drilled depth: Measured: 1,4_5_Q.JL R3L. J,2 ft__

Lignite beds:. -55-65; 114-118

Remarks:

Litho'ogy
Recorded by: _

Hole size: 4 K in. Air fl Water

Geophysical logs
.._ ._. Geologist Kx recorded by: .....__Lechner Yo*

Lithology

Gamma

T.C._3_ Range 1Q.O cps_

Recording speed 20it/min

Logged depth _...2.6.0_ft_

T.C.

Density

3 Range .5_OQ_c£s

<*j

Recording speed 2Q_rt/ mjn

Logged depth _?_6pjt_ _

Depth

0-11 Siltstone, yellowish-brown, sandy

11-18 Claystone, yellowish-brown, silty
18- 19 Claystone, dark-brown, carbonaceous
~ 19-37 Claystone, medium-gray

37- 38 Lignite, black
_ 38- 40 Claystone, dark-brown
40- 49 Claystone, medium-gray
49- 50 Lignite, black
50- 58 Claystone, grayish-green
58-60 Lignite, black
60- 61 Claystone, medium-gray
~ 61-66 Lignite, black
66- 68 Claystone, medium-gray
68- 69 Lignite, black
~ 69-73 Claystone, medium-gray
73- 76 Sandstone, medium-gray
76- 80 Claystone, grayish-green, silty
~ 80- 96 Siltstone, bluish-gray, clayey
_ 96-111 Claystone, greenish-gray, silty
111-115 Lignite, black
115-135 Siltstone, greenish-gray
_ 135-155 Sandstone, grayish-green, silty

~ 155-196 Sandstone, grayish-green

- .--..---0-0

196-200 Siltstone, medium-gray

200-212 Claystone, medium-gray
212-250 Sandstone, grayish-green

250-260 Siltstone, dark-gray, clayey

- 300

_ -100

221

Hole number H 20

SP

Sens, setting_50.&1V _ Recording speed 20
Logged depth ._ .2.60 ft_

Resistivity
Sens, setting 100 &/min Recording speed 2Q.fymin Logged depth -.-_.£p..y_>.f._

Depth

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1

- 0-0

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,-250 i
i- -30'

r-300

1- -100,

- 350

222

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: __H_2l__ _ __Mnp:_CojTin_Buttes_ _ Date:.J£:k7Z_State: J^P___County :_ ..Grant..._____ Elcv.: . 2,685 jt_... Location: T. 131.X , R...9pJ?, Sec. .2. .., Tract: cccc_ Drilled depth: __. .360jt_ __ Measured: _84jt_ l-SL, _?4_ft_ FWL. Hole size: 4 3A in. Air [j Water [X] Cored: Yes f] No C Lignite beds: .64-6^.93-98; 192-199; 201-204; 251-254 ...__._._.. . ___ ._.._._.. ..

Remarks:

Lithology
Recorded by: RandallJBie_iche_r; t_._..___, _ . . YP8 Geologist 20$

t Geophysical lops
recorded by: ...___Lechnej-_.

Lithology

Gamma

T.C.-^Z_ Range _10.acps_

Recording speed 20'Vmin

Logged depth __3.6D_ft_

Density

T.C. 2 Range .LOQ_cps_

Recording speed 20_tt/ mm

Logged depth _360_ft__

Depth

<_> o

0- 4 Sandstone, very light gray, very fine grained 4-11 Siltstone, very light gray, sandy
11-12 Sandstone, orange, very fine grained
12-25 Siltstone, very light gray
25- 60 Sandstone, yellowish-gray, very fine grained

60- 63 Sandstone, greenish-gray, very fine grained to fine-grained
63- 65 Lignite
65- 75 Siltstone, greenish-gray, clayey
75- 87 Claystone, medium-gray, silty
87- 88 Lignite, black
88- 92 Claystone, medium-gray, silty
92- 97 Lignite, black
97-100 Claystone, greenish-gray, silty
100-110 Siltstone, medium-gray, clayey
110-133 Claystone, medium-gray
133-135 Siltstone, brown, carbonaceous
135-136 Lignite, black
136-140 Siltstone, medium-gray, clayey
140-156 Claystone, greenish-gray, silty
156-164 Gaystone, grayish-green, silty
164-188 Clay stone, greenish-gray

188-194 Lignite, black

194-206 Claystone, medium-gray, silty

206-210 Siltstone, light-brown, clayey

210-220 Claystone, greenish-gray

220-222 Claystone, light-brown, carbonaceous 222-231 Claystone, greenish-gray, silty
231-238 Siltstone, medium-gray, clayey
238-242 Claystone, brown, silty, carbonaceous 242-245 Lignite, black
245-248 Sil(stone, screen, clayey
248-254 Lignite, black
254-258 Siltstone, green, clayey
258-259 Sandstone, green, very fine grained, cemented 259-260 Siltstone, green, clayey
260-271 Sandstone, green, very fine grained
271-277 Siltstone, olive, clayey
277-278 Claystone, medium-gray, silty
278-360 Sandstone

- 0-0

- 50

- 20

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,_ ' _~~ _,~^..:_ ~*~ ____ ^.jr^ _ _"" _ L ~ L__7-..__ J

223

Hole number H 21

Resistivity Depth
Sens, setting - 5Q.

SP
Sens, setting 5Q-MY.__
Recording speed_2Q. ft/min Recording speedJ^Q^/min Logged depth _ _3j5.0._ft__ Logged depth -_.3.60..ft._

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- - - 80'

__ -100

^350

224

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__JbL22__ ..___ Map:_CoffinJiu£rcs._.._ Datc:._IOrl-Z7_State: __NJD__County;_ Grant, Elcv.:_-2,54Q_fL_ Location: T.JL32&, R.9.0._wX, Sec. 32 .... Tract:, dddd __ Drilled depth: __..21Q_ft_.__ .._. Measured: _28&lt_ FSL. _5.1_£L

Lignite beds: _103=112j .1.61-163

Hole size: __jL3Airu.._ Air D Water 3 Cored: Yes No

Remarks:

Lithology
Recorded by: _JRandall ReicherL ^ i Geologist Ye

Geophysical logs
recorded by: . _.__ iechnejr_..

Lithology

Gamma

T.C._2_ Range JLQO cps_

Recording speed 2ir r/min

Logged depth _2j4Q_£t__

Density

T.C. _2_ Range

Recording speed 2.0_ rt/min

Logged c.'t? depth i 240

- -

ft__

Pepth

II

0- 20 Sandstone, yellowish-gray, very fine grained to fine-grained

20- 22 Sandstone, orange, very fine grained
_ 22- 24 Sandstone, greenish-gray, very fine grained,
cemented
24- 45 Sandstone, medium-gray, very fine grained
45- 52 Sandstone, grayish-orange, very finegrained to
~ fine-grained
52- 60 Sandstone, yellowish-gray, very fine grained to
~ fine-grained
_ 60- 65 Sandstone, yellow, very fine grained
65- 75 Sandstone, yellowish-gray, very finegrained,
silty
_ 75- 86 Sandstone, light-gray, very fine grained
86- 90 Claystone, medium-gray, silty
~ 90-100 Siltstone, medium-gray, clayey
_ 100-110 Lignite, black
110-1] 6 Gaystone, greenish-gray, silty
~ 116-122 Siltstone, medium-gray, clayey
_ 122-125 Qaystone, brown, silty, carbonaceous
125-128 Claystone, greenish-gray, silty
128-131 Claystone, brown, silty, carbonaceous 131-135 Claystone, greenish-gray, silty
~ 135-140 Siltstone, greenish-gray, clayey
_ 140-141 Claystone, white
141-144 Claystone, brown, silty, carbonaceous 144-156 Siltstone, medium-gray, clayey
156-158 Lignite, black
~~ 158-161 Claystone, medium-gray
_ 161-162 Lignite, black
162-183 Claystone, light-greenish-gray
~~ 183-198 Siltstone, brown, clayey, carbonaceous
_ 198-201 Claystone, white, silty
201 -205 Claystone, light-green
205-213 Siltstone, medium-gray, clayey
213-221 Claystone, medium-gray, silty
~~ 221-222 Claystone, brownish-gray
_ 222-223 Claystone, white
223-229 Claystone, medium-gray, silty
229-240 Sandstone, medium-gray, very line grained

- 0-0

r-50

-20

-300

_ -100

225

Hole number 22

SP

Sens, setting 5Q-MV Recording speed _2Q ft Logged depth __. 240 ft._

Resistivity
jScns. setting 50 ^Recording speed _2Qft/ni in Logged depth-..240.fr-

1 _j

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Depth

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t

50

- 20;

100

- 40'

r'50

r

-200-60

- 250 i
- -80

- 300

i_ -100

^350

226

NORTH DAKOTA GEOLOGICAL SURVEY

Map: Coffin Buttes Date: 10-1-77 State: _ ND County: Grant Hole No: _ H.23_ r "~~~~ " -"" " " ~~ " " "" ' ""~ " Elcv.: 2,447.JJL_ Location: T. 132.3 , R._9..Q_WV. Sec. _.2_0_ , Tract:. _aaaa _ Drilled depth: __. 260jt. . Measured: J2_5jL_ls£, _45..ftJewL, Hole size: __Ai4iru__ Air D Water S Cored: Yes ["] No Lignite beds: ._65-l4U30^134 . ... ____._. ._ ..

Remarks:

Lithology
Recorded by: RatxdalJLReicherJL.

Geophysical logs
._ - _. Geologist XK recorded by: __ _Lechner[

Litholo^v

Gamma

T.C.-2- Range 10_QLcps_

Recording speed 20.^1 mm

Logged depth _260. ft_

Density

T.C. _2_ Range JJ)0_cps,

Recording speed ^O-

Logeed depth _260 ft

C*V 1 ~"~ """"

Depth

0-5 Sandstone, yellow, very fine grained
5-6 Siltsfone, yellowish-gray, sandy
6-7 Sandstone, white, very fine grained, cemented
7 - 12 Siltstone, yellowish-gray, sandy
12 - 15 Sandstone, yellowish-yray, very fine grained
15 - 20 Siltstone, yellowish-gray, sandy
20 - 33 Sandstone, yellowish-gray, very finegrained
33 - 35 Sandstone, orange, very fine grained
35 -41.5 Sandstone, medium-gray, very fine grained 41.5- 42 Lignite, black
42 -45 Sandstone, medium-gray, very finegrained 45 - 63 Claystone, medium-gray, silty
63 - 74 Lignite, black
74 - 76 Claystone, very light pray, silty
76 - 80 Claystone, grayish-green
80 - 86 Siltstonc, brownish-gray, silty
86 - 97 Claystone. medium-gray, silty
97 -101 Siltstone, light-green, clayey
101 -105 Claystone, greenish-gray, silty
105 -108 Siltstone, medium-gray
108 -109 Sandstone, white, very fine grained, cemented. 109 -111 Claystone, medium-gray
111 -113 Claystone, brown, silty, carbonaceous
113 -120 Claystonc, medium-gray, silty
120 -121 Claystone, white
121 -128 Siltstone, medium-gray, clayey
128 -130 Siltstone, brown, clayey, carbonaceous 130 -135 Lignite, black
135 -140 Claystone, light-grayish-green, silty
140 -155 Siltstone, light-green, clayey
155 -187 Sandstone, greenish-gray, very fine grained 187 -187.5 Lignite, black
187.5-196 Siltstone, medium-gray, clayey
196 -200 Siltstone, black, clayey, carbonaceous
200 -212 Siltstone, brownish-gray, carbonaceous
212 -225 Sandstone, light-green, very tine grained 225 -243 Siltstone, dark-grecnish-gray, sandy

243 -244 Sandstone, white, very fine grained, cemented 244 -255 Claystone, medium-gray
255 -260 Siltstone, greenish-gray, clayey

- 4-0-0

- 20

60

_ -100

227

Hole number H 23

SP

Sen*, setting ...10 MV__ Recording speed .2&_fymin Logged depth __. 260..£t__

..I

Resistivity
Sens, setting 50_ Recording speed 2-Qfymin Logged depth -.2_60.ft ..__

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Depth

- 0-0

- 50

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^300
r-

L -100

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228

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:._.H.21._ __ Map: Hc^y X.ejLpzig_Sputh_ Date: .1.0-13-77_State: _ND__ County:..Grant__ _ Eicv.: _ J2,4£Q_ft_. Location: T. .UlS , R...90.W. Sec. .A _., Tract: _ddac ._ Drilled depth: __?00jt__ . ....._

FEL Measured:_90Pli_ FSL, 1PO ft. &&. Hole size:
Lignite beds: .46-iU_84,a6; 107-109; .149-153

Remarks:

Lithology
Recorded by: __RandaH Reichert__ _ _ _.._. _ _

._ Air D Water [X| Cored: Yes ["] No

^ , - Y« Geologist»»

Geophysical K>gs
recorded by: .__. Lechner

Lithology

Gamma

T.C. ._2_ Range .IQQ.cp_s_
Recording speed 2DW

Logged depth _2D.Q.£t

Density

T.C. _3_ Range lPP_cps_
Recording speed 2_0_* t/min

Logged depth __200_ft_

Depth

0- 2 Siltstone, yellowish-gray
2- 10 Claystone, yellowish-brown
10- 20 Siltstone, yellowish-brown
20- 31 Siltstone, yellowish-gray, clayey
31-33 Lignite, black
33- 47 Claystone, medium-gray
47- 48 Lignite, black
48- 50 Qaystone, medium-gray, silty
50- 52 Lignite, black
52- 75 Claystone, medium-gray, silty

75- 85 Claystone, brown, .silty
85- 87 Lignite, black
87- 97 Siltstone, light-gray, sandy
97-106 Siltstone, medium-gray, sandy
106-107 Lignite, black
107-121 Siftstone, light-gray

121-123 Limestone, dark-gray
123-180 No samples

- 0-0

-20

180-185 Claystone, light-gray, silty
185-200 Siltstone, medium-gray, clayey

_ -100

229

SP

Sens, setting_.. J&MV_ Recording speed 20 ft/ mjn Logged depth _.. ..2.0.0 ft _

Hole number H 24

Resistivity
Sens, setting __10Q_.__ Recording speed.2Q.fr/rmn Logged depth ...JLQO ft_.._._

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i -i

j
J

Depth

hO-O

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-40.

HI50

i-200-60

- - 80

h300

_ -100

^-350

230

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__H 25 ___Map:I^w.L£ip2;ig_Sp_u_th_ Date:.JJL3.-17_State: _N_D__County:__Grant___ __ Elcv.: _2,485. ft__. Location: T. 121 § , R._89_w , Sec. __10__, Tract:. .dada_ Drilled depth: _._?60_ft_ . __ __ Measured: I£21_C t_ FSL , ^8_jk _|»t,

Lignite beds: .-.128-131. .. .

Hole size: __434.ijU_ Air [j Water Cored: Yes D No

Remarks:

Lithology
Recorded by: Richard Scattolini .. ___ Geologist us

Geophysical logs
recorded by: .__ Lechner

Lithology

Gamma

T.C.._2_ Range .lQ_Q_cp_s_

Recording speed 2.0.'Vmin

Logged depth _2.4D_.£t__

T.C.

Density

2 Range 100 cps

Recording speed2QL* t/rnin

Logged t*O depth I 260 -

ft --T-,.

Depth

0- 5 Sandstone, brown, siliceous and well cemented 5- 9 Sandstone, yellowish-brown, unconsolidated 9-12 Siltstone, brownish-yellow
12- 13 Siltstone, reddish-brown, hematite
13-18 Sandstone, yellowish-brown, unconsolidated 18- 20 Siltstone, brownish-yellow
20- 25 Claystone, brown, slightly silty
25- 30 Sandstone, yellow
30- 36 Siltstone, brown, clayey
36- 66 Sandstone, yellowish-brown
66- 68 Claystone, dark-gray, carbonaceous 68-104 Claystone, medium-gray

104-125 Claystone, light-gray, silty

"125-126 Claystone, dark-gray, carbonaceous .126-134 Lignite, black
134-135 Claystone, grayish-brown, carbonaceous 135-156 Claystone, light-green

' 156-260 Sandstone, medium-gray, fine-grained to medium-grained

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L-o-0

- 50

-20

- 100

-40

150

(20

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-20D"60 £00 -r. -r-n-rr:.--.... .rnr- .-r~

^ .... i.- . _ - __.. _ .- _ - - -

-300

_ -100

231

SP

Hole number H 25

Resistivity
Sens, setting _ ..._5i).MiL_ Sens, setting -5Q. Recording speed -2G_ ft/ min Recording speed-2-Qft/Logged depth _ 26Q.ft__

J
J

- I

- - mn

Logged depth . 260 .ft.__

Depth

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H-50

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;-iso

r

-200-60

-250 !
- - 80

r-soo

- 100

- 350

232

NORTH DAKOTA GEOLOGICAL SURVEY

No? H 26 Map: New Leipzig South Date: 10-11-77 State: ND County: ___Grant__. _. Elev.:__2,16jQjL_ Location: T. 122.2 , R.. SJLw . Sec. __22_ , Tract: ._baab __ Drilled depth: __ _. 32Qj£t. Measured:_20_ft__Jtt, 2$5.Q_ftJ^, Hole size: 4 % in. Air C] Water (XJ Cored: Yes fj No Lignite beds: 151-155 .... ____.__._____

Remarks:

Lithology
Recorded by: Randall Reichert

Geophysical logs
___Geologist Mac recorded by: ._ Lechner

Lithology

Gamma

T.C._2_ Range JLQP_.cps_
Recording speed 20.^1'min
Logged depth _320.it_

Density
T.C. _3_ Range
Recording speed 20. *V min
Logged depth 320 ft

Depth

0- 35 Sandstone, yeDowish-gray, very fine grained

35- 38 Sandstone, orange, very fine grained
38- 62 Sandstone, yellow, very fine grained to fine-grained

- 62-63 Sandstone, orange, very fine grained
63- 85 Sandstone, yellow, very fine grained to fine-
~" pained
"~ 85- 87 Qaystone, medium-gray, silty
_. 87- 88 Lignite, black
88- 95 Qaystone, medium-gray, silty
- 95-117 Siltstone, green, clayey
__ 117-120 Sandstone, grayish-green, very fine grained

- 120-320 No samples

- 0-0

- 20

_ -100

233

Hole number H 26

SP ^ ; Resistivity Sens, setting 5Q_MV Sens, setting ___1Q£L.__ Recording speed 20 ft/ miniRecording speed 3£fa(min i Logged depth _. -320 ft_ (Logged depth .__32P..£t:._

Depth

- I

J

UQ-O

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H-50

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i

r

HOO

-201

-40!

_l

-200-60

-250 !
- - 80'

p-300
r~

^_ -100;

H-35C i

234

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:.___H_2Z.._ __ Mnp: Bentley _Date:._l_0:13I7_7State: __

. !!_., Tract:. C

Measured: .2.9JL__ Psf, _36.(L_ FWL, Hole size: __ 4_%.in, _ Air D

Elcv.: _-2,4jL2_ft__. Location: T. 121X , R.91_w , Sec. 11 _., Tract:. cccc. Rbtbc

_ County: Hettinger

Drilled depth: __.200_ft_._ .

Water ISO Cored: Yes [j No j

Lignite beds:..

Remarks:

Lithology
Recorded by:.

124-127; 178-180

_ . . Yes
Geologist 3K6

Cioopliysical lo

recorded by: Lechner

Lithology

Gamma

T.C..JL- Range _lQQ_cgs.

Recording speed 2.CL"/min

Logged depth 20Q.ft._

Density

T.C. 3 Range .50uc

Recording speed 20.'£/

Logged depth 200 ft

Depth

II

5
6
8
13
17
20

0-
5-
6-
8-
13-
17-
20- 27
27- 28
28- 30
30- 35
35- 40
40- 48
48- 53
53- 60
60- 76
76- 80
80-115
115-118
118-119
119-122
122-126
126-135
135-146
146-151

Sandstone, brownish-gray, very fine grained
Siltstone, yellowish-gray
Siltstone, orange
Siltstone, yellowish-brown, sandy
Sandstone, yellowish-brown, very fine grained Siltstone, yellowish-gray
Lignite, black
Claystone, dark-brown, silty, carbonaceous
Lignite, black
Claystone, dark-gray
Siltstone, medium-gray, sandy
Claystone, light-gray, silty
Claystone, brown, silty, carbonaceous
Siltstone, grayish-green, clayey
Claystone, green
Claystone, light-gray, silty
Sandstone, medium-gray, very fine grained
Claystone, dark-brown
Lignite, black
Siltstone, grayish-green
Lignite, black
Siltstone, green, clayey
Siltstone, green, clayey, carbonaceous
Cluystone, greenish-gray, silty

- 0-0

- 20

151-165 Siltstone, medium-gray, clayey

165-180 Sandstone, medium-gray, very fine grained

180-185 Siltstone, greenish-gray, clayey
185-200 Sandstone, greenish-gray, very fine grained

/to

2,00 r _.. ;.. _ _. .jrr 200" 60

- 250

~ -80

- 300

.. -100

235

Hole number 27

SP

Sens, setting 5.0..MV
Recording s
Logged depth _2Qd£t._ _

Resistivity
Sens, setting 50
peed ?flfymin Recording speed20.fy Logged depth -200. ft

Depth |

1

1-I

ho-o

r -20

i-ioo
L

- 40'

- 200-60

L

250 I
- 80'

- 300

_ -;oo

- 350

236

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_H_28_

Elev.:_2»457jt_

___Map! Bentley ___Date :.10rl3iZl_ State: _Iffi_._County:_Hertm^er.

Location: T.121st, R.9L.W. Sec. _34_ , Tract: _baaa _ Drilled depth: __ 200 ft_. ,

Measured: _55JEt_JtBt, 2J5£Q_£rFWL, Hole size 4 3^ in. Air [j Water T3 Cored: Yes G No Lignite beds: ._15=1SL54=60; 78-80; 101-103; 144-146

Remarks:

Lithology
Recorded by: Richard Scattolini___ _.

v<^ Geophysical lugs
.__ Geologist XX recorded by: . _ Lechner

Lithology

Gamma

T.C. _2_ Range _

Recording speed 20 'Vmin

Logged depth __20Q ft_

Density

T.C. _J_ Range ,iOO_cp.S_

Recording speed2Q_'Vmin

Logged depth _200jt__

Depth

- 0-17 Sandstone, yellowish-brown

- 17-18 Lignite, black
__ 18-28 Siltstone, yellowish-brown, sandy
28- 29 Lignite
- 29- 30 Siltstone, yellowish-brown
30- 37 Claystone, grayish-blue
~ 37-38 Clay stone, brownish-gray
_ 38-40 Claystone, grayish-blue
40- 45 Siltstone, grayish-green
_ 45- 54 Claystone, medium-gray
54- 60 Lignite, black
- 60- 70 Claystone, greenish-gray, silty
__ 70- 77 Claystone, medium-gray
77- 80 Lignite, black
- 80- 86 Claystone, light-gray
86- 91 Limestone

~ 91-102 Claystone, pale-grayish-green
-.102-103 Lignite, black
__ 103-105 Claystone, dark-brown, carbonaceous
105-139 Claystone, medium-gray, silty

- 139-140 Lignite
_ 140-145 Clay stone
145-147 Lignite, black
- 147-157 Claystone, light-green
157-180 Sandstone, light-green

180-200 No samples

- 0-0

- 50

-ao

- 100

- 40

_. -100

237

Hole number H-28

SP j Resistivity Depth
Sens, setting 50__MV_. Sens, setting ___10_Q_.._ \ '^ i Recording speed_20. wminjRecording speed-^P^/min i £ « \ Lo^ed depth _. .200_ft._ jLogged depth .. 200.ft. _ \ £ £ \ \ '
- 0-0
L

- 20

- 100

- 40.

- 200"60

- 250

- -80

- 300

_ -100

- 350

238

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__H 29 ._ Mnp: Mott 4.NE___._ Date:. 1Q=13=Z3LState: _NB._County:_Hcttinger....._ Elev.: 2,530.(L_ Location: T. 122.ft, R.JSULw , Sec. ._26__ , Tract: __baab.__ Drilled depth: _2_QQ_ft__.... _.._ Measured: _J.15jt_ KSfc. 2JQOJ&FWL. Hole size: 4 % in. Air [j Water SI Cored: Yes D No H Lignite beds: .-J9i2i-_._ . . .._... ... ______.__.. ...__

Remarks:

Lithology
Recorded by: _Richard Scattolini ___ .._._.__ Geologist x* recorded by: ____Lechner._ _.. .._._..

Litholog)'

Gamma
T.C. ._2_ Range JLQQ cpi_
Recording speed 2D' t/min
Logged depth __20_0_ft_

Density
T.C. _i. Range .10.0_£RS
Recording speed -2.Q
Logged depth 200 ft v*C* I

Depth

0-18 Sandstone, yellowish-brown
18- 25 Lignite, black
25- 43 Claystonc, medium-greenish-gray

43- 45 Qaystone, dark-brown, carbonaceous
45- 60 Claystone, medium-gray, silty

60- 70 Sandstone, grayish-green, unconsolidated
70- 73 Sandstone, greenish-gray, well consolidated
__ 73-146 Sandstone, greenish-gray, unconsolidated, fine-
grained to medium-grained

- 0-0

- 146-147 Lignite, black
147-150 Sandstone, greenish-gray
~ 150-155 Siltstone, gray
_ 155-170 Siltstone, greenish-gray, clayey

- 170-200 Siltstone, greenish-gray

.200" 60

-250
- - 80

- 300

_ -100

239

Hole number H 29

SP j Resistivity Depth
Sens, setting 50 MV Sens, setting 1QO. . ^
Recording speed _2XL &/minlRecording speed2Q.it/min * 5 i j Logged dcpth_ .200 ft._ Logged depth ._.... 200.ft_ £ g I_ _.____ .. _ _. .^ ..-...._. .. _ .. _....... _ _. _ _. .__.

- 1-^.. .-";--1 -" - - -, U-o

50

- 20

h-
HCO

-40

r!50

- 200-60

,-250
!- -80

- 300

- IOO

- 350

240

NORTH DAKOTA CF.OLOGICAI, SUKVKY

Hole No:._H30. . . ...Map:. No.Topo Onto: 9-29-77 Snitc: ND .County: Adams Elev.:_.2,5QSit _ Location: T. 131s, R. 91 w. Sec. 4 .Tract: aaad Drilled depth: 200 ft

Measured: _L31_5_ ft

Surface ownership:

Lignite beds:

30t Hole size: jL&llL. __..__ Air i. J Water [54 Cored: Yes fee!

_... _ _ .... _ . ____ _.... Coal ownership: ________ _

rL(L5_. . _ . ______ .... ._ _ _

Remarks: jCore_hple_H 3QC_was located 70 fe.et east of H 30; cored interval was 60 fn JO fppt- r Lithology Yes Geophysical logs Recorded by Randall Reichert _______________ Geologist Wf recorded by :

in f?g t

Lech

Lithology

Gamma

T.C..-2 Range ..lOOcps.

Recording speed 20. /min

Logged depth _2QO ft . ..

Density

T.C. _2... Range . 10Q..cps

Recording speed 20- Vmin

Logged depth . 200 ft.

Depth

0-5 No samples
5-7 Claystone, greenish-gray
7-9 Claystone, dark-brown, silty, carbonaceous
9 - 13 Siltstone, greenish-gray, clayey
13 - 14 Sandstone, white, very Fine grained
14 - 20 Siltstone, medium-gray, clayey
20 -21 Sandstone, white, very fine grained, cemented 21 - 25 Siltstone, medium-gray, clayey
25 - 36 Claystone, medium-gray
36 - 47 Siltstone, medium-gray, clayey
47 - 52.5 Ctoystone, medium-gray, silty
52.5- 53 Siltstone, dark-brown, carbonaceous
53 - 57 Claystone, medium-gray
57 - 60 Lignite, black
60 - 63 Claystone, greenish-gray, silty
63 - 74 Lignite, black
74 - 87 Siltstone, light-greenish-gray, sandy 87 - 92 Claystone, brown, silty, carbonaceous 92 -97 Siltstone, green, clayey
97 -102 Siltstone, light-green, clayey
102 -106 Claystone, light-green, silty
106 -107 Siltstone, brown, carbonaceous
107 -110 Claystone, green
110 -112 Siltstone, light-green
112 -115 Lignite, black
115 -122 Siltstone, light-green, clayey
122 -124 Siltstone, dark-brown, carbonaceous 124 -141 Siltstone, green, clayey
141 -200 Sandstone, light-greenish-gray, very fine grained

- 0-0

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, t /f Q .V. -_h.tl{-.-i_:

i-50

-20

- 100

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- 40

150

- ~'"^££^a f?^ r-^f .': ; -:L;r[fr-j"^! S^.-.^j U2O?T 60
- ::- - :.^T. -~~_~ *°° t^Lr^-.-!:: t.-:- : ri-rr:^ - ^L: r+ - - ^T ^-uo

j-250

~ -80

J-300

_ IOC

241

Hole number H-30

SP | Resistivity
Sens, setting JiQ_MV Sens, setting 5.0 Recording speed_2il.rt/minjRecording speed-2D^t/min Logged depth _2DQ_£L__ [Logged depth .__2QO_ft_

_i

J

rr^zzr*7.~ t-."r~~^.i~'~T' Jr ^~* ~" IT z..j^zrzrmzirr

~r- ? ;

" * *~ ' ' * T '^"" ~ f~~ "" ' ' *~ ^~" --~-->

> r *» ".".." 1:3.

- - - - - -j

Depth

L-0-0

r50

- 20

- 100

-40.

- 150

- 200-60

250 i
- - 80

^300

^ -iOO;

- 350

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242

NORTH DAKOTA GFOLOGICAL SURVEY

Hole No:__tL.31_ __ Ma p: __Mo .tt_l NE_ ______ Date:..9^.9:7.1__ State: __NP_County:__Hcttjngcr..._ Elev.: _-2,5_Q5_ft__ Location: T. 121X , R.9_L_w . Sec. _20._., Tract: _._aada _ Drilled depth: __26Qjt. Measured: J__30Q_ft_ xsax _J6. ft _ £*<_;. Hole size: __4 34_in___ Air D Water K

Lignite bods:.._112_Il4;.220-223 _ ... . _._.....__...__.. _.

Cored: Yes [j No

Remarks:

Lithology
Recorded by:

Yei

Geophysical logs
ardJka_ttQj.ini___.__.__. .___ Geologist uroc recorded by: ..__Lechner.__.

Lithology

Gamma

T.C. .2_ Range J.QQ cps_
Recording speed 2.0.^/min

Logged depth _2.6.Q.£.___

Density

T.C. _2_ Range JLQ.Q.cps
Recording speed 2Q.'Vmin
Logged depth _258 ft

Depth

0- 42 Sandstone, yellowish-brown; limonite oxidized, niedium^rained to fine-grained

~ 42- 95 Sandstone, light-to medium-gray, medium-
_ grained

0-0

- 20

95- 96 Lignite, black
96-112 Siltstone, greenish-gray, clayey

112-113 Lignite, black
113-115 Qaystone, dark-grayish-brown, carbonaceous 115-125 Claystone, light-greenish-gray, slightly silty 125-126 Lignite, black
126-133 Claystone, dark-brown, carbonaceous 133-157 Claystone, pale-greenish-gray
157-159 Claystone, dark-gray, carbonaceous 159-160 Lignite, black
160-171 Claystone, medium-gray

171-190 Siltstone, green, clayey

190-202 Siltstone, greenish-gray, clayey
202-219 Sandstone, gray, very fine grained

219-223 Lignite, black
223-224 Claystone, dark-brown, carbonaceous 224-227 Claystone, gray, sandy
227-228 Lignite, black
228-260 Sandstone, gray

_,. _ ___. _ ._,___. ... _ .. . t,^ *" "." - '-, V~' *~ T^TT- '^.~~~I ~ - - - - ^^

_ -iOO

243

Hole number H 31

SP

!

Sf Resistivity
Sens, setting _5Q.MV_ [Sens, setting __ .5.0___ Recording speed_20 ft/rmniRecording speed 20.ft/min Logged depth .... _26Qjt._ lLogged depth ._ __260 ft _

J

Depth

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h-o-o
i

- 50

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-iOO

- 150

-ZOO'60

-250 !
-- -80-'

- 300

- 100

- 350

244

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_..ti_3J2 __ _._ Map: JBlujnJ3utte___._ Date: .SL2SL-27__ State: ___.NQ__ County :_Hcttinger . ..._ Elev.:....?,49_5.ft__ Location: T. .132£, R.._92_w. Sec. ..26., Tract: aaad. _ Drilled depth: __... 26_0_ft_. Measured: _28Q_ft_x8!k _J25.£r._ H±, Hole size: __£%.in^__ Air [j Water H Cored: Yes Q No [x] Lignite beds:--41--5H__ . .. . _. . .. ______._._.. .._ _

Remarks:

Lithology
Recorded by- .Richard Scattolini

Geophysical logs
GeologisDNb recorded by: _.._ Lechner

Lithology

Gamma

T.C._2__ Range _100 cps_

Recording speed ZQ'Vmin

Logged depth _26_0..ft__

Density

T.C. _!_ Range _lQQ_cps

Recording speed ?IL

Logged depth 260 ft

Depth

0- 4 Sandstone, brownish-yellow
4- 11 Si Itstone, brownish-yellow
11-21 Claystone, brownish-yellow, silry

21- 27 Claystone, medium-gray, silty
27- 28 Claystone, dark-gray, carbonaceous 28- 35 Claystone, light-gray
35- 36 Lignite, black
36- 39 Gaystone, light-gray
39-48 Lignite, black
48- 55 Claystone, medium-gray
55- 56 Lignite, black
56- 60 Claystone, light-greenish-gray
60- 61 Lignite, black
61-62 Claystone, light-brown
62- 70 Claystone, light-greenish-gray
70- 72 Sandstone, gray
72- 78 Gaystone, light-greenish-gray
78- 79 Lignite, brown
79- 82 Claystone, grayish-brown
82- 93 Siltstone, greenish-gray, clayey
93- 94 Gaystone, dark-gray
94- 95 Lignite, black
95-106 Claystone, grayish-green
106-108 Siltstone, light-brown
108-112 Claystone, daik-gray
112-115 Claystone, light-green
115-121 Sandstone, light-green
121-145 Siltstone, light-green, sandy
145-160 Sandstone, pale-green
160-177 Claystone, medium-gray
177-260 Sandstone, pale-green, silty, finegrained to very fine grained

0-0

-20

20 M^W» ><; ;.

_ ^-^. ^ >_^» - ^)

.- -.. . ..__«cr^: rri
T~n~"H £_zr _"_r_zi*^r_ir_^._I.._L~.Ii_~~ ~"~T~TV

-J Vr7 t-^'*rr^--Hr-'- -ry.?f .tr!""v '""fr:-*l::r-r»;«r.:"

- 300

_ -lOO

245

Hole number H 32

SP

Sens, setting _ .3D.M_V.__ Recording speed _2£L ft/min Logged depth __.. .260/t_

J

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- i

1

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-I

Resistivity
Sens, setting .50_____ Recording speed _2_0tt/m in Logged depth . 260 ft._

Depth

o-o !
i
i i

f-
r~

i

50

j-
t-I-
HOO
L
L

-20;

- 40

j-150

- 200-60

- 250 !
- -80

;-300

- lOC

246

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_..H.33 Map:_Mouu3JME.-_ Date:._.9.-:2_8r7.I_State: ... ND._County: Elevv_.---2A70.ft_ Location: T.JUlst, R. 93. Jv . Sec. _._2P_, Tract: ._cccd ._ Drilled depth: __24Qjt___..__. Measured: _36_ft_HL, 344_.ft_ RVL. Hole size: __4_MJn._ Air l7i Water 0 Cored: Yes [xj No f Lignite beds: .._41;5Qi 5.6^67; 123-126;. 133= 135

Remarks: Core hole H 33C was located 50 feet south of H 33; cored interval 41 to 47 feet; recovery 6.feet. Lithology Ycg Geophysical logs
Recorded by: Randall_Reicliert ___._ __..._..._ Geologists^ recorded by: . .__Lechner._....

Lithology

Gamma

T.C.._2- Range _1QO cps_
Recording speed 2D' c/min

Logged depth _240. ft_

Density

T.C. _2_ Range J.OO cp.S
Recording speed 2Q.'Vmm

Logged depth __24Q_ft._

Depth

I I

0-2 Gravel, yellowish-brown, fine-grained to coarse-grained
2- 6 Sandstone, yellowish-gray, very fine grained
_ 6-36 Siltstone, grayish-yellow, clayey

~~ 36- 40 Siltstone, yellowish-gray, clayey
- 40- 50 Lignite, black
~~ 50- 55 Claystone, greenish-gray
55- 65 Lignite, black
~ 65- 70 Siltstone, medium-gray
~ 70- 79 Siltstone, greenish-gray, clayey
_ 79- 86 Siltstone, light-green
86-100 Siltstone, greenish-gray, clayey

~~ 100-116 Siltstone, medium-gray, clayey
~ 116-126 Qaystone, medium-gray, silty
- 126-127 Lignite, black
_ 127-130 Gaystone, medium-gray, silty
130-133 Lignite, black
133-143 Gaystone, green
143-152 Qaystone, dark-brown, silty, carbonaceous
"* 152-232 Sandstone, greenish-gray, very fine grained tc _ fine-srained

- 0-0

232-233 Sandstone, white, very fine grained, cemented 233-240 Sandstone, greenish-gray, very fine grained to fine-grained

^ --.loo --

v^ t*0 l^ - -^-*^^

^j^' _"^i__^ 'T'"--^ i "."-- * "-""*_. i, 'JJ _-i~-T-^1 ' _^^^r'~' ^ ~ *"^»,^ "~""~-

_ 100

24;

Hole number H 33

SP

Sens, setting 5.Q.MV.._._ Recording speed 20 ft/mi
I Logged depth ... 24Q_ft__

Resistivity Depth
Sens, setting - 9. .._ ^
min Recording speed20.ft/m i n ^ » Logged depth _?40 ft

-0-0

L
-50

- 20.

HOO
L

i

-40.

- 150

-2CO-60'

r250 I
I I

u- -60

r-300

- ICO

350

r

248

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__±L24. _ ..._Map:__Byrt_____.. __ Date:._2-28r7.Z_ State: _.NJQ__ County:_Hatlingcr_...._ Elcv.:_2A38.CL.. Location: T.U1.&, R.92Jf, Sec. .22., Tract: _b.bbb _ Drilled depth: ___24Q_ft..__ ... _ Measured: _45_ft_>{$*, _4.5 Ct_ FWL, Hole size: __i.3/Ua.-_ Air G Water H Cored: Yes D No |x] Lignite beds: -_.37-43L_58,60; 90-92; 100-103 . .. ... ._.._._... .. ______..____._

Remarks:

Lithology
Recorded by: ___Richard_Scattglini____ _..

Geophysical lo
.- __ Geologist 38i? recorded by: Lechner

Lithology

Gamma

T.C.._2__ Range ._ia0.c.ps_

c Recording speed 2$Vmin
Logged depth _.24.0. ft_

Density
T.C. _2_ Range _10.Qj:ps
Recording speed 20.'V
Logged depth _240 ft

Depth

4_, flj

8

_ 0- 80 No samples

80- 84 Gaystone, grayish-brown
84- 85 Lignite, black
85- 89 Claystone, medium-gray
89- 90 Lignite, black
90- 97 Clays tone, grayish-green, silty
97- 99 Lignite, black
99-102 Claystone, dark-brown, carbonaceous 102-170 Sandstone, greenish-gray

170-172 Sandstone, greenish-gray, well ccmentea 172-211 Claystone, medium-gray

211-223 Siltstone, medium-gray, clayey
223-240 Claystone, medium-gray

249

Hole number H 34

SP

Sens, setting 50 MV_. Recording speed _2H fymin Logged depth _. 2_4_Q ft__

Resistivity
Sens, setting -50 Recording speed 2Q_ft/m in Logged depth -240 £t_.._._

Depth

. B
II

-o-o

-50

L

- 201

HOO
I
r

i

r - 40:

r

r250 !
L- -80

- 300

t-350

250

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__H_3_5___...__Map:__Bcnfa__.__._ Date:._iQiL2£77State: _ND County:, Hcttinger __ Elcv.: _ 2,408_ft_ _ Location: T. 133.&, R.5.1-W , Sec. ? , Tract: >bab_ Drilled depth: __22_Q_ ft..__.._...._ Measured: .58 ft §stx _860lt_ FWL, Hole size: __4_% u

Lignite beds: ._... .. ..

Air D Water H Cored: Yes Q No

Remarks:

Lithology
Recorded by:_Richard Scattolini

Geophysical logs
.___ Geologist NX recorded by: . -___^

Lithology

Gamma

T.C. ._2_ Range JLQO_cps_
Recording speed 2Q
Logged depth _.2.2(L

Density
T.C. _3_ Range .IPQ_£E.s
Recording speed ^QJV
Logged depth 220 ft

" C* t ~ "~~~ ~ *- T--

Depth

0- 75 Sandstone, yellowish-brown

75- 76 Gaystone, carbonaceous
76- 96 Gaystone, grayish-green

96- 97 Lignite
97-106 Gaystone, medium-sray
106-117 Siltstone
117-129 Gaystone, slightly silty
129-139 Sandstone, medium-gray
139-142 Gaystone, brown, carbonaceous
142-148 Siltstone, grayish-green
148-170 Sandstone, grayish-green

170-171 Lignite, black
171-172 Gaystone, brown
172-199 Gaystone, pale-green
199-210 Gaystone, dark-brown, carbonaceous

210-220 Sandstone, dark-brown, carbonaceous

-0-0

^50

-20

r~^-^-!00

£-fJ^i-^^rE3 30

y 7x) ^r~rr^--- ^ - ^-i - ^- -_ - - a-^\ ^-~- _-_^

/ i^/o . _.-_i. rz^.~- ~7 _ ^ f r\s ~^ _ "*":^n _ _ir _. mz,Ti^ir. M
l~7Tn^ .. ' "" 7!. j,:; _.- ". ~"y .. ,__ ,^____^

^ - - '" ' - "^""|''^~^*; _TJ_^ ' "Vr^"/-'^-'-,-

.-^jr^r^r-i " i i t.-f

251

Hole number H 35

SP i Resistivity | Depth j
Sens, setting_.....SQ My... Sens, setting ...lO.O... i i Recording speed_20_ ft/minRecording speed_20t*/min ! £ £ j j Logged depth __ 22Q ft___ JLogged depth ____22Q.ft._ j £, _| j

-j
H
J

_j

ro-o '

- 50

- 40

!50

-ZOO' 60

- 250

- - 80

300

- 100

- 350

NORTH DAKOTA GEOLOGICAL SURVEY

HolcNo:._.tL36__ _...Map: ._Mntlev__....._Datc:..lP:l.l-7.7 State: ND County: Hcttingcr __ Elev.:_.2,4Q5.ft__ Location: T.lJis, R.2L.W, Sec. __2_t., Tract:.. bccc Drilled depth:__.380_f.t_.... . _ Measured: 2.5jSDJt_ Ksfe _50.fi_ FWL, Hole size: 4 %_m.__ Air G Water (3 Cored: Yes [j No |X] Lignite beds: _196JJ)_8. ._ . . .._... .. ____....__.__ .. ._._

Remarks:

Lithology
Recorded by: Richard ScattoUni

Geophysical loirs \ 09 ' -' - - *
.__ _... __.___ Geologist*£" recorded by: .___..Lechnel..

Lithology

Gamma

T.C._3_ Range _l.QQ.c£s_
Recording speed 2Q«Vmin

Logged depth _...38_Q_ft_

Density
T.C. 3 Range _500_cps Depth

Recording speed 20_"/ni jn

Logged depth _380 Jt_

0-12 Siltstone, brown

12-16 Lignite, black
16- 18 Claystone, brown, silty
_ 18-20 Lignite, black
20- 32 Claystone, medium-grayish-brown
_ 32- 33 Sandstone, yellowish-brown, fine»grained
33- 40 Claystone, greenish-gray, silty
~~ 40- 60 Sandstone, grayish-blue, fine-grained to
medium-grained
~ 60-109 No samples

109-120 Claystone, medium-gray, silty

120-160 No samples

- 0-0

-50

-20

160-175 Clays tone, pale-green

175-280 No samples

280-282 Lignite, black
282-290 Sandstone, medium-gray
290-380 No samples

(Logs continued on page 257)

IbC) ~. ~ '~r~~~r~r~.~ "~'i -

100

253

Hole number H 36

SP Resistivity
Sens, setting . ..$0 MV__ Sens, setting - 50-._ Recording speed ._20.^/min|Recording speed ^Ofr/Logged depth .. .3.8Q ft _ Logged depth . .380 ft

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i
J

j
-i
J

- i

Depth

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L

-20:

I-

-40:'

- 200" 60

-250 :
- 80

_ ~ICC;

- 350

254

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_.hL3Z__ _._ Map:.North Star Bu_tte._ Date:._10.-.li-7_7.State: ...ND__County:__ Grant _ Elcv.: __2A95._ft_._ Location: T. JJHs , R.~9Q_\V . Sec. __8___, Tract:.... bccc_ Drilled depth: __ 400jt__._._... _ Measured: 2,3MJL J=Bk, _2Q ft_ HVL. Hole size: __4 34 jn._ Air G Water S Cored: Yes ["] No H Lignite beds:._?4-i2j.l4M44; 177-185; 315-317 . ..._..___.. . ____.._____... .._

Remarks:

Lithology
Recorded by: _Richard_ScaJloUni..

Geophysical logs

__ Geologist*a& recorded by: ____...Lechn.cj _

Lithology

Gamma

T.C.._2_ Range 10(Lcp§_

Recording speed 20'Vmin

Logged depth __^.QP_ft_

Density

T.C. _3_ Range 5.00_cps_

Recording speed 20.^/min

Logged depth 400 ft _

Depth

5
7
10
12
13

0-
5-
7-
10-
12-
13- 17
17- 22
22- 23
23- 26
26- 37
37- 38
38- 39
39- 47
47- 48
48- 54
54- 86
86- 87
87- 88
88- 90
90- 92
92- 93
93- 96
96-107
107-115
115-140
140-142
142-165
165-175
175-178
178-180
ISO-185
185-191
191-192
192-197
197-207
207-230

Siltstone, yellowish-brown
Claystone, yellow
Claystone, brown
Qaystone, dark-brown, carbonaceous
Claystone, light-brown
Qaystone, light-yellowish-brown, silty
Claystone, yellowish-brown
Lignite, black
Qaystone, yellowish-brown
Qaystone, greenish-gray, silty
Qaystone, medium-gray
Lignite, black
Qaystone, medium-gray
Lignite, black
Siltstone, medium-gray
Qaystone, medium-gray, slightly silty
Qaystone, dark-brown, carbonaceous
Qaystone, medium-gray
Qaystone, dark-brown, carbonaceous
Lignite, black
Qaystone, medium-gray
Lignite, black
Qaystone, medium-gray, silty
Qaystone, green
Qaystone, medium-gray
Lignite, black
Sandstone, medium-gray, silty
Siltstone, medium-gray
Lignite, black
Qaystone, medium-gray
Lignite, black
Siltstone, medium-gray
Siltstone, light-brown, sandy
Siltstone, medium-gray
Sandstone
Siltstone, green, sandy

- 0-0

~ 230-242 Qaystone, medium-gray

~ 242-245 Qaystone, dark-brown, carbonaceous
_ 245-257 Qaystone, grayish-green
257-260 Sandstone, medium-gray
~ 260-310 No samples

310-312 Lignite, black
312-370 Qaystone, medium-gray, silty

(Logs continued on page 259)

255

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NORTH DAKOTA CKOLOGICAI, SURVEY

Hole No: _ H.39... . .__Map:_ __No_Topo.

Elev.:_2»5.Q5_£t Location: TX31...3S , R.9 FNL PEL

Measured: _afLfi__ £8k, 9J^_fi«t, Hoie size-:

Surface ownership: __________ .._.. _ ._. ._. _ Lignite beds:_8M2__. ____ ._. __ ... . Remarks: _______ ._._ ... ... ._.. _..__

.Onto: 9-29-77 Stntc:

, Soc. 2 , Tract: aaaa

ND County: Adams

Drilled dqnli: 180ft
r r - i

Air lJ Water ijfl Cored: Yes

._. Coal ownership: ____ __

No

Lithology
Recorded by Richard Scattnlini

Geophysical logs
Geologist IM recorded by: __ Lechner

Lithology

Gamma Density

T.C. .I Range 100 cps .. T.C. 2 Range 100 cps . Recording speed 20. c/m in j Recording speed 20. Win in

Logged depth-J.80 ft _ _ Logged depth _ 180 ft

Depth

II

0-21 Sandstone, yellowish-brown, medium grained

21- 27 "Scoria"

27- 33 Sandstone, yellowish-brown
33- 40 Sandstone, reddish-brown; limonite
40- 81 Sandstone, bluish-gray

=t~-

81- 87 Lignite, black
87- 88 Claystone, dark-brown, carbonaceous 88- 92 Lignite, black
92-101 Claystone, light-gray
101-104 Claystone, grayish-brown, carbonaceous 104-108 Claystone, dark-brown, carbonaceous 107-108 Lignite, black
108-116 Claystone, pale-green, slightly silty 116-126 Claystone, grayish-green
126-133 Siltstone, dark-brown, clayey, carbonaceous 133-135 Lignite, black
135-144 Claystone, pale-greenish-gray
144-146 Claystone, dark-brown, slightly silty, carbonaceous
146-147 Lignite, black
147-149 Claystone, buff-tan
149-161 Claystone, light-green
161-165 Sandstone, pale-green
165-175 Siltstone, grayish-brown, clayey
175-180 Sandstone, pale-green

Y ---r-'f-n r

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- , -50

- 20

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TITT yr

ES:?:; .__ - t- tr^ii r ! . . t_,. _

Hole number continued

H36

Lithology

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Gamma

TC, 2 R ari gr 100 cps

f Recording speed _2Q_*Vmin
T-Opp^d dpnth 3,3.0 ft

vv ' . .. :T^J40 r:

V-- " ' W34 .

i/ /f (3d fl

. AT/-*
....

Density

T.C. 3 Ranpe 500 cps

tf "" '

Recording speed 2Q_rt/m in

Lopped depth 380 ft

: "" ' ^ -:

f\ " ^.i

Depth

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£ 2

- - 120

-400

257

Hole number H 39

SP ; Resistivity
Sens, setting 5P.MY (Sens, setting 5.0 _ j Recording speed -2Q_ft/min Re cording speed2Q.it/min i Logged depth 180 ft __ Logged depth _lSLQ_£t._

t

I

-4

t

-

"*7r>~i'- -jj.r ,^".T-i'i 1 """^ * r-^"'"* *

Depth

1-0-0
i

r50

-20>

- 100

-40!

,-150

- 200"60

- 250
-80

^300

100!

- 350

258

Mole No:_._.LL4_Q._ __Map:_jCa£finJBiuttes.. _._ Date:. 1Q-J13.:Z7_State: ___JS[D__ County:__ _.__....... Elcv.: __2,420 ft... Location: T.JJ2S, R..9Q.5. Sec.._21, Tract: cccc. _ Drilled depth: _._ 20QJ1. . Measured: _9_5 ft.__ *s?L, _30_ft JFW.. Hole size: __134in.._ Air iTj Water £] Cored: Yes [1 No Lignite beds: ._ 20-13....- ... - . .._... .. .. ____...__.__ ..

Remarks:

Mtholo^y
Recorded by: _Rlchard_Sc_attp]i_ni_

Geophysical lo^s
Geologist NX recorded by: _.__..Lechner_.

Lithology

Cannna

T.C._2_ Range J.OQ_cps_
Recording speed 2Q'
Logged depth _200_£t

Density
T.C. _Ji_ Range J5.0Q__cps
Recording speed 20-' c/rnin
Logged depth _200_£c_

Pepth

0-18 Siltstone, >e!low, clayey
- 18-22 Lignite, black
- 22- 23 Claystone, light-brown
_ 23- 30 Cbystone, pale-green
~ 30- 37 Claystone, light-gray
_ 37- 38 O.aystone, dark-gray
38- 47 Qaystone, medium-gray
~ 47- 60 Siltstone, medium-gray, clayey
60- 65 Siltstone, dark-grayish-brown, sandy
65- 85 Qaystone, dark-brown, carbonaceous, sandy

- 85- 88 O.!}stone, medium-gray
_ S3- 89 LUnite
89- 96 Ciaystone, grayish-£reen
96-102 Sikstor.e, dark-brown, carbonaceous
_ 102-104 Lignite
104-107 Claystone, dark-brown, carbonaceous
- 107-115 Siitstcme, dark-grayish-brown, cbyey
115-120 Sandstone, grayish-brown, clayey
~ 120-125 Qaystorte, dark-brown, carbonaceous
_ 125-130 Siltstone, brownish-gray
130-145 Sandstone, dark-brown, carbonaceous, very fine grained
145-170 Sand'stone, dark-green, very fine grained

~ 170-200 C'uiy-itor.e, dark-brosvn, carbonaceous

0-0

_____

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"

Hole number continued
H37

Lithology

370-385 Sandstone, greenish-gray, marly
385-390 Claystone, dark-green, marly, silty 390-400 Qaystone, dark-green

Gamma

T.C. 2 Range 100 cps
Recording spppri 20 ft/m jn

Logged depth 400 ft

Density
T.C. 3 Range 500 cps
Recording speed20_ft/m in
Logged depth 400 ft

Depth

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259

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NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_...HJJL_- .._-Mnp:_Bentky_ Date: 1M2JZ- State: ND County :_Grant_..._._.__ Elcv.: __2,38.Q_ft__. Location: T. 133_x, R...?P_w , Sec. _3_0_., Tract: .dd.cld _ Drilled depth: __26QJL._.._._

JcNk Measured:_3Q_ft_ FSL, _X
Lignite beds: .JZ.5-ZZ . .

Measured: _3D_ft_ FSL, _125.Jt H, Hole size: __4_%m.__ Air [j Water SI Cored: Yes Q No

Remarks:

Lithology
Recorded by: __Ei. .hard.Scattpljni.

YC9 Geophysical logs

._ __ Geologist xx recorded l)y: ..__..Lechn_er_.

Litholocrv

Gamma

T.C.._2_ Range JLQO_cp_s_

Recording speed 20' c/min

Logged depth _260.ft__

Density

T.C. _1_ Range 30.0-.cps.

Recording speed 2D-' c/min

Logged depth _2_60.£t__

Depth

0- 5 Siltstone, yellowish-brown
5- 6 Limestone, gray
6- 16 Siltstone, yellowish-brown, clayey
16- 17 Clay stone, light-gray
17-18 Lignite, black
18- 25 Claystone, light-gray
25- 36 Gaystone, bluish-green
36- 71 Claystone, medium-gray, slightly silty

71-72 Claystone, dark-gray, carbonaceous 72- 74 Lignite, black
74- 75 Claystone, medium-greenish-gray
75- 77 Lignite, black
77-81 Claystone, grayish-brown
81- 93 Siltstone, bluish-green, sandy
93- 95 Siltstone, grayish-green, sandy
95-100 Sandstone, medium-gray, very fine grained 100-127 Sandstone, medium-gray, very fine grained 127-135 Claystone, brownish-gray
135-145 Siltstone, brownish-gray
145-160 Sandstone, medium-gray, fine-grained

160-168 Siltstone, medium-gray, clayey
168-180 Siltstone, medium-gray, sandy

180-182 Siltstone, light-gray, well consolidated 182-195 Siltstone, grayish-brown, sandy
195-235 Sandstone, medium-gray, fine-grained

235-260 Claystone, medium-gray, silty

._.._. /-O-O

- 20

_._ _ _ ._ ^-.. r - ---^-_ - -- - -^

n : : 1_:

, __^_ ^ ^ -~"~ __ _. . m ..

- -fOO

261

Hole number H 41

SP

Sens, setting . Recording speed 20 it/mi Logged depth_ 2_6Q.ft._

Resistivity
Sens, setting -.-.
min Recording speed 2.0 ft/min Logged depth ..260.ft...__

Depth

*J U

II

-0-0

im t

50

- 20!

MOO i t l

f-150

- 250 I
I i

"- -80

;-300 iT-
- 100

H-350 '

262

NORTH DAKOTA GEOLOGICAL SURVEY

Jkntky: N

Hole No:__H 42 _Map:. __ Date: .10=12=71- State: .__M2_ County: Grnnt Elcv.: _2,355.ft_ . Location: T. 13=1. fc, R._9.0_w , Sec. _32_., Tract: ...cccd . _ Drilled depth: __._2_2Q_fL__. - _

f

Mif "t?Rlc r~~~t r*_ _ irLJ.
SL, _470_ftFWL, Hole size: __13^ia,_. Air [_J Water SI Cored: Yes U No H

Lignite beds: .._99rlOU.Ul-134;.141-143; 192-194

Remarks:

Lithology
Recorded by: _Rij£hard_S_cati:olini_..

Geophysical loirs

^ i Yes lit ^ T r

_ Geologist XX recorded by: ..__Lecnner._

Lithology

Gamma

T.C. _2_ Range JLQO £ps_

Recording speed 20 "7mm

Logged depth _22_Q ft._

Density

T.C. _3_ Range _5.QO_cps

Recording speed 20_"/min

Logged C*O depth l ' " 220 " ~ "" ~~~" ft

Depth

0- 2 Claystone, yellowish-brown
2- 3 Lignite, brown
3- 5 Qaystonc, yellowish-gray
5- 20 Claystone, brownish-gray
20- 21 Lignite, black
21- 32 Qaystonc, bluish-green
32- 34 Lignite, black
34- 39 Claystone, dark-brown, carbonaceous 39- 40 Lignite, black
40- 50 Qaystonc, greenish-gray
50- 55 Qaystone, dark-brown, carbonaceous 55- 57 Lignite, black
57- 74 Qaystone, medium-gray, silty
74- 87 Siltstone, light-to medium-gray
87- 90 Siltstone, medium-gray, clayey
90- 94 Qaystone, medium-gray
94- 95 Lignite, black
95-106 Claystone, medium-grayish-green, silty 106-108 Qaystone, dark-brown, carbonaceous 108-129 Siltstone, light-gray, clayey
129-133 Lignite, black
133-140 Qayslone, grayish-ereen
140-141 Lignite, black
141-150 Qaystone, medium-gray
150-165 Claystone, brownish-gray, silty

165-173 Sandstone, brownish-gray, line-grained

173-175 Claystone, medium-gray
175-188 Sandstone, light-greenish-gray, fine-grained 188-190 Lignite, black

190-220 Sandstone, medium-gray

- =-o-o

-50

- 20

Hole number H 42

SP

Sens, setting-.50 MY _._ Recording spec
Logged depth ._. 22.Q.ft ._

Resistivity
Sens, setting .__50____
d 20 ft/min Recording speed2Q_ft/min Logged depth .. 22D..ft..._

-- . !l*

Depth

- 0-0

I50

L -20:

HOO

[-150

250 i

- -so;

- 300

- 100;

-350

264

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: H 43 _.__Map:__Leip?ig-2_NW _ _ Date:.JJ3-_1Z-7J7_State: MD County: Grant _ Elcv.: -2,4_10_ft_ . Location: T. Ills , R._?0_w . Sec. _.26_ , Tract:. .J>_ccb Drilled depth: _._3QOJ[t_.... ... _

Measured: 2i?_QQ.£t_Rs£;_35_fl_F^. _ _ _ -

Lignite beds:. Jt7-5ZU6.Qr.263. .

Hole size: u_ Air [j Water 0 Cored: Yes No

Remarks: Core hole H 43C was located 45 feit north of H 43; cored interval was 48 to 58.5 feet; recovery 10*5

TA Af*

Lithology Geophysical Yc Recorded by : ^i.pj^tfd .S^tqlini _ ___ ___.. .__ . Gcologistxab" recorded by: ... ___ Lechner.

Lithology

Gamma

T.C. 2 Range lQQ_cps_

Recording speed2CL' t/min

Logged depth _3HQjt__

Density

T.C. _1_ Range AQ

Recording speed 2Q"/rnin

Logged depth 300 ft

£ <? I *~^ *

Depth

tok-
«-* * {
o
o

ti. o

0- 3 Sandstone, light-brown
3- 40 Sandstone, yellowish-brown, poorly con-solidated

~ 40- 48 Sandstone, grayish-green
48- 56 Lignite, black
56- 62 Claystone, medium-gray

62- 64 Lignite, black
_ 64- 71 Qnystone, medium-gray, silty
71- 75 Claystone, dark-brown, carbonaceous 75- 90 Qaystone, medium-gray

~~ 90- 97 Siltstone, medium-gray, clayey
_ 97- 98 Lignite, black
98-102 Claystone, grayish-green
~ 102-109 Siltstone, medium-gray, sandy
_ 109-135 Claystone, light-to medium-gray

~ 135-168 Siltstone, medium-gray, sandy

168-174 Claystone, light-gray

174-177 Sandstone, brownish-gray
177-178 Lignite, black
178-196 Sandstone, medium-gray
196-201 Claystone, medium-gray

201-204 Claystone, dark-brown, carbonaceous 204-205 Lignite, black
205-215 Claystone, pale-greenish-gray
215-218 Sandstone, dark-brown, carbonaceous 218-224 Claystone, pale-green
224-240 Siltstone, light-to medium-gray

240-254 Gaystonc, light-greenish-gray

254-256 Lignite, black
256-260 Siltstone, grayish-brown
260-300 Sandstone, grayish-green, finegrained

- 0-0

-20

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- 1^3 L

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265

Hole number H 43

SP
Sens, setting
Recording speed -20. ft/ min Recording Logged depth _. 300. ft _

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I -t

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_l

Resistivity
Sens, setting -_.
speed 20.ft/min
Logged depth- 300.ft_....__

Depth

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r -40
riso

r

-ZOO"60

r-250
'- -80

r-300

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266

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_ . HJ4___ .....Map:.___NoJEapa_.__ Datc:.iOr!4:72_State: __.ND___County:__C.rant_.... ..._ Elcv.:_.2,315_ft_. Location: T.JLH&, R._9.Q..JK Sec.-12., Tract: ._aadd __ Drilled depth: _180 £t_._.... ._ Measured: JL,056.ft_ 8Sl* J>0_f.L_JF»t, Hole size: __4J4in,_ Air D Water Cored: Yes [j No Lignite beds: .-51-.5&J8--61; 9.4-97

Remarks:

Lithology
Recorded by:. Richard.JSiattol

Geophysical logs

~ i Ye» iii h
._. Geologist NS recorded by: ._._

Yes Lechnej-..

Litholog)'

Gamma

T.C.J2__ Range lQO_cps_

Recording speed 2QWmin

Logged depth _120. h__

Density

T.C. ^L. Range .SOCLcps.

Recording speed -2Q rt/min

Logged depth _164 ft

Depth

u

0- 30 Sandstone, yellowish-brown, fine-grained

30- 37 Sandstone, yellowish-brown, very coarse grained 37- 52 Clay stone, light-gray

52- 56 Lignite, black
56 58 Claystone, dark-brown, carbonaceous
58- 60 Lignite, black
60- 68 Claystone, grayish-brown, carbonaceous
68- 75 Claystone, medium-gray, slightly silty
75- 86 Claystone, very dark brown, carbonaceous 86- 88 Siltstone, very dark brown, carbonaceous 88- 91 Sandstone, very dark brown, carbonaceous 91- 95 Siltstone, very dark brown, carbonaceous 95-100 Sandstone, pale-greenish-gray, fine-grained 100-101 Lignite, black
101-102 Sandstone, grayish-green
102-180 Sandstone, greenish-gray

- 0-0

K50

- 20

- 100

100

267

Hole number H 44

SP

Sens, setting _5Q_MV _ _ Recording speed .20 »t/ min Logged depth ._ 12Q.ft.._

Resistivity
Sens, setting 1QQ_.__ Recording speed.20ft/min Logged depth _170.ft. _._

Depth

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-20:

h« 00
L

H50

-200r60

250 :
- - 80'

h-300

-iOO'

- 35C
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268

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: _.H_45__ ._ Map:._._Leipzig.2.NW_ Date:.
N on ?C

State: ND County: jOf* !
Elcv.: -_2,335_£t_. Location: T. 12! S , R. JL9.W . Sec.. 32_., Tract: .baaa __ Drilled depth: _._2JKLft_.._ .;_
irV'T ^Fft I ' r~ I _

Measured: iO_£t__f5Hc.2^2.^_fj RVL, Hole size: 4 % in._ Air U Water [XJ Cored: Yes G No |x] Lignite beds:._66-.69iJ_2-74; 104-106; 113:115

Remarks:
Lithology
Recorded by:

Geophysical logs
.__ _.. _ .._ Geologist N* recorded by: ____Lechner__.

Lithology

Gamma
T.C..-2 Range 100.cps_
Recording speed 20. ' c/min
Logged depth _ ._196 Jt__

Density
T.C. _3_ Ran
Recording speed 2.0._> t/m in
Logged depth 200ft

Depth

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O *^
S Ji

No Samples -0-0

- 20

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- 250
- - 80

- 300

_ -100

269

Hole number H 45

SP

Sens, setting . -5_Q.M.y_._ Recording speed?0_ ft. Logged depth _.. AM ft__

-I

Resistivity
Sens, setting -_5.Q__ ft/min Recording speed-2Qft/min Logged depth . 196 ft._

. ^_r J^ Wll " j" ' ^."T""*! - " f ' n"_..^!

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Depth

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ft) *^

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-40'

150

200 60

- - 80

r .;
i_ '

j-300
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L -100:

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-35C

270

.Map: .No Topo ____ Date:
N

Hole No:. State: ND County: Grant Elev.:__2,M5_ft__ Location: T. .Uii, R.9Q__w , Sec. _1(L , Tract: .._£cdd_ Drilled depth:__40QJL.. _ Measured :_J 5 Jt_ FSL, _L35I2£t^. Hole size: 43£in. Air D Water H Cored: Yes G No (3

Lignite beds: .J.6-.2iU22-126; 169-172; 206-212^316-318

Remarks:

Lithology
Recorded by: J&char4ScaltoJ_im.

o Y Geophysical logs
Geologist^? recorded by: Lechner

Lithology

"Gamma

. _ Range 1QQ cps_

Recording speed 2Qft/rnin

Logged depth 400 ft __

Density

T.C. _3_ Range 500 cps

Recording speed 2Q_"/min

Logged depth 400 ft

Depth

0- 15 Sandstone, yellowish-brown, silty

15- 35 Claystone, yellowish-brown; limonite

35- 37 Lignite, black
37- 60 Claystone, medium-greenish-gray, slightly silty

~ 60- 65 Claystone, dark-gray, carbonaceous
_ 65- 66 Lignite, black
66- 77 Cluystone, dark-brown, very carbonaceous 77- 83 Claystone, light-grayish-green
_ 83- 84 Lignite
84- 86 Claystone, greenish-gray
86- 90 Sandstone greenish-gray
_ 90-91 Lignite
91-101 Claystone, dark-brown, carbonaceous 101-118 Siltstone, medium-gray
118-122 Claystone, grayish-brown
~~ 122-126 Siltstone, greenish-gray
126-128 Lignite, black
128-155 Siltstone, grayish-green, clayey
~~ 155-165 Claystone, grayish-green, silty

~ 165-167 Claystone, dark-gray, carbonaceous
_ 167-168 Lignite, black
168-195 Claystone, medium-gray

195-197 Claystone, dark-brown, carbonaceous 197-206 Claystone, medium-gray
206-208 Lignite, black
208-210 Claystone, medium-gray
210-215 Lignite, black
215-235 Siltstone, light-brownish-gray

235-240 Sandstone, medium-gray

240-260 Siltstone, medium-gray, clayey

260-300 Claystone, light-green

300-320 Sandstone, medium-gray, silty

320-345 Clay stone, light-gray

345-350 Claystone, dark-brown, carbonaceous

350-370 Claystone, light-grayish-brown

.."£: 3=3 -0-0

- 50

- 20

;- ;_:~._j-_ :_j- ..- -- ~c-> '

~'."^.T^-"~t^^l- ' . «!_jj_rZ !' .'. -"""

350

Hole number continued
H46

Lithology

370400 Sandstone, medium-gray, silty

Gamma

TT. 2 Range _JjQ£L£pS Recording speed JllLJ Logged depth 400 ft

Density
T.C._3 Range Recording speed2fLfymin Logged depth 40 Q ft

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400

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U0*7?

H450
- 140

Depth

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ft *-
t» O

500

- 160

h550

- 180
600

-650-EIoo

- 700

- -220

- 750

272

Hole number H 46

SP Resistivity
Sens, setting . ...50.MV {Sens, setting .50__.._ Recording speed 20- &/ min Recording speed20."/min Logged depth _.. AOQ ft__ Logged depth -IpOjt .._

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Depth

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h-0-0
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h

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- 40.

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^200

- 250
- - 80'

- 300

- 100

- 350

273

Hole No:__Ji-42_ ___Map: , « - _ _.... Date: JOr_6-77_State: . _....-- ND County: __- Grant..,

Elcv.: _-2A8Q_£t_. Location: T. -13.4* , R.-9_Q_W, Sec. __2_.__, Tract: ..._dccc ..__ Drilled depth: __4QDJL.__ ..__ Measured: _25jt j1SL,2J>35_ft RWfc Hole size: _JL&UU_ Air D Water [S Cored: Yes Q No H Lignite beds: ._7.9-82j.l25,128; 169-174; 247-249;.294-297 ......_.. ._.. .. ______.__ ... ..__

Remarks:

Lithology
Recorded by:

Geophysical logs
Geologist**** recorded by: .__Lechner

Lithology

Gamma

T.C. _2__ Range lQO_cps_

Recording speed 2H"/min

Logged depth _J

Density

T.C. _3_ Range 5fl.0jlpjs_

Recording speed 2.0. "/min

Logged depth 4QQ ft__

Depth

« 2

0-2 Siltstone, yellow
2- 3 Gaystone, light-brown
""3-8 Claystone, dark-brown, carbonaceous
^ 8- 10 Sandstone, light-brown, finegrained to
medium-grained
10- 20 Sandstone, yellow, fine-grained to medium-
_ grained
20- 23 Lignite, black
23- 27 Claystone, dark-brown, carbonaceous
27- 31 Claystone, greenish-gray
31-32 Lignite, black
32- 39 Gaystone, greenish-gray
~ 39- 40 Lignite, black
_ 40- 70 Gaystone, greenish-gray
70- 71 Lignite, black
~" 71-73 Gaystone, dark-brown, carbonaceous
_ 73- 78 Qaystone, grayish-brown, carbonaceous
78- 81 Lignite, black
81- 90 Gaystone
_ 90-113 Sandstone, grayish-green
113-120 Gaystone, gieen
120-125 Sandstone

125-128 Claystone, greenish-gray
123-131 Lignite, black
_ 131-150 Claystone, grayish-green
150-151 Claystone, dark-brown, carbonaceous 151-J60 Gaystone, medium-gray
_ 160-161 Lignite, black
~~ 161-166 Gaystone, medium-gray
_ 166-174 Lignite, black
174-181 Gaystone, medium-gray
181-190 Siltstone, light-green
_ 190-210 Siltstone, medium-gray, clayey

"~ 210-240 Siltstone, brown

240-246 Gaystone, medium-gray
246-247 Siltstone, light-brown
247-291 Sandstone, medium-gray

291-294 Lignite, black
294-300 Gaystone, medium-gray
300-309 Siltstone, medium-gray, sandy
309-320 Sandstone, medium-gray, silty

320-322 Siltstone, medium-gray
322-325 Gaystone, very dark brown, carbonaceous 325-340 Gaystone, medium-gray, silty
340-400 No samples

- 0-0

- 20 V-r* fcO P--T

~

_ -100

- 350

Hole number continued
H47

Lithology

Gamma

T.C. 2 Range _100_c Recording speed 2H_ Logged depth 400 ft

Density T.C._3_Range 500 cps Recording speed20JVmin Logged depth 400 ft

-450
- 140

Depth

»- o

8

500

- 160

1-550

- 180
600

- 700

- - 220

- 750

275

Hole number H 47

SP

Sen*, setting 50.MV
Recording speed 2Q_ ft/min
Logged depth __ 4QQ_ft _

Resistivity
Sens, setting 1QO____
ing speedZQ/Vmin
Logged depth -4Q_Q.ft.._.._

-i

i

1

Depth |

« «

II

-0-0

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i -40;

- 250
- 80

p300

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276

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:____B_43 __ __ Map: 1 NW Date: 10-6-77 State: ND. __ County: Grant
Elcv.: _2,4ia.£t_. Location: T. Hi s , R. ?i_w . Sec. __18__ , Tract: __aaad__ Drilled depth: _32DJL_.._ .... ~. ._ Measured: 52.8_f£ lsk, -10 fL_Ht Hole size: 4 % in. _ Air [j Water H Cored: Yes Q No [x] Lignite beds: .._6-llL3.9.-.43j 96-98; 175,177; 297-299

Remarks:

Lithology
Recorded by: Richard-Scatcolini.

Geophysical logs

.. -_ Geologist i& recorded by: _.__Lechncr_

Lithology

Gannna

T.C..-2- Range JlO.O cps_

Recording speed 20.^/min

Logged depth _320 ft__

Density

T.C. _1_ Range

Recording spee

Logged depth _ 32Q_ft __

m n

Depth

i_> <U

0 «j

u! 2

0-5 Siltstone, brownish-yclbw
_ 5- 7 Lignite, black
7-11 Siltstone, yellowish-brown
_ 11-24 Siltstone, brownish-yellow, clayey
24- 38 Gay stone, pale-greenish-gray
- 38- 39 Lignite, black
_ 39-41 Siltstone, medium-gray, clayey
41-42 Lignite, black
- 42- 58 Sandstone, greenish-gray
58-59 Lignite, black
59- 65 Claystone, light-grayish-green
65- 70 Sandstone, grayish-green
~~ 70-71 Lignite, black
_ 71- 75 Claystone, grayish-green
75- 80 No samples
~ 80- 82 Claystone, grayish-green
_ 82-97 Claystone, medium-gray
97- 98 Lignite, black
98-106 Claystone, medium-gray
_ 106-117 Ciaystone, light-green
117-145 Siltstone, light-green

- 145-170 Sandstone, pale-green

170-175 Claystone, light-green
175-176 Lignite, black
176-188 Claystone, pale-green
188-220 Claystone, medium-grayish-creen, silty

220-223 Lignite, black
223-246 Claystone, grayish-green, silty

246-290 Claystone, grayish-brown

. -0-0

- - - - - - 50

- 20

290-298 Claystone, grayish-green
298-306 Claystone, brown
306-320 Sandstone, light-green

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NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: _ .H_49L_ __ Map:_,J*£ipzig_2_NW ._ Date :.JL£Li5r7.Z_ State: ND County: _ _ Grant ... .._ _

N K Elcv.: _2l3J.Q_ft_. Location: T. .135* , R._89_w , Sec. __32__ , Tract: cccc _ Drilled depth: _3_20 .&_.__ . _
Measured: IPQjt __ FSL. _10 ft__w. Hole size:

Lignite beds:. .JU8=12a; 157-159; 226-228

L3Ami__ Air Water Cored: Yes [j No

Remarks:

Lithoiogy
Recorded by: _Hal .Qwcn_

(icophysical logs
_ -_ Geologist NX recorded by: . .__..Lechnej_..

Lithoiogy

Ganima

T.C._2__ Range _10Q_cgs_
Recording speed ZlrV

Logged depth _3.19 ft

Density

T.C. _1_ Range .10Q_c.ps.
Recording speed 20_iVmin

Logged depth _120_ft_

Depth

s s

£ I

~ 0- 3 Sandstone, brown; some limonite _ 3- 25 Sandstone, brown

~~ 25- 47 Sandstone, medium-gray

47- 48 Limestone

48- 66 Sandstone, medium-gray

66- 67 Limestone

67- 70 Sandstone, medium-gray
70- 74 Limestone

74- 88 Sandstone, medium-gray
88- 95 Limestone

95-115 Sandstone, medium-gray

115-J18 Lignite
118-125 Silts tone, medium-gray
125-126 Lignite
126-133 Siltstone, medium-gray
133-134 Lignite
134-144 Claystone, medium-gray
144-145 Lignite
145-151 Claystone, medium-gray
151-152 Lignite
152-160 Siltstone, medium-brown
160-172 Siltstone, medium-gray
172-173 Limestone
173-175 Siltstone, medium-brown
175-230 Sandstone

230-233 Lignite
233-235 Limestone

235-263 Siltstone, medium-gray

263-270 Claystone, carbonaceous

270-280 No samples
280-293 Siltstone, medium-brown

'293-295 Lignite
295-320 Siltstone, medium-brown

-_--.:- -0-0

- 20

-too

279

Hole number H 49

SP

Sens, setting__5Q.MV.._. Recording speed _2A fymin Logged depth 31S.&

Resistivity
Sens, setting --l.QD__ Recording speed 2(1 fymin Logged depth ... 31£ft..._._

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K^:_s^-.-

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Depth

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- 150

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r-250 i

-80;
r-
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"300

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i-

- 100:

I-35C

280

NORTH DAKOTA GKOLOGICAL SURVEY

Hole No:__ H.-50...- __ Map: J3ear.t_^.te_$JE_ _ Date:_1&-1-Z7_State: _ ..N_D__County:__.Grant_.._._..._. Elcv.:.-. 2,295. fs__. Location: T..125&, R.A9..W , Sec. ...1.4., Tract: ._ccbb ._ Drilled depth: __2.6.Q_£tL..... , Measured: i280jLFSL, .-l?._ft__ FW, Hole size: __!_% m.._ Air G Water [X] Cored: Yes D No 0 Lignite beds: --216^218. _ _. ... . _._._.. ____..._._._ ...

Remarks:

Litliology Geophysical logs
Recorded by: ^at^allRcichcrt.._.._____.. .._ Geologist NX recorded by: . .JLechner _

Lithology

Ganuna

T.C..-Z- Range J.QQ..cps_
Recording speed ^.Qi

Logged depth _2_60ft

Density

T.C. _3_ Range 50P_cps_
Recording speed 20'Vmin

Logged depth __257_£t _

Depth

0-15 Sandstone, yellowish-gray, very fine grained

~ 15 - 16 Sandstone, orange, very fine grained
_ 16-24 Lignite, black
24 - 30 Sandstone, yellowish-gray, very fine grained
~~ 30-33 Claystone, dark-brownish-gray, silty,
_ carbonaceous
33-35 Lignite, black
35-36 Claystone, brownish-gray, silty
36 - 60 Siltstone, light-gray, clayey
~~ 60-86 Sandstone, light-gray, very fine grained

86 -105 Siltstone, light-gray, clayey

105 -135 Sandstone, medium-gray, very fine grained

135 -140 SHtstone, light-gray, clayey
140 -168 Claystone, light-gray, silty

168 -172 Claystone, medium-gray

172 -175 Claystone, brownish-gray, carbonaceous 175 -185 Siltstone, medium-gray, clayey
185 -195 Claystone, medium-gray, silty
195 -196 Limestone, dark-gray
196 -208 Claystone, mcdium-eray
208 -208.5 Lignite, black
208.5-217 Siltstone, medium-gray, sandy
217 -219 Lignite, black
219 -260 Sandstone, greenish-gray, fine-grained to very fine grained

- 0-0

-20

-40

_ . 12.0 r.--~ .

: 220 =r=r=~-.-- .-

- "rrr ^"zrz-'irrr. ~

_ -100

281

SP

Sens, setting 50L.MV Recording speed 20 Logged depth ._. 26Q ft._

Hole number H 50

Resistivity
Sens, setting -3Q_ Recording speed .20. &/ Logged depth -.260 ft.

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i

Depth

*J CJ

- 0-0

}-50

r -20

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L

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r250 i
i- -80'

- 100'

282

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_JHL5X-_ __ Map:_He_art_Buttei_SI___ Date :._.1Q;5_-7J7_ State: _ND__County:. G_rant___ ..._. Elcv.:..._2,35Q_ft_.. Location: T.13JL&, R..8_8_w , Sec. ..18_., Tract: .dddd _ Drilled depth: _3QO.ft_...._..

Measured: 60_ft___ ?SL. JL8 _ft_.J^L. Hole size: _JJ4.UU__ Air G Water 63 Cored: Yes f] No

Lignite beds:. J7.8-&!;_! 14_-118; 239-241 ... ...__ .... ____._._.__.

Remarks:

Lithology
Recorded by: Randall Reichert,

Ccophysicnl logs
.___ Geologist so1 recorded by: .__Lechner__..

Lithoiogy

Gamma

T.C. .JL_ Range ._1Q_Q cps_

Recording speed 20. ' c/min

Logged depth _3DD.£t.._

Density

T.C. _1_ Range _5QO_cps

Recording speed ?.Q.rt/ mjn

Logged depth 300 ft

Depth

0- 1 Sandstone, yellowish-gray, very fine grained 1- 10 Qaystone, yellowish-gray, silty
10- 12 Claystone, dark-brown, silty, carbonaceous 12- 15 Qaystone, light-yellowish-gray, silty
15- 20 Qaystone, yellowish-gray
20- 21 Siltstone, yeUowish-gray, clayey
21- 23 Claystone, medium-gray
23- 25 Lignite, black
25- 31 Oaystone, medium-gray
31- 32 Sandstone, very light gray, very fine grained, cemented

32- 35 Oaystone, medium-gray, silty
35- 36 Qaystone, dark-gray, silty
36- 38 Claystone, greenish-gray
38- 39 Sandstone, white, very fine grained, cemented 39- 46 Claystone, medium-gray
46- 48 Lignite, black
43- 63 Sandstone, greenish-gray, very fine grained to fine-grained
63- 64 Lignite, black
64- 65 Sandstone, medium-gray, very fine grained 65- 70 Lignite, black
70- 75 Sandstone, greenish-gray, very fine grained 75- 76 Qaystone, medium-gray
76- 80 Lignite, black
80- 90 Siltstone, medium-gray, sandy
90- 92 Qaystone, medium-gray, silty
. 92- 93 Limestone, dark-gray
93-100 Siltstone, medium-gray, clayey
100-107 Qaystone, green
107-112 Claystone, medium-gray
'112-117 Lignite, black
117-122 Claystone, greenish-gray, silty
122-128 Claystone, greenish-gray, silty
" 128-135 Claystone, brownish-gray
.135-142 Siltstone, medium-gray, clayey
142-145 Limestone, dark-gray
- 145-147 Siltstone, medium-gray, clayey
147-152 Claystone, medium-gray, silty
152-155 Claystone, brownish-gray, silty
- 155-160 Sandstone, light-gray, very fine grained
160-164 Qaystone, light-gray, silty
" 164 172 Qaystone, light-gray
. 172-173 Lignite, black
173-177 Claystone, light-gray, silty
177-178 Qaystone, brown, silty
178-180 Siltstone, light-gray, clayey
" 180-183 Clayhtonc, light-gray, silty
- 183-184 Lignite, black
184-185 Siltstone, light-gray, clayey
185-190 Siltstone, brown, clayey, carbonaceous
. 190-192 Siltstone, light-gray, clayey
192-196 Oaystone, light-gray
" 196-200 Siltstone, brown, clayey, carbonaceous
_ 200-215 Siltstone, grceaish-gray, clayey
215-232 Sandstone, <:rcenish-gray, very fine grained

- 20

2.30 ^^^-~r~

_ -100

283

Hole number H 51

SP

Sens, setting 50.MV Recording speed-2Q_ ft/mir Logged depth _.. .100..ft __

Resistivity
Sens, setting 5 Recording speedr-O Logged depth ~3p0.fc

Depth

- o-o !

1-50 !

-ioo

- 40'

150

-ZOO"60

- 250 I
- - 80;

r

f-300

- 1001

- 350
l

284

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: __ H_52__ __ Map:_Rcgcnt __ . ___ Date:. _UH5-Z7_ State: __i£D_ _ County :_jicmngcr . ...._ Elev.: 2,535. ft_. Location: T. US. St , RM. _w", Sec. ..30. , Tract: jxbb _ Drilled depth: __520_ft____.. ... _ Measured: _L.Q5Q jt_ FSL, 75 ft__ FWL, Hole size: 4 K in. Air fj Water
Lignite beds: 5-9j 1M022L220-223; 33.1-353; 355-357; .41 2-4.15 ;.482-485;

Cored: Yes No

Remarks:

Lithology
Recorded by: _Rkhard_Scattolinj.. . ____.___ Geologist

Cioophysical lc>i».s
recorded by: ..__ Lechner

Lithology

Gamma

T.C._2_ Range ,.lPO.cps_
Recording speed 20 ^/

Logged depth _520_ft

Density

T.C. Jl_ Range
Recording speed 2Q.*t/min

Logged depth 520 ft__

Depth

8

0- 2 Gaystone, yellowish-brown, silty
2- 6 Lignite, black
6- 25 Claystone, grayish-brown
25- 27 Claystone, greenish-gray
27-38 Siltstone
38- 45 Sandstone, grayish-green
45- 47 Sandstone, grayish-green, well cemented 47- 77 Sandstone, grayish-green

77- 79 Sandstone, grayish-green, well cemented 79-115 Sandstone, grayish-green

115-125 Claystone, medium-gray
125-127 Claystone, dark-gray, carbonaceous 127-142 Gaystone, medium-gray

142-162 Siltstone, medium-gray

162-171 Lignite, black
171-200 Claystone, greenish-gray, slightly silty

200-213 Siltstone, medium-gray

- 213-215 Lignite, black
_ 215-220 Claystone, medium-gray, silty
220-230 Siltstone, medium-gray
230-240 Claystone, greenish-gray
- 240-329 Gaystone, medium-gray, silty

329-351 Lignite, black

- -: -= -0-0

- 50

-20

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LZ___ 2. '..I. ^~TI~ ,'_ ^7^7J7J~ _

. . .-_: p _ -.....- ' 2

-40

-250
~ -80

300

- 100

285

Hole number continued
H52

Lithology

385-416 Sandstone, medium-gray, silty

416-423 Siltstone, light-brown, clayey
423-440 Quystone, dark-brown, carbonaceous

440-445 Sandstone, greenish-gray
445-460 No samples
460-485 Siltstone, dark-gray, sandy

485-499 Sandstone, medium-gray, fine grained to medium-grained
499-502 Lignite, black
502-520 Sandstone, medium-gray

Gamma

T.C-2_ Range-lODcps Recording speed 2Q wmin Logged depth 520 fr

Density
T.C._3 _ Range 500 cps
Recording speed ZH/Vmi
Logged depth 520 fr

Depth
V) t_l
<_ O

U, 8 IS

- 120
400

'.." " ~~~ "" f^"~"~-T"i :~~.-^

r550

- - 180
- 600

160

650

-2<00

- 700

- - 220

- 750

286

Hole namber H 52

SP

Sens, setting 5Q_MV Recording speed 20 (t/mi Logged depth ... 520 ft._
L ___-_ .

Resistivity
Sens, setting __50___ in Recording speed J2Q&/m in Logged depth ...__ 520 ft__

-I

-i

J

1

1

__ __ ____. . __.. ^3

Depth

- o-o

- 50

-20

- 40

-200- 60

250
- 80

- 300

_ -100,

- 350

287

Hole number continued
H52

SP

Sens, setting _...50 MV Recording speed _2flL Logged depth __.5.20it ,.

Resistivity
Sens, setting __ .. .50_... _ . Recording speed?0;t/ min Logged depth . 520 ft

i

- I

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J

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~l

Depthl

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j-400 ;

-450
- 140;

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h j

h500 i
i_

I- -160!

r ;
- 550 !
I '.

r i h :
» -180'

600 i

- 650 j

' -200! i-
»

700

- -220.

- 750

288

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_..!±_5JL_ __Map:___Ha.ydock__ _ Datc:.JO-1 SzZT.State: __ND__County:_Hettjnger _ Elcv.:.-2,570.ft_. Location: T.13is, R._96_w, Sec. ..24_ f Tract: .^4?c.__ Drilled depth: __!6.°.JL_.... _.._ Measured: _2.Qjt__ FSL, LP.OQjt|SL. Hole size: 4 K in. Air [j Water [3 Gored: Yes D No [X] Lignite beds: ._50^4j,.60-j65; 89-91; 163-172; 201-207 .... ____.__. . .

Rern.Trks:

Lithology
Recorded by:_._HsJ.Qwen______ ____ _ _ Geologist Ye8 Geophysical logs

recorded by: ..__e

Lithology

Gamma

T.C. ~2_ Range -XQQ cps_
Recording speed2jQ.

Logged depth _ 36_QJt

Density

T.C. _1_ Range _5QO_cps
Recording speed 2Q_ity min

Logged depth _360 ft OC* l -" """* "

Depth

u,

- 0-17 Sandstone, brown

- 17-25 Siltstone, medium-brown

- 25- 29 Siltstone, gray
_ 29- 30 Lignite
30- 42 Ciaystone, gray
- 42- 43 Lignite
43-48 Ciaystone
48-55 Lignite
_ 55- 60 Ciaystone
60- 64 Lignite
- 64- 90 Siftstone, gray

90- 96 Lignite
96-105 Siltstone, gray
105-109 Limestone, gray
109-122 Ciaystone, gray
122-127 Limestone
127-145 Ciaystone, gray

145-150 Ciaystone, dark-gray

150-155 No samples
155-160 Ciaystone, gray
160-170 Lignite
170-190 Siltstone, gray

190-193 Limestone

193-197 Siltstone, gray
197-203 Lignite
203-220 Siltstone, dark-gray

220-245 Sandstone

245-360 No samples

^0-0

- 20

)2O i~.__: -- -_.-:-.

>

- -300

- - 100

- - ^--- 3^;---..-

289

Hole number H 53

SP

Sens, setting .50_MV_ Recording speed 2SL fym in Logged depth _3<>0 ft _

Resistivity
Sens, setting 50___ Recording speed-2Qft/min Logged depth ._J36Q.ft_..__

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H

Depth

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- 40

M50

- 200"60

- 250 :
i i
'- -80

r300

- 100

--35C

290

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__BJ___ __Map:^ine.rButte_.___Date:. JH-18.-.ZZ. State: __N_O__County :_Dunn.__ ..._ __ Elev.: _2»125_ft__ Location: T. 142* , R._93_w , Sec. .JO.., Tract: .._cbcc _ Drilled depth: __5QOjt_........_ Measured: :U4&QJr_1fL, _12.iL_fwl Hole size: 4 # in. Air D Water S Cored: Yes ["] No H Lignite beds: .J38-40L5P:52; 184-187; 252-261; 327-331; 404^06; 459-474

Remarks:

Lithology
Recorded by: _J&ichard3jCattQUni.

Geophysical logs
.__Geologist SK" recorded by: .__.JLecjiner.

Lithology

Gamma

T.C. 2_ Range JLQO_cps_

Recording speed 2.0. tymin

Logged depth _._5JD_0_ft__

Density

T.C. _2_ Range lQQ_cps_

Recording speed2Qjt/min

Logged depth _5QOit__

Depth

s

0- 2 Sandstone, yellowish-brown
2- 4 Siltstone, brown
4-10 Sandstone, yellowish-brown
10-13 Qaystone, yellowish-gray
13-31 No samples
31 38 Claystone, light-gray
38- 39 Gaystone, brown, carbonaceous
39- 40 Lignite, black
40- 50 Gaystone, light-gray
50-53 Gaystone, dark-brown, carbonaceous
53- 55 Lignite, black
55- 60 Siltstone, medium-gray
60- 75 Sandstone, medium-gray, very fine grained 75- 76 Lignite, black
76-106 Siitstone, medium-gray, clayey

106-107 Gaystone, dark-gray, carbonaceous 107-132 Gaystone, light-gray

- 132-135 Siltstone, olive-drab
_ 135-140 Siltstone, medium-gray
140-145 Gaystone, medium-gray
- 145-150 Siltstone, medium-gray, sandy
150-171 Qaystone, greenish-gray
~ 171-174 Gaystone, dark-brown, carbonaceous

"174-175 Lignite, black
_ 175-184 Gaystone, greenish-gray
184-187 Lignite, black
- 187-188 Sandstone, olive-drab
_ 188-205 Siltstone, greenish-gray, sandy
205-230 Gaystone, greenish-gray, silty

230-250 Siltstone, medium-gray

~~ 250-255 Lignite, black
_ 255-259 Siltstone, greenish-gray
259-260 Lignite, black
260-280 Siltstone, greenish-gray

~~ 280-302 Siltstone, greenish-gray, clayey, carbonaceous

~ 302-305 Gaystone, medium-gray, silty
_ 305-310 Siltstone, medium-gray, clayey
310-311 Lignite, black
311-315 Gaystone, medium-gray, silty
_ 315-322 Gaystone, light-gray, silty
322-323 Sandstone, medium-gray, very fine grained, cemented

323-329 Siltstone, greenish-gray, sandy
329-335 Lignite, black

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250

- - 80

- 300

: -iOO

291

Hole number continued
Bl

Lithology

343-365 Siltstone, greenish-gray, clayey, carbonaceous 365-370 Gaystone, medium-gray, silty
370-387 Siltstone, medium-gray, cbyey
, 387-402 Siltstone, greenish-gray, clayey

402-404 Siltstone, brown, carbonaceous
404-410 Lignite, black
410-426 Gaystone, medium-gray silty
426-429 Siltstone, medium-gray
429-435 Sandstone, greenish-gray, silty
435-450 Siltstone, medium-gray, sandy

Gamma

T.C._2_ Range _mQ_cps
Recording speed J^L

Logged depth 500 ft

Density

T.C. 3 Range 500 cps
Recording speed 20/t/m in

Logged depth _5QDJL__

Depth

«_, o
O £
O "

u, 2

~" 450-460 Sandstone, greenish-gray, very fine grained -460-480 Lignite, black

480-500 Sandstone, greenish-gray, very fine grained

- 140

500

- - 160

- 550

- - 180
-600

-65(
Eoo

700

- 220

r-750

292

Hole number B 1

SP Resistivity Depth
Sens, setting . 2Q.MVL, Sens, setting _.._.. 50.. ..__ Recording speed 20 ft/min Recording speed .2.0/t/m in £ & Logged depth .... 5DO. ft__ Logged depth . ._500 ft ._ g ^

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_ -100

-350

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.T"V * " " \ " _ ^*_. _".'-..

293

Hole number continued
B 1

SP Resistivity
Sens, setting__2Q MV Sens, setting____3Q...._ Recording speed 20 it/ min Recording speed 2Qtt/mi Logged depth __500 ft ... Logged depth .500 ft

min

Depth!

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1

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i

-I

-I

- I20:
-400

-- 450 :
- I40:

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h500

-550

r i
L -180:

600 ; -

1-650 !

: -200;

r-700

1-
- - 220

t-750

294

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: __ B_2 ___ _-__Map: _ £mcrson_... . ^ .. Date:.. IQ.-.18-Z7_ State: __ND__ County :_.

Eicv.: _ _2,35Q.ft__ Location: T. Ails , R.J>_?_W , Sec. __1(L , Tract: . ._ aadd._ Drilled depth: __ 600_ft _ Measured: 1.056 ft &, _20 ft__ Hole size: __li» m^_ Air [j Water [x] Cored: Yes D No Lignite beds: . JL5-1&J.1-.7-6; 102-105; 187-195; 206-208; 303-305; 359-366; 380-382; 493-496; 509-518

__522-524; 527-530 . ...

Remarks: . ...

Litholoiry v Geophysical logs

D/ 11 1 T CS i

Recorded by:_Rlcnard^_cattQhm _ ... ____ ....___._ Geologist icac recorded by: .. _ Le.cn ncr _.__.. . .._.

Lithology

Gamma

T.C_2_ Range .10Q_cps
rrJinrr cnr»r»rl 70 't/mf.

i .v^. _.^__ rvange .^ VVL^I

Recording speed 2jQ/Vr

O *

Logged depth _6QOjt..

Density

T.C. _3_ Range -5Q£_cps
Recording speed

Logged depth __55.d_£i

Depth

fcu

0-10 Sandstone, brownish-yellow, medium-grained

~ 10-13 Claystone, yellowish-brown
_ 13- 16 Lignite, very dark-brownish-black
16-31 Claystone, medium-grayish-grecn
31-41 Sandstone, crayish-grcen, silty

41-46 Claystone, light-green, slightly silty
_ 46- 64 Siltstone, medium-gray, sandy

64- 71 Sandstone, medium-gray

71-76 Lignite, black
_ 76-90 Claystone, grayish-green, silty

" 90-102 Claystone, medium-gray

~ 102-103 Claystone, very dark brown, carbonaceous
_ 103-105 Lignite, black
105-121 Sandstone, medium-gray, very fine grained, silty
~ 121-125 Claystone, very dark-grayish-black; lignitic
_ 125-128 Claystone, dark-brown, carbonaceous
128-138 Sandstone, medium-gray, silty
138-143 Gaystone, grayish-green
143-170 Siltstone, light-gray, sandy

170-186 Claystone, light-gray

186-1^5 Lignite, black

195-201 Sandstone, grayish-green, very fine grained

201-205 Lignite, black
205-212 Sandstone, medium-gray, fine-grained 212-215 Claystone, medium-gray
215-252 Sandstone, medium-gray, very fine grained

252-254 Sandstone, medium-gray, very fine grained, well consolidated
254-257 Sandstone, medium-gnu-, very finegrained 257-260 Clay stone, medium-gray
260-267 Sandstone, medium-gray, very fine grained 267-270 Siltstone, medium-gray
270-278 Cluystonc, mediunj-grayi>h-grcen
278-298 Siltstone, medium-gray, sundy
298-299 Lignite, black
299-308 Claystonc, medium-gray; plant fragments, carbonaceous
308-310 Lignite, black
310-338 Siltstone, mcdium-grayish-green
338-360 No samples

- 0-0

- 20

- 40

_ -ICO

295

Lithology

370-382 Claystone. medium-gray, silty
382-386 Lipniic, black
386-408 Siltstonc, medium-gray, cbyey

408-410 Lignite, black
410-420 Claystone, grayish-frcen
420-600 No samples

Hole number conrinucd
B2

Gamma

T.C. 2 Range _1QP_C£L Recording speed 20

Density
T.C. _1_ Range 500 cp Recording speec
x, 596 ft.

Depth

w O o *-*
o "

- 120
-400

h650 -2i00

- 700

- - 220

- 750

296

Hole number B2

SP

Sens, setting_.. ..5.0 MY... Recording speed 20 ft/ min Logged depth _.. ..60.0 ft.__

Resistivity j Depth Sens, setting .50..... Recording speed 25. ft/m in i « «3 Logged depth . ._6_00 ft

- 1

- I

r-O-O

I-

r-50

- 20

- 100

-200-60

- 250
- 80'

3CO

297

Hole number continued
B2

SP Resistivit Depthi
Sens, setting_50.MV jScns. setting _.___50_..__. £ ! Recording speed_2£L_ft/ min|Rccording speed20/t/min I <j o ! Logged depth _._.600 ft .

-j

J

1

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J

Logged depth .600 ft .! u-

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450
- 1401

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f- -160!

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L -I80

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1-650 j
: -200

L

- 700

- - 220

1-750

298

NORTH DAKOTA GEOLOGICAL SURVRY

Hole No:._. B..3___.____Map:_Manning__ _._ Date:.lQ.:i9_-77_State: __N_P__County:_2u?_n__......_ Elcv.:.. 2,310.ft_ Location: T.-ii^S, R..?6_.w , Sec. __14_., Trnct: ...baab._ Drilled depth: __._ 620_ft__ Measured: 40_ft__Jra,2JQOjt^L. Hole size: 4 % in. Air [j Water 0 Cored: Yes Q Lignite beds:".-80._87.Ll44:l46; 151-153:172-191; 253-255; 332-334; 356-360; 376-379; 462-464; 544-549

Remarks:

Lithology
Recorded by:^ajLdall_Reichert__ t

_- Geologist Ye.

Geophysical logs
recorded by: ._ Lechner

Lithology

Gamma

T.C. ._2_ Range _1QO c.pi_

Recording speed 2P' Vmin

Logged depth _6_19..£t_

Density

T.C. _3_ Range _50.Q_cp.§

Recording speed 2P_"/rnin

Logged

£*<.»

depth

L 620

- ^

ft_- -

Depth

0- 1 Gravel, medium-gray, sandy, fine-grained to medium-grained
1- 71 Sandstone, yellowish-gray, very fine grained to medium-grained

71- 73 Lignite, black
73- 80 Sandstone, medium-gray, very fine grained 80- 86 Lignite, black
86-100 Siltstone, greenish-gray, clayey

100-107 Sandstone, medium-gray, very fine grained 107-115 Siltstone, medium-gray, clayey
115-120 Claystone, medium-gray
120-122 Lignite, black
122-125 SiUstone, medium-gray
1 25-143 Claystone, medium-gray, silty, carbonaceous 143-147 Lhrnitc, black
147-150 Gaystone, medium-gray, silty
150-155 Lignite, black
155-362 Siltstone, light-gray
162-168 Lignite, black
168-173 Siltstone, light-gray, clayey
173-195 Lignite, black
195-223 Gaystone, medium-gray, carbonaceous, silty

223-225 Siltstone, medium-gray, clayey
225-235 Claystone, medium-gray, carbonaceous 235-252 Siltstone, greenish-gray, clayey

252-253 Lignite, black
253-267 Siltstono, greenish-gray, clayey, carbonaceous 267-268 Lignite, black
268-276 Siltstoni?, medium-gray, clayey
276-300 Sandstone, medium-gray, very fine grained

300-315 Claystone, medium-gray, silty

315-335 Siltstone, grayish-green, clayey, carbonaceous

335-342 Claystone, medium-gray, carbonaceous

342-343 Limestone, dark-gray
343 355 Claystone, greenish-nray, silty
?55-363 Lhinitc, black

- 0-0

- 20

- 100

-40

ISO

-2CO- 60

- 250

- 80

-300

_ -100

f-350

299

Hole number continued

B3

Lithology

"" 370-386 Claystone, medium-gray

386-396 Claystone, greenish-gray, silty

~ 396-398 Claystone, green, carbonaceous
_ 398-410 Claystone greenish-gray, silty

~ 410-414 Clay stone, green
_ 414-418 Claystone, greenish-gray, silty
418-426 Stltstone, medium-gray, clayey
- 426-427 Limestone, dark-gray
427-432 Siltstone, greenish-gray, clayey
"" 432-445 Qaystone. greenish-gray, silty
- 445-462 Qaystone, light-gray, silty

~ 462-468 Lignite, black
- 468-472 Qaystone, medium-gray, silty, carbonaceous
472-474 Lignite, black
- 474-476 Qaystone, medium-gray, silty
_ 476-485 Qaystone, light-gray, silty
486-498 Qaystone, greenish-gray, silty
~ 498-499 Lignite, black
_ 499-542 Qaystonc, light-gray, silty

542-550 Lignite, black

550-572 Claystone light-gray, silty

572-595 Sandstone, light-gray, very fine grained

595-597 Lignite, black
597-600 Siltstone, light-gray
600-606 Qaystone, medium-gray, silty
606-607 Lignite, black
607-620 Qaystone, light-gray

Gamma

T.C.-2_ Range _100 cps

Recording speed 20 ft/min

Logged depth 619 ft

Density

T.C.__2_ Range 500 cps

Recording speed 2Q_ft/m in

Logged depth 620 ft

Depth

«_» o

-650

-2<00

- 700

- -220

- 750

300

Hole number B 3

SP Resistivity j Depth j
Sens, setting .SQJVTvI._ iSens. setting 50.... I - i Recording speed_2Q. ft/mini'Recording speed 2(lft/min
i Logged depth .... 61.9 ft ._ Logged depth _ 61.9 ft .....
r ------ - - - - - - --

1
I
- I
i
i

- 0-0

-20

- 40

:50

i
-20C

250 '
- 80

- 300

_ -100

- 350

301

Hole number continued
B3
._ . __..... . . -. " "i .._..... .. _.

SP i Resistivity
Sens, setting_. 5Q MV._ IScns. setting __ 3.Q ._. Recording speed _2£L'V mini Recording speed 2C(c/ni in Logged depth _619 ft. .._ (Logged depth 619 ft

Depth!

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-650 I -200;
L ;

- - 700

- - 220.

- 750

302

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__..B4__ _._Map: Manning NW Date: 10-20-77 State: _M?___County:_Dunn_ __ Elev.:__2,4_3Q_ft_ Location: T.HlS, R_?7_W , Sec. ...12., Tract:. _bbbb_ Drilled depth: _.6.6.0.ft_ ..... Measured: J9_4_JL__ ^t _ 7.10^, Hole size: 4 3A in. Air [j Water H Cored: Yes L"j No & Lignite beds: 74-76: 78-83: 109-ll4;.118-128; 142-144; 247-250; 270-277; 398-400;_479:488

Remarks: No Gamma-log.

Lithology
Recorded by:_JUdb^d5catt.Qlini. _ . . Yes Geologist r*>x

C.cophysical logs
recorded bv: .._ Lechner

Lithology

Gamma

T.C. __ Range
Recording speed 20'V

Logged depth _. ...6.53.JJL.

Density

T.C. JL_
Recording speed -2Q"/min

Loeeed depth _655 ft

fC1 1 ~ * - - - - -

i Depth

II

0- 25 Sandstone, brownish-yellow

25- 37 Siltstone, brownish-yellow, clayey
37- 40 Siltstone, light-gray, well cemented

40- 52 Siltstone, medium-gray, clayey
52- 73 Claystone, medium-gray, slightly silty

73- 77 Lignite, very dark-brownish-black
77- 81 Claystone, dark-brown, carbonaceous 81- 95 Lignite, very dark-brownish-black, woody 95-100 Sandstone, medium-gray, silty

- -.- -0-0

- 50

- 20

?ray

100-101 Lignite, black
101-109 Siltstone, medium-
109-112 Lignite, black
112-118 Claystone, medium-greenish-gray
118-126 Lignite, black
126-131 Siltstone, medium-gray, clayey
131-133 Sandstone, medium-gray
133-142 Clay stone, greenish-gray
142-149 Siltstone, greenish-gray, clayey
149-173 Gaystone, grayish-green, silty

173-195 Sandstone, greenish-gray, fine-grained

195-200 Sandstone

200-220 No samples

220-241 Gaystone, grayish-green

241-250 Siltstone, dark-brown, carbonaceous

250-252 Lignite, black
252-260 Claystone, medium-green
260-270 Claystonc, medium-gray
270-275 Lignite, black
275-300 Sandstone, green, marly

300-305 Siltstone, dark-green
305-345 Sandstone, green, silty

345-360 Siltstone, grayish-green

- 40

_ -too

350

303

Hole number continued

B4

Lithology

390-392 Lignite, black
392-400 Claystone, light-gray
400-412 SUtstonc light-gray
412-418 Claystone, light-gray, silty
418-427 Siltstone, light-gray
427-428 Lignite, black
428-466 Qaystonc, light-gray, silty

- 466-471 Lignite, black
_. 471-475 Sandstone, medium-gray
475-480 Lignite, black
- 480490 SUtstone, light-gray
- 490-525 Sandstone, medium-gray

525-595 Claystone, medium-gray

595-596 Lignite, black

596618 Siltstone, medium-gray

618-620 Lignite, black

620-660 Sandstone, medium-gray

T.C..

Gamma

Range.

Recording speedZQ_fymin Logged depth 655 ft__

Density

T.C._3_ Range 500 cps

Logged depth 655 ft

Depth

- 750

304

SP

Sens, setting 50.MV___ Recording speed_20 fymin Logged depth _. ..455 ft._

Hole number 5 4

Resistivity
Sens, setting _._. 50___ Recording speed 20.ft/min Logged depth _ 655.ft.._._

Depth

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L

o

- i 00
L

- 40'

150

-200

250
80

- 300

^-350

305

Hole number continued
B4

SP
Sens, setting.._30 MV _ Recording speed_J2&_ rt/min Logged depth __._..655. ft...

- -

!

-4

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-i

I

Resistivity
Sens, setting _._._ .._5CL ._. Recording speed 20 wm in Logged depth 655 ft

Depth!
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S ~ ! o !

C :j

120.
400

J--450 '
- 140'

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160
r

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_ -180
- 600

-650
: -200

~l

- 700

r~ -220.

306

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: EJL_._ __Mnp:__BcIfkid________ Date:. 1<L-2<L77_State: ..__ND__County:_Stark__ Elev.: _2,58Q_ft_ Location: T. .HpS , R._?9_w . Sec. ..24.., Tract:..._ bccc__ Drilled depth:._ 70QJL. Measured: ° -fc Hole size: 4 3/; in. Air G Water 0 Cored: Yes [1 No gcJ

Liimitc beds- 40-47; 76-78; 220-228; 339-341; 355-358: 402-405; 421-423; 529-531; 547-549; 690-696 i-rifc' 1 111V« C'V **« * - « *-- -- ' ' - -*.-.. - . _ ._. _ ,-.__. __ _..»._ .

Remarks: No Gamma-log.

Lithology Yi,s , , t. Recorded by:-RicJuurd^£3£Io.liiu_ __ _.._...._... _ Gcologistsos recorded by: _Le_chner _ ....._..

Geophysical logs

Litholog}'

Gamma Density/

T.C._.__ Range ._.........__ T.C. JL_ Range 500jcp.s.

Recording speed 20.^/min Recording speed 20 rt/min

Logged depth _70Q ft__ Logged depth __ZQO_£t__

Depth

0- 5 Siltstone, yellowish-brown
5- 17 Claystone, yellowish-brown, silty
17- 25 Gaystone, medium-gray

25- 26 Siltstone, medium-gray
26- 27 Lignite, black
27- 28 Claystone, brown, carbonaceous
28- 35 Gaystone, green
35- 38 Sandstone, medium-gray, fine-grained
38- 41 Siltstone, medium-gray
41-47 Lignite, black
47- 55 Gaystone, dark-brown, carbonaceous; trace of lignite at 53 ft
55- 60 Gaystone, grayish-green, silty
60- 64 Sandstone, medium-gray
64- 67 Gaystone, medium-gray
67- 81 Gaystone, dark-brown, carbonaceous
81- 84 Lignite, black
84- 95 Siltstone, medium-gray
95-127 Sandstone, medium-gray, silty
127-133 Siltstone, medium-gray

133-142 Sandstone, grayish-green

142-158 Claystone grayish-green

158-170 Gay stone green

170-182 Claystone, grayish-green, silty

182-185 Sandstone, medium-gray, silty
185-214 Claystone, medium-gray

214-216 Lignite, black
"2J6-220 Claystone, medium-gray
.220-227 Lignite, black
227-242 Gaystone, grayish-green, silty

242-256 Sandstone, grayish-green

256-271 Claystone, medium-gray, silty

271-272 Lignite, black
272-285 Gaystone, dark-green, silty
285-295 Siltstone, medium-gray
295-311 Sandstone, medium-gray, silty

311-314 Lignite, black
314-370 Sandstone, medium-gray

- 0-0

r-50

-20

307

Hole number continued

B5

Lithology

- 370-400 No samples

400-407 Lignite, black
407-412 No samples
412-419 Clay stone, medium-gray, silty
419-420 Lignite, black
420-423 Claystone, medium-gray
423-425 Lignite, black
425-430 Sandstone, medium-gray, clayey
430-440 Siltstonc, medium-gray, clayey
440-480 Siltstonc, medium-gray, well consolidated

_ 480-638 No samples

- 538-541 Lignite, black

"~ 541-544 No samples
_ 544 547 Lignite, black
547-550 No samples
- 550-551 Lignite, black
551-570 No samples
~~ 570-580 Claystone, medium-gray

"~ 580-600 Sandstone, medium-gray

600-629 Claystone, light-gray

629-631 Lignite, black

631-690 Claystone, light-gray

- 690-700 Claystone, light-gray

T.C..

Gamma

Range.

Recording speed 20 ft/min

Logged depth 700 ft

Density

T.C._2_ Range 500 cp;

Recording speed2Qfr/ini

Logged depth 700 ft

Depth

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Htoo4?7 ^>*~r^^^^J^7j£~&s*^^-= -220

- 750

308

Hole number B 5

SP
Sens, setting_ 5Q_MV_ Recording speed 2£L ft/ min Reco Logged depth _. .ID.O ft._

Resistivity
Sens, setting 50

J

-1

Logged depth-70_Q ft...

Depth |

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r '

- 30

- 20

- 100

-40'

- 2CO" 60

- 250 :

~ -80

- 300

-35C

309

Hole number continued

_ B5

SP j Resistivity
Sens, setting _ 50 MV iSens. setting __ .50.. Recording speed_20_ ft/miniRccording spced20^ Logged depth _.7.00 ft _ [Logged depth 700 ft

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Depth!

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j- -160;
r \

- 550 i

r

-600

|-650 i
! -200!

r-700

-220.

750

310

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_...B_6__ _._Map:__£elfiel$LNE_ .__ Date :.l£i20-7_7_ State: ___ND_County:_JBiliingS_..._....__ Elcv.:-2,635Jt_. Location: T. .141.2 , R.5.8.W . Sec. ..28..., Tract: Jddd ._ Drilled depth: __620..ft._. .... _ Measured: _125J[t__ FSL, _50.fjL_ i!i. Hole size: __l^.m,^ Air D Water K] Cored: Yes fj No H Lignite beds: .J60J_64; 2_20-222; 368-372; 382-389; 508-513

Remarks: No Gamma-log.
Lithology
Recorded by: -

(ic*op!iysical loes
_ t YC« III Geologist NO recorded by: T L

.__ Lechner_.

Lithology

Gamma

T.C..__ Range._
Recording speed 20 't/
Logged depth _i

Density
T.C. _1_ Range JQO_cps

c Recording speed2Q_tt/ m jn
Logged depth _61D.it._

Pepth
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»-> o o * *
"1 ^J

0-12 Sandstone, yellowish-brown
12-18 Siltstone, yellowish-brown
18- 25 Claystone, light-brown
25-620 No samples

- 0-0

- 20

_ -iOO

311

Hole number continued
B6

Lithology

T.C..

Gamma

Range
Recording speed _2£L"/min Logged depth 611 ft

-Density
T.C..J_Range 500 cps
Recording speed TSLfymin Logged depth 610 ft

Depth

^ o

650

-2i00

r700

- -220

- 750

312

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Feet

Meters

SP

Hole number-continued
B6

Resistivity
Sens, setting __5Q_MY Sens, setting _5CL.._. Recording speed_2(L. fc/min Recording speed 20tt/ min Logged depth __.611 ft .._

-4-i

j

- i

i

1
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i

_ I

j

Logged depth 611 ft

Depth!

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I -140-

-500 ri
- - 160:

-550

r
L -180

f-650 j
! -200l

L

- 700

r -220.

I

750

314

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__JLJL Map: Leff3 NW Date: 9-27-77 State: ND County: Adams______ Elcv.:__2J825_ft_ Location: T.132.S, R._98_w, Sec. __31_, Tract: _ad_dc__ Drilled depth:__300ft Measured: 2r 54Q ft Rsfe 35JCL& §&; Hole size: 4 3/4 in. Air Q Water Q Cored: Yes D No |X] Lignite beds: ..JL28-130;. 220-230. ... . . _.. ....

Remarks: .

Lithology
Recorded by:-JUshard Scattoljni.

Geophysical logs

Y«S r / C*

Geologist MX recorded by: -

Lithology

Gamma

T.C._2

Recording speed ZQ'Vmin

Logged depth 3QO ft

T.C.

Density

2 Range 100 cps

Recording speed J2jQ"/min

Logged depth 300 ft

Depth

II

0- 6 Sandstone, yellowish-brown
6-18 Siltstone, yellowish-brown
18- 20 Siltstone, reddish-brown, clayey

20- 45 Siitstone, brown, clayey

45- 50 Sandstone

50- 120 No samples

- - .-,,-0-0

~~ 120-128 Claystone, grayish-brown
_ 123-129 Lignite, black
129-135 Claystone, medium-gray
135-140 Oaystone, bluish-green
j 40-146 Claystone, light-gray
146-151 Claystone, dark-gray, carbonaceous
_ 151-169 Claystone, light-grayish-green
169-172 Lignite, black

172-182 Siltstone, grayish-green

182-193 Claystone, grayish-brown, carbonaceous

193-201 Sittstone, light-gray, sandy

~ 201-207 Gaystone, medium-gray
_ 207-212 Claystone, dark-brown, carbonaceous
212-213 Lignite, black
213-215 Siltstone, medium-gray, clayey
215-218 Claystone, light-gray
"218-232 Lignite, black
_ 232-247 Siltstone, medium-gray
247-261 Claystone, medium-gray, silty

~ 261-268 Claystone, dark-brown, carbonaceous
_ 268-275 Siltstone, dark-cray, carbonaceous
275-283 Claystone, grecnish-dark-gray

~~ 283-288 Claystone, dark-grayish-brown, silty
288-289 Lignite, black
289-297 Sandstone, grayish-green, fine-grained
~ 297-300 Siltstone, dark-grayish-grecn

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En-.- 1- Lf;

1 8 d i7; ~:~'~~~'~i- -'.':' - ---~:.''~

- 20

- 100

-40

150

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300

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315

Hole number L 1

SP

Sen*, letting
Recording speed _2£ Logged depth

ft/min Recording speed 2£L ft/ Logged depth 1(10-6.

Resistivity
Sens, setting . 5A.

Depth

- B

- 0-0

- 50

-2CJ

MOO

- 150

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u250
- 80

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r

300

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j-350 i
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316

NORTH DAKOTA CF.OLOCICAI. SURVEY

Hole No:_.L.2_._._.. ___Map:_Scrantoji NE. . ..Date: 9-27-77 . State: Elcv.: _2*825_£t_ Location: T. 112.5 , R. 9£.Jy , Soc. .14 . , Tract: cede

Measured: 40 ft FSL T 700 ft FWL, Hole size: 4 3/4 in. Air d

Surface ownership:______

Lignite Ws-. 54-6Q;118-12Q;

Remarks:_________.__

Lithology
Recorded by Richard Scattolini

ND -- .County: Bowman

Drilled depth: 345 ft

[U Water Q Cored: Yes ["] No

_ Coal ownership: ___________

Geophysical logs
. Geologist 3S* recorded by: Lechner

Lithology

Gamma

T.C..2_. Range 10.0.cps_

Recording speed20. rc/min

Logged depth _JH6_ft.._

Density

T.C. 2__. Range _10a.cps DePt]l

Recording speed 20.'Vmin

Logged depth _.. * g
& 2

0 - 2 Sandstone, yellowish-brown
_ 2 - 7 Siltstone, yellowish-brown
7 - 15 Lignite, black
15 - 23 Qaystone, gray
23 - 23.5 Lignite, black
"~ 23.5- 35 Siltstone, grayish-brown, sandy
__ 35 - 40 Sandstone, grayish-green
40-54 No samples
"54 - 60 Lignite, black

"60-67 Claystone, bluish-gray
_ 67 - 70 Lignite, black
70 - 72 Qaystone, grayish-green
72 - 81 Qaystone, bluish-green, silty
__ 81 - 86 Qaystone, medium-gray; shell fragments
86 - 87 Qaystone, dark-brown, carbonaceous
87 - 91 Qaystone, grayish-brown, carbonaceous 91 - 95 Qaystone, medium-gray
"95 - 96 Qaystone, dark-brown, carbonaceous 96 -103 Qaystone, greenish-gray, silty
103 -105 Lignite, black
105 -117 Qaystone, grayish-green
_ 117 -119 Lignite, black
119 -13 5 Qaystone, greenish-gray
135 -143 Siltstone, medium-gray, clayey 143 -155 Qaystone, medium-gray
155 -346 No samples

- 20

- 100

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rrrt-T.-: r ->=* _-.-4
- * - . . It* . .. .

J .{.£ _ 100

317

SP

Sens, setting 5Q MV
Recording speed_2£L ft/:
Lojwred deoth 346ft

Hole number

Resistivity
is. setting 5Q
« Recording speed_2£L ft/minkecording speed2Q.ft/min -ogged depth 346 ft . togged depth __34Lft_

Depth

si

-o-o

-50

-zcj

- 100

- 150

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-200"6

h
L

i-250 I

M

j-300

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^-350

318

NORTH DAKOTA GEOLOGICAL SUR.YKY

Hole No:_L3..__.._..__Map:_ AmidonSE. _ Onto: 9-4-77 State: ND County: Bowman Elcv.: _2,9_97_ft _ Location: T. .132 } , R. 101$, Sec. 3 , Tract: cddd Drilled depth: 200 ft Measured: 78 ft HL. ^^iltpw?, Hole size: 4 34 in. Air [?_ Water Cl Cored: Yes [".] No [^ Surface ownership:_______..._-_.___.____.._.__.______ Coal ownership:_________ _ _ Lignite herh: 22-28;55-59;93-110;144-151;157-160 ___ _ ___,____ ______________" ' ' Remarks: _________...__._..._ __ ._._._......
Lithology
Recorded by Richard Scattolini_____________

Geophysical logs
. Geologist yot recorded by: Lechner

Lithology

Gamma

T.C..2L_ Range JQO.cps_
Recording speed 2Q^/mtn
Logged dcprh _2.QO ft.._

Density
T.C. 2... Range IQO cps
Recording speed 2.Q. 'Vmin
Logged depth J?PO_ft_._.

Depth

8 1
U, 2

_ 0- 8 Sancktone, yellowish-brown
8- 24 Claystone, yellowish-brown

_ 24- 29 Lignite, black
29- 40 Claystone, grayish-yellow

_ 40- 54 Sandstone, yellow
54- 59 Lignite, black
59- 80 Claystone, yellowish-brown

80-200 No samples

- 0-0

-50

-20

- 250
- ~80

- 300

_ -100

'r-350

319

Hole number L

SP

Sens, setting SDJ Recording speec
Logged depth 200ft

Resistivity
Sens, setting L-5D mnRecording speed 2H.fr/rn in Logged depth _2QCLft__

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Depth

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r -20

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- 40

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-206~60

-250

- - 80

j-300
r
u

L_

- 100

1-350

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320

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: _..__Map: Talb.QtJJu.tte. .. ._ Date: 9-4-77 . ..State: Elcv.:_2£ll_£t _ Location: T..131&, R. 101**, Sec. 22 ..Tract: aaaa Measured: 60 ft

Surface ownership:
Lignite
Remarks:

SSKT _2.6__X5KL, Hole size:

18-20:22-25:58-63

ND . .County: Bowman
Drilled depth: 180 ft
. Air D Water SI Cored: Yes ["1 No [X] ____ Coal ownership: __________..... __

Lithology
Recorded by- Richard Scattolini Geologist

Geophysical logs
recorded by: __ Lechner

Lithology

Gamma
T.C..-1.. Range 100_cps_
Recording speed 2Q' t/min
Logged depth _JJ?Q .£?._

Density
T.C. 2_ Range 1QQ cps.
Recording speed20.'Vrnin
Logged depth _180 ft__

Depth
(«h.

<_ CJ II

0-16 Sandstone, yellowish-brown, fine-grained 16-18 Lignite, black
18-21 Claystone, yellowish-brown, carbonaceous 21-25 Lignite
25- 47 Claystone, medium-gray
47- 49 Lignite, black; Claystone, dark-brown, carbonaceous
49- 56 Claystone, yellowish-medium-gray
56- 58 Claystone, dark-brown, carbonaceous 58- 63 Lignite, black
63-81 Claystone, medium-gray
81- 98 Claystone, grayish-green, silty
98-112 Claystone, medium-dark-gray

112-121 Claystone, pale-greenish-gray
121-136 Claystone, medium-gray, slightly silty 136 141 Siltstone, medium-gray, siliceous
141-154 Siltstone, medium-gray, saiidy
154-171 Claystone, medium-gray, silty

171-180 Sandstone, medium-gray, clayey

- 0-0

h-50

- 20

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30 E^^HZ:^E^-=--

~rr~nzr;:: -r-^^- -^-iso

-40

- 250
- - 80

-300

100

321

Hole number

SP

Sens, setting 50 MV
Recording speed 20 ft/ Logged depth 180 ft

Resistivity
Sens, setting 50 Recording
Logged depth 180 ft

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Depth

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1-350 i
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322

NORTH DAKOTA GKOLOGICAI, SURVEY

Hole No: _L__5__ _. _ __ Map: ..Talbpt_Butte. .. Date: .9-4-77 State: ND ... . County: Bowman Elcv.: _3,P_10 jt _ Location: T. 1328 , R. 10.1 w*. Sec. 26 . , Tract: bccc Orilled depth: 200 ft Measured:_2^22jl^SK,_65jjL_F^; Hole size: _4j%_in.___ Air G Water S Cored: Yes ["] No (Xj Surface ownership:__________________ __________ Coal ownership: ___________._ ..__ Lignite V>erk; 9-l4;72-83__________.__ ._.._______. __ __.._ ____._.__...___________

Remarks: _________-__ _____ - ___--______ . __ __-________________________

Lithology
Recorded by? Richard Scattolini___________ Geologist

Geophysical logs
recorded by:

Lithology

Gamma

T.C..-2-Range !Q_q_cps_

Recording speed 20^/min

Logged depth _2_QQ_ft _

Density

T.C. JL_ Range

Recording speed ^.Q^/

Logged depth __200_ft

Depth

0- 2 Qaystone, yellow, silty
2- 6 Claystone, yellowish-brown
6-11 Lignite, black
11- 22 Claystone, dark-brown, carbonaceous; wood fragments
22- 32 Claystone, medium-dark-gray
32- 33 Claystone, light-yellow
33- 38 Claystone, yellowish-dark-brown, silty
38- 40 Sandstone, yellow
40- 47 Claystone, medium dark-gray, silty 47- 52 Lignite, black
52- 59 Claystone, dark-brownish-gray
59- 61 Claystone, yellow
61-66 Claystone, medium-dark-gray
66- 69 Sandstone, gray, clayey
69- 72 Claystone, gray, silty
72-81 Lignite
81- 84 Claystone, brown-gray, silty
84-103 Claystone, medium-gray
103-104 Lignite, black
104-106 Claystone, dark-brown, carbonaceous 106-118 Claystone, light-green, silty
118-132 Claystone, medium-gray, silty
132-170 Sandstone, grayish-green, very fine grained

170-171 Siltstone, yellowish-brown
171-172 Lignite, black
172-185 Claystone, medium-gray
185-200 Claystone, brown

-.- .-. ~o-o

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-250

- -8C

-300

. -IOC

-350

323

Hole number L 5

SP Resistivity f ' Sens, setting 2Q.MY. Sens, setting
Recording speed_20_ ft/min Recording Logged depth 200 ft

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Depth

_ speed20_ft/min
Logged depth 200 ft

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324

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: _L6__. . __ Map: .Stewart.Lake .. .. Date: 9-4-77 Elcv.:_23 957_ft_ Location: T.13.2&, R.IO,^, Sec. 8. ..Tract: dccc

Measured: 48 ft FSL, 2.626
Surface ownership:__________
Lignite berk; 16-19:72-74:86-89
Remarks: _______.__ .... .
Litl;ology
Recorded by? Richard Scattolini

ND County: Bowman
Drilled depth: 100 ft

Hole size: 4 3A in. Air Q Water E*] Cored: Yes L'l No _____.__.__________ Cool ownership:__________......

Geologist

Geophysical logs
recorded by: Lechner

Lithology

Gamma

T.C..2__. Range 10_0_cps_.
Recording speed ?Q 'Vmin
Logged depth-AQQ. ft __

Density
T.C. 2__. Range 1PQ cps_
Recording speed 2Qit/ 1Tl j n
Logged depth _JOO ft_ __

Depth

0-17 Sandstone, yellow
17- 19 Lignite, black
19- 20 Claystone, brown, carbonaceous
~ 20- 41 Siltstone, pale-green, sandy, very fine grained

41- 42 Siltstone, light-brown
42- 56 Siltstone, light-green, sandy
56- 59 Claystone, brown, carbonaceous
59- 72 Sandstone, pale-green, silty

72- 75 Lignite, black
75- 77 Qaystone. pale-green, silty
77- 78 Siltstone, green, siliceous
78- 82 Claystone, pale-green, silty
82- 85 Gaystone, very dark-gray, carbonaceous 85- 91 Gaystone, very dark gray, carbonaceous 91-100 Claystone, very dark-greenish-brown

- 0-0

- 20

- 40

325

Hole number

SP

Sens, setting 5P-MYL Recording speed 20 &/min Logged depth 100 ft .

Resistivity
Sens, setting - 20 Recording speed 20. ft/min Logged depth._IQOjt_

Depth |

1

1

J

- 0-0

rso

!r' -

rlOO
i

L

20

- 40

h

ISO

1-
20d~60

250

- - 80

(-300

u
- 100

-350

326

NORTH DAKOTA GKOLOOICAL SURVEY

Hole No:__L_7__ . __Map:_Arnidpn SE . Date: 9-4-77 ..State: ND .. .County: Bowman Elev.:-3,0716 Location: T. 132&, R. 102w, Sec. .12 ..Tract: . dddd Drilled depth: 200ft Measured:. fL_!sL,275.ft_ FEL Hole size:

Surface ownership:____________________._______
Lignite h-^ 30-35;37-39;109-118;167-192_. ________
Remarks: __________.____.. - ___ ._._______________
Lithology
Recorded by Richard Scattolini___________

4 % in. _ Air D Water [X] Cored: Yes L'l Cool ownership:

No

. . Ye, Geophysical logs
Geologist *« recorded by: Lechner

Lithology

Gamma

T.C. 2 Range .10P_cps
Recording speed 20't/
Logged depth _2QO_ft.

Density
T.C. _1.. Range lPO_c.ps_
Recording speed 2Q.'t/min
Logged wC* depth I ~~" " 200 """" " ft"" ""*

Depth

0-12 Sandstone, gray, fine-grained
~~ 12-14 Sandstone, yellow, silty
_ 14- 26 Sandstone, gray, fine-grained
26- 39 Lignite, black
~~ 39- 43 Qaystone, medium-gray
43- 45 Qaystone, medium-grayish-brown, carbonaceous
_ 45- 50 Qaystone, light-gray
50-104 Claystone, light-gray, slightly silty

- 0-0

-20

104-119 Lignite, black
119-127 Qaystone, brownish-gray, carbonaceous 127-166 Claystone, grayish-green

166-171 Lignite, black
171-173 Claystone, medium-gray
173-193 Lignite, black

193-200 Claystone, medium-gray

._. .

-300

_ -100

-350

327

Hole number L 7

SP

setting. 50 MV
Recording speed . 20. ft/min Logged depth 200 JL_

Resistivity
Sens, setting
Recording speed ^"/m in
200ft

J
i

Depth

**

- o-o !

-50

h

-20

rioo

- 40

h

i_
i

r
h
-200~60

r
- 250

- 80

r

300

r
u

L_

-lOOi

- 350

i

328

NORTH DAKOTA GEOLOGICAL SURVEY

HolcNo:__.L.a.

Elev.:_2,7.S8_fL

Measured: IS.QJt

___ Map:__£edanLake_.___- Date:._Sb27_-72_State: .

.ocation: T. !33_$s R.98 ._£ . Sec. .Al., Tract:. aaad FNL .-/ . FEL

ND _County:_l!P

Drilled depth: __520_ft___

Hole size: __U4 jn.__ Air C\ Water [x| Cored: Yes G No

Lignite beds: -2P-23;_3 2:3_5; 95-100; 109-112; 250-252; 275:278; 313-316; 329-332 ______ ___

Remarks:

Ltthology
Recorded by: RaQ.dall. ._. _.___ Geologist

Geophysical lop
recorded by: . Lechner

Lithology

Gamma

T.C. .-2 Range JLO.Q.cps_

Recording speed 2H' t/min

Logged depth _ _520.£t_

Density

T.C. _2_ Range lP_Q_crjs_

Recording speed .2.0.

Logged depth _520 ft

C*C* I - - -- " --

Depth

t. O

s I
t, s

0- 6 Sandstone, yellowish-gray, very fine grained 6- 13 Sandstone, brownish-yellow, very fine grained 13- 19 Cbystone, yellowish-gray
19-21 Lignite, black
21-24 Qaystone, medium-gray, silty
24- 25 Lignite, black
25- 29 Claystone, medium-gray
29- 35 Lignite, black
35- 39 Sandstone, yellowish-gray, very fine grained 39- 46 Clay stone, greenish-gray
46- 51 Sandstone, medium-gray, very finegrained 51-53 Siltstone, medium-gray
53- 60 Claystone, medium-gray, silty
60- 64 Claystone, medium-gray
64- 67 Guystontf, dark-brown, silty, carbonaceous 67- 70 Claystone, greenish-gray
70- 80 Siltstone, medium-gray, clayey
80- 85 Siltstone, medium-gray, sandy
85- 91 Sandstone, medium-gray, very fine grained 91-100 Lignite, black
100-103 Siltstone, light-gray, clayey
103-110 Lignite
110-115 Claystone, grayish-green, silty
115-120 Claystone, medium-gray, silty
120-126 Siltstone, medium-gray, clayey
126-130 Claystone, medium-gray, silty
130-135 Siltstone, medium-gray, sandy
135-140 Siltstone, medium-gray, cbyey
' 140-144 Siitstone, li_^ht-gray, clayey
. 144-153 Siitstone, lij£ht-gray, sandy
158-214 Sandstone, light-gray, very fine grained

"214-218 Lignite, black
.218-234 Gaystone, light-gray, silty

"234-241 Claystone, medium-gray, siJty
. 241-242 Sandstone, light-gray, very fine grained, cemented
242-247 Siltstone. lidit-gray, silty
'247-253 Lignite, black
253-260 Siltstone, medium-fray, clayey
260-268 Cbystone, medium-gray, silty
-268-270 Lignite, black
270-274 Claystone, brownish-yrny, itlty, carbonaceous
" 274-276 Ohystone, bro\\ nish-gray, silly, carbonaceous
. 276-280 Li»nitc, black
280-283 Claystone, bro\vnish*:ray, silty, carbonaceous
' 2S3-29? Silt.stonc, lieht-ereenish-yray. clayey
293-3 10 Sjiiustone, hJu-greeiu-.!i-vray, \ery fine yraincJ "310-317 Lignite, black
- 31 7-320 Siltston-j, browni.-h-gruy
320-323 Siltstone, greenish-gray, clayey
" 323-32S Claystone, medium-gray, silty
..328-331 Lignite, black
331-333 Sandstone, light-gray, \ery fine grained, cemented

- 0-0

r-50

-2C

=r,-.-..5g=

250

_ _. :.::L ...... <"IE_^ -300
^^.

__-^-_^_^_ ..^^._^^^L35o

- 80

- 100

329

L8

Lichology

5-485 Siltstone, greenish-gray, clayey

5-520 No samples

Gamma

T.C 2 ... Range-Ifl.Q cps Recording speed 20 ft/min Logged depth 590 ff

Density
T.C. _2_ Range 100 cps Recording speed 20/c/min Logged deprh 520 ft

f~_' ..... . _..-. .

t

' *ZZ. """ ~» " ^""""1^7.*"
*"'-".. _. .. .-.--_.

Depth

I-. O

8

-500

- - ISO

550

- - ISO
-600

650 -200

700

- 220

- 750

330

Hole number L 8

SP

Sens, setting 5.0_MV_ Recording speed _2Q. ft/mii Logged depth _. J52QJt_

Resistivity
Sens, setting 50 . in Recording speed-2fift/min Logged depth __5_2_Q_fL.__

ff.:^r?^

Depth

*_. u

II

- o-o

- 50 [-'1
- 100

-40.

150

h
^ ,;
L-200-60

h ;

r250 I

I '

'- -80'

,-300

_ -100,

-35C

r

331

Hole number continued
L8

SP
Sens, setting _5.Q MY
Recording speed _2Q_ ft/ min Recording speed20.tt/Logged depth _._.520_ft _

Resistivity
Sens, setting ___5Q__._
min

Logged depth 5.20 ft

Depth!

- - 120,
Uoo ;

r
i

-450
- 140

h
[-500

k i
[- -160
r

- 550

r
L -180

|-600
r
L

L

j-650
i -200

I-
I-

'r-700
\
t-
!

r -220

- 750

332

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No: __ L_9_ __ _._Mnp:.WarnkcJBiH. __ ..._ Date:. _9i26_-77_ State: _..NJ2___ County .-Slope ___

Elcv.: --2,7.42 Jt__ Location: T. .133 £ , R. _9JLw . Sec. J3JL , Tract: ._aaaa _ Drilled depth: __ 400ft__ __ ._ Measured: IQ5 ft __ ESfe .27_5_lt_ F*i. Hole size: 4 3/» in. Air [j Water [XJ Cored: Yes D No (Xj beds: ._J3-3fc.&0-J53; Ul-114; 165-168; 222-226; 256-260; 274-277; 33 6-33 8^3^4^56-358

Remarks:

Lithology
Recorded by:_Ran.dall Reichert_ _..__ Geologist

ogs
recorded by: . __Le_chner.

Lithology

Gamma

T.C.-2 Range -lQp_cps_

Recording speed ZfrV

Logged depth _4_Q_0_£t

Density

T.C. _2_ Ran

Recording speed? O 'Vm in

Logged depth 40Q

Depth

0- 2 Sandstone, yellow, very fine grained
2- 16 Clays tone, yellowish-gray, silty
16- 21 Sandstone, yellowish-gray, very fine grained

21- 27 Sandstone, medium-gray, very finegrained 27- 32 Claystone, medium-gray
32- 36 Lignite, black
36- 45 Siltstone, grayish-green, clayey
45- 52 Sandstone, medium-gray, silty
52- 59 Siltstone, medium-gray, clayey
59- 60 Lignite, black
60- 62 Claystone, light-^ray
62- 65 Claystone, brown, carbonaceous
65- 69 Clayscone, light-gray
69- 72 Claystone, brown, carbonaceous
72- 73 Lignite, black
73- SO Siltstone, medium-gray, clayey
80- 8i Claystone, brownish-gray, clayey
81-83 Lignite, black
S3- 85 Siltstone, medium-gray, clayey
85- 92 Guystone, dark-greenish-gray
92- 95 Gaystone, medium-gray
95-104 Siltstone, medium-gray, clayey
104-111 Claystone, medium-gray
111-116 Lignite, black
116-119 SHtstone, light-green, clayey
119-134 Claystone, greenish-gray, silty
134-155 Siltstone, medium-gray, clayey
155-161 Claystor.e, li^ht-gray
161-167 Lignite, black
167-170 Claystone, light-greenish-gray, silty 170-176 Siltstone, grayish-green, clayey
176-185 Sandstone

185-225 No samples

225-233 Lignite, black

233-236 Siltstone, medium-greenish-gray, clayey 236-260 Sandstone, medium-gray, very fine grained

260-265 Lignite, black
_ 265-276 Claystone, medium-gray, silty
276-279 Lignite, black
279-283 Cljvstone, medium-gray, silty
283-296 Siltstone, greenish-gray, clayey
~ 296-300 Lignite, black

~~ 300-303 Claystone, gray ish-brown
_ 30S-3 15 Stkstune, rrccnisli-^ray, cla> cy
315-320 Siltstone. greenish-gray, sandy
320-322 Claystone, dark-brown, silty, carbonaceous
_ 322-333 Claystone, greenish-gray, silty
333-337 S: ltstone, greenish-gray
337-338 Lignite, bLick
338-342 Cbystone, dark-brown, silty, carbonaceous
~~ 342-346 Clavstone. niciliinn-t-rnv. silrv

-o-o

- 50

- 20

- 100

L^~ri-l-Ii --"rrr^.^EI^^^Er^ - 40

^ __ _^_ ^ " "_:. - ^--^-~-* - ' Y1 " -r-ir^j^r~r^" ^

. > ---300

333

L9

Lithology

351-355 Gaystone, greenish-gray, silty
355-365 Siltstone, grccniih-gray, sandy
365-367 Lignite, black
367-400 Claystone, gieenish-gray, silty

Gamma

T.C 2 Range JLQflLcpi. Recording speed 20 Logged depth 400 Fr

Density
T.C. _2_ Range 100 CDS Recording speed_20/c/min Logged depth 400 ft

Depth

<-> o

450
- 140

500

- ISO

r-550

-ISO
600

H650 -EI00

- 700

- -220

- 750

334

Hole number L9

SP

Sens, setting 5Q-MV. Recording speed20- ft/mi Logged depth _.40Q.ft_

Resistivity
Sens, setting 5.0-. min Recording speed20-fymin Logged depth _4QOft_.___

I

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Depth

4J «

21

-0-0

-50

-20!

I-IOO !

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r -40! (

i !

h'50 ;
r i
L
i

- -80

-300

- 350 i

r

r

335

Hole No: _ L.1Q._. . .__Map:.Amidon SE. ... Date: 9-12-77.. State:
Elcv.: _M 12jt._ Location: T.U3_s:, R. IQQw, Sec. .6 ..Tract: aaaa

Measured: JLSjt._Isk, _S5Jt.SL, Hole size: _43Ljn.__ Air [j Water (XJ Cored: Yes [_]

ND.County: Slope

Drilled depth: 460ft

Surface ownership: .
Lignite beds:_-LQZJQAul32a44;2S9--26I_..

Lithology
Recorded by Clarence Carlson __________

Coal ownership:

Geophysical logs
Geologist 3st» recorded by: Lechner

Lithology

Gamma

T.C..-2 Range 10Q cps _

Recording speed 20."/min

Logged depth _45JL£t _

Density

T.C. _2_. Range _1QO cps

Recording speed 2.0."/min

Logged depth _459jt_,_

Depth

-

u,

0-3 Gravel, light-gray
3- 10 Sand, light-gray, medium-grained to coarse-grained gravelly
10- 28 Sandstone, light-gray, medium-drained to coarse- grained; claystone, Hght-greeru'sh-gray
~" 28- 33 Claystone, yellowish-brown
_ 33- 38 Siltstone, medium-light-gray
38- 39 Lignite
39- 40 Gaystone, yellowish-brown
40- 47 Siltstone, medium-light-gray
~~ 47- 48 Claystone, light-brownish-gray
__ 48- 55 Claystone, medium-light-gray
~" 55- 57 Claystone, greenish-gray
57- 58 Shale, brownish-black, lignite
__ 58-63 Claystone, greenish-gray
"" 63- 64 Lignite
64- 67 Claystone, greenish-gray
__ 67- 80 Siltstone, greenish-gray
~~ 80- 90 Sandstone, light-greenish-gray, fine-grained to
very fine grained
90-100 Clay stone, brownish-gray
~" 100-103 Siltstone, light-greenish-gray
103-112 Lignite
112-120 Claystone, light-greenish-gray
120-127 Lignite
_ 127-136 Siltstone to sandstone, light-greenish-gray,
very fine grained
_ 136-142 Lignite
142-160 Siltstone, light-greenish-gray
160-200 Sandstone, light-greenish-gray, very fine grained to fine-grained, silty

~ 200-245 Sandstone, light-greenish-gray, fine-grained to _ very finegrained

245-256 Claystone, light-greenish-gray

256-258 Lignite
258-260 Claystone, light-greeuish-gray
260-282 Siltstone, light-greenish-gray

282-283 Lignite
283-288 Siltstone, light-grcenish-gray
288-289 Lignite
289-293 Claystone, light-greenish-gray
293-300 Siltstone, light-greenish-gray
300-305 Claystone, light-greenish-gray
305-306 Shale, brownish-gray, carbonaceous 306 317 Siltstone, light-greenish-gray
317-367 Claystone, light-greenish-gray

0-0

- 20

- 40

=^ -~-~~-- -^' ~ .\ -350

Hole number continued
L 10

Lithology

367-382 Gaystone, brownish-gray
382-412 Siltstone, light-greenish-gray

412-413 Lignite
413-428 Siltstone, light-greenish-gray
428430 Gaystone, brownish-gray
430-437 Claystone, light-greenish-gray
437-460 Siltstone, Hght-greenish-gray

Gamma

T.C._2_ Range-lQ.CLcpS Recording speed -2£Lftfmin Logged depth 45R ft

Density
T.C. _2__ Range 100 cps Recording speed20jt/mj n Logged depth 459 ft

Depth
V) l_
w O

8 S £ s

-500

- - 160

h550

. -180
-600

650 -200

- 700

- -220

- 750

337

Hole number L 10

SP

Sen*, setting 5<LMY_
Recording speed 20- fymii
Logged depth _. -458_ft_

Resistivity
Sens, setting
in Recording speed20.fr/min
«ogged depth _45BJft-..__

i -i ^ *!^ ~~~^^~ ~ " -

~... .ri.^-^rrrrzz^ -:.~~^-z~~

Depth

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- 50

-20:

HOO

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L :
i

tsoo-60'

r

- -80;

h i
I
300

100 r

r
L_
i-350

r

338

SP

Hole number continued
L10

Resistivity
Sens, setting_50 MV iScns. setting___50....._ Recording speed 20 ft/min Recording speed20.it/min Logged depth ___45 8. ft _ Logged depth 458ft

H
- I

-j
~i

r

Depth

w U
8

j- -I20J
j-400 ;

i-450 .
- 140;

- 500

r

!60|

- 550

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r '

L -iao|
p600 i

-j
i
1

h550 j
: -200

i

H
I

H

- i

J

r 700 '.
r

r -220,

i- 750

339

Hole No:__.L_lL

Elev.:-_2,928j:t_

Measured: ADSL&.

_____ Map: Mineral Springy Date: _9r6£77_ State: ND County: sl°Pe_______ Location: T. 133 &, R. 100 w , Sec. _JL4_ , Tract:. Aaad.. _ Drilled depth: __460 jt_._...._ size: LI?:_ Air D Water Q Cored: Yes [j No

Lignite beds: _27-Z2UQ2J05; 188-191; 288-291; 303:307;,

Remarks: .

Lithology
Recorded by- Richard Scattolini ..Geologist**

Geophysical lo

recorded by: Lechner

Lithology

Gamma

T.C.-1- Range !_00_c£S_

Recording speed ZQ'Vmin

Logged depth -4.60 .ft__

Density

T.C. .2__ Range

Recording speed 2Q f

Logged depth 460 ft__

Depth

0- 5 Sandstone, yellowish-brown, very fine grained 5-19 Sandstone, gray, fine grained
19- 21 Sandstone, grayish-green, iine»grained, well cemented

21- 48 Sandstone, reddish-brown, very fine grained

~ 48- 75 Sandstone, dark-green, marly, fine-grained

75- 76 Claystone, dark-brown, carbonaceous
76- 79 Lignite, black
79-102 SUtstone, gray, clayey

102-105 Lignite, black
105-106 Claystone, light-brown
106-109 Claystone, light-green, silty
109-126 Claystone, medium-gray and pale-green, silty 126-127 Lignite, black
127-129 Claystone, dark-brown, carbonaceous
i 29-131 Claystone, pale-green, silty
131-159 Claystone, medium-grayish-greeh, silty 159-161 Claystone, brown

161-176 Gaystone, medium-gray

176-177 SUtstone, gray, well consolidated
177-186 Sandstone, grayish-green, marly, clayey 186-196 Lignite, black
196-198 Claystone, medium-brown
198-210 Claystone, greenish-gray, slightly silty

210-231 Claystone, gray

231-232 Lignite, black
232-233 Gaystone, dark-brown
233-282 Claystone, medium-gray

282-287 Lignite, black
287-297 Claystone, medium-gray, silty
297-305 Lignite, black
305-323 Claystone, medium-grayish-brown

323-324 Gaystone, pale-green
324-336 Gaystone, medium-gray
336-337 Sandstone, gray-brown, clayey
337-342 Claystone, dark-brown, carbonaceous 342-346 Gaystone light-green
346-362 Lignite, black

- 20

._...-. -J-350

Hole number continued
Lll

Lithology

362-377 Qaystone, grayish-green; plant fragments , 377-386 Claystone, dark-green
, 386-398 Gaystone, dark-brown, carbonaceous
. 398-406 Sandstone, dark-gray, fine-grained .406-415 Claystone, dark-gray
. 415-460 Sandstone, silty

Gamma

T.r. 2 Range 100 cps Recording speed 20.
Logged depth 460 ft

" ^_fc ~"

~33O

Density
T.C._2_Range 100 cps Recording speed .2Qfc/min
Logged depth 460 ft

Deptli

r500

1- -160

-550

. -180
-600

-200

- 700

-220

750

341

Hole number L 11

SP Resistivity
Sens, setting _.._54)-M3L_ Sens, setting 5Q__ Recording speed 20- "/min Recording speed_20«/ Logged depth _4£0lt. _

mm

Logged depth -_46Qit_

H

Depth

- o-o

- 50

r -2°-

- 100

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- 40!

- 150

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' -80|

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I

- 300

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r- ~ IOOi

l_

^-350 '

342

SP

Hole number continued

Lll

Resistivity
Sens, setting_50 MV Sens, setting___5Q_... ^ ___.__.__.__ Recording speed_2iL"/min Recording speed20Jt/min Logged depth __460.£t _

-I

Logged depth 4.60 ft

Depth!
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«J ^i i u, 5

i

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1- 00

- 450
- 140;

500

L - 160:
I-

550,1-

i

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r -180'

h600 ,

r

L-650 j
: -200j

1-

r-700

i- 750

343

Hole No:__L.12. .Map: Date: 9-6-77 State: __NjD__ County: Elcv.:_2,865..ft_ Location: T..U3JS , R._10Qw, Sec. ..3_Q_., Tract: dddd _._ Drilled depth: _220jt__ Measured: _A5J&__HL. _25_fL KWK, Hole size: 4 34in^_ Air E Water D Cored: Yes Q No 3 Lignite beds: .-J!8-i2:iJLl(kl 12;.144-148; 169-178. .... .. ._.... .... _________

Remarks: .
Lithology
Recorded by:

Geophysical logs
. Geologist NO recorded by: .___ JLechnei_.. . ._..___

Lithology

Gamma

T.C._2_ Range 100 cps
Recording speed 20' c/min
Logged depth ___220-£t_

Density
T.C. _2_ Range
Recording spee
Logged depth 220 ft

Depth

s

No samples -0-0

- 20

. _ nf".. _ '_ *

-300

_ -100

-350

344

Hole number L 12

SP

Sens, setting _SQ_MY_
Recording speed 20
Logged depth ..22£L£t

1

Resistivity
Sens, setting 50 __
Recording speed_20ft/mm
Logged depth _220 ft. _

________ "~;^^ _, _ __ ' r . -. TT^^^^^ ^T~r^-7~'-~ * "c _ ' -^

Depth

[-0-0

f-50

- 20i

h
HOO
L

150

r

-200- 60

u

- 00

r300

-1 -100;

^-350

345

Hole No:__L_13. ; Amidon SE Date:._9£L3:77_State: ND County; Slope Location: T. 133.X , R.101w , Sec. __4_._, Tract: .jkdcL ___ Drilled depth: __200jt__.... __._
Measured: _18_ft_'FSL, L_63.7_£tHfe, Hole size: 4 % in. Air D Water H Cored: Yes D No H Lignite beds:-8:121146,167... .. _ ....___....._.... .. __________... ..__

Remarks:

Lithology
Recorded by: -Randall Reichert.

Geophysical logs
__Geologist sw: recorded by: Lechner

Lithology

Gamma

T.C._2_ Range J.QOL.cps_
Recording speed2Q_it/rnin
Logged depth 198ft

T.C.

Density
_2_ Range lPQ_cps.
Recording speed20_rt/ mm '
Logged depth _198 ft _

Depth

0- 5 Sandstone, yellowish-gray, very fine grained
5- 10 Lignite, black
10- 11 Siltstone, brownish-gray, carbonaceous
11-15 Siltstone light-brownish-gray, clayey
15- 70 Sandstone, brownish-gray, very fine grained

70- 92 Gaystone, medium-gray

~ 92- 93 Lignite, black
_ 93-100 Claystone, medium-gray, silty
100-105 Siltstone, medium-gray
105-109 Sandstone, medium-gray, very fine grained, silty
_ 109-118 Siltstone, medium-gray
118-138 Claystone, medium-gray, silty
"~ 138-143 Siltstone, medium-gray, clayey
~ 143-155 Lignite, black
"" 155-200 No samples

. . -0-0

- - - - - - ~ -50

-2C

100

- 250
~ -80

- 300

_ -100

-350

346

Hole number L 13

SP

Sens, setting _50_My
Recording speed.20
Logged depth _ JL9.a.ft_.

-1

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- i i

Resistivity
Sens, setting 50_____
ft/min Recording speed_2Qfr/min
Logged depth _

Depth

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- 0-0

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t
-40!

r

-POO"60

i-250
'- -80'

300

-t -IOO;

-35C

347

Hole No; L 14 ___ Mnp: Amidon SE Date: 9-12-77L State: ND County: Slope Elcv.:--2»925Jft_Location: T..123&, R.lQlvf, Sec. JLfL , Tract: .__ccbc_ Drilled depth: _220Jt__... Measured: 323JEt FSL, lSit_fwl Hole size: 4 ^.m^ Air E Water Q Cored: Yes D No Lignite beds: _8rlQU20-_137; 196-206.. _.. ...._.._.... _.... ... _________... ...

Remarks:
Lichology
Recorded by:

(Geophysical U>gs
._ Geologist NO recorded by:

Lithology

Gamma

T.C._2_ Range 10Qjcgs_
Recording spee
Logged depth22.QLf!

Density
T.C. _2_ Range 100 cps
Recording speed ^Q-'
Logged depth _220 ft

Depth
v>
!_.
4_. O

8 I b 2

No samples ^-_^ -0-0

- 20

- 250
"- -80

- 300

_ -100

-350

348

Hole number L 14

SP

Sens, setting_50_MV__ Recording speed 20 fymin Logged depth _. .22Q.ft._

I

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Resistivity
Sens, setting 5.Q._.___ Recording speed2Q.it/min Logged depth -_2ZO..ft__

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> ,-~ ' -. ~r~~ TL1 v ly

~'"~~ ~J" "vr

Depth

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HOO i

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- 40

1-150 '

-200-60'

r-25C
- 80;

r300

-lOOj

I

349

Hole No:__LJL5 __ ____ Map: Ste wart Lake, ._ Date: ._3Jb77 _ State: ND
Elev.: _J,QHOJt _ Location: T.131jS , R.101_w , Sec. _1_8_. , Tract: . bbcc _ Drillea depth: _26Q_ft Measured: lJMiL_ySK,__20-£t-'FWL. Hole size:
Lignite beds:. -32-IO.aU32-139; 170-173.... ..

Air D Water

County : _§!?£?_ __ ..__.
epth: _26Q_ft __ ....
Cored: Yes Q No

Remarks:

Lithology
Recorded by:

Geophysical logs
Geologists** recorded by: Lecnner__ _ __

Lithology

Gamma

T.C. _2_ Range
Recording speed2.Q_"/min
Logged depth 36Q ft

Density
T.C. _2_ Range 100 cps
Recording speed ZQJV
Logged depth 260 ft

Depth

0-62 Claystone, yellow, silty

~ 62- 69 Siltstone, yellowish-gray, clayey
__ 69- 80 Gaystone, gray

~ 80-108 Lignite, black

108-111 Claystone, brownish-gray
111-129 Siltstone, gray, clayey
129-141 Lignite, black

141-152 Sandstone, grayish-green, glauconitic, very fine grained
152-153 Lignite, black
153-155 Siltstone, grayish-green
155-165 Claystone, dark-brown, carbonaceous 165-170 Lignite, black
170-195 Claystone, greenish-gray, silty

195-200 Claystone, brown
200-215 Claystone, gray
215-230 Sandstone, very fine grained

230-260 No samples

rn 3^^ 60 ^ ".LTr.jrf-:!.",

V-o-o

-50

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-ao

-300

« -100

-350

350

Hob number L15

SP

Sens, setting 5Q.MV Recording speed 2SL ft/mi Logged depth _.. _2.6.0.ft_

|^-~^

B^T±

[~~]J^^, a L T .

Resistivity
Sens, setting 50... min Recording speed.2flfymin Logged depth __2dQ_&...__

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Depth

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i
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351

Hole No:__JL!6_ . Map: Amidon SE Date: ._9Jfc21_ State: _ND__ County: Slope Elev.: _2,916_ft__ Location: T.-UlS, R.1Q1.W, Sec. __21., Tract:. _.chbh_ Drilled depth:__280ft Measured: 2A3JLfL*SL, _2.Q..(L^.. Hole size: 4 34.in^. Air D Water 0 Cored: Yes Q No Lignite beds: .-H4J12; ^2-134;.187-_201j 259-261 . .. .._........ . ..

Remarks:

Lithology
Recorded by:

Geophysical logs
Geologist NO" recorded by: .___Lechner_ _ _

Lithology

Gannna
T.C. _2_ Range .100 cps_

f Recording speed 2H rt/rnin
Logged depth _2aO_ft__

Density
T.C. _!_ Range iP.
Recording speed2£L"/min
Logged depth 280 ft

Depth

~ 0-100 No samples

1 CO-116 Sandstone, gray, clayey
116-118 Lignite, black
118-123 Sandstone, gray, fine-grained
123-136 Lignite, black
136-141 Qaystone, grayish-brown
141-187 Sandstone, gray

187-198 Lignite, black
198-260 No samples

r-0-0

h50
- 20

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- "60

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r-.--.-:-d r . - ..-^-c^w

250
- 80

?-t-"r-i^Z5-^300

_ -too

-350
352

Hole number L 16

SP

Sens, setting_... Sfi.MV Recording speed .2Q
Logged depth ._. 280._ft._

Resistivity
Sens, setting 50_____ ft/min Recording speed J2Qft/min Logged depth .28Q_ft_...__

J

_j

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Depth

- o-o

u
h50

I- -20

h i
MOO i
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U 150

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-ZOO"60

r250 I
L - -80

-300

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L...

353

Hole No:__LJJ____ Man: Stewart Lake Date: 9-3-77_State: ND County: §lopg__

r v -c . . . . J '~f
Elcv.: _2£SU&__ Location: T. 131

Measured: JL25Jt__*SK, .^5QJL FWL,

Lignite beds:.-22-32L65--69 .....

:, R. J02w. Sec. _.JL4_., Tract: ..Jjbbb__ Drilled depth: ,120 ft

Hole size: 4 2A in. Air D Water Jxl Cored: Yes [1 No

Remarks:

Lithology
Recorded by; Richard Scattolini . Geologist 3S*

CIcophysical K>gs
recorded by: __ Lechner

Lithology

Gamma

T.C._2_ Range 100. cp.s_
Recording speed 20. "/min
Logged depth 120 ft

Density

T.C. _2_ Range lQQ.£Di_
Recording speed2Q_"/min

Logged depth 120ft

Depth

u* <J
O «

0- 2 Gaystone, dark-brown
2- 5 Siltstone, brown, siliceous
5- 10 Gaystone, yellowish-brown, mottled 10- 20 Sandstone, yeilowish-brown, fine-grained 20- 33 Lignite, black
33- 36 Qaystone, dark-brown, carbonaceous 36- 42 Claystone, greenish-gray
42- 44 Qaystone, dark-brown, carbonaceous
44- 49 Claystone, light-greenish-gray, silty
49- 53 Claystone, dark-gray
53-66 Gaystone, medium-gray, silty
66- 68 Lignite, black
68- 98 Claystone, greenish-gray, slightly silty

98-100 Gaystone, dark-brown to black, carbonaceous

100-120 Gaystone, gray

-o-o

j-50

- 20

- 100

-40

r-150

-200-60

- 250
~ -80

- 300

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-350

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Hole No:_ L 18__._Map:__Stewart Lake _Date:._9i3-J.7__State: _ND__County:_^.-r - ___

Eiev.:_2,9JL5Jt__ Location: T. 13lfi , R.1Q2.W. Sec. _22._, Tract: ..cccc ..Drilled depth: __120_ft_.__.__

PNif _ _ f xi.li ..i . At/' - f I r r-»xl ^-\ i \r i f «. t r -\>i Measured: ITS ft rsL. J^SLfL^L Hole size: _ J_34iru_ Air D Water Cored: Yes Q No
Lignite beds:. -IS-^JtS-^;. 82-85; 87_-95.._

Remarks: .

Lithology
Recorded by: -RighaBJ Scattojini,

Geophysical logs
_. ___ Geologist NK recorded by: __Lechner_ ... ___

Lithology

Gamma

T.C_2_ Range JPO_cps_

Recording speed 2.Q"/min

Logged depth _120 ft

T.C.

Density

2 Range JLQ.CLcps.

Recording speed 2{L* c/rnin

Logged depth 120ft

Depth

8

0- 6 Sandstone, yellow, very fine grained 6- 7 Siltstone, yellowish-brown, clayey
7-11 Qaystone, yellowish-brown
11-12 Siltstone, reddish-yellow
12-16 Claystone, brown
16-17 Gaystone, dark-brown, carbonaceous 17- 19 Lignite, black
19- 26 Qaystone, grayish-brown, silty
26- 33 Lignite, black
33 35 Siltstone, brown, clayey
35- 40 Claystone, green
40- 46 Claystone, grayish-green, silty
46- 66 Claystone, green, silty
66- 67 Qaystone, brown, carbonaceous
67- 68 Lignite, black
68- 72 Qaystone, grayish-brown
72- 74 Claystone, siliceous
74- 87 Qaystone, gray, silty
87- 89 Lignite, black
89- 90 Qaystone, greenish-gray silty
90- 96 Lignite, black
96-120 Claystone, grayish-brown, silty

250

r -so

-300

_ -100

-350

356

Hole number L 18

SP
Sens, setting _- -5_Q M_V_ Recording speed _2£L ft/mi Logged depth _.. I2Q. £t__

t

Resistivity
Sens, setting - 50__ Recording speed-2jQrt/min Logged depth __ ._120.ft. ._

~'.-~-.'..-. fO^:~- SQ- ---~~-=^
l -5M - :.-.- - ->tV -=»
. . . " "^C.

Depth

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- 40'

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p206-60|
i i

- 80

r-300

- 100'

357

Hole No: __LJJ>____ Map: _ Stewart Lake Date: ._9dLZ7_ Stare: ND County: Slope Elcv.: 2»906_ft_. Location: T.121$, R.J-02w , Sec. .2A-., Tract: _.jcccc ._ Drilled depth: _._12QJL_._ Measured: _5(LCL__*SIL, _215_£tFWU Hole size: __4_&in*_ Air Q Water S Cored: Yes [1 No Lignite beds:. »3>11UP.M07_... . ... _...._....._..... _ __________...

Remarks:

Lithology
Recorded by: -JSiciiard-Scatt.Qlini______.

Geophysical logs
Geologist iw recorded by: ___ Lechner

Lithology

Gamma

T.C. JL_ Range JQO cps_

Recording speed 211 W

Logged depth _120 f

Density

T.C. _2_ Range lD.Qj:p_s.
Recording speed 20_"/min

Logged depth 120 ft

Depth

II
0- 1 Qaystone, medium-brown
1- 22 Claystone, light-greenish-gray

22- 23 Lignite, black
23- 33 Siltstone, medium-gray, clayey
33- 41 Lignite, black
41-45 Siltstone, greenish-medium-gray, clayey 45- 55 Siltstone, greenish-medium-gray, sandy
55- 58 Lignite, black
58-78 Claystone, light-gray, silty

78- 79 Lignite, black
79- 90 Claystone, medium-gray, silty

90- 92 Claystone, dark-grayish-brown, carbonaceous 92- 97 Claystone, Ught-grayish-green
97-101 Claystone, dark-brown, carbonaceous 101-107 Lignite, black
107-112 Clay stone, brown, carbonaceous
112-116 Claystone, green
116-120 Sandstone, light-grayish-green, silty

r -0-0

- 50

- 20

- 100

40

- 150

-ZOO"60

-250

- - 80

- 300

_ -100

- 350

358

Hole number L 19

SP

Sens, setting -50 MV. Recording speed-2Q_ "/m in Recording Logged depth _. 120..&

-f
i

Resistivity
Sens, setting . ~yP_____ peed20_ft/min
Logged depth _.12Q.ft_.._

Depth

a, 2

- 0-0

L
i
[-50

h-

HOO

L

r -40

150

^-250 i
'-' -80

!_ -100;

L- j

- 35C i

359

Hole No:.___L_2fiL_-__Map:JtelLRainyJBiiJUtle_ Date:._9=2Q.-:Z7_ State: __ND__ County:. Elcv.:_2,78_5.ft_ Location: T.121s, R.-5>sJ?, Sec. __14_, Tract: ._aaad __ Drilled depth: Measured: _27_5_£t__ *SU _25.fiLjS. Hole size: 4 3A in. Air D Water H Cored: Yes

Slopfi__.__.__
660_£t_...__._

Nofx]

Lignite beds: 24-27:215-217; 313-322; 376-380.

Remarks:

Lithology
Recorded by: Richard Scattolini

Geophysical logs
.____Geologists' recorded by: Lechner.

Lithology

Gamma

T.C._2_ Range LQQ_cps__

Recording speed2H_* t/min

Logged depth _MQ.it_

Density

T.C. _2_ Range JKKLcps.

Recording speed ZCL'Vmin

Logged ^^f depth ^ _653 .^^ ^^. ft __- m

Depth

0-15 SUtstone, yellowish-brown

"" 15- 22 Claystone, gieenish-gray, silty

"" 22- 24 Lignite, black
24- 26 CUiystone, gray
26- 27 Lignite, black
27- 36 Claystone, medium-gray
_ 36- 37 Lignite, black
37- 42 Sandstone, grayish-green, very fine grained
_ 42- 56 Claystone, grayish-green, very fine grained
56- 58 Sandstone, grayish-green, well consolidated
58- 66 Sandstone, grayish-green, very fine grained, clayey
__ 66- 67 Lignite, black
67- 71 Claystone, grayish-green
71- 80 Siltstone, greenish-gray
_ 80- 82 Siltstone, light-gray, sUiceous
" 82- 90 Sandstone, gray
90- 91 Claystone, dork-brown, carbonaceous
__ 91- 92 Lignite, black
92-107 Claystone, pale-green
107-121 Claystone, grayish-green, sandy
121-131 Claystone, medium-gray
~~ 131-136 SUtstone, medium-gray, siliceous
_ 136-140 Claystone, light-gray
140-165 Claystone, light-green

~~ 165-183 Claystone, medium-gray

183-216 Siltstone, medium-gray, clayey

216-222 Lignite, black

222-232 Claystone, pale-greenish-gray

' 232-240 Siltstone, medium-gray, clayey

240-243 Claystone, light-gray
243-262 Siltstone, grayish-green

262-271 Claystone, medium-gray

271-306 Sandstone, pale-green

306-310 Claystone, medium-gray

310-312 Claystone, dark-brown, carbonaceous 312-325 Lignite, black
325-332 Siltstone, greenish-gray, clayey
332-333 Ugnite, black
333-339 Claystone, grayish-brown
339-356 Claystone, green
355-358 SHtstouc, pale-grcenish-gray, siliceous 358-361 Siltstone, greenish-gray

- 0-0

' " " ' " ' " ~ "~''~

~x=3- -80

-300

_ ~!00

350

360

Hole number continued
L20

Lithology

' 361-374 Claystone, grayish-brown ~ ' 374-380 Liunite, black
380-400 Claystone, grayish-green, slightly silty

400-478 Sandstone, pale-greenish-gray

478-550 Sandstone, greenish-gray, silty

550-553 Sandstone, greenish-gray, siliceous 553-575 Sandstone, greenish-pay, silty
575-630 Claystone, medium-gray

T.C.

Gamma

Range
Recording speed 20__ft/min
Logged depth 660 Ft

Density
T.C. 2 Range 100 cps
Recording speed 20jt/rnin
Logged depth 653 ft

Depth

«- O

o £ o "

630-635 Siltstone, medium-gray
635-660 Claystone, medium-grayish-brown, carbonaceous

' *- ^- - ' j _| --* jm»^i"*» ^» . r » ~j-^+*t~. . ^_^. .

- 700

- -220

- 750

361

Hob number L 20

SP

Sen*, setting 2Q.MY
Recording speed J2Q_ fr/min Recording speed 20.ft/Logged depth A60jt_

i

Resistivity
Sens, setting
1 mm

Logged depth -A60 ft_._

Depth

-o-o

- 50

- 20

i

L ~ 40

j-150

:_

T250
L- -80

r
i
r

j-300
I"

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[_ -.00,

I
1-350 '

362

Hole number continued

L20 "I

SP Resistivity i i^tpiu< Depth!
Sens, setting _J2<LMY_ iSens. setting__5.0 _..._.! g ! Recording speed_2Q_fyminRecording speed2(/Vruin j |j £ i Logged depth __.660 ft ._ Logged depth .660 ft ' ^ ^ '

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160

_ -ISO
- 600

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' -200

- 700

" -220.

363

Hole No:__JU2.1__.__Map;_Bl.acJLButtg____ Date: 9-15-77 State: ND County: Slope

Elev.: _2,818 Jft __. Location: T. JLH.S , R.J.OLw , Sec. _ A_, Tract:. _hbbb_ Drilled depth: _22.0_ft

FNL f fZK - - < - Measured: _j6PJlt_ SSEC, ^iQO_tt FWL, Hole size: L Air D Water (XJ Cored: Yes Q No
Lignite beds:..-85-82l^6-_126; 200-205

Remarks: .

Lithology
Recorded byt J^andall Reichert

Geophysical logs
Geologist 5»* recorded by: Lechner

Lithology

Ganima

T.C.._2_ Range
Recording spee

Logged depth _22DJEt

T.C.

Density

2_ Range J,QO_c£S

Recording speed 2D."/min

Logged depth 220 ft

Depth

0- 74 Sandstone, yellow, very fine grained -0-0

- 50

- 20

- 74- 75 Lignite, black
75- 78 Claystone, medium-gray
~ 78- 79 Sandstone, medium-gray, very fine grained,
- cemented
79- 82 Claystone, medium-gray
~~ 82- 88 Lignite, black
_ 88- 92 Siltstone, light-gray, clayey
92- 94 Claystone, light-gray
"" 94-126 Lignite, black
_ 126-130 Siltstone, light-green, clayey
130-146 Claystone, greenish-gray, silty
- 146-154 Sandstone, green, very fine grained

- 154-160 Siltstone, light-green, clayey

- 160-167 Siltstone, greenish-gray, clayey
167-168 Claystone, brownish-gray, silty, carbonaceous "168-169 Lignite, black
- 169 177 Claystone, brownish-gray, silty
177-198 Siltstone, medium-gray, clayey
- 198-207 Lignite, black

- 207-220 Siltstone, green, clayey

~ - : J t=-T.J \.',..-. .- --

p ___~ T1^^^

-300

. -100

- 350

364

SP
Sens, setting _ - -50. MV. Recording speed 2Q fr/mi Logged depth _ .220 ftL_

Hole number L 21

Resistivity
Sens, setting _ -5.0 Recording speed2.Q_ft/min Logged depth _..

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Depth

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- 250 ;
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-300

100,

-350

365

Hole No:_. L_22__.__ Map: Black Buttc___ Date:._J^3£77 State: ND _County:_ Elcv.:_2,87.0it_ Location: T. 1M.&, R.IMw , Sec. _.3__- , Tract: ._dddd_ Drilled depth: _J4Q_ft___ Measured: J.17jt__ FSL, J^jLjiwi. Hole size: 4 3A in. Air D Water IE Cored: Yes Q No Lignite beds:-125JL291144-182 ... _ ... . _. ..__.._._._..__ _________._. ..

Remarks: .

Lithology
Recorded by:

Geophysical logs

i OS - -

_......__Geologist 3t& recorded by: Lechner

Lithology

Ganima

T.C._2_ Range _10.Q_cp.s_
Recording speed 20."/min

Logged depth _24Q ft

Density

T.C. ^_ Range JLO.Q_c.pJ.
Recording speed 2Q.*

Logged depth 240 ft

JDepth

0- 1 Gravel, medium-gray, fine-grained to medium- grained
1- 27 Siltstone, yellowish-gray
27- 32 Siltstone, dark-gray
32- 37 Siltstone, brownish-dark-gtay, carbonaceous
37- 45 Siltstone, medium-gray
45- 75 Sandstone, medium-gray, very fine grained

- 75-123 Claystone, light-gray

123-128 Lignite, black
128-130 Siltstone, very dark gray, carbonaceous, clayey 130-142 Claystone, medium-gray
142-180 Lignite, black

~" 180-200 Qaystone, greenish-gray, silty

200-202 Siltstone, light-brown
202-206 Siltstone, green, clayey
206-210 Siltstone, greenish-gray, sandy
210-220 Siltstone, greenish-gray, clayey
220-225 Lignite, black
225-240 Siltstone, greenish-gray, clayey

r-0-0

- 20

"-" "L-T^L *~ "^rry *."*"- ' "'"** ^*' y" 7^"T- -'-' » H

. -100

-350

366

Hole numbei L22

SP

Sens, setting _ 50_MV_ Recording speed 2SL. &/ min Logged depth _.. _24Q jt_

Resistivity
o 7fl Sens, setting 4y_____ Recording speed_2J)ft/min Logged depth _ 24_Q.ft..__

- I

Depth

- o-o

[-50 j

[-20:

pHOO

i
L

|-

,-150

- 80'

f-300

- 100:

367

Hole No:__L_23_ __Map:_^ieu/££l_Lake__Date:._JL13:ZZState: _ND___County:_Slq£e__._ __ Elev.: _2,939JL_. Location: T. J^X, R. JLDJlw , Sec. _3.2., Tract:. _£ccc ._ Drilled depth: _2pO_£t___. _._ Measured: J5.it__ FSL, _2Q_ft__ FWL, Hole size: 4 K in. Air E Water D Cored: Yes [j No X Lignite beds:--

Remarks: .

Lithology
Recorded by:

Geophysical logs
.___Geologist NO' recorded by: ___.L

Lithology

Gamma

T.C._2_ Range J_Qfi_cps_
Recording speed 2.QWmin
Logged depth ?nn ft

Density
T.C. _2_ Range _5_QQ_cp_s
Recording speed 2.Q' c/niin
Logged depth 200ft

Depth

No samples Q,Q

- 50

- 20

_ ^-.^r^. ^Q-r^iri -40

368

-250
~ -80

- 300

_ -100

M50

Hole number L 23

SP

Sens, setting_50_MV_

f *** f*

Recording speed 2£L.ft/min Recording speed.20.ft/ Logged depth .... -200 ft

1

j
I

JI

-J
!

1

j
_i

Resistivity
Sens, setting .__20... _
_ speed.20it/min
Logged depth ._-2_00.rt ...._

Depth j

- 0-0

hlOO

-40:

- ISO

-2CO-60

r250 I
' -80'

- 300

- IOO

- 350

369

Hole No:__L-2_4_.._ __Map:_BladL&wttfi___ Date:.__9:13-77 State: _^ND_. County; Slope _ Elcv.:_2,9.41_£t_.. Location: T.1J4.S, R.102.W , Sec. __12~, Tract: ._.cdcc__ Drilled depth: _J_QCLft__._ ... ._ Measured: A4JJ:__**L, L8P_Q_ftFWL. Hole size: 4 3/d in. Air D W'ater H Cored: Yes D No (X[Lignite beds: .Jl.16JL4.2i 149-162; 212-2l4;.216-219 ..._ ...._.... .. ____.._.___...,_.

Remarks:
Lithology
Recorded by: ____ Geologist xS recorded by: .__Lechner_ _ _

Lithology

Gamma
T.C.-2- Range LOOLc^s_
Recording speed 2D'Vi
Logged depth _3QOJt

Density
T.C. _2._ Range .lPO_cg.s_
Recording speed 20.'
Logged depth __3_QOjt

Depth

<-> o

0-12 Sandstone, yellowish-brown, very fine grained
12- 15 Siltstone, yellowish-brown, clayey
15- 38 Sandstone, yellowish-brown, very fine grained

38- 39 Claystone, yellowish-brown, silty
39- 47 Claystone, medium-gray
~ 47- 54 Claystone, yellowish-brown
54- 88 Sandstone, yellowish-brown, silty, clayey

88- 90 Lignite, black
90-117 Claystone, medium-gray

117-120 Lignite black
120-121 Claystone, medium-gray
121-140 Lignite, black

140-150 Claystone, medium-gray
150-161 Lignite, black
161-205 Claystone pale-greenish-gray, silty

- 205-230 Gaystonc, dark-gray

230-246 Claystone, grayish-green
246-300 Sandstone, green, marly, clayey

- 0-0

-20

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. l -->:"'

SO j-r-rr '~ ~

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t

zr^.-.::.--'- - -T. -r^; 1.1>*
'---^ 4'- r ^ ;-^^-jtirfl n

- 350

370

Hole number L 24

SP

Sens, setting - .-50 MV__
Recording speed.1Q_ ft/mi Logged depth _. 3£0. ft._

Resistivity
Sens, setting 5Q.
Recording speed -2_Qft/m jn
Logged depth ._3AQ.&....._

Depth

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- o-o

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r -2 °:
i '

i :
i-100 i

t
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r
f~i50 ;

-200- 60

r-250
-80

;-300
r

_ - too.

J

-350

r

371

Hole No: __L_25_ __ Map: _Black. Butte Date: 9-13:7Z State: ND ._ _ Coun ty: _Slgge__,.__.__ Elcv.:__2,886.ft_ Location: T. 121 £, R. JLDSw , Sec. ..26., Tract: ...cbcc._ Drilled depth: _2_00jt___... _.__ Measured: i6_QQ.ft_fsL. _62Jjt_ FWL. Hole size: _4j4jn._._ Air G Water H Cored: Yes Q No (x] Lignice beds:.-71-82L.il 4-116; 131-134 ... ._....._.. .. ____ ____... ._._

Remarks:

Lithology
Recorded by: _-Ricli3rd._Scat..tplini_

Cicophysical logs
.__.Geologist NX recorded by: __._Lechner

Lithology

Gamma

T.C.._2_ Range _1.0.0_Gps_

Recording speed ZO^/

Logged depth 200 ft

Density

T.C. _2_ Range .

Recording speed 2D_"/min

Logged depth 200 ft_

Depth
C/1
w-

fcj O

II

0-5 Sandstone, yellowish-brown
5- 10 Lignite, brownish-black
* 10- 12 Qaystone, yellowish-brown
_ 12- 32 No samples

32- 35 Siltstone, yellow, clayey
35- 40 Claystonc, grayish-yellow
~ 40- 62 Siltstone, yellow, clayey; with occasional plant
_ fragments

62- 71 Qaystone light-gray

71-73 Qaystone, brown, carbonaceous
_ 73- 83 Lignite, black
83- 92 Qaystone, dark-brown, carbonaceous
92-109 Qaystone, medium-gray, silty

109-t 14 Qaystone, dark-brown, carbonaceous

114-116 Lignite, black
_ 116-119 Qaystone, brown, carbonaceous
119-131 Qaystone, brownish-gray
131-135 Lignite, black
_ 135-147 Qaystone, brownish-gray
147-148 Lignite, black
148-157 Qaystone, brownish-gray
157-158 Lignite, black
""158-166 Qaystone, brownish-gray
_ 166 191 Qaystone, grayish-green, silty

191-193 Lignite, black
193-200 Qaystonc, brown

-. _..._-0-0

- 20

- - _--*- --^ rjQ ; - __ - - ^. z.?*

-20CT 60

- 250

- 80

- 300

_ -100

-350

372

Hole number L 25

i

SP Resistivity Depth
Sens, setting_5Q.MV Sens, setting __50._...__ ,
Recording speed _ZQ_ "/ min Recording speed_20rt/min £ «J Logged depth __. _2.QQ_ft_ Logged depth .. 2QO.ft_...._ £ ^

-1
-J

r -.r^v

hO-O

r

L

H50

- 20:

i-ioo
L

L

- 150

- 200 60

- 250 I
- - GO'

-300

- 100,

-350

373

Hole No:__.L.2<5_ _Map:_Mannaj:thJ NW_Date:._8-Jl-.Z7_State: __ND _County:_Slope._......._ Elev.:_J,Q42.ft__. Location: T. .134s , R._103w , Sec. ...6_ , Tract:... _adda._ Drilled depth: __24p_£t__._..... __ Measured: 2,255. ft_ £s*. JP. JLjjSfc Hole size: __4.3/4.m._ Air [X> Water D Co.-ed: Yes D No H Lignite beds: ...66-6iL7.5-_18; 103-106;.178-180; 205-210 ...._... .. _______.__ .

Remarks:
Lithology
Recorded by: -

Cicophysical loirs

_ , . YC8 ^ 1 I I ^ T U

..___Geologist NO recorded by: ....___Lecnner..

Lithology

Ganima

T.C..-2_ Range AOjQ_ep_s_
Recording speed 20'Vmin
Logged depth _21&Ji__

Density
T.C. _2._ Range IP.Ocps.
Recording speed 2Q_"/min
Logged depth _238 ft

Depth

No samples -0-0

rr^ 9 o Ei^==z=z==?rTT±:

-20

- 100

'"

- 300

. 100

- 350

374

Hole number L 26

I

,

H

J

i

1

SP

Sens, setting 50 _MV __ Recording speed _2£L w min Logged depth .._. -238 ft._

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% .' -;-

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Resistivity
Sens, setting .5Q..__ Recording speed-20it/mi n Logged depth _ -?38 ft_

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::-~H>-Lvi"-i ?:H

s~1

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~ ... .: __ : __:

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. ;._-:-| ? r . ^-P-'.-j
': Lr: r-:".-::-;.: -
^---T 3T-;.:J

-J^f- I'Xrl

^if . - ?:":. ;-^
XT. .- . ...-:-;
,^'1fr~:;::~^z^:i
^" ... - _..

S,."- : -^

Depth

^0-0 I

-20

"-ICO

-40:

- 150

- 300

- 350

375

Hole No:_..L..27__ __ Map:__Marmjuj:h JJSIW_ Date:.333JL_State: _ND__ County:_Sjp£_e__ _ __ Elcv.:_2,0_68_(t_._ Location: T. 1M.§ , R..103* , Sec. ..2_0_., Tract:. Jb.abb.__ Drilled depth: __.200_ft____ __ Measured: _6.Qlt__ KSK, 1^4.7 ififwl Hole size: __4_&.in.___ Air E Water D Cored: Yes Q No S Lignite beds:. JM-2&_3.2-35; 61-68; 157-160 . ... _______.__...

Remarks:
Lijhology
Recorded by: -

l logs
..__ Geologist NO recorded by: .._Lechner..._ _.

Lithology

Gamma

T.C._2 Range JLQQ.cps_
Recording speed 2H' t/rnin
Logged depth __2PJ)_ft__

Density
T.C. ^3_ Range _500_cpj
Recording speed2.0_ft/rmn
Logged depth 200ft

Depth

-~ No samples _-0-0

- 20

~"^; "*. ^^- J~ 7r ^ , j'J.JT

".j_|..^j;j._j_ _' _

F; -. : -p^r_"'- ~~r~^ ' .T'w_~r^»T-t-~'~;)

^=-20CF60

_ -100

-350

376

Hole number L 27

SP Resistivity
Sens, setting_ .5.0 MY_ . jsens. setting ._ . 50 _ Recording speed .2Q_ it/ min
Logged depth ._. ZOO. ft __

_i

Recording speed_2Qft/min
Logged depth - .200.ft...._

i

i

Depth

- 0-0

- 50

L

- 20,

r
;-!00
L

i
-40!

1-150

H

- 80

-J

- 300

377

Hole No: _ .L.28__ . __ Map: __ Marrnarth 1 NW Date: 9-3-77 State: NO County: Slope Elev.:-2,122..ft_.. Location: T.1.?A>&, R..lQ2w. Sec. _JJ2_. , Tract:. _ hbbb_ Drilled depth: _180jt__ Measured: _1Q jt . ._ y.m. _6.0 JL FWL. Hole size: _JJ4 m,_ Air Cl Water [x] Cored: Yes D Lignite beds:. ..44-64j_lP8:116; 156-158 .._ . ..._._.. ..

No (X]

Remarks:

Lithology
Recorded by: _

(Geophysical lo^s
___.Geologists* recorded by: ..__Le_chner__ .._._

Lithology

Gamma

T.C.._2_ Range J^Q_cp.s_

Recording speed 2$*l

Logged depth _180 ft

T.C.

Density

Range

Recording speed 2_Q.* t/min

Logged depth _ 180_ft _

Depth

!_. <U 8
u,

0-35 Siltstone, yellow, mottled, clayey

35- 42 Siltstone, yellowish-brown, clayey

42- 43 Lignite, black
_ 43- 46 Claystone, dark-gray, silty
46- 62 Lignite, black

62- 66 Claystone, medium-brown
66- 97 Claystone, greenish-gray, silty

97- 99 Sandstone, gray, very fine grained, clayey 99-102 Claystone, gray
102-103 SHtstone, yellow
103-110 Claystonc, gray
110-118 Lignite, black
118-121 Claystone, brown, carbonaceous
121-128 Claystone, gray
128-131 Sandstone, green, glauconitic
131-134 Claystone, gray
134-136 Lignite, black
136-140 Claystone, brownish-gray, carbonaceous 140-159 Claystone, grayish-green
159-162 Lignite, black
'162-164 Gaystone, gray
164-166 Lignite, black
166-174 Claystone, grayish-brown
174-175 Lignite, black
175-178 Claysrone, green
17S-179 Lignite, black
179-180 Claystone, gray

- 0-0

-20

-EOS60

H250

- 80

-300

_ -100

-350

378

Hole number L 28

SP Resistivity Sens, setting _ 5QMV__ jSens. setting _.._.50_____ Recording speed -20. "/min Recording speed_2P"/min Logged depth __. .180. ft. _

J

J

Logged depth . -180 ft. _

Depth

£ 5

- 0-0

r-50

I

- 20;

MOO

L

-40

hl50

-200-60

r

-250 !
-90

-300

- 100'

-3bC '

379

Hole No:_ -. JL?JL . __ Map: _MiVtmatdl 1 NW_ Date: ...3-2-27., State: __NIL_ County: __Slope_ ...._ Elcv.: -3.02.0 ft_.. Location: T..L34s, R...104J , Sec._.!__., Tract:, bcbc _ Drilled depth: _180_ft__... .... Measured: i?75 ft. £XK, JJU_ft*m. Hole size: 4%in... Air [j Water 53 Cored: Yes [1 No fx] Lignite beds: _14rllsJ56-_$4; 155-162 .... __.__. . _____

Remarks:

Lithology
Recorded by: __Richard.S_cattoJini_.. _, . .

. _ Geologist

Yes

Geophysical logs
recorded by: ,_ Lechner

Lithology

Gamma

T.C.-2- Range JLQ&.cps_
Recording speed2£i* llmin
Logged depth _JJO_ft_

Density
T.C. __2_ Range _10a cps
Recording speed 2.0_"/min
Logged depth _JL8.Q_Ct_

Depth

w O

u,

0-15 Sandstone, very tine grained
15- 24 Lignite, black, friable
24- 36 Gaystone, gray
36- 37 Lignite, black
37- 50 Claystone, gray

50- 55 Gaystone, gray, silty
55- 65 Lignite, black
65- 80 Gaystone, gray, silty

- 80- 85 Gaystone, gray
_ 85- 87 Siltsrone, grayish-green, clayey
87-100 Gaystone, gray, silty
~ 100-115 Gaystone, gray and brown, clayey blebs
- 115-123 Siltstone, gray, slightly clayey
"123-125 Siltstone dark-brown, carbonaceous
_ 125-132 Gaystonu, palc-grayish-yreen
132-133 Lignite, black
- 133-154 Claystone, gray

~ 154-161 Lignite, black
161-165 Siltstonc, brown, carbonaceous
_ 165-180 Gaystone, brownish-gray, silty

- 20

380

-250
~ -80

- 300

_ -iOO

-350

Hole number L 29
SPResistivity
Sens, setting 50.MV___Sens, setting 50
Recording speed_2Q_ ft/min Recording speed.2.0ft/min
Logged depth ..18Q.fr ._ Logged depth - ...!.§Q ft ..._
-
Depth
h-O-0
H-50
L
-20-
i-lOO
L
-40
r 150
-ZOO"60
 250 ;
-80'
-300
-100
381

Hole No: _ .L_3.(L- . Mnp: East Rainy Butte pate: _.?I?A:ZZ_ State: ..._ND __ County :_.S]op.c Elev.: _2,765_ft__. Location: T. .ll^f , R.M.w . Sec. ..22 . , Tract: . bbaa .._ Drilled depth: __54Q jt_ Measured: J.00jt__.^a, U.QQ_ft FWL. Hole size: __4_^4 in, _ Air [j Water tK] Cored: Yes H Lignite beds: .178.-182; 230-232: 257-259: 290-293; 360-364; 442-4*5

No

Remarks:

Lithology
Recorded by: -Randall Reicherj. ._. . Geologists*

Geophysical logs
recorded by: . ....

Lithology

Gamma

T.C..J2- Range JLQQ_cp.s_

Recording speed 20 ft/min

Logged depth _54J)_ ft_

Densit

T.C. 2 Range jJjyjE

Recording speed^Aj

Logged C*" depth I -i--_j._ 540 -- - - _-- ft

Depth

S
2

0-2 Sandstone, yellowish-gray, very fine grained 2-18 Siltstone, grayish-yellow, clayey
~~ 18-21 Siltstone, brownish-dark-gray, clayey,
_ carbonaceous
21- 33 Siltstone, dark-gray, clayey
33 36 Claystone, green, silty
36- 70 Sandstone, greenish-gray, very fine grained

- 70-160 No samples

. 0-0

- 50

- 20

- 40

160-170 Sandstone, greenish-gray, very fine grained

170-178 Siltstone, greenish-gray, clayey
178-180 Lignite, black
180-185 Siltstone, greenish-gray, clayey
185-186 Lignite, black
186-200 Qaystone, greenish-gray, silty
200-235 Qaystone, medium-gray, silty

235-236 Lignite, black
. 236-242 Siltstone, green, clayey
242-251 Siltstone, medium-gray, clayey
' 251-255 Sandstone, medium-gray, very fine grained
. 255-257 Siltstono, medium-*;ray
257-260 Lignite, black
260-264 Ciuystonc, medium-gray, silty
264-276 Siltstone, medium-gray, sandy
276-286 Claystone, medium-gray, silty
286-289 Claystone, brown, silty, carbonaceous 2S9-290 Lignite, black
290-294 Claystonc, green
294-298 Siltstone grayish-j;recn, clayey
298-300 Claystoiic, greenish-gray
1 300-305 Siltstone, light-gray
. 305-306 Lignite, black
306-313 Siltstono, light-greenish-gray, clayey 313-317 Claystone, green, silty
317-342 Siitstonc, medium-gray, clayey
342-360 Claystone, medium-gray

360-365 Lignite, black
382

.j ... . - ---^- - - -- _> -^ ^> .TTT: * * c* t_. .^ r .IT ' ~ .n_ " -_. ;~_._ *' -;_~

--_- . *,~ f~r - _ _-_:_ -_^___T-^. ^*"^^:

tT"~^~"I'*"^p"~' _ .?_^.",T"" . 1- » Wv

Hole number continued
L30

Lithology

365-381 Siltstone, medium-jiray, clayey
381-395 Clayitone, medium-gray, silty
395-405 Guystone, light-green, silty
405-U5 Siltstone, medium-gray
415-442 Sandstone, medium-gray, very finegrained

442455 Lii-nitc, black
455-540 Sandstone, medium-gray, very fine grained

Gamma

T.r. 2 R a ngg 100 cps Recording speed J2Q_ft/min
Logged depth 540 ft

Density Depth
T.C.__1_ Range 100 cps Recording speed20_«/min
Logged depth 540 ft

w O

r-rr."~T~rr: 'c 'i :: - 500

- - 160

550

- - 180
- 600

650 -200

- 700

- -220

- 750

383

noie numocr JL JU

SP

Sens, setting .50 MV__ Recording speed 2.0
Lodged depth __ _5_4Q.ft__

i

i
- i

J

Resistivity i Depth
Sens, setting . .5Q..._.._ I
ft/min Recording speed.--9^/min I £ ^ Logged depth ...540 ft _._ '

-u . ? »

-o-o

-»

:

L -40'

"150

-250 I
l- -80

r300

- 350

384

Hole number-continued
L30

SP Resistivity
Sens, setting __ 50 MV Sens, setting __50..._ .._.. Recording speed_2iL^/min Recording spced20 .ty min j Logged depth _34.0 ft _ Logged depth 540 ft

_!

- i

-i

- \

-\

i

Depth!

i- - 120.

UOO ;

i-450
140;

h

r

500

- 160!
I-

L550 i
i

. - -ISO1

[-600 :
i ;

L

1-650 |
: -200

I
U

r 700
i

i

385

Hole No:_.L.2L... . __Map: JVe5tRaLn)LBu«e_ Date:__9-_20rIlState: _.ND County:_Sip£e__......_ Elev.:_.2,8JiCLCt__ Location: T. .135s , R.29__w, Sec._34.,Tract: J>1>»__Drilled depth:__500jt_.. _. . Measured: _5ift _ KSK. _£0_ fLl&t Hole size: 4 K in. Air D Water (3 Cored: Yes Q No |X]

Lignite beds: ..36-MU50.152; 253-255; 379-383; 462-476;.491^494 _ ____ ____ _

Remarks:

Lithology
Recorded by: JtichardJScattolini Yen

(icoph/sica! logs
____ Geologist sx recorded by: . ..._Lechner _ __ _

Lithology

0-6 Sandstone, yellowish-brown
6- 26 Siltstone, yellowish-brown

26- 27 Lignite, black
27- 56 Siltstone, medium-gray, clayey

- 56- 60 Lignite, black

60- 61 Chy stone, dark-brown, carbonaceous
61- 77 Gaystone, medium-gray, silty
77- 98 Siltstone, greenish-medium-gray, clayey

98-110 Sandstone, greenish-gray

110-113 Sandstone, well cemented
112-125 Sandstone, greenish-gray
125-126 Lignite, black
126-148 Claystone, pale-greenish-gray, slightly silty

- 148-149 Lignite, black
149-153 Claystone, brown, carbonaceous
"" 153191 Claystone, greenish-gray

191-197 Siltstone, medium-gray, clayey
_ 197-198 Lignite, black
198-209 Claystone, greenish-gray, slightly silty 209-219 Siitstone, greenish-gray, clayey
219-221 Lignite, black
22 1 -244 Claystone, grayish-green

- 244-246 Lignite, black
246-249 Claystone, grayish-brown
249-260 Sandstone, gray
- 260-374 No samples

-

Gamma

T.C. _2_ Range J.(lQ.Cp
Recording speed 2Q"/m

Logged depth 500 ft

Density

S T.C. 2 R^ge 100.eps

in Recording speed -20"/min

Loeced depth 500ft

.- . -"^ r'^rT

" f* "- ~""^-l

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- - -- :T- n

~" * - ~ '*^-" «* *-" "-

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263

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J20

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" _»^ . . ... _.. .

* -Vfc--.. . . _: ." -r ^"^'" ^~T~""V """~";^|
JL_^ -- -, "".. - ".'^^:::-^ . ~~~-

~*«'l~i'tr' >o~$«* "V "--

-~ ~ -: .... _^5L --r
r, .- rr . *

P^.--^4T-"-fc

..::.. ._;::.-. -_:. : ."-.- - :^.
- ^^l~:-~-.--^^~

h ~_-."_._-'~:zr_" vz.^z. ~.^'--... : £ ~. __

^-^^-I:-=r-*-=--|^>-

r r- "r.-rr === --^5.-==,
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- . -. r---.--"^ "^

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Depth
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II

- 0-0

3W

" -20

- 100

-40

- 150

£* f\ -2o?y 60

- 250

- 80

-300

_ IOJ

-350

386

Hole number continued

L31

Lithology

374-380 Lignite, black

380-384
384-390
390-405
405-407
407450

450452
452464
464-465
465-467
467476
476478
478495
495497
497-500

Siltstone, gray
Lignite, black
Siltstone, gray
Lignite, black
Qaystone, light-gray

Sandstone, well cemented
Qaystone, medium-gray
Lignite, black
Qaystone, brown, carbonaceous
Lignite, black
Sandstone
Qaystone
Lignite, black
Qaystone

T.C..

Gamma

Range 1QD Cps Recording speed _20_ft/min Logged depth 500 ft

Density

T.C._2__ Range 100 cp< Recording speed 20jft/min Logged depth 500 ft

Depth

« o

-600

650 -20C

- 700

~ -220

- 750

387

Hole number L 31

SP

Sens, setting -5JLMY...... Recording speed _2Q (t/min Logged depth .500 ft _.

Resistivity
Sens, setting 50. Recording speed
Logged depth .500ft

Depth

- o-o

-50

- 20!

hi 00

L

i i
L

1-250
L- -80

r
i
r

i
f-300
r

r -100

j-350

r

388

Hole number continued
L31

SP

Sens, setting _5,0. MV Sens

Resistivity Depth)
.... 0 _.. .__;_ ..- . setting _____ 5Q_. ._. 21 Recording speed_^Q_fr/minJRccording speed20.fr/min » t> « i

Logged depth ..._.500 ft Logged depth 500 ft J u. 5 ' "h
- ~ TUT""* <T "' ' ^r~u m
., * tr. ~_ _ ^rr"._ ' . rr_ . _ "

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r- --=:--. .- -..

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- I
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i

-j
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-450
- 140!

r-500 ;
i_
j
i- -160:

r

p550 I

'\- :

!_ -180!
,-600 ,

650 ; -200

- - 700

- 220.

389

HoleNo:_....L_32___..__Map:__JQagluin __. Date:._9.-17-77.State: _ND_ County:_S]o.pe ...... Elcv.:--2J.a5.ft_.. Location: T. 135.*, R.1QQ.W, Sec. _X1_, Tract:.._cbbb__ Drilled depth: __.5QO &___._.

Measured: 2*470 Ct.FSU JLO.ft__ F^. Hole size: . 4 3/4.m..._ Air D ^ater [X] Cored: Yes Q No

Lignite beds: .J?8-34LX34r.l36; 203-206; 218-226;.361-367; 377-380; 391-416; 478-484; 494-500__

Remarks:

Lithoiogy
Recorded by:_J

_ . . Yes .___Geologist aa

Geophysical logs

recorded by: . ._ Lechner

Lithology

T.C.

Gamma

2 Range

Recording speed 2£l/ t/»nin

Logged depth _5.QD_it __

Density

T.C. _2_ Range .LQQ_c.ps_

Recording speed 2_Q.* t/nrin

Logged depth _JLQP.iL_

Depth

«-. u

0- 2 Sandstone, yellowish-brown
2- 8 Clinker

8-21 Claystone, brown

21- 28 Claystone, medium-gray
28- 33 Lignite, black
33- 42 Claystone, dark-grayish-brown
42- 43 Gaystonc, dark-brown, carbonaceous 43- 46 Claystone, medium-gray
46- 47 Claystone, dark-brown, carbonaceous 47- 52 Siltstone, grayish-green, clayey
52- 59 Sandstone, grayish-green, silty
59- 60 Sandstone, yellowish-jray, well cemented 60- 70 Claystone, grayish-brown
70- 76 Gaystone, green
76- 82 Claystone, medium-gray
82- 83 Siltstone, !i»ht-gray, well cemented
83- 91 Gaystone, medium-gray
91- 93 Gaystone, dark-gray, carbonaceous 93-110 Gaystone, medium-gray, carbonaceous 110-112 Siltstone, medium-gray, clayey
112-113 Gaystone, brown, carbonaceous
113-132 Ciaystone, greenish-gray
132-133 Lignite, black
133-133 Claystone, brown, carbonaceous
138-157 Gaystone, medium-dark-gray
157-158 Gaystone, very light gray
158-163 Ciaystone, brownish-gray
163-166 Claystone, yellowish-gray
166-170 Siltstone, gray, clayey
170-176 Claystone, medium-gray
176-183 Siltstone, medium-gray, clayey
183-202 Gaystone, medium-gray
202-207 Lignite, black
207-215 Claystone, gray
215-216 Lignite, black
216218 Gaystone, brown
218-221 Lignite, black
221-223 Gaystoue, gray
223-226 Lignite, black
226-246 Siftstorte, gray, sandy
246-250 Gaystcme, medium-gray
250-251 Lignite, black
251-293 Claystone, grayish-green

293-310 Sandstone, gray, very fine grained

310-355 No samples

355-356 Lignite, black
356361 Siitstoiie, gray

- 0-0

-20

1 1 \'~ ~^~_ ~_ izi__n.*«"ii. ^. i~r .,~i*_ ^~ .~" r c ~'.

'T**" ' " - -" '" - ~~_ " "" * " ""*"'"~ ~* jl_^ ~"" "~ ~~ *- ~ r~'~ .*

=^=====~~==Je5==~ -350

- 100

Hole number continued
L32

Lithology

- 361-365 Lignite, black
- 365-377 Claystone, medium-gray
_ 377-380 Lignite, black
380-390 Claystone, gray
- 390-397 Lignite, black
_ 397-402 Claystone, gray
402-421 Lignite, black

42M69 Siltstone, gray, sandy

469-477 Lignite, black
477-482 Chystone, gray
482-483 Lignite, black
483^93 Siltstone, gray, clayey
'493^97 Lignite, black
497-500 Claystone, gray

Gamma

T.C. 2 Range JLOO_£ps_
Recording speed 20 "/min
Logged depth 500 ft

Density
T.C._2_ Range 100 cps
Recording speed-20fc/min
Logged depth 500 ft

Depth

t-inv ^-C."rz..". :cr_-r^rzjriz.j | ""^""^"-^"Lr""'-'-^"" "~-r"*~'~"" \ _mr~ IT^?v~rzz

- - 160

-550

- - 180
-600

650 -200

- 700

- - 220

- 750

391

Hole number L32

SP I Resistivity
Sens, setting _50.MV-.._. !Sens. setting - 50 Recording speed _2£L "/min
Logged depth _50.Q.£t_

Recording speed .20 wm in
Logged depth _.5.QO ft. _..

1

-I

i

J

j

r^-::! --p "-'^..-_- _

~~__^1 *^" " S»-_tl'~"7 ^* ~ '~^ _|_~_'"-

Depth;

- o-o

h-50

-100

-40!

150

- 80'

r-300

- 100;

^-350

i

392

Hole number continued
L32

1
SP Resistivity Depth
Sens, setting_..5Q_MV_ jScns. setting___._.5Q..._. E i Recording speed _2(L ft/min Recording speed20Wmin o % ; I Logged depth.,..,500 ft _ Logged depth 500ft ~~

-1

_

-400

[--450
I --I40,
h

[-500

I- -160:

r

! i I

t-550 i

,- -180'

- 600

: -200|

i
H

. 1
I

- 700

393

Hole No:__L 33_- ._Map:___Amidan____ ._Date:.^17rll-State: ... N_D_ County :_.Slppe____.._ _ Elcv.:-_2,9.45.ft__. Location: T. 135.x , R.1QQ.W . Sec. ..30., Tract: ...bbbc ._ Drilled depth: _52p.ft___. ...

Measured: J7.5.ft_ ra& _. 5_4_£tnvL. Hole size: __4JUn,_ Air U Water [x] Cored: Yes G No

Lignite beds: ..J..OOJ.Q2; 104-109; 122-124.1209-211; 398-422; 498-501. . ._ ____...._.__ ... .

Remarks:

Lithology
Recorded by: _Kich.ard ScafitftUnL _ . . Yes Geologist :EH

C.cophysical logs

recorded by: __..Lechner__.

Lithology

Gamma

T.C. JL_ Range -1QD. cp.s_

Recording speed 211 "/min

Logged depth _J32Qjt_

Density

T.C. _Z_ Range _10..0_cps

Recording speed -^D

Logged depth __520_ft

Depth

0- 6 Siltstone, yellowish-brown
6- 17 Claystone, yellowish-brown
17- 18 Claystone, dark-gray, carbonaceous
18- 19 Cluystonc, medium-gray
19- 22 Claystone, dark-brown, silty and carbonaceous 22- 26 Lignite, black
26- 30 Claystone, dark-brown, silty
30- 45 Sandstone, grayish-brown
45- 46 Siltstone, brown
46- 48 Claystone, brown
48- 50 Sandstone, grayish-brown
50- 58 Siltstone, yellowish-brown, sandy
58-61 Siitstone, medium-gray, sandy
61-71 Siltstone, yellowish-brown, sandy
71- 80 Sandstone, yellowish-brown, siity and carbonaceous

80-100 No samples
100-108 Lignite, black, woody
108-114 Claystone, medium-gray
114-120 Siltstone, medium-gray, clayey
120-121 Ugnite, black
121-126 Claystone, greenish-gray
126-131 Siltsrone, greenish-gray, clayey
131-146 Claystonc, light-greenish-gray
146-178 Claystone, medium-gray, siity

178-179 Lignite, black
_ 179-181 Claystone, medium-gray
181-182 Siltstone, light-gray, siliceous
- 182-208 Claystone, medium-gray, silty

- 208-210 Lignite, black

210-214 Clay stone, medium-gray
___ 214-215 Lignite, black
215-242 Claystone, medium-gray

- 242-243 Lignite, black
243-262 Claystone, greenish-gray

- 262-263 Siltstone, yellowish-tan
__ 263-279 Claystonc pale-green
279-280 Siltstone, yellowish-tan
- 280-289 Claystonc, pale-green
__ 289-290 Claystone, dark-brown, carbonaceous
~~ 290-300 Claystone, pale-green
- 300-315 Sandstone, green, glauconitic

"~ 315-395 No samples

-20

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1*0 -; --

T^.-'. --- ~ - y~^~^=>- 7 Sn
-_ .. ..."J: r ' JU

T_I_ ;-==-- ?===,

Hole number continued
L33

Lithology

395-423 Lignite, black

423-450 Claystoue, brownish-gray

450-460 Sandstone, yellowish-brown
460-480 No samples

480-494 Claystone, grayish-green
494-497 Lignite, black
497-520 Claystone, medium-gray

Gamma
T.C.___2L Rang<» IQOcps

Recording speed 2Q fymin Logged depth 520 ft

Density
T.C. 2 Range _10Q.C.ps
Recording speed 2H/c/min Logged depth 520 ft

Depth

f.. ... -~^ , -7 JJ A I

.. _: <±rrzT _ ' -J o O

< n - r -

- 160

- 550

- - 180
-600

h65Q -200

H-700

- -2EO

- 750

395

Hole number L 33

SP
Sens, setting . 5.CLMY._._ Recording speed 20
Logged depth _. -S.2Q ft._

Resistivity
Sens, setting 5Q_____ ft/min Recording speed _2Qfr/min Logged depth _.520.ft_..__

Depth

1.

-j

j

1

I

H

_J

hO-0

i
1-50
i

t

- 20

r
HOO
L

L

- 40'

r

r-250

- SO

r-300

- 100

I--350

I

396

SP

Hole number continued
L33

Resistivity
Sens, setting_ 50 MV iScns. setting_._ ...50 ._.

C I C

Recording speed _2CL.fr/min Recording speed _2C?t/nnn Logged depth ._.520 ft

J

- |
i -\

Logged depth .520 ft

- -J

Depth

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600 '

- 1
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Ji
~]
-4

J

H

- 700

220

397

__.LJ34___ __Map:_Eo£kyJgjdge__ ._Date:._9-16;77_State: ._N_Q__County:__^ Elcv.:__2,77.0ft__ Location: T.135&, R. 102 w, Sec.. 12. , Tract:. _aaaa ..Drilled depth: __5_pOJL__. . ___ Measured: _52jt _ ESL, _110 folwu Hole size: __4J4in_.._ Air D Water |x] Cored: Yes D No [Xj Lignite beds: ...44-46.L81,88; 145-148;. 151-153; 157-167; 179-181; 196-201; 203-208jJ230-235_ _

Remarks:

Lithology
Recorded by: >_RicHard_Scattolini_ Yes

Geophysical logs

_..._....___Geologist^1 recorded by: ___Lechner _.... .._. _

Lithology

Gamma

T.C.-2_ Range .J.QO_cps_

Recording speed2JQjr/min

Logged depth __SQ.Q_£t_

Density

T.C. 2_ Range JLQO_cps

Recording speed 20.*t/min

Logged

V*W

depth

L

_ 500 ft_

Depth

i_> O
O t

0-6 Silts tone, yellowish-brown, clayey
6- 16 Claystone, yellowish-brown
~ 16- 17 Siltstone, light-gray
__ 17-24 Siltstone, brownish-gray
24- 29 Sandstone, medium-gray, clayey
29- 36 Claystone, gray
36- 42 Claystone, grayish-green
~~ 42- 44 Claystone, dark-brown, carbonaceous
_ 44- 46 Lignite, black
46- 54 Claystone, greenish-gray
54- 57 Claystone, gray
57- 58 Lignite, black
58- 67 Claystone, green
_ 67- 69 Claystone, dark-gray
69- 79 Claystone, greenish-gray, silty
79- 88 Lignite, black
_ 88-101 Claystone, medium-gray
101-116 Siltstone, gray, clayey
116-122 Claystone, dark-gray, carbonaceous

122-136 Claystone, pale-green

136-137 Lignite, black
137-144 Claystone, brown, carbonaceous
"~ 144-145 Lignite, black
145-146 Claystone, brown, carbonaceous
146-147 Lignite, black
"~ 147-148 Claystone, brown, carbonaceous
_ 148-150 Claystone, gray
150-152 Lignite, black
152-158 Claystone, gray
__ 158-167 Lignite, black
""167-176 Claystone, gray, silty
_ 176-177 Lignite, black
177-196 Claystone, medium-gray, silty
196-200 Lignite, black
_ 200-204 Claystone, gray
204-210 Lignite, black
210-221 Cay stone, medium-gray
221-229 Sandstone, grayish-green
~ 229-233 Lignite, black
_ 233-236 Claystone, brown, carbonaceous
23o-259 Sandstone, grayish-green
259-263 Lignite, black
_ 263-271 Claystonc, dark-brown, carbonaceous
271-289 Gaystone, grayish-brown

~ 289-294 Claystoue, grayish-green, silty

~ 294-500 Sandstone, green, glauconittc

- 0-0

-50

-20

-too

-40

-200-60

-300

-too

- 350

Hole number continued
L34

Lithology

Gamma

T.C. 2 Range-JLOfl Recording speed -lO Logged Hpprh 500 ft

Density
T.C. _2_ Range 100 cps Recording speed^Q Logged depth __J2Mi

Depth

- 120
400

H550

L -180
H600

- 200

H700

h -220

399

Hole number L 34

SP

Sens, setting 20 MV Recording speed_2Q_ Logged depth ._. .5DQ ft

Resistivity
Sens, setting 20_ min Recording speed J2Q"/min Logged depth 500ft .

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- 1

J

Depth

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8 S

hO-0

r50

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i
i
r
HOO

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1-150
t
L_

r

-200-60

-40;

- -so

-300

_ -iOO1

-35C

400

Hole number continued
L34

SP ! Resistivity
Sens, setting_...20'MV - [Sens, setting__J?0_ Recording speed_2£Lft/min>Rccording speed 2Cfa/ Logged depth __._.5_00.ft ._ (Logged depth 500 ft

1

J

i

i
i

J
i

1

-_ __ -- _- ^"_-_i ^-_-^i _ r __ i _ f

Depth!

*_. <U

L450
- 140;

h
- 500

-i6o

550

- 180!

1-650 I
: -200

- 700

-220.

401

Hole No: _ JL25L. - .. Mnp:__Rpck>L_BJdge __ Date :.._M6_;7jL State: _ND __ County :_S!.qj_e __ .... _ Elcv.:__ 2,833_ft__. Location: T.JJis, R.J.01\v , Sec. .JL8_. , Tract: _add.d__ Drilled depth: _340jt_ _ _ Measured: Measure: 2,620 , lt._^£L. t._£L. _125jtt KTO, KTO, Hole oe size: sze: __ l^.in,_ Air [>3 Water Q Cored: Yes D No Lignite beds: .J29JJ.6; 2_Q2-219; 284-290; 308-313

Remarks:
Lithology
Recorded by:

Geophysical logs
._.._ Geologist NO* recorded by: .__Lechner _

Lithology

Gamma
T.C._2_ Range LQO_cps_
Recording spee
Logged dept

Density
T.C. JL Range _10
Recording speed 2jQ_*t/rnin
Logged depth 338 ft_____

Depth

u O

II

0-17 Siltstone, yellow, clayey
17- 19 Gravel, limonitic stained clays
19- 60 Sandstone, yellow; poor sample

60-340 No samples

-0-0

-20

> _: a/> i

E^T r_^"_^'"n_' -^^i* ^ v._ ~* --_' -__-^~_~^ - *£." : -i-^.-^^s 2<>o ^

r~ r~i^._:.::."

-250
- 80

-300

- 100

350

Hole number L35

SP

Sens, setting 50M/. Recording speed -2£Lfymin Logged depth _. .318 ft_

Resistivity
Sens, setting . 50... Recording speed 20 "/m in Logged depth ...338.ft.......

Depth

ij O

II

- 0-0

u

f-

r 150

r

r

250 I
- 80

-300 ,

...

_ -100;

I
-350 !
i ,

L

403

Hole No: L.16 _ __ Map: _Amidon_NE_ _ __ Date: ._9il5_-77_ State:

r xr n

_._ _._.________ f ND County :..Slope_ Elev.: _2,a21.Ct_. Location:' T. .115& f R.lQl_w. Sec. _^S- . Tract:. _^ddd __ Drilled depth: _360.^_..... __ _ 1T?OC ^*££ / f" ~"j * -^ .._
Measured: .91 &__ i-SL, iP ft_ FWL, Hole size: 4% in._ Air LJ

Lignite beds:.. 136-138; 190-218; 275-280; 309-311 _..

Water (X] Cored: Yes [j No

Remarks:

Lithology
Recorded by: - Richard Scattoiini

(oophysicai logs

Geologist x& recorded by: _

Lechner

Lithology

Gamma

T.C. _2_ Range !OP_£E§_

Recording speed 2^"/min

Logged depth __3Mit__

Density

T.C. _2_ Range _LO_Q_cps

Recording speed 3_Q

Logged depth 360 ft

mn

Depth

SHtstonc, yellowish-brown, clayey
Sandstone, yellowish-brown
Lignite, brown, powdery
Claystone, yellowish-brown, carbonaceous
Claystone, brown, carbonaceous
Qaystone
Sandstone, yellow
Claystone, yellowish-brown
Claystone, greenish-gray
Claystone, dark-brown, carbonaceous
Lignite, brown, weathered, clayey
Claystone, brownish-orange
Siltstone, gray, clayey
Siltstone, brown, clayey
Sandstone, brown
Lignite, black

- 0- 8
8- 10
' 10- 11
. 11- 17
17- 18
- 18- 20
20- 24
' 24- 27
- 27- 32
32- 34
- 34- 35
35- 37
37- 51
. 51- 55
55- 99
99-101

101-103 Claystone, medium-gray
103-104 Claystone, dark-brown, carbonaceous
* 104-107 Claystone, gray
107-138 Sandstone, yellowish-gray

- 138-143 Lignite, black

143-152 Clay stone, gray, sil ty

152-153 Lignite, black
153-155 Claystone, medium-gray
"155-156 Lignite, black
- 156-162 Claystone, greenish-gray
162-165 Sandstone, gray
165-182 Claystone, light-gray
. 182-183 Lignite, black
183-189 Claystone, medium-gray, silty
- 189-221 Lignite, black

221-275 Claystone, dark-gray, silty

-0-0

~~^E::= -so

- 20

~ 275-318 Claystone, grayish-green, silty

318-319 Lignite, black
319-321 Sandstone, yellowish-brown
321-335 Siltstone, brownish-gray, silty
335-360 Sandstone, green, glauconitic, clayey

300 ££.'^."_'iri:-"i::.Tii.'." -".I^EE^ -300

- 100

350

404

Hole number L 36

SP

Sens, setting -5.CLMY Recording speed 20 ft/mi Logged depth __ -360 £L_

50

Resistivity
Sens, setting
Recording speed_20ft/min Logged depth ..3.60. ft. ....

. ,_.. ...

Depth

- 50

-

r _

L

20i
:

I

100 i

-40!

|-!50

h

r250
- 80

300

- 100

- 350 I

405

Hole No; L37 __ Map:_M£d.QCa_lSE _ 8-23-77 State: ND County :_Slpp_e Elcv.: __ 2 J_1Q_ f t_ Location: T. 155. S , R. 102$. Sec. J _ , Tract: __aado_ . ._ Drillea acpth: 1.80 It ___ __ Measured: 700ft >£gL. _35jLTO, Hole size: __ l&JJk- Air Q Water Q Cored: Yes Q No Lignite beds: ._.3M^30^52;.54=64 _....__ ... .__.._ ..___.._ ... ______ . __ _.

Remarks: .

Lithology
Recorded by: _Michael Camara

Geophysical U>gs
Geologist#* recorded by: .__ Lechner

Lithology

Gamma

T.C. __ Range

Recording speed 2i.fr/min

Logged depth 180 ft

Density

T.C. __ Range _____

Recording speed 20.»*/ min

Logged depth 180 ft

Depth

£

0- 1 Claystone, grayish-white, silty
1- 5 Claystone, brownish-orange
' 5- 7 Siltstone, yellowish-brown
. 7-10 Clay stone, very light-gray
10-11 Limestone, light-gray
11- 19 Siltstone, light-gray
19- 22 Siltstone, orange
22- 30 Claystone, light-gray
30- 37 Siltstone, light-gray
37- 38 Siltstone, light-brownish-gray
38- 39 Siltstone, black, carbonaceous
39- 42 Siltstone, light-brownish-gray, clayey 42- 45 Lignite
45- 55 No samples
55- 60 Lignite
60- 61 Claystone, light-brownish-gray
61- 65 Lignite
65-200 No samples

[to &^5=-=

L : -i^L._ ..:.g: vv" f.~J. ' " J"r-v T'.!.:. ;. ". ".'rv-^,::-?:'^

~~*""~~" ""* -.-.^j '~"' " ' "**!
. » _ . ._ -^t __. .

406

-250

~ -80

-300

_ -100

-350

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:___LJ_8__ _Map:. Date:._8Z25_-17_State: _ND__County:. Elcv.:_2J.8(Lft__ Location: T.135.S , R.JLD3w, Sec. _4_._., Tract:. aaba ._ Drilled depth: __l_60jt_._ __ _ Measured: _3JL£t.__^, JIPQ £t_swx. Hole size: ___fL34.»».___ Air [j Water [3 Cored: Yes [j No [X] Lignite beds: ._69-19j_l_Q6-_109; 124-129

Remarks:

Lithology
Recorded by:_-Randall.Rekhert_

Yc, Geophysical logs
Geologist X* recorded by: ..__Lechner.

Lithology

Gamma

T.C._2_ Range _10Q..cp*_

Recording speed 2.Q.' c/min

Logged depth _16.Qjft__

Density

T.C. _2_ Range lQQ_crjs_

Recording speed ?-Q_"/min

Logged depth _160 ft_

Depth

^ o

8 «

0- 4 Sandstone, yellow, very fine grained
4-10 Siltstone, yellowish-gray
' 10-12 Siltstone, whitish-gray
12-13 Sandstone, white, very fine grained
13-18 Siltstone, yellow
18-22 Claystone, gray, silty
22- 27 Sandstone, brownish-gray, very fine grained 27- 30 Claystone, yellowish-brown, silty
. 30- 32 Claystone, brownish-gray, silty, carbonaceous
32- 35 Sandstone, white, very fine grained
. 35- 36 Claystone, white, silty
36- 37 Lignite, black
37- 40 Claystone, gray
40- 45 Claystone, greenish-gray
45- 52 Claystone, gray
52-61 Siltstone, gray
61- 67 Claystone, greenish-gray, silty
67- 90 Lignite, black
90- 95 Claystone, grayish-green, silty
95-103 Siltstone, gray, clayey
103-107 Sandstone, gray, very fine grained
. 107-110 Lignite, black
110-121 Siltstone, greenish-gray, sandy
121-123 Siltstone, grayish-black, carbonaceous 123-130 Lignite, black
130-152 Claystone, whitish-brown
152-160 Siltstone, greenish-gray

- 0-0

- 20

- 40

-EOS 60

- 250

- - 80

-300

_ -100

407

Hole number L 38

SP Resistivity _ I Depth,
Sens, setting__ .50 MV.. Sens, setting----- 50 __ ._ :
Recording speed .20.. ft/min Recording speed20.it/min Logged depth ... .160 ft._ Logged depth .._JL6Q.ft._ £

- 0-0

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r

,-250 !
!-- -80'

- 300

^-350

408

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__L_12_._.__ Map:__Medora.4 SW__ Date:._j>:25:_77_State: _ND__ County:_.Slope _ _ Elcv.:_-2,83(Lfc_ Location: T. 121 £ , R. JP3w , Sec. _.7_., Tract: ...aaaa __ Drilled depth: _240jFt___ ._ _. _ Measured: _J40 .ft._ KSK, _7.2 ft_l*i. Hole size: __1%J?L_ Air D Water H Cored: Yes G No (X] Lignite beds: ..5.3-56;.60-64; 82-84; 136-157; 204-212 _ _ ____.__. __ ...

Remarks:

Lithology
Recorded by Randall Reichert Y{t«

. _ . ___ . Geologist JQ4

Geophysical loes i / c* _. i
recorded by: .. . _ Lecnner_

Lithotogy

Gamma

T.C. ._2__ Range .100 cps _

Recording speed 20.' c/niin

Logged depth _24Q.fj_

Density

T.C. _2_ Range 10Q_cp.s_

Recording speed 2Q.ity mjn

Logged depth _24P Jl_

Depth

S -

- 0- 3 Sandstone, yellow, very fine grained
3- 5 Claystone, white
5-16 Clay stone, light-gray
. 16- 20 Claystone, yellowish-gray
20- 25 Siltstone, yellowish-gray
"25-41 Qaystone, yellowish-gray

-41-43 Claystone, gray
43- 52 Qaystone, brownish-gray, carbonaceous " 52- 55 Lignite, black
55- 58 Qaystone, greenish-gray
58- 62 Lignite, black
- 62- 74 Qaystone, gray, stlty
74- 75 Lignite, black
' 75- SO Claystone, gray, silty
. 80- 82 Lignite, black
82- 97 Claystone, gray
"97-102 Siltstone, gray, clayey
.102-104 Qaystone, gray, silty
104-105 Lignite, black
'105-115 Siltstone, gray, clayey
_ 115-120 Qaystone, gray, silty
"120-130 Qaystone, liaht-greenish-gray
- 130-132 Lignite, black
132-136 Siltstone, gray, clayey
- 136-156 Lignite, black
_ 156-172 Siltstone, light-gray, sandy

- 172-185 Qaystone, light-grayish-green

- 185-196 Qaystone, gray, silty

- 196-198 Lignite, black
. 198-204 Claystone, gray
204-213 Lignite, black

'213-220 Qaystone, greenish-gray

~220-231 Qaystone, brownish-gray, silty, carbonaceous

-231-237 Qaystone, gray
_237-240 Siltstone, gray, clayey

- 0-0

- 20

_ -100

409

Hole number L 39

SP Resistivity
Sens, setting .5Q.MY. Sens, setting 50__ Recording speed.2LCL ft/min Recording speed 2_Oft/; Logged depth _.. 240. ft._ Logged depth -2.40 ft. __

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Depth

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-35C

410

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__L_4Q__ __ Map: Marmarth 1 NW Date: 8-31-77 State: ND _County:_ $lo£e___ ... Elcv.: _2,9.5Q_ft_ Location: T. Ills:, R...lP3w , Sec. __2Q_., Tract: bbbb _ Drilled depth: _240 _ft_____._ . *TEX: "^f XL f~"~"-T

Measured: ____6_7Jl-TSK, _69lt_'FWL, Hole size: __A.%.m^._ Air [j Water

Lignite beds: ._58-.64i.l_17J22; 151-162; 166-170; 175-178; 225-228 _

I t

Cored: Yes [J No

Remarks:

Lithology
Recorded by:_-Richard Scattolini

Geophysical logs
._ .._ Geologist v» recorded by: _._.._Le_chner _

Lithology

Gamma

T.C. _.2_ Range JQP. C P-L_

Recording speed .2(XVmin

Logged depth __240. £t._

Density

T.C. _2_ Range JLOO^ps.

Recording speed 20_"/ min

Logged

C*C? depth

i

__240

~"

ft _

Depth

tu

0- 5 Gaystone, yellowish-brown, silty
5- 7 Gaystone
7- 10 Siltstone, brown, clayey
10-12 Siltstone, brown
12- 15 Lignite, brownish-black
15-17 Siltstone, yellowish-brown, clayey
17- 20 Gaystone, grayish-green
20- 30 Gaystone, yellowish-brown
30- 37 Guystone, gray
37- 40 Lignite, black
40- 51 Gaystone, gray
51- 55 No samples
55- 68 Lignite, black
68- 75 Gayitone, gray
75- 80 Gaystone, gray
80- 95 Gaystone, gray
95-115 Gaystone, gray

115-117 Gaystone, grayish-brown
117-119 Gaystone, gray, carbonaceous
119-122 Lignite, black
122-125 Gaystone
125-129 Gaystone, gray, carbonaceous
129-130 Lignite, black
130-133 Gaystone, brownish-gray, silty
133-137 Gaystone, gray
137-138 Lignite, black
138-142 Gaystone, gray
'142-143 Sandstone, very fine grained
.143-155 Gaystone, gray
155-160 Lignite, black
160-162 Gaystone, green
162-163 Lignite, black
163-165 Gaystone, gray
. 165-170 Lignite, black
170-175 Gaystone, grayish-pale-green
'175-180 Lignite
. 180-183 Gaystone, brownish-gray
183-186 Lignite, black
186-190 Gaystone, brownish-gray
190-193 Gaystone, brownish-gray
193-195 Gaystone, brownish-gray
. 195-196 Lignite, black
196-200 Gaystone, brown
' 200-205 Gaystone, brown, silty
.205-210 Gaystone, gray
210-221 Gaystone, gray
221-226 Lignite, black
. 226-230 Gaystone, brown
230-233 Gaystone, brown
233-240 Gaystone, crayishrrctrn

- 0-0

- 50

-2C

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i-250

-300

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f-

411

Hole number L 40

SP

Sens, setting 50.MV. ._
Recording speed 2JL ft/min Recording speed 20.ft/Logged depth _.. .2.4.0. ft ___

Resistivity
Sens, setting - - . 50 _
20ft/min

Logged depth ._240_ft__

Depth

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50

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-40!

- 150

i-

250 !
- 80'

r-300

- 100:

-35C I

412

NORTH DAKOTA GEOLOGICAL SURVEY

.MarmSLthJ NE_Date: __2:2-77_ State:
N

Hole No: ND County: _SJopc_.... L 41 __ Map:. Elcv.:..-2,854_ft_ Location: T. 115.5, R.J.03w . Sec. __28_. , Tract: ._ aaab_ Drilled depth: _!60jt_ Measured: _66_ft __ ys&, J.64 ft. pace; Hole size: __1% iru ._ Air G Water H Cored: Yes G No [Xj Lignite beds:. ^l-30i_43-46; 99-103

Remarks:

Lithology
Recorded hy; Randall Reichert

Geophysical logs
Geologist 3ns recorded by: .... __.JLechner

Lithology

Gamma

T.C.._1_ Range J,Q_Q.cps

Recording speed ^.d

Logged depth _15 5. ft

Density

T.C. _2_ Range

Recording speed

Logged depth _155 ft

Depth

0-13 Sandstone, white, very fine grained

13-18 Siltstone, light-gray, clayey
18- 20 Siltstone, yellowish-gray, clayey
~ 20- 30 Lignite, black
30- 35 Claystone, light-brownish-gray
35- 36 Lignite, black
~ 36- 37 Siltstone, light-brown, clayey
_ 37-41 Siltstone, green
41- 45 Lignite, black
45- 52 Siltstone, light-green, sandy
52-53 Lignite, black
53- 56 Qaystone, grayish-brown, carbonaceous
_ 56- 62 Siltstone, light-gray
62- 69 Claystone, light-gray, silty
69- 70 Lignite, black
_ 70-77 Siltstone, light-gray, sandy
77- 78 Sandstone, light-gray, very fine grained, cemented 78- 80 Claystone, light-gray
_ 80- 90 Sandstone, light-gray, very fine grained
90- 95 Siltstone, light-gray
_ 95- 97 Claystone, light-gray
97-105 Lignite, black
"105-116 Claystone, gray
_ 116-123 Siltstone, gray, sandy
123-127 Lignite, black
_ 127-137 Claystone, dark-greenish-giay
137-139 Sandstone, greenish-gray, silty
139-145 Claystone, dark-greenish-gray
_ 145-150 Claystone, dark-brown, carbonaceous
150-160 Siltstone, green, sandy

- 0-0

- 50

- 20

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-eoo"60

-250

- - 80

- 100

413

Hole number L 41

SP

Sens, setting ._. 5Q..MV__ Recording speed _2Q. "/min Logged depth ._15_5.ft .

1

-i

Resistivity
Sens, setting _. 5_Q_._ Recording speed2-Q "/min Logged depth ._15.5.ft.._._

Depth j

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- 200'60

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- -80-

-300

- 100

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414

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__L_42__ __Map:_Mj£do.ra_4 SW__._ Date:.^z2Dz7.2_State: _M1___ County: _S]ope_....... Eicv.:_^»'Z75.ft_Location: T.X35.S, R..104w , Sec. _.3_., Tract: ..accc. __ Drilled depth: __400 ft__.... Measured: 2.605 ft R£L, ^.Sjtfwx, Hole size: 4 K in. Air [XJ Water D Cored: Yes G No Lignite beds: _!MSbJJ4il76; 206-210; 216-218 _. .. _.. ._ . ____ __ _

Remarks:
Lithology
Recorded by: -

Geophysical logs
Geologist NO recorded by: ._.__Iyechner

Lithology

Gamma

T.C.._!_ Range JLQO_cp.s_
Recording speed 2Q.
Logged depth _392_ft

Density
T.C. _2_ Range _!Q(Lcp-S
Recording speed -±y
Logged depth __386_jt

Depth.

No samples .:__.,-0-0

- 50

- 2

415

Hole number continued
L42

Lithology

330

Gamma

T.C. 2 Range 1QO cps Recording speed 20 1
Logged depth _222_£t

Density
T.C._2_ Range 100 cps Recording speed 20_n/min
Logged depth 386 ft

ggM^qfe-.- ":.i±::. :.-.._::::_:j^

Depth

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o * *

I s

- 120
400

-450
- 140

- 500

- - 160

- 550

L
- - 180
-600

h650 -200

- 700

- -220

- 750

416

Hole number 42

SP
Sens, setting .50. MV__ Recording speed _2Q_ ft/miri Lo^ed depth _. _392jt__

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t1
-i

Resistivity
Sens, setting .50_____ Recording speed2Q.ft/min Logged depth ...39.2 ft....._

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Depth
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-0-0

- 50

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.-250 :
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". -80

- 300

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417

Hole No: __ L.4.3_._ __ Map: _ Marmarth 1 NW Date: 9-2-77 State: ND County : _Slope __ Elev.: _-2,8_5i ft__ Location: T. -125&, R. JD4w , Sec. ..21.. , Tract: Jbbbb_ Drilled depth: _160_ft_.... Measured: UUt _ 21. ft.- FWU Hole size: 4 3d in. Air D Water [£ Cored: Yes D No Lignite beds:. ^0-2I;3.6-58; 65-67; 96r101.

Remarks:

Lithology
Recorded by: JB,andall.Reichert.

Cioophysical logs
Geologist tax recorded by: .-.__Lechner._ _ _ _

Lithology

Gamma

T.C._2_ Range JD.Q.cp.s_

Recording speed 2£ftlmin

Logged depth 16D-ft

Density

T.C. _2 Range lQO_cp_s.
Recording speed 20.rt/mjn

Logged depth 160 ft

Depth
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0- 5 Sandstone, yellow, very fine grained 5- 25 Siltstone, yellowish-brown

25- 27 Siltstone, grayish-yellow
27- 34 Lignite, black
34- 35 Siltstone, yellowish-gray
35- 37 Lignite, black
37- 39 Siltstone, yellow
39- 45 Gaystonc, greenish-gray
45- 46 Lignite, black
46- 48 Gaystone, grayish-brown, silty
48- 52 Siltstone, greenish-gray, clayey
52- 53 Lignite, black
53- 54 Siltstone, brown, carbonaceous
54- 56 Siltstone, greenish-gray, clayey
56- 58 Lignite, black
58- 63 Gaystone, green, silty
63- 65 Siltstone, greenish-gray, sandy
65- 67 Lignite, black
67- 75 Siltstone, grayish-green
75- 80 Sandstone, greenish-gray, silty
80- 95 Siltstone, light-gray, sandy
95- 96 Gaystone, Hght-gray, silty
96-100 Lignite, black
100-103 Siltstone, light-gray
103-104 Sandstone, grayish-green, cemented
104-107 Siltstone, grayish-brown
107-118 Gaystone, greenish-gray, silty
118-120 Sandstone, greenish-gray, silty, very fine grained 120-134 Gaystone, grayish-brown, silty, carbonaceous 134-137 Sandstone, greenish-gray, very fine grained 137-140 Siltstone, grayish-brown, clayey
140-148 Gaystone, greenish-gray
148-1.49 Lignite, black
149-154 Sandstone, green, very fine grained
. 154-160 Siltstone, green, clayey

- 0-0

-20C» 60

-250

~ -80

- 300

_ -lOO

- 350

418

Hole number L 43

SP Resistivity
Sens, setting_5.Q.MV Sens, setting .50.. Recording speed 20 ft/min Recording speed _2Q ft/min Logged depth _. JL60.fi;_ Logged depth _... JL6.Q. £t. _

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Depth

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-200 60

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- 250

- 300

L- -loo-

- 350

419

.LA4__ __ Map: Marmarthl NW T Date:. e: ___Np_ County:_Sl9££ Elev.:_-2,94.0.it_..Location: T.115&, R._l.Q4w , Sec..2.5- ,Tract:._ccbb _ Drilled depth: _J.6^_ __

^Mtr IXK r -> c_ ^_ Measured: L.QOOLft_ FSL, _1.10jtFWL, Hole size: 4 3A in._ Air LJ Neater DC] Cored: Yes [J No Q3
Lignite beds:-22-^.57-60; 113-117 . ...__......... .. _________ _

Remarks:

Lithology
Recorded by:_Eichard.Scajt.o_lini

Geophysical logs
_ Geologist SWC recorded by: .. Lechner ..__.

Lithology

Gamma

T.C. ._2_ Range 10Q.cgs_

Recording speed 20.^1 min

Logged depth _160 ft

Density

T.C. JL. Range JLQQjcps

Recording speed 2fi'V

Logged depth _L^O ft

C"O t ^ J ' ~

Depth

S 2

S 4? fcu 2

0- 5 Siltstone, yellow
5- 7 Siltstone, brownish-yellow, carbonaceous 7-11 Sandstone, yellowish-gray, silty
11-12 Clay stone; lignite
12-21 Sandstone, grayish-yellow
21- 27 Lignite, black
27- 29 Claystone, brown
29- 35 Claystone, pale-grayish-green
35- 36 Lignite, black
36-41 Clay stone, grayish-green
41-42 Claystone, light-yellow
42- 43 Lignite, black
43- 47 Claystone, brownish-gray
47- 50 No samples
50- 56 Claystone, grayish-green
56- 61 Lignite, black
61- 69 Claystone, medium-grayish-green, slightly silty 69- 77 Siltstone, dark-grayish-green
77- 79 Claystone, greenish-gray
79- 81 Lignite, black
8J- 91 Siltstone, dark-grayish-brown
91- 92 Lignite, black
92- 95 Claystone, mcdium-grayish-green
95-1 i 2 Qaystone, medium-gray
112-115 Lignite, black
115-117 Sandstone, dark-brown, very fine grained, carbonaceous

117-125 Qaystone, daik-grayish-brown
125-135 No samples
135-148 Claystone, pale-grayish-green
148-155 Sandstone, gieen, glauconitic
155-160 Siltstone, grayish-green

- 0-0

-20

-ZOO"60

250

r -so

-300

_ -100

350

420

Hole numbe 44

SP
Sens, setting - -5D MY_. Sens, setting

Resistivity Depth

Recording speed ^Q_ ft/ m in Recording speed -ZQit/m in i £ £ Logged depth _.. ,l6Q.ft. Logged depth -16.Q fl....__ £

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-4

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h-0-0

50

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-40:

- 200"60

r

250 '
- 80

- 300

- 100

- 350

421

Hole No: __ L_!5 _ . __ Map ! _ Rocky Ridge_ _ Date: ._M9£77_ State: _ND __ County: Slope _

Eiev.:_-2,835j[t_ Location: T..136*. R..10Q$. Sec.. 2_0_., Tract:. _k!>]>tL Drilled depth:_660_ft ____ Measured: _iQ_£t_ __ xsk, ._.6_Qjt FWL, Hole size: _JL%.ln:._ Air Q Water [X] Cored: Yes Q No fX] Lignite beds: .40-4^0.05,112; 202-211; 252-254; 334-348; 351-356; 374-376; 475-489; 530-532; 549-564; _

__642-645 ....
Remarks:

Lithology
Recorded by : ^.

Y Geophysical logs
.. ..__.._ Geologist ocac recorded by: . _ Lechner

Lithology

Gamma

T.C.-JL Range 10Q cps_
Recording speed 2Q**lm'm

Logged depth _6j6Q.£t_

Density

T.C. _2_ Range _10ILcps
Recording speed ^O.'

Logged depth 659 ft

Depth

II

0- 27 Sandstone, yellowish-brown, very fine grained

27- 28 Claystone, dark-gray, carbonaceous
28- 39 Claystone, medium-gray
39- 44 Lignite, black
44- 80 Claystone, grayish-green

-0-0

- 20

80- 95 No samples
95-105 daystone, gray
105-115 Lignite, black and woody

115-120 No samples
120-127 Siltstone, medium-gray, clayey
127-138 Cluystone, medium-gray
138-140 Sandstone, yellow, medium-grained to fine- grained
140-155 Oaystone, medium-gray
155-180 No samples

180-185 Sandstone, yellowish-brown, medium-grained 185-206 Claystone, medium-gray

206-215 Lignite, black

215-254 Oaystone, medium-gray, silty

254-255 Claystone, dark-gray, carbonaceous 255-257 Lignite, black
257-334 Siltstone, greenish-gray, clayey

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2.20 .'r.'i

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334-338 Lignite, black
338-345 Claystone, black
345-347 Lignite, black
347-354 Claystone, gray
354-356 Lignite, black
356-375 Claystons, medium-gray

;J^Or

Hole number continued

L45

Lithology

- 375-376 Lignite, black
_ 376-390 Sandstone, grayish-green

"~ 390-430 Claystone, pale-green

430-431 Lignite, black
431-469 Claystone, greenish-gray

469-472 Lignite, black

472-483 Claystone, light-gray

483-484 Lignite, black
484-486 Claystone, light-gray
486-488 Lignite, black
488-504 Claystone, light-gray
504-505 Lignite, black
505-523 Claystone, light-gray

523-524 Lignite, black
524-536 Clay stone, light-gray
536-537 Lignite, black
537-542 Clay stone, light-gray
542-544 Lignite, black
544-548 Claystone, light-gray
.548-550 Lignite, black
550-553 Claystone, gray
553-556 Lignite, black
556-579 Sandstone, gray
579-584 Siltstone, gray, clayey
. 584-590 Sandstone, gray
590-620 No samples

620-627 Claystone, greenish-gray
.627-641 Sandstone, gray

'641-642
642-645
645-648
648-653
653-656

Lignite, black
Sandstone, gray
Lignite, black
Sandstone, gray
Lignite, black
656-660 Claystone, gray

Gamma

T.r. 2 Rang,* 100 cps Recording speed 20 ft/min Logged depth 660 ft

Density

T.C.. 2_ Range 100 cps Recording speed2Q_/c/min Logged depth 659 ft

Depth

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f*^E3- -120

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v rCx -- - - - * -- . ~ ~_zj** -

-650 -200

- 700

- - 220

- 750

423

Hole number 45

SP

Sens, setting __5Q_M.V_ Recording speed 20_ ft/mi Logged depth _.660_ft.._

Resistivity
setting - 5.0
in Recording speed 2.Qft/min Logged depth -660 .&.___

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Depth

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-300

- 100!

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Hole number continued
L45

SP

Sens, setting_ 5.0 MV Recording speed _20_ fy Logged depth _.660 ft

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i

Resistivity
Sens, setting ____5CL..._ min Recording spced?0 it/ min Logged depth 660 ft

Depth!

C - ! o ° !

tu 5

j- -120'

f-400 ;

U-450
- 140,

- 500

- - 160.

r ;

^. -I80:

- 600 ;

r
L

'-650 I

: -200,

L

700

r -220.

\-750

425

L 46 __ Map: _ g or ley Ridge Date: 9-19-77 State: ND County : _Sjope . ___

Elcv.: _ 2,740 jt_ Location: T. 136ac, R.lQlw , Sec. _21_ , Tract: __accc__ Drilled depth: _.._460 ft Measured: 2.585 ft $k 2AWS&. Hole size: 4 34 in. Air D Water Q Cored: Yes Q No Lignite beds: 52^60; 84-88; 99-101 ;_108.-_1 10; 126-128; 133:115; 256-268; 275-284: 299-303: 305-307: 310-.315

Remarks: .

Lithology
Recorded by:_lUchadJkattoIini

(. cophysi'jal logs
Geologist a* recorded by: .._ Lechner

Lithology

Gamma

T.C. __2_ Range

Recording speed 20. Wmin

Logged depth

Density

T.C. 2 Range 100 cps

Recording speed 211 "/min

Logged depth 459 ft

Depth

w o

21

0-14 Silts tone, yellowisli-brown, clayey

14-16 Claystone, brown
_ 16- 19 Siltstone, brown
19- 34 Qaystone, yellowish-brown
- 34- 39 Claystone, light-medium-gray
39- 41 Oaystoner dark-gray, carbonaceous
~ 41- 52 Claystone, medium-gray

- 52- 58 Lignite, black
58-77 Claystone, medium-gray

- 77- 78 Lignite, black
_ 78- 84 Claystone, dark-greenish-gray, silty
~" 84- 83 Lignite, black
- 88-91 Qaystone, dark-gray, carbonaceous
91- 98 Claystone, grayish-green, silty
98- 99 Lignite, black
-- 99-104 Claystone, medium-gray
_ 104-105 Lignite, black
105-107 Claystone, medium-gray
- 107-109 Lignite, black
109-113 Claystone, medium-gray
"113-114 Lignite, black
114-125 Qaystone, medium-gray, silty
~ 125-127 Lignite, black
- 127-132 Siltstone, light-gray, clayey
132-133 Lignite, black
~~ 133-142 Claystone, grayish-brown
_ 142-145 Lignite, black
145-205 Siltstone, grayish-brown

- 205-250 Qaystone, medium-gray

L-o-0

-20

- 250-263 Lignite, black

- 263-270 Qaystone, gray

~ 270-286 Lignite, black

- 286-289 Claystone, light-gray
._ 239-297 Lignite, black
~ 297-300 Qaystone, light-gray
-300-301 Lignite, black
,301-303 Qaystone, gray
303-312 Lignite, black
- 312-320 Qaystone, «ray
__ 320-335 Lignite, black
"~ 335-355 Siltstone, grayish-green, clayey

355-410 Qaystone, grayish-green

426

Hole number continued
L46

Lithology

.410-440 Siltstone, medium-gray

440-460 Sandstone, gray

Gamma Density T.r 2 Ring* 100 cps T.C._2 Rangg 100 cps Recording speed-20_rt/min
Logged depth 460 ft

Recording speed 20_ft/min
Logged depth _45£Jl_

Depth

- 500

- - 160

- 550

180
-60O

- 700

- - 220

r
r
[-750

427

Hole numberL46
SP
Sen*, setting _5.0_MV
Recording speed _2& (t/min Rec
Logged depth __
Resistivity
Sens, setting 50.
Logged depth --_4-60.ft..._
"1
Depth
-o-o
-50
-20!
r
hi oot
j-150
'
r
L
h
-40
r250 !
L.. _80;
j-300
r
L -,
U
1-350
;
r
428

Hole number continued
L46

Sens.

SP
_ 50 MV

^

Recording speed ^Q_"/min
Logged depth __ 460. ft _

Resistivity
[Sens, setting __._50_..._
Recording speed20/Vniin
Logged depth 460 ft

- I

1

1

-j

J
-i

J

-|
.J

i i

"1
- \

Depth

t

L,400

1-450
I -140;

h i
j-500 j

u ',
I

i- -160;

r ; K-
i ;
^550 I

h

h
p i
L -I80i

l-soo ;

'-650 i
: -200!

- 700

1 -220.

[-750

429

riole No:
Elcv.:

I, 4? Date: _8z23^ZZ_ State:
L_ Location: T. JL3& X , R. 1Q-2.W. Sec. _1I_, Tract: __ccdd.
Measured: _6fl_£t__ FSL. U)Q.QJEtfH Hole size: 4 3/4 in.._ Air D Water Lignite beds: . -62iZlL80^.89;.113-116i.l 18-120; 126rl32 __...___..._._ ... _.

ND County: Slope
. Drilled depth: __160jft
Cored: Yes Q No

Remarks: .

Lithology
Recorded by:

Geophysical logs
Geologist v* recorded by: . _ Lechner

Lithology

Gamma

T.C.-JL. Range 1QQ cps
Recording speed 20."/min
Logged depth 160 ft

Density
T.C. -2. Range 100 cps
Recording speed 2H"/min
Logged depth 160 ft

Depth

_> o

U,

Sandstone light-yellow, very fine grained
Siltstone, light-yellowish-gray

0- 7
7- 12

12- 22 Claystone, whitish-gray
22- 32 Siltstone, yellowish-gray
Qaystone, whitish-gray

-o-o

- 32- 51

51-57 Qaystone, greenish-gray
57- 70 Qaystone, gray

70- 77 Lignite, black
77- 80 Siltstone, gray, sandy
80- 90 Lignite, black
90-107 Siitstone, gray, sandy
107-114 Qaystone, gray
114-119 Lignite, black
. 119-128 Qaystone, grayish-green
128-137 Lignite, black
'137-150 Silts tone, brownish-gray

150-157 Siltstone, greenish-gray
157-160 Sandstone, greenish-gray, very fine grained to fine-grained

-20

i_.. ' . "v V-T.. .."- ... --. rr*. *£- *. . JT?

-25O
~ -80

-300

. -100

350

430

Hole number L 47

SPUi Resistivity 1X1. JU^lH lb
Sens, setting 50_MV Sens, setting 50 Recording speed 2Q_ ft/ m in Recording speed-2Qit/ Logged depth __16J}..ft_ . _ Logged depth _ I6DJt.._._

min

Depth

- I

- I

r v-

T^-fcS

^-0-0

- 50

HOO
L

- 40

150

250
- 80

I
- 300
i
r

- 100

1-350

431

Hole Nn; L48 __ Map; Medgra 4,SE __ Date: 8-23-77 State: ND County; Slope ______ Elcv.: _ 2 JQO..£L- Location: T.JL36*. R.1Q2.W. Sec. J21L. , Tract: _lccd ._ Drilled depth: 4.70ft _

xss. PEL Measured: 20 ft FSL,2^28JL& FWB. Hole size:
Lignite beds: ._.l40-166q74-183 .... _. ..

Air D Water H Cored: Yes Q No

Remarks: .

Lithology
Recorded by: Michael Camara

Geophysical logs
Geologist sac recorded by: . JLgchner_.. ..___.__

Lithology

T.C

Gamma

2 Range HKLcps.

Recording speed 2jGL"/min

Logged depth 470 ft

Density

T.C. -JL_ Range 100_cp_s.

Recording speed2IL*t/min

Logged depth 470 ft

Depth

0-10 SUtstone, yellowish-brown, clayey

_ 10- 27 Sandstone, yellowish-brown, fine-grained to
very fine grained
27-31 Siltstone, dark-brown, .to black, carbonaceous; _ with lignite fragments
31-47 SUtstone, light-gray
47- 48 SUtstone, gray, sandy
48- 50 SUtstone, dark-brown to black, carbonaceous
~~ 50- 55 SUtstone, greenish-gray
55- 57 Siltstone, greenish-gray, sandy
"" 57- 68 Sandstone, greenish-gray, very fine grained
_ 68- 75 Sandstone, dark-brown, silty, carbonaceous
75- 84 Siltstone, greenish-gray
84- 86 Claystone, light-gray
_ 86- 87 Limestone, light-gray
~~ 87-104 SUtstone, light-gray
104-105 Lignite
105-114 Gaystone, light-greenish-gray
~" 114-134 Siltstone, light-gray

134-136 Claystonc, gray
136-137 Lignite
~ 137-140 Claystone, light-gray, silty
__ 140-145 Lignite
145-154 Claystone, light-gray
154-160 Lignite
160-163 Claystone, light-gray
"163-166 Lignite
_ 166-171 Siltstone, grayish-white
171-176 SUtstone, greenish-gray
176-181 Lignite
_ 181-187 Claystone, grayish-brown
187-260 Sandstone, greenish-gray, very fine grained to . fine-grained; poor samples

-o-o

- 20

260-275 Siltstone, light-grccntsh-gray, sandy

275-281 Siltstone, dark-grayish-brown, clayey

281-290 Siltstone, grayish-brown

290-314 Sandstone, greenish-gray, very fine grained to fine-grained

314-337 Siltstone, dark-grayish-brown, sandy

337-338 Lignite
338-394 Sandstone, greenish-gray, very fine grained to fine-grained

t"*"*~* ^ - "7* ' ~ '~'^*-^ '_j '-: "' - - - '
r _.._ ^_ _ T-^IT rrrr ^" r"." ~^. ' i

=;A-:^i60

y-^'.j,-- --T__.,n._.._^^,^ i--^-^--,:: j_ ^^ . -f~~^ j-, T^J * Af\

"r^.- r:-^-' VT"'T7T--.r .I- *n~ ' ,* -- -T^15^*'^'~^"-''^~

Err^EEF^ 100

432

Hole number continued
L48

Lithology

394-395 Sandstone, white, very fine grained, silty 395-405 Sandstone, grayish-green, very fine grained 405-415 Siltstone, dark-brown, clayey, carbonaceous 415-420 Siltstone, grayish-green, sandy
420-430 Siltstone, dark-grayish-green
430-450 Siltstone, very dark gray

450-465 Claystone, dark-grayish-brown, silty 465-470 Siltstone, dark-grayish-brown, sandy

T.C

Gamma
2 R? ng* 100 cps
Recording speed JZQ-ft/min
Logged depth 470 ft

Density
T.C. __2__ Range 100 cps
Recording speedlQJVmin
Logged depth 470ft

-400

~ "~~ ' ~'~ -- - ~'- ~

S-450
- 140

V?o

. . n.

~ -fr

Depth

*^ o

-500

- - 160

-550

- - ISO
-600

-650 -200

- 700

- - 220

\-750

433

Hole number L 48

SP

Sens, setting ...5Q.MV__ Recording speed 20 ft/min Logged depth _.. 42.Q ft

i

Resistivity
Sens, setting 5P - Recording speed2Q.it/min Logged depth _._470_ft..__

Depth

- 0-0

- 50

r -20:

i-
HOO

150

h

-ZOO"60

- 250
i
- - 80

r-300

- 100

- 350

434

Hole number continued
L48

SP j Resistivity Sens, setting.._50 MV iSens. setting___.5CL. .._ Recording speed_2jQ_ft/minRecording speed20.wrnin Logged depth _._470.ft ._

-J

H

- I

Logged depth . 470 ft

Depthi

4_, <U <u "
t) £2

_ i ^~^.~~ ~^« ^T J f*

j- -.20
1-400 ;

L450
- 140;

500 i

I- -160:
r i

-550

{

1
H

_J

. -180!
-600 ,

650 !
- 200!

J

. - 700

- 750

435

Hole No:___LJL(L___ Map: Medora 4 SB. Date: 8-23-77 State: __ND_County: Slope Eiev.: __2J20 jt_ Location: T. -US*, R.1Q2.W , Sec. _3L, Tract: __4.444__ Drilled depth: __200ft_ Measured: 20ft. $S? __.6(LfcK*k. Hole size: 4 K in._ Air D Water 13 Cored: Yes Q Lignite beds: .__.5kZ&-l 06-11.0.. ._..._..-.- -.... ...._......_.... ... _______

No

Remarks: .

Lithology
Recorded by:.E_JidaJJLR.cichfij±.

Geophysical logs
Geologist sac recorded by: ._ JLephner_.. .._. _..

Lithology

Gamma

T.C. _2L Range 100 cpi.

Recording speed 20"/min

Logged depth _ 200 ft

Density

T.C. _2_ Range .100 cps

Recording speed^ "/min

Logged depth 200ft

Depth

0-12 Sandstone, whitish-yellow, very fine grained

12-15 SUtstone, yellowish-gray
15- 13 SUtstone, yellow
"~ 18- 38 SUtstone, light-gray
38- 40 Sandstone, light-gray, very fine grained, cementej

~ 40-41 SUtstone, yellowish-gray
_ 41-43 Lignite, black
43- 56 Claystone, gray
_ 56- 77 Lignite, black

77- 86 Claystone, greenish-gray, silty

- 86- 88 Lignite, black
_ 88- 93 Claystone, white, silty
"~ 93-100 Claystone, green
- 100-106 Siltstone, greenish-gray, clayey
106-108 Sandstone, greenish-gray, very fine grained to ~~ fine-grained
- 108-115 Lignite, black
115-123 Claystone, greenish-gray
~ 123-130 Siltstone, greenish-gray, clayey
_ 130-136 Siltstone, dark-brownish-gray
136-150 Sandstone, gray, very fine grained to fine-
- grained
150-200 No samples

-250

- - 80

- 300

. -JOO

- 350

436

Hole number L 50

SP

Sens, setting_50_MV
Recording speed 20- fymin Recording

Resistivity
Sens, setting .50.
si

Logged depth __ 2QO..ft__

i

- i

Depth

Logged depth -200 ft_.._._

m

j f
r"" "" -'' '" "d i

- 0-0

r50

.i: -

I
r

r
^-100
L

- 40.

,-150

-250 i

- - 80

- 300

-350

437

Hole No: LSI ,Map: MedoraA-SW Dace: ft-7.4-77 State: _ ND County Slope______ Elcv.: 2*876 ft_Location: T.1M.S , R.LQlw, Sec. J_,Tract: -dcac _ Drilled depth :_._500_£L

_ _ _ f £t£L ^ «»-« / FEL .. i . A 3/ : » fvi »ir_^-_ I I /^^__ J. \s_ f 1 Measured: _ 800 ft Hole size: 4 %.in.. Air B Water D Cored: Yes D No Lignite beds: .«2l2=222t251-257; 28a.-29^; 3.20-323;.A68-47.7.._...._ .

Remarks:.

Lithology
Recorded by: Mifihafi

Geophysical logs
Geologist xac recorded by: .

Lechner

Lithology

Gamma

T.C- i .^.-. 2_Range-liKL ^_ rw*ngc
Recording speed 20«/min

Logged depth _ 495 ft

Density

T.C. i Range 500 cps

Recording speed J2D"/min

Logged depth 480ft

Depth

0-20 Gravel, orangish-brown, fine-grained to medium-grained

20-52 Gravel, orangish-brown, coarse-grained

52-55 Sandstone, brownish-orange, very fine grained, cemented

55- 90 Sandstone, yellowish-brown, very fine grained; poor samples

90-100 Claystone, light-yellowish-gray

100-115 Siltstone, light-yellowish-gray

115-117 Siltstone, black, carbonaceous
117-121 Clay stone, gray
121-122 Gaystone, yellowish-brown
122-123 Siitstone, yellowish-brown
123-125 Siltstone, brown
125-127 Siltstone, dark-brown to black, carbonaceous 127-128 Siltstone, light-gray
128-130 Claystone, gray
130-140 Siltstone, light-gray
140-142 Claystone, light-grayish-green
142-160 Sandstone, greenish-gray, very fine grained; poor samples
160-500 No samples

-0-0

-50

-20

-40

Hole number continued
LSI

Lithology

Gamma

T.C._2_ Range _lM-qis Recording speed 20 Logged rlgpfh 495 ft

Density
T.C. J__ Range 500 cps Recording speed2Q."/min Logged depth ^80 ft

__-r-- ^

Depth

*j O

II

- - 160

-550

L -180
1-600

- 700

- -220

- 750

439

Hole number L 51

SP

Sen*, setting 50_MV Recording speed _2Q_ &/ mi Logged depth _.__495.ft_

Resistivity
s. setting 50 ording speed 20. fym in depth _19i.ft_..__

i

Depth

12 « «

II

-o-o

r-50

- -ao;
I- i

t
r'50

r

:
!~ I
- 250 i

5- -ao

-300

I-35C

-

440

Hole number continued
LSI

SP I Resistivity
Sens, setting_ 50 MV .Sens, setting __._5Q_..._- Recording speed_2Q_ft/miniRecording spced?0ft/min Logged depth _._.495_ ft _ Logged depth 495 ft .

"1

-i

i

*

- I
i
!

J
- I

Depth!

j. _...__

- 120-

+00 ;

-450
- I40:

- 160!

-550

I

.. -I80;

- 600 .

'-650 ;
' -200!

!

I
J

_J

- 700

-- - 220

- 750

441

. L52 __Map- Medora4S£ pate: 8-24-77 State: ND County: Slope

Elcv.:_2,680 fL. Location: T. 136 «, RjOlw, Sec. 22_, Tract:__adda._Drilled depth: 160ft _.._

Measured: 2.000 ft FSL, _.a5J&S. Hole size: 4 % in. _ Air D Water Q Cored: Yes Q No (2 Lignite beds: .46-71 .. . ._ . _. ....._. . ... _ ...__

Remarks: .

Lithology
Recorded by: Michael Camara

Cicophysical logs
Geologist N* recorded by: Lechner_.. .__.__

Lithology

T.r.

Gamma

2

Recording speed 20ftymm

Logged depth _ 160 ft

Density

T.C. .2_ Range 10_Q_c

Recording spe<

Logged depth 160 ft

Depth

4J O

I I

- 0- 4 Sandstone, yellowish-brown, very fine grained
4-10 Sandstone, yellowish-gray, very fine grained 10- 13 Siltstone, yellowish-brown, mixed with orange siltstonc
13- 17 Siltstone, yellowish-gray
- 17- 23 Siltstone, light-gray, clayey
23- 28 Claystone, dark-brownish-gray
" 28- 30 Claystone, light-gray, silty
- 30- 39 Siltstone, light-gray
39- 46 Claystone, light-gray
- 46- 50 Lignite
50- 51 Claystone, light-gray
- 51-70 Lignite
. 70- 72 Siltstone, gray, sandy
72- 75 Siltstone, brownish-gray
- 75- 77 Siltstone, dark-brown, carbonaceous
. 77- 88 Claystone, greenish-gray
88- 92 Siltstone, greenish-gray
- 92- 95 Siltstonc, gray
95- 97 Claystone, greenish-gray
97-100 Siltstone, light-brownish-gray
- 100-117 Siltstone, greenish-gray
117-125 Claystone, greenish-gray
"125-130 Siltstone, greenish-gray
.130-145 Siltstone, dark-brown, carbonaceous 145-150 Claystone, light-gray, silty
- 150-155 Siltstone, light-gray
155-160 Siltstone, brown, carbonaceous

-o-o

- 20

100

|-250

- - 80

- 300

_ -100

- 350

442

Hole number L 52

SP

Sens, setting . -50..MY Recording speed _2Q_ ft/ min Recording Logged depth __. _16Q.ft__

Resistivity
Sens, setting 50

- i

speed 20. w min
Logged depth -JUSD.ft ..._

- .y o_-^i

==:^EE^

. «-._. j» jfc. __ _.» _

=ygg---=r
'! -^/^
^

Depth

2

- 0-0

L
-50

- 20!

- 100

L_

-4o;

150

- 200-60

r-250 .
- - 80;

r !

'-300
r~

' i
- 1001

'--350

443

Hole No:_. _ .L_53_ __ Map: _ McdojcaA NW ._ Date : ._jy..6rZ7_ State: ND County : Golden Vajley_ Elcv.:~2,aS6.£t__ Location: T.lMx, R.JL04w, Sec. ..3...... Tract: ._aaaa _ Drilled depth: _2_6p_£t_ _ _._ _ Measured : ^7Ji t __._ J*K, _12.£L_KWK Hole size: ___4jiJJb_ Air D Water 53 Cored: Yes Q No [X] Lignite beds:. _I9-2i^.O.-^4;2^4-227;_237-239

Remarks:

Lithology
Recorded by: Randall-Rcichert

Geophysical logs
.___ Geologist MZC recorded by: . ._!-ejchn_er_

Lithology

Gamma

T.C. _2_ Range JLCHLcps_

Recording speed ZTrV

Logged depth _J26Q

Density

T.C. -JL Range

Recording speed 2

Logged depth 260 ft

Depth

o -
8 «

0-15 Siltstone, yellow, sandy

15- 20 Lignite, black

20- 25 Siltstone, yellowish-gray, clayey
25- 32 Sandstone, yellowish-gray, very fine grained 32- 52 Sandstone, gray, very fine grained

52-56 Gaystone, greenish-gray, silty
56- 59 Siltstone, greenish-gray
59- 84 Sandstone, greenish-gray, very fine grained, silty

84- 89 Siltstone, greenish-gray, sandy
89- 91 Lignite, black
91- 93 Siltstone, greenish-gray
93- 94 Lignite, black
94- 95 Sandstone, greenish-gray, very fine grained 95-107 Claystone, grayish-brown, silty
107-118 Claystone, gray, silty <
118-151 Siltstone, brownish-gray, sandy

- 151-165 Sandstone, brownish-gray, silty, very fine
_ grained to fine-grained
165-172 Siltstone, gray, sandy

- 172-173 Lignite, black
_ 173-182 Siltstone, brownish-gray
182-192 Siltstone, green, clayey
- 192-197 Siltstone, gray, clayey
_ 197-200 Siltstone, green, sandy
200-206 Claystone, gray, silty
- 206-208 Lignite, black
208-216 Claystone, greenish-gray, silty
""216-217 Sandstone, white, very fine grained
__ 217-223 Siltstone, whitish-gray, clayey
223-225 Siltstone, gray
- 225-227 Lignite, black
_ 227-236 Siltstone, gray, clayey
236-240 Sandstone, greenish-gray, very fine grained
-- 240-251 Siltstone, greenish-gray, silty
_ 251-256 Claystone, gray, silty
256-260 Sandstone, white, very fine grained

f-0-0

h-50

- 20

-100

40

150

- 300

. -100

-350

444

Hole number L 53

SP
50 M V

Recording speed 20 tt
260 ft
h-

]

1-j
i

j -\

J

j

Resistivity
lg _y _5JL

Depth

ft/min Recording speed.2Q.ft/min Logged depth ._260 ft._

,'1 ' ".' ."... _ _ . . i)

i ->fc=r

' *-

^-. r ' _ ti Y ___ ^ __ _ __ . _ _ _ __,
"__-__^L_L_,_ JJ. Jm :- J_'-.^-,.|-ni, . _,r^^£^ ^~-*"~~ s ' '" "'"""'""^^
* j- ^T - .~_q -_ _ ^_ -_ -jT^--" _ _ __ T^^_-^i
- ... -.__..! . _J '" " - ~ ^^'- - ~.. T-^T 0-- .r. 1

- 0-0

L

[-50
I
r _20!

L i

i L ~ 40'
! I

hso

-200-60

- - 80

-500

-lOOi

^350

445

-lole N*V L 54 Map: Mednra4SW Date: 8-31-77 State: ND County: Slope ____ Elev.: __ 2i690 ft_ Location: T. 136JJ t R.JO_4$, Sec. _UL , Tract: . JfeW>_ Drilled depth: 200ft _.._ Measured:... 48 ft
Lignite beds:. .26^2

Remarks:
Lithology
Recorded by:

Hole size: ___4&ilk- Air (XJ Water Q Cored: Yes D No

Geophysical logs
Geologist NO recorded by: Lechner_.. .__._..

Lithoiogy

Gamma

T.C. 2. Range 100 cps
Recording speed 20ft/mjn
Logged depth 200ft

Density
T.C -3- Range 500 cps
Recording speed ZQ.'
Logged depth 198ft

Depth

<_, <U

No samples _.._-- . --.,.. --- -0-0

h50
- 20

r-100

.... ----.- - --_ :i-r_s ~^Jr-r.".-.:_ -40

150

ISO

446

- 250
- - 80

-300

_ -100

- 350

Hole number L 54

Sens, setting_5Q_MY
Recording s
Logged depth _. J2DQ Jt._

- I

1I

] -1
i
1
1

-1

SP Resistivity Sens, setting
peed _2_Q_ ft/ min Recording speed_2_Qft/min Logged depth 19.8..ft.._._

Depth

<u

S

- 0-0

hso i

r-

1-100

M50

- 200-60

- 250

L -00

- 300

100

- 350

447

lole Nn; L55 __Map:-_Me.dQiaJ.SW_Hare: 8-30-77 State: ND County: Slope ;]cv.;_2,880 fL_ Location: T. Ill*, R.Ifllw, Sec. 26 , Tract: ___aabb_ Drilled depth: _240 ft ._ Measured: 42ft j§K.U.44UEt K»k Hole size: 4 3/4.iiL, Air H Water Q Cored: Yes Q No .inite beds: .-.16M74;.188-198 . .__ ... . _____.._._ . .. ._ _ ..

Clcophysicu
Geologist NO recorded by: . Lechner

Lithology

Gamma

T.C. 2. Range IQO cps
Recording speed 2Q"/min
Logged depth 240ft

Density
T.C. _2_ Range 100 cps
Recording speed 20.fr/min
Logged depth 240 ft

Depth

M <u II
a -0-0

- 20

- .- .-7! / SO ' - ~ - -

r250
F~ -80

-300

. -100

-350
448

Hole number L55

SP

Sens, setting 100 MV

Resistivity
Sens, setting 100__
Recording speed _2Q rt/ min Recording speed-20.it/min Logged depth _. .240 _ft._ Logged depth _24Q ft __

J

J

Depth

- 0-0

u

h-50

hiOO i-

- 40'

M50

1-200" 60

p250 :
L-- -80

- 300

- 100:

-350

r

449

Hole No:

Elcv.:

L56 ____ Map; Medora 3 SE Date: 8-11-77 State: ND County: Golden Valley __

2,634 ft Location: T. .1362 , R. l.Q5_w , Sec. .26

Measured: _20QJt_,_5P_ft_wL, Hole size:

Tract: _aaa_a___ Drilled depth: _JL6?

4 % in. Air D Water B Cored: Yes D No

Lignite beds: . JL2d5^1-Z3:98-lQl;147:14_9;152-154 _

Remarks:

Lithology
Recorded by: Michael Camara

Geophysical logs
Geologist*!* recorded by: Lechner

Lithology

Gamma

T.C. 2 Range 100 cps

Recording speed J^

Logged depth _160jt

Density

T.C. _2_ Range 100 cps
Recording speed 212-1

Logged depth 160ft

Depth

0 * *

Is

0-5 Siltstone, light-olive-gray, sandy
5- 6 Siltstone, white, sandy, cemented
6-7 Siltstone, brownish-orange, cemented
7-10 Gay stone, dark-olive-gray
"" 10- 17 Siltstone, dark-olive-gray
17- 18 Siltstone, brownish-orange
18-21 Sandstone, grayish-brown, silty, very fine grained 21-22 Clinker
_ 22- 28 Siltstone, olive-gray, sandy
28- 30 Claystone, greenish-gray
_ 30- 31 Siltstone, grayish-brown
31- 35 Sandstone, grayish-brown, very fine grained
35- 37 Siltstone, dark-grayish-brown
37- 39 Sandstone, grayish-green, very fine grained to ~~ fine-grained
39- 40 Siltstone, dark-brown to black; with lignite fragments
40- 44 Lignite
_ 44- 47 Claystone, dark-olive-gray
47- 53 Siltstone, dark-brown to black, lignitic
~~ 53- 55 Lignite
_ 55- 56 Claystone, dark-brown, lignitic
56- 60 Siltstone, dark-olive-gray
60- 61 Sandstone, dark-grayish-brown, silty
61-63 Siltstone, dark-brown, lignitic
" 63-71 Lignite
71- 75 Siltstone, grayish-green
75- 96 Sandstone, grayish-green, very fine grained to fine-grained
_ 96- 99 Siltstone, dark-brown to black, lignitic
99-100 Lignite
100-105 Siltstone, dark-brown to black, lignitic 105-115 Sandstone, grayish-green, very fine grained
~" 115-125 Siltstone, dark-grayish-green
_ 125-138 Sandstone, grayish-green, very fine grained to
fine-grained
~ 138-139 Sandstone, white, very fine grained, cemented
_ 139-148 Sandstone, grayish-green, very fine grained
to fine-grained
148-152 Lignite
_ 152-155 Siltstone, dark-brown, lignitic
155-160 Claystone, light-gray, silty

- 0-0

- 50

- 20

-250

- - 80

- 300

_ -«oo

-350

450

Hole number 56

SP

Sens, setting 50 MV

Resistivity
Sens, setting - 50__.
Recording speed_20_ ft/min Recording speed 20.^/01 in Logged depth 160ft _ ^Logged depth _16Q_&.__

Depth j

J

!
i
~1
i

1

2

0-0 [-
r

1-50

- 20

, L

- 150

r
-200-60

- 250 '

- - 80

- 300

- 100;

- 350

451

Hole No:__L_£Z_ __ Map: JRQckvRidge NW_ Date: Ji21-7_7__ State: ND _ County :__Bi|lings ...._ Elcv.:__2,560_ft_ Location: T. 1215 , R.iQlw', Sec. _34__, Tract:. __ cbbc_ Drilled depth: 3Mit_.._ _. _ Measured:^QOQ.ft.lsK, J,QQ.ft.^. Hole size: 4 3/4Jm_ Air D Water H Cored: Yes D No H Lignite beds:..^2-iOL.58-J_2;119rl25; 4.80^82 . ..... _._. ._._.._.. . ._ . ... _

Remarks:

Lithology
Recorded by: JWlckae.LCamar.a- _ . . Geologist Yes

Geophysical logs
recorded by: _. Lechner

Lithology

Gamma

T.C._2_ Range JLfiQ..CpS_

Recording speed 2Q"/min

Logged depth _.JiQfl ft

Density

T.C. _2_ Range _10Q_cps.

Recording speed 2iL *V min

Logged depth 500 ft

Depth

0- 20 Sandstone, grayish-brown, very fine grained to fine-grained

20-21 Siltstone, dark-brown, clayey, carbonaceous 21- 23 Claystone, light-gray
23- 35 Siltstone, yellow-gray
35- 40 Siltstone, light-gray, clayey
40- 49 Lignite
49- 56 Siltstone, light-brownish-gray
56- 57 Gaystone, dark-brown, silty, ca'bonaceous
57- 72 Lignite
72- 75 Claystone, light-brownish-gray
75- 76 Siltstone, light-brownish-gray
76- 80 Sandstone, light-brownish-gray, very fine grained 80-120 Sandstone, light-grayish-green, very fine grained; poor samples

120-125 Lignite
125-130 Claystone, grayish-white
130-137 Claystone, grayish-brown, silty
137-139 Siltstone, grayish-white
139-145 Siltstone, light-grayish-green
145-153 Siltstone, grayish-brown, clayey
153-180 Sandstone, light-greenish-gray, very fine grained

' 180-187 Siltstone, dark-grayish-olive
187-197 Sandstone, olive, very fine grained
197-2)0 Siltstone, dark-grayish-brown, sandy
' 200-234 Sandstone, grayish-green, very fine grained to fine-grained

234-245 Siltstone, grayish-green

245-255 Siltstone, very dark brown, carbonaceous

255-282 Claystone, very dark brown, silty, carbonaceous

282-297 Siltstone, grayish-green

297-360 Sandstone, grayish-green, very fine grained to fine-grained

-0-0

/ r\ i " ' '___ _ ~_ IrO L --_ J*~

-50

-20

- 100

i-150

2'r_EZT::.':! 1 4 0 - - -, :---_ - -~ ~~_ '-_-
"T . . :-_Si ,-

"" 360400 Sandstone, grayish-green, very fine grained to

-40

452

Hole number continued
L57

Lithology

360-400 fine-grained; with beds of siltstone, dark-grayish-brown, clayey

400-402 Sandstone, white, silty, cemented
402-408 Siltstone, dark-olive-gray
408-410 Siltstone, dark-grayish-brown, carbonaceous 410-447 Siltstone, dark-olive-gray, sandy

447-452 Sandstone, white, very fine grained, cemented 452-465 No samples

465-475 Siltstone, dark-gray, sandy
475-483 Claystone, grayish-white
483-485 Lignite
485-500 Claystone, dark-grayish-brown to black, silty, carbonaceous

Gamma

T.C. 2 Rang,* 100 cps
Recording speed 2P__tt/min

Logged depth 500 ft

Density
T.C. _2_Range 100 cps
Recording speed2£Lfymin
Logged depth 500 ft

Depth

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___._ _«C:^£r: 3° ^-

Ho zriTTI'.'^.._.-".'r".!""7T.?ZIZ

-550

. -180
-600

h650 -200

- 700

- -220

- 750

453

Hole number L57

SP
Sens, setting 5.Q.MVL Recording speed 2Q fymin Logged depth _~ -5QD it-

Resistivity
Sens, setting 50 Recording speed_2Qtt/m in Logged depth - 50_Q.ft.__

i

- I

Depth

2

- 0-0

H-50

-20'

HOO

- 40'

150
I-

200-60

r

r250
- 80'

r~

|-300

L -100!

-350

i

454

Hole number continued
L57

SP Resistivity
._5Q_MV___ Sens, setting __50.._...___ Recording speed_2Q_fynunjRccording speed 2(ft/niin Logged depth __5.QO ft ._ j Logged depth 500 ft

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i

1

1

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j
H

Depth3

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-450
-!40:

h !
p500 i
i

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i-

L : i

- 550 i

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r i i
L -ISO:
1-600 I

r650 !
! -200

- i
t

i

- 700

L-,750

455

Hole No:___ .U53_.__Map: Medpra4NE__Date: JL2&L7_State: _ND_County ;_Billing.,

Elcv.:__2,55jQ_ft__. Location: T..131* , R.1Q2.W, Sec.__2_._, Tract:._accb__Drilled depth: _6_0_QA Measurcd: Z2QD fL *SK, ZjSQQ-fjEWS, Hole size: _

Lignite beds: .-_26-_22U3iLl92.;.345-34.9; 357-362.

Remarks:

Lithology
Recorded by:_B>and41.IL<asheiI ,

am. in._ Air [j Water Cored: Yes D No

Geophysical logs
Geologist NX recorded by: Lechner

Lithology

Gamma

T.C._2_ Range JLQQ-£ps_

Recording speed ZQ'Vmin

Logged depth __

Density

T.C. _2_ Range J,QO_cps
Recording speed 20_*c/min

Logged depth 598ft c*v i ------

Depth

- 0-17 Sandstone, yellow, very fine grained

- 17-22 Siitstone, yellow

- 22- 28 Gaystone, light-gray
28- 32 Lignite, black
32- 38 Siltstone, whitish-yellow
_ 38- 46 Claystone, yellowish-gray
46- 47 Sandstone, yellowish-gray, very fine grained
~ 47- 67 Sandstone, yellowish-gray, very fine grained

- 67- 70 Sandstone, orangish-brown, very fine grained,
cemented
- 70- 73 Claystone, white, silty
_ 73- BO Claystone, gray
80-112 Sandstone, light-yellow, very fine grained

112-115 Lignite, black
115-127 Claystone, light-gray
127-129 Claystone, dark-grayish-brown, silty 129-134 Claystone, gray, silty
134 135 Siltstone, brownish-black, carbonaceous 135-138 Siltstone, light-gray
138-157 Claystone, Ught-grayish-green
157-163 Siltstone, gray, sandy

163-164 Lignite, black
164-168 Siltstone, blackish-brown, carbonaceous 168-169 Lignite black
169-170 Siltstone, grayish-green, clayey
170-177 Claystone, gray
177-196 Lignite, black
196-210 Claystone, gray

210-303 Sandstone, gray, very fine grained to fine-grained

:-.. -0-0

h50

- 20

303-305 Claystone, gray
305-30'J Lignite, black
306-317 Siltstone, grayish-green
317-332 Claystonc, grayish-green, silty

332-340 Claystone, dark-gray, silty

340-343 Lignite, black
343-355 Sandstone, gray, very fine grained 355-365 Lignite, black

- i -~gr^ ~

i: '"':. '" ".."'_ _ _!""_" '__L !_T* ~^*'"~' _
r;__ .....__._" ^.T '. .^_- .._.._.

=^=L- 100

=rr'-i-.i^g-r== -350

Hole number continued
L58

Lithology

365-381 Sandstone, gray, very fine grained 381-388 Siltstone, grayish-green, clayey
3S8-422 Sandstone, gray, very fine grained

422-423 Sandstone, white, very fine grained, limey 423-445 Sandstone, greenish-gray, very fine grained

445-446 Sandstone, white, very fine grained, limey 446-500 Sandstone, gray, very fine grained

~ 500-545 Siltsrone, greenish-gray

545-550 Sandstone, greenish-gray, very fine grained 550-600 Siltstone, greenish-gray

Gamma
T.C. ? Rang* IQOcpS

Recording speed _20_JVmin
Logged depth 598 ft

Density Depth
T.C. 2 Range 100 cps
Recording speed J^
Logged depth 598 ft

«j O

o -

£ I

-650 -200

- 700

- - 220

- 750

457

Hole number L 58

SP

Sens, setting 50.MY Recording speed . 2Q fr/min Logged depth __. 52afc._

Resistivity
Sens, setting --5CL.. Recording speed JZOrc/m jn Logged depth _5.9^ ft. .._

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- I

Depth

___.j

- 0-0

50

P
- 100

L

L

-40.

~ -80

j-300

35C

458

Hole number continued
L58

J
-

-

_

SP
Sens scttmff 50 M^^
Recording speed _20__fymin Logged depth __5SL8 ft._ ._

^S

. . . . _.. .. .. _,

Resistivity Depth
Sens, setting ..J50..__ _ 2
Recording spec
Logged depth

-tprr i ' i !
r^_r=nzr^rr=d

~ " T-} i ! '

^""" u T_. .- -. -^_J _ I_^_ ^ ' * r__^. _ ; 1 " " _ .'i !!_._, !_.---

| ^%EF ' ' "
.Z«" i/" ! > i.j - -

N^=i=S

L-ET- S-

i^_ - ~- "_r-«.rr~

'

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i\r~r~ . !,.-:- ;~~rf
k ^f^rr* - i.- i. . *^..

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tnr.Crr~r"^t: . . . :

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j-400

-450
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i-

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p500

i- -160

r -

- 550
L

h

[L- -180
j r-600

] "
\
r

- 650 -200

f
i

'-- 700

- - 220

r-

j-750

459

Hole No:_.-.L_52__ __Map:_Eo£ky.-Ridge_NWDate:.8=2I-IZ__State: ND County; Billings Eicv.: 2,500. ft_. Location: T.HL^, R.LQ2.W, Sec. _24_. .Tract: aa.da..__ Drilled depth: _2QOjt____. Measured: _200_£t_ SL, _35_ft__lwL, Hole size: 4 % in. _ Air |XJ Water Q Cored: Yes Q No Lignite beds:-_175^19U97-199. . _. .... ._....._.._ _________.

Remarks:
Lithology
Recorded by:

Geophysical lugs
Geologist NO recorded by: ___Lechner.

Lithology

Gamma

T.C._2_ Range JOO cps_
Recording speed 2Q"/min
Logged depth __.2MJL_

Density
T.C. _2_ Range JOOjcps
Recording speed 2Q. *
Logged depth 200ft

Depth

~~ 0- 15 Siltstone, yellowish-brown
~ 15- 18 Siltstone, yellowish-brown, sandy _ 18- 30 Qinkcr
~"30- 200 No samples

- O-O

- 50

- 20

-250
- - 80

- 300

_ -100

- 350

460

Hole number L 59

SP

Sens, setting 5Q_MV Recording speed_2Q. ft Logged depth _ J200ft._

H

Resistivity
Sens, setting 50__ Recording speed 2Q.fymin Logged depth-_-200.ft_

Depth

t-0-0

(-50

- 20.

40!

150

J

- 300

- 100,

461

..__,_.__L_60_.__Map:J^d.QraJ:NE.__Date:._8_-.9£Z.7.__State: __MD__County:_Biliing.s....._...__ Elcv.: __2,668_ft;_... Location: T. 122_ *, R. Jl.02* , Sec. ._2&_, Tract: ..aaaa.. _ Drilled depth: ___. _6Q_0_fc__. Measured: _4QJk__l&, -7.0.ft_l»aL, Hole size: __±&in.._ Air D Water H Cored: Yes [j No (x) Lignite beds: ..J22JL24; 251-266;.291-297; 346-351; 389-392;.583-587. ... ..

Remarks: . Lithology

Recorded by: _^il^eJ_Ca_rnara____.____ _.. _.__ Geologist

Geophysical lo^s
recorded by: . Lechner_

Lithology

Gamma

T.C._2_ Range JLQO-Cps_

Recording speed20_'t/min

Logged depth

Density

T.C. _2_ Range J.QQ_cp.s

Recording speed 20.^1 min

Logged depth 600 ft__

Depth

w «J

- 0-3 Siitstone, dark-brown, sandy
3- 12 Sandstone, yellowish-brown, pebbly
~ 12- 17 Claystone, light-yellow
_ 17-21 Siitstone, Ught-ycllowish-brown
21- 30 Siitstone, brown; poor samples
- 30-31 Lignite
_ 31- 33 Claystone, light-gray
33- 35 Claystone, greenish-gray
- 35- 50 Siitstone, greenish-gray
50- 54 Sandstone, greenish-gray, very fine grained, silty
- 54- 79 Sandstone, gray, very fine grained

- 79- 85 Claystone, light-gray, silty

- 85- 89 Siitstone, gray
_ 89- 90 Lignite
90- 92 Claystone, gray
- 92-114 Gay stone, light-brownish-gray
_ 114-115 Claystone, dark-brown
115-120 Claystone, light-olive-gray, silty
- 120-127 Claystonc, grayish-green
_ 127-130 Claystone, light-gray
130-134 Sandstone, light-gray, very fine grained
- 134-135 Lignite
135-146 Claystone, light-grayish-brown
- 146-147 Lignite
_ 147-155 Claystone, greenish-gray; with lignite fragments
~ 155-157 Siitstone, light-gray
- 157-175 Claystone, light-gray
175-181 Siitstone, light-gray
~ 181-184 Claystone, light-gray
184-186 Claystone, grayish-brown, silty
~ 186-187 Lignite
- 187-190 Claystone, dark-olive-brown
190-196 Claystone, light-gray
~ 196-197 Claystonc, light-brownish-gray
_ 197-198 Lignite
198-202 Claystone, light-brownish-gray
- 202-204 Siitstone, light-gray; with lignite fragments
_ 204-215 Clay stone, iight-greenisu-gray
215-220 Claystone, light-gray
- 220-227 Claystone, grayish-green
227-228 Siltstoao. light-brown
"" 228-233 Claystonc, dark-brown; with lignite
_ 233-245 Claystone, light-greenish-gray
245-248 Claystone, dark-grayish-brown
- 248-256 Lignite
__ 256-257 Claystone, light-greenish-gray
257-261 Lignite
- 261-267 Claystonc, dark-olive-gray
267-270 Siitstone, greenish-gray
" 270-278 Claystonu, light-grayish-grccn
- 278-284 Siitstone, olive
284-286 Lignite
~~ 286-287 Claystone, light-grayish-green
_ 287-291 Claystone, light-brown; with lignite fragments,
silty
~ 291-305 Siitstone, light-groenish-gray
_ 305-307 Claystouc, grayish-green
307-310 Siitstone, greenish-gray, sandy

- 0-0

- 50

- 20

MOO

-40

trUU-._- _"I~1-.r._ -I. ~ijT. . P~ 150

:^E-:~_ ~ioo

- - 350

462

Hole number continued

L60

Lithology

310-314
314-316
316-318
318-328
328-330
330-333
333-335
335-336
336-345

345-350
350-365
365-375

375-388
388-390
390^35
435-436
436-440
440-500

500-520

Sandstone, dark-brown, silty, very fine grained Siltstone, dark-brown
Lignite
Claystone, light-greenish-gray
Siltstone, light-greenish-gray
Claystone, dark-brown, silty
Lignite
Claystone, grayish-green
Claystone, dark-brown, silty; with lignite
fragments
Lignite
Siltstone, dark-olive-gray, sandy
Sandstone, grayish-green, very fine grained to fine-grained
Claystone, dark-brown; with lignite fragments Lignite
Siltstone, dark-grayish-green, sandy; poor samples Limestone, light-brown
Siltstone, daik-olive-gray, clayey
Sandstone, dark-grayish-green, very fine grained to fine-grained
Sandstone, dark-grayish-green, very fine grained

Gamma

T.C. 2 Range 100 cps

Recording speed 20 ft/

Logged depth 600ft

Density

T.C. 2 .Range 100 cps

Recording speed20_ft/min

Logged depth 600 ft

Depth

II

520-525 Siltstone, dark-gray, clayey
525-550 No samples

. 550-574 Sandstone, dark-grayish-grcen, very fine grained to fine-grained

.574-582 Lignite

582-600 Silistone, dark-grayish-green, sandy

.. ./_. _... '.CO i=r. I _.__n.. k^rurr.

- 700

- -220

- 750

463

Hole number L 60

SP

Sen*, setting ...-50 M\L_
Recording speed 2SL fymir
Logged depth _.. -600 ft_

Recording speed 2SL fymin Recording speed_2Qft/

Resistivity
Sens, setting .50
1 lAf*.,
mm

Logged depth..__ 6pQ_ft _

T722J . * "2, *T"*"*jn *%J "* "7 "~ ".""" """" * «. "~~tl
. . . ,. .. .. ..-.__ . _. .. _ -f

Depth

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r-250 ;
!- -80'

:-30o

- 100'

(-350

r

464

Hole number continued
L60

Sens, setting _.5Q_MY.
Reco

Logged depth __6.QO ft _

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- I

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SP Resistivity
- Sens, setting___._5<L..._- rding speed _2Q_ /m in Recording speed20tc/min Logged depth 600 ft

Depth</»
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o 4i
u, 2

Moo i

450

r500 i *
I- -i60;

r :

- 550

- 180!i
r-600

(r- I

- 650 ;
-200!

- 700

- - 220.

750

465

Hole No:__L61 __ Map:_Medora_4 NW _ Date: JL5U.7_State: ND County: Golden Valley Elev.:_2.».!l5ft__ Location: T.JlZJk R.._iaJ, Sec.2___., Tract: .aaab. Drilled depth: _44.Qlt__._ . ._ Measured: JtPOjt__3RjK, .i5Qjft_|wi* Hole size: 4 % in. Air S Neater Q Cored: Yes D No 0 Lignite beds: _J.7?M72j3_7_2-374;431-4_34.... .. . ._...._.... .... __________. ....__

Remarks: .

Lithology
Recorded by: MlchaeljCamara. _ . . Geologist Ye,

Geophysical logs
recorded by: __Le.cliner__._ ..

Lithology

Gamma

T-C- 2 Range _10Qxps_

Recording speed 20. "/min

Logged depth _MQ_ft_

Density

T.C _2_ Range _10Q_cps

Recording speed 20."/min

Logged depth 440 ft

Depth

w o

- 0- 10 No samples

- 10- 21 Siltstone, light-yellowish-brown

- 21- 25 Clinker

_ 25- 33 Sandstone, light-yellowish-brown, very fine graineo>
to fine-grained
- 33- 34 Claystone, black
34- 35 Claystone, gray
~ 35- 37 Lisnite

_ 37- 39 Claystone, light-grayish-green, siliy
39- 45 Sandstone, gray, very fine grained, silty
_ 45- 56 Siltstone, white, clayey
56- 93 Siltstone, gray, clayey

93-102 Siltstone, gray, sandy, clayey

102-132 Sandstone, dark-gray, very fine grained to fine-grained

132-133 Siltsione, dark-gray sandy
, 133-140 Sandstone, dark-gray, very fine grained, silty 140-142 Sandstone, grayish-green, very fine grained 142-155 Sandstone, dark-brownish-gray, silty
155-157 Siltstone, light-greenish-gray, sandy
'157-158 Sandstone, white, very fine grained .158-160 Siltstone, light-greenish-gray, sandy
160-161 Siltstone, light-grayish-brown, sandy
161-165 Sandstone, white, very fine grained, cemented 165-166 Siltstoae, grayish-brown
166-169 Lignite
169-180 Siltstone, dark-grayish-brown, clayey
180-185 Sandstone, dark-grayish-brown
185-202 Siltsione, dark-brown to black; with lignite fragments, clayey
" 202-207 Sandstone, dark-grayisu-brown, very fine grained 207-211 Siltstone, dark-brown, clayey; with lignite fragments
' 211-220 Claystone, light-gray to white
. 220-225 Gay stone, dark-olive-gray
225-292 Sandstone, greenish-gray, very fine grained to fine-grained

292-320 Sandsfonc, grayish-green, very fine grained to fine-grained

320-321 Sandstone, white, very fine grained, cemented 321-364 Sandstone, dark-green, very fine grained to fine-grained

364-368 Siltstone, dark-gray ish-brown, clayey, sandy

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- 20

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\<TSU , - .___ . ~. . -

_ -100

-350

466

Hole number continued L 61

Lithology

Gamma
T.C.-2__ Rang,* 100 cps

Recording speed _2Q_/t/min
Logged depth 440ft

Density
T.C._2_ Range 100 cps

o

Recording speed 20 ft/
Logged depth_440jt

mm

368-373 Lignite
373-374 Siltstone, dark-grayish-brown; with lignite fragments, clayey
374-380 Sandstone, dark-grayish-green, very fine grained to fine-grained
380-400 Siltstone, dark-grayish-brown, sandy; poor samples 400-440 No samples

>=== _ uo

Depth

« o

- 500

- - 160

- 550

- - 180
-600

650 -200

700

-220

750

467

Hole number L 61

SP

Sens, setting 50 MV Recording speed22. fy Logged depth __44Qjt_

1

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J

Rcsiscivity
Sens, setting 50 Recording speed?0_ft/min Logged depth-_J4Q_ft.._

Depth

- e

r-O-O

r-50

-20;

- 100

-40;

1-150
t-
- r-r:

-250 :
'~ -80

[-300

- 100;

-350

I

468

Hole number continued L 61

SP j Resistivity Depth
Sens, setting _ 50 MV __ jScns. setting ______ 5.0__. 2 Recording speed ZCL-WminlRccording spccd20Tt/min w £ Logged depth ...440 ft

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Logged depth 440 ft

- - 120,

[--400 :

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500

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-550

!- -ISO,

- 600 '

-650 ; -200.

- 700

- 220

469

Hole No:__J* 62____ Mnp. Mcdora 4 NW Date: 8-10-77 State: ND County: Golden Valley Elcv.:-2.74Q.ft_.. Location: T.13L&, R.lQ^w , Sec. _2.3_., Tract: _«<*._ Drilled depth: _J^_°Jl___ . Measured: _18Q_ft__ FSL, _20.Q.£t_ FWL, Hole size: 4 3A in. Air [f§ Water (~1 Cored: Yes CD No | Lignite beds:..J24IL26il28-132;165-169;218-225;236-238 , ___ _ __________ _

Remarks:

Lithology
Recorded by:_..MichaeLCamara .

Geophysical loes

TGS *r 1

GeologistJNO recorded by: . Lecjiner__ _ __

Lithology

Gamma

T.C.JL.. Range
Recording speed 2.0 ^/mi

Logged depth _260_£t__

Density

T.C. _3_ Range 500 cps

Recording speed ^D-'

Logged depth 260 ft

Depth

0-20 Siltstone, olive-brown

20- 23 Sandstone, brown, very fine grained
23- 24 Clinker

24- 26 Sandstone, brown, very fine grained, silty
26- 40 Siltstone, brown
40- 45 Gaystone, orangish-brown; with lignite fragments 45- 48 Clinker, orange, soft; with lignite fragments
48- 49 Sandstone, orangish-brown, very fine grained, cemented

49- 54 Gaystone, light-grayish-green
54- 64 Claystonc, light-gray
64- 65 Gaystone, dark-gray; with lignite fragments 65- 75 Gaystone, light-gray
75-260 No samples

-0-0

- 20

-40

470

-300

_ -100

-350

Hole number L 62

SP

Sens, setting-_50_MV_ Recording speed2Q_ ft/minRcc Logged depth

Resistivity
Sens, setting 5Q.____ ording speed2£Lfymin Logged depth __.260_ft.___

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Depth
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- - 80

1-300 i

- 100

-350

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471

-k.63__- __Map:__Meciora_4.NW___Date:._8-_lQ=ZL.State: _NQ_County:_Goldc.n_yalky._ Elcv.:-__2>7_5P_ft__. Location: T.IJZ-S, RlP3_w , Sec.3_L__ , Tract: .hbbb.__ Drilled depth: _.26Qit.___. __ Measured: _38jft__*SX, ^4_&jSwt Hole size: 4 3A in._ Air D Water H Cored: Yes D No S Lignite beds:. 32-J6;jS7-71;l 28-137 . .._ . ..._..___._._... .. ____.____._...,.._._

Remarks:

Lithology
Recorded by: Michael.Canaan Yc«

C.oophysu'al logs
GcologistW recorded by: _.Lechner,

Lithology

Gamma

T.C. 2_ Range ._lQO.cp.s_

Recording speed ^O'V

Logged depth _26p ft

Density

T.C. _2_ Range _IQP_cgs

Recording speed 2£L"/min

Logged depth 260 ft

Depth

3

£ 2

_ 0- 2 Siltstone, grayish-white, clayey; with lignite
fragments
2-4 Claystone, yellowish-brown
_ 4- 6 Claystone, light-gray
6- 9 Siltstone, yellowish-gray
9-11 Siltstone, brownish-orange
11- 20 Siltstone, brown
" 20- 23 Siltstone, light-gray
23- 25 Siltstone, black, clayey, lignitic
25- 26 Claystone, dark-brown to brown
26- 29 Sandstone, grayish-brown, very fine grained to fine-grained
29- 30 Siltstone, brown
_ 30- 31 Claystone, brown
31- 36 Lignite
~ 36- 40 Siltstone, light-grayish-green
_ 40- 50 Claystone, light-grayish-green
50-51 Siltstone, light-grayish-green
51-55 Sandstone, light-greenish-gray, very finegrained, _ silty
55- 60 Siltstone, light-greenish-gray
60- 65 Claystone, light-gray
65- 67 Claystone, Hght-olive-gray
" 67-71 Lignite
_ 71- 75 Siltstone, grayish-green
75- 81 Siltstone, light-gray, sandy
81-84 Claystone, light-gray
84- 85 Lignite
"" 85- 89 Claystone, gray, sandy
89- 90 Lignite
90- 93 Claystone, dark-grayish-brown
93- 94 Lignite
_ 94- 96 Claystone, dark-brown
~ 96-103 Claystonc, gray, silty
._ 103-124 Siltstone, light-gray, clayey
124-126 Claystone, olive-gray
~ 126-129 Claystone, black to daxk-brown, silty, lignitic
__ 129-137 Lignite
137-141 Claystom:, light-olive-gray
~ 141-153 Siltstone, light-greenish-gray
153-155 Claystone, light-gray
155-156 Lignite
156-158 Siltstone, grayish-green, clayey
158-160 Claystone, light-gray, clayey
160-165 Siltstone, dark-brownish-gray
165-173 Siltstone, lisjht-grayish-grcen
173-183 Siltstone, dark-olive-gray
_ 183-185 Siltstone, dark-brown, lignitic
185-186 Siltstone, dark-olivc-gray
~~ 186-188 Siltstone, dark-brown, lignitic
._ 188-192 Siltstone, lujht-greenish-gray
192-193 Siltstone, dark-brown, lignitic
193-202 Siltstone, light-gray; with thin layers of lignite
_ 202-204 Sandstone, white, very fine grained, cemented;
poor samples
204-206 Siltstone, light-gray; poor samples
206-210 Lignite; poor samples
210-213 Siltstone, light-gray; poor samples
_ 213-220 Sandstone, light-greenish-gray, very fine grained;
poor samples

- 0-0

-50

- 20

40

230-234 Siltstone, dark-brownish-gray
234-235 Lignite
235-241 Siltstone, dark-grayish-brown
241-255 Siltstone, grayish-olive, sandy
255-260 Siltstone, dark-green, clayey

472

_ -100

-350

Hole number 63

I , I SP j Resistivity Depth j
Sens, setting --5-Q-M-Y iSens. sctting _..._-5Q_.__ ^ |
Recording speed_20. ft/ min.Recording speed-2-Qft/min j £ «> ! Logged depth ___260_£t_ jLoggcd depth ._26Qft _ j £ ^> ! I ._

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- 350

473

Hole No:__L_64___ __Map:_MedQiaJLNE___ Date:.JLl_kZL_State: __NQ.__County:_Gplden Valley._

Elcv.: _J»785_ft__ Location: T. 121s , R.iQlw , Sec. __?0_, Tract: _ J>bbb _ Drilled depth: _20pjt_

Measured: FNL fn ^ ret .. , . j4J4-Ln,__ Air D Water B Cored: Yes JtLft_ tSf. _60JL_ FWL,
Lignite bccU:._5.9-£2il42^47_. ...

Remarks:

Lithology
Recorded by: .-MkhaeLC.arnara , ..

Hole size: No

~ ,

. __ Geologist Ye,

Geophysical logs
recorded by: _.__ Lechner

Lithology

Gamma

T.C.JL Range 100 cps_

Recording speed ?0"/min

Logged depth _200_ft__

Density

T.C. 2_ Range lP.O_cpA

Recording speed 20_"/min

Logged depth _iJLO_0 _£c__

Depth

*-. o

II

0- 1 Claystone, grayish-white
1- 2 Claystone, brownish-yellow
2- 5 Claystone, light-gray
5- 6 Gaystone, light-brown, silty
6- 10 Claystone, gray
10- 12 Claystone, light-olive-gray
12- 14 Claystone, light-gray
14- 15 Claystone, dark-grayish-brown
15- 16 Lignite
16- 20 Siltstone, light-gray
20- 26 Claystone, light-gray
26- 27 Claystone, light-brown
27- 30 Claystone, light-gray
30- 33 Claystone, orangish-brown
33- 35 Claystone, light-gray
35- 36 Claystone, light-brown
36- 37 Limestone, light-gray
37- 38 Claystone, light-grayish-brown
38- 40 Claystone, light-gray, silty
40- 48 Siltstone, light-grayish-brown
48- 49 Limestone, gray
49- 57 Claystone, light-gray
57- 59 Siltstone, light-gray, clayey
59-62 Lignite
62- 74 Siltstone, light-grayish-green, clayey
74- 75 Lignite
75- 76 Claystone, grayish-brown
76- 84 Claystone, grayish-green
84- 85 Siltstone, grayish-green
85- 95 Sandstone,grayish-green, very fine grained 95-140 Sandstone, grayish-green, very fine grained; poor samples
140-148 Lignite
148-152 Claystone, light-gray
152-154 Siltstone, gray
154-155 Claystone, light-gray
155-159 Siltstone, gray, clayey
159-161 Claystone, light-gray
161-170 Sandstone, grayish-brown, very fine grained 170-172 Lignite
172-179 Siltstone, gray, sandy
179-180 Lignite
180-187 Siltstone, grayish-green
187-188 Lignite
188-192 Siltstone, dark-olive-gray
192-193 Siltstone, dark-brown, lignitic
193-194 Lignite
194-197 Claystone, grayish-green
197-200 Siltstone, dark-grayish-green

- 0-0

- 50

- 20

- 100

,m_ J^ ''""* "ir_" "*" ~]""V,-^- T "'..-.^i'_- .\ " "^r T",-""i ^"
:*" ~ ~ *' . "_' ^~

474

-40

- 150

-EOS60

- 250

- - 80

h300

_ -100

- 350

Hole number L 64

SP Resistivity
Sens, setting 50_MV Sens, setting _ 50 Recording speed-^O. it/ min Recording speed-20."/.. Logged depth _J20pJt_ Logged depth . 200 ft

Depth

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r

50

- 20

- 100

- 40!

H50

-200"60

^-250 ;
- -80

^-300

L_ -100:

-350

475

, _ __ M* p; Medora3 SJL__ Date: J*:1A:Z1_ State: _ND County; Golden Valley _ Elev.:_^7_69.ft_ Location: T.136_s, R..104w, Sec. _26., Tract: .hb.ba. _ Drilled depth: _5_Q_0_ftL____ Measured: _54___ Kfc, _4PQ.£t_ ^L. Hole size: 4 3A in. Air D Water Q Cored: Yes D No Lignite beds:. _33-_28iZ4-Z9;135-l42;37.7-383 . . .._...... ... .

Lithology
Recorded by: _J&aDdall-Rfiidxcrl_.

Geophysical logs
.___ Geologist ^ recorded by: .__^c_hner.

Lithology

Gamma

T.C._2_ Range UQO_cp_s_

Recording speed 20 "/min

Logged depth _500jt_

Density

T.C. _1_ Range lPQ_cps.
Recording speed 2Q.fr/min

Logged depth 500ft__

Depth

0- 5 Sandstone, dark-brown, very flne grained 5-12 Claystone, yellowish-gray
12- 15 Gaystone, yellow, silty
15- 22 Sandstone, white, very fine grained
22- 25 Gaystone, light-gray, silty
25- 27 Gaystone, dark-gray, silty
27- 30 Gaystone, yellowish-gray, silty
30- 33 Siltstone, yellowish-gray
33- 35 Gay stone, gray
35- 37 Lignite, black
37- 40 Sandstone, gray, very fine grained
40- 56 Claystone, gray
56- 58 Sandstone, gray, very fine grained
58- 60 Claystone, gray
60- 62 Sandstone, gray, very fine grained
62- 68 Claystone, gray, silty
68- 70 Siltstone, gray, sandy
70- 75 Qaystone, gray, silty, sandy
75- 77 Claystone, gray
77- 78 Lignite, black
78- 90 Siltstone, gray
90- 97 Sandstone, gray, very fine grained
97-103 Siltstone, gray, clayey
103-108 Gaystone, gray
108-109 Limestone, dark-gray
109-136 Gaystone, gray
136-140 Lignite, black
140-147 Sandstone, dark-gray, very fine grained 147-148 Lignite, black
148-162 Sandstone, gray, very fine grained 162-173 Gaystone, gray
173-175 Siltstone, gray
175-181 Claystone, gray
181-183 Sandstone, gray, very fine grained 183-190 Gaystone, gray, silty
190-228 Siltstone, gray, sandy
228-231 Sandstone, gray, silty

231-232 Sandstone, gray, limey
232-239 Claystone, green
239-240 Lignite, black
240-245 Siltstone, gray, clayey
245-255 Claystone, grayish-green
255-270 Siltstone, gray

270-281 Siltstone, grayish-green, clayey

281-312 Siltstone, gray, clayey

312-330 Gaystone, gray

330-332 Lignite, black
332-340 Siltstone, dark-gray, sandy
340-345 Claystone, gray
345-349 Siltstone, grayish-green, clayey, sandy 349-350 Lignite, black
350-365 Claystone, gray

0-0

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476

Hole number continued

L65

Lithology

365-367
367-373
373-374
374-378
'378-381
381-385
385-386
. 386-391
391-392
'392-395
395-401
'40M05

405^17
'417^20
.420-427

Gaystone, brown, silty
Siltstone, gray, clayey
Lignite, black
Sandstone, gray, very fine grained to fine-grained Lignite, black
Gaystone, gray, silty
Lignite, black
Siltstone, grayish-green
Sandstone, gray, limey
Gaystone, gray, silty
Siltstone, brownish-gray, clayey
Sandstone, grayish-green, very fine grained to fine-grained
Siltstone, grayish-green, sandy
Gaystone, gray
Sandstone, greenish-brown, very fine grained to

Gamma

T.C.J2_ Range 100 cps Recording speed 2® wmi Logged d^pth 500 ft

medium-grained
Gaystone, brown
Gaystone, green
Gaystone, grayish-brown
Sandstone, grayish-green, very fine grained to medium-grained
"485-500 Poor samples

427^30
430^35
'435-440
-440-485

Density

T.C_2_Range 100 cps Recording speed_2Q

Logged depth_ 5QQ ft

^320 . ___::nir^=
; ; .!- ' -.- '

9-co "" "^pmnr.'JEjyr \

- - 120

-400

-450
- 140

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Depth

w O

- 550

- 180

600

650

-2i00

- 700

- - 220

- 750

477

Hole number L 65

SP

Sens, setting. 50 MV
Recording
Logged depth _5fiJL&-

Resistivity
Sens, setting _.__
speed JSL ft/ min Recording speed -ZOfyrmm Logged depth 5QO_ft._

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- 0-0

Depth

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478

Hole number continued
L65

SP Resistivity
Sens, setting _ .50 MY__ jScns. setting_._50_.__ O f ' /* Recording speed 20_rt/ miniRccording speed 2CFt/min Logged depth 500 ft __ (Logged depth 500 ft

Depth

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i-600 '

i-650 !
! -200

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479

_L_66 __Map:.J^4pIilNW._._Date:._l:i7-12_ State: ND County: Golden Valley Elcv.:_-2,728_ft_._ Location: T. 137.*, R.lPJLw. Sec. _..4__, Tract:. W>bb _ Drilled depth: __200_ft_ _ Measured: _32_ft _ B§L, _9.6J[L n&. Hole size: __i.% »k_ Air D Water [X| Cored: Yes D No H Lignite beds: -33-J1LZ3.-75; 77-79; 176-17.9 . ..._....._._ _________.. .....

Remarks:

Lithology
Pvecorded by: Michael.Cainara_.____..___ ___ Geologist Ye, Geophysical logs

recorded by: ..._.__Lechner_ . __

Lithology

Gamma

T.C._2_ Range JL0.Q£ps_

Recording speed ZQ'V

Logged depth 200ft

Density

T.C. _2_ Range AQOcps

Recording speed 2Q.fr/min

Logged depth 200ft

Depth

1 u- 12

0- 2 Qaystone, light-grayish-brown, silty
2- 6 Siltstone, dark-brown to black, sandy
6- 7 Lignite
7- 13 Claystone, light-yellowish-gray; mixed with clinker 13-18 Siltstone, grayish-white
18- 20 Qaystone, grayish-white
20- 23 Siltstone, yellowish-gray
23- 26 Claystone, brownish-gray
26- 29 Claystone, gray, silty
29- 31 Siltstone, dark-brown to black, lignitic 31-36 Lignite
36- 41 Claystone, light-gray
41-42 Claystone, dark-brown to black, carbonaceous 42- 45 Claystone, gray
45- 47 Qaystone, grayish-green
47- 49 Limestone, light-gray
49-51 Siltstone, light-gray, sandy
51-72 Qaystone, greenish-gray
72- 77 Lignite
77- 80 Qaystone, very light gray
80- 82 Qaystone, grayish-brown
82- 88 Qaystone, light-grayish-green
88- 90 Qaystone, grayish-green
90- 92 Qaystone, dark-brown, carbonaceous 92-113 Claystone, light-gray, silty
113-115 Siltstone, light-grayish-brown, clayey
115-124 Claystone, grayish-brown
124-135 Sandstone, dark-brown, carbonaceous 135-163 Sandstone, grayish-green, very fine grained to fine-grained
163-168 Siltstone, dark-olive-gray, sandy
168-171 Sandstone, light-greenish-gray, very fine grained 171-178 Lignite
178-186 Siltstone, dark-olive, sandy, carbonaceous 186-187 Lignite
187-194 Siltstone, olive, sandy
194-196 Sandstone, dark-brown, silty, very fine grained 196-200 Sandstone, grayish-green, very fine grained to fine-grained

- 0-0

-20

- 100

-40

150

- 250

- - 80

L-300

. -100

- 350

480

Hole number L 66

SP Resistivity

i

i

J

J

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Sens, setting .2Q_MV Sens, setting _.. .5.0__.__ Recording speed _2JL ft/rninv
i Logged depth 200 ft
i.____. ._.__..._. __

Depth ;

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Logged depth __2QO ft __ £ £

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rSOO

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481

_Ii 61_..___Mnp-_Medora3NE__ Date:_8JJ:71_State: ND County: Golden Valley__ Elev.: _2,Z.70_ft_ Location: T. 137% , R.1Q5.W , Sec. _..12., Tract: .jK.ec. _ Drilled depth: ___42JLfi_~ __

Measured: _24ft_ FSL. ._11.5Jl Hole size: 4 K in. Air D Water (H Cored: Yes Q No Lignite beds:. ._21z25l.5.4^56; 267.-270i.282.-285;.3.92-398

Remarks:

Lithology
Recorded by:^lkb.acLCarnara.. _ , .

.. _ Geologist Ye.

Cieophysical logs
recorded by: . .__L?chner___. .._._...

Lithology

Gamma

T.C._2_ Range JLQQ.cp&_

Recording speed 20"/min

Logged depth ^420 ft

Density

T.C. _2_ Range . ia(Lcp5

Recording speed _2Q"/min

Logged depth _420ft

c*w i

Depth

vj O

II

_ 0- 10 Claystone, grayish-yellow

_ 10-15 Sandstone, light-ycllowish-brown, very fine
grained, lignitic
- 15- 19 Claystone, gray
_ 19-26 Lignite
26- 27 Ciaystone, grayish-green
_ 27- 35 Claystone, gray
35- 52 Siltstone, gray
~ 52-54 Claystone, gray
54- 56 Lignite
~~ 56- 59 Claystone, gray
_ 59-61 Siltstone, light-brown, lignitic
61- 80 Claystone, greenish-gray, silty
- 80- 92 Siltstone, gray
_ 92-97 Limestone, dark-gray
97-102 Claystone, gray
- 102-104 Siltstone, light-gray
_ 104-116 Siltstone, dark-brown to black, lignitic
116-119 Claystone, dark-brown, lignitic
~~ 119-122 Claystone, light-greenish-gray
_ 122-125 Siltstone, light-greenish-gray
125-173 Sandstone, grayish-green, very fine grained to
- fine-grained

- 173-177 Siltstone, dark-brownish-gray
177-180 Siltstone, dark-brown, sandy, lignitic
~~ 180-188 Sandstone, dark-brown, lignitic
_ 188-192 Siltstone, dark-brown, lignitic, sandy
192-200 Sandstone, dark-brown, lignitic
- 200-214 Sandstone, gray, very fine grained to fine-grained

- 214-216 Sandstone, greenish-gray, very fine grained to
fine-grained
~ 216-217 Lignite
__217-234 Siltstone, greenish-gray
234-239 Siltstone, dark-brown, lignitic
- 239-241 Claystone, dark-grayish-green
_ 241-24 2 Lignite
242-246 Claystone, dark-greenish-gray
- 246-253 Siltstone, white
_ 253-258 Claystone, greenish-gray
~ 258-263 Siltstone, dark-brown, lignitic
_ 263-269 Lignite
269-280 Sandstone, grayish-green, very fine grained ~ 280-283 Claystone, olive-gray
_ 283-287 Lignite
287-290 Siltstone, grayish-green, clayey
- 290-300 Siltstone, gray
_^ 300-305 Gaystonc, light-gray
305-306 Limestone, gray
- 306-322 Claystone, light-gray
322-330 Sandstone, grayish-green, very fine grained
~~ to fine-grained
_ 330-333 Siltstone, greenish-gray, clayey
333-345 Siltstone, dark-brown to black, lignitic
-- 345-351 Sandstone, grayish-green, very fine grained to
fine-grained

- - 0-0

-50

-20

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482

Hole number continued

L67

Lithology

351-354 Claystone, olive
354-355 Lignite
355-357 Siltstone, dark-brown, lignitic
357-365 Siltstone, dark-olive-gray, clayey
365-395 Sandstone, grayish-green, very fine grained to fine-grained
395-398 Lignite
398-405 Sandstone, grayish-green, very fine grained to fine-grained
405-415 Siltstone, grayish-green
415-419 Gaystone, white, silty
419-420 Claystone, olive-gray

T.C..

Gamma

Range 100 cps

Recording speed 2Q ft/min

Logged depth 420 ft

Density

T.C._2_ Range 100 cps

Recording speed2Q/c/min

Logged depth 420 ft

*- * -j r_ ".'-_'" ~" -* * ^-- -^"- -T_-_^_^_~~ f'--^--^ j

Depth

*-. o

« I
u, S

120

400

450
- 140

500

- 160

r-550

-ISO

600

650 -200

- 700

- - 220

- 750

483

Hole number L 67

SP Resistivity
Sens, setting JsP-MY Sens, setting .5.0. Recording speed 20 ft/min Recording speed2Q.ft/ j Logged depth _42_Q_£t

J

j

J

Depth

Logged depth._4.2.0.ft.

- ! :

-r-

-

50

- 20.

i-ioo

40-

i 50

; zoo'60

-250 i
- 80

u
iOO;

- 350

484

NORTH DAKOTA GEOLOGICAL SURVEY

Hole Nn: L68 __.Map:_-.Er>J?Jirg___._Date:._8il_8:77.._State: ND County: Billings Elev.:_2,7_40.ft__ Location: T. 138.5 , R.100_^, Sec. _JL5L, Tract:. aaaa_..__ Drilled depth: _?6P_ft__.._.. _ Measured: 15QJ&__**£. JL20 fbBWL, Hole size: 4 ^ in. Air D Water 0 Cored: Yes D No H Lignite beds: -JO-J^p^lS; 243-247; 356-358; 401-404; 433^436; 626-632 ____..._______

Remarks:

Lithology
Recorded by:_J^khaeLCamara_ ^ i Yc*

..__ Geologist HZ

Geophysical logs

recorded by: .. Lechner

Lithology

Gamma

T.C._2_ Range .10.0 cp.s_

Recording speed 2.0.'Vmin

Logged depth _.J76(Lft_

Density

T.C. _2_ Range lPOLc£s_

Recording speed SCL

Logged depth 756 ft

m n

Depth

8

0-5 Siltstone, brown sandy
5- 7 Siltstone, brown, clayey; with some clinker fragments
7- 10 Claystone, gray
~~ 10- 17 Siltstone, gray
17- 18 Siltstone, brownish-gray, sandy; with clinker fragments
18- 27 Sandstone, grayish-brown, very fine grained to
_ fine-grained, silty
27- 45 Sandstone, gray, very fine grained to fine-grained
_ 45- 47 Siltstone, very dark brown to black, carbonaceous
47- 48 Lignite
48- 50 Sandstone, gray, very fine grained, silty
50-52 Gaystone, gray, silty
~~ 52-59 Siltstone, brownish-gray
59- 60 Lignite
60- 63 Claystone, grayish-brown, silty
~ 63- 73 Lignite
_ 73- 77 Gaystone, olive-gray; with lignite fragments
77- 80 Qaystone, greenish-gray
~~ 80- 90 Siltstone, gray, clayey
_ 90- 91 Sandstone, white, very fine grained, cemented
91- 95 Siitstone, gray
~~ 95-100 Gaystone, greenish-gray
_ 100-106 Siltstone, dark-gray, clayey
~ 106-107 Limestone, yellowish-white
107-114 Siltstone dark-gray, clayey
114-116 Claystone, gray, silty
"116-120 Gaystone, dark-brown to black, carbonaceous
_ 120-124 Siltstone, grayish-green
124-125 Siltstone, dark-gray; with lignite fragments 125-135 Siltstone, greenish-gray, sandy
_ 135-136 Gaystone, dark-brown, carbonaceous
136-137 Lignite
_ 137-140 Gaystone, olive
140-143 Sandstone, grayish-green, silty
143-146 Gaystone, gray, silty
_ 146-15 8 Gaystone, gray
158-160 Siltstone, gray
160-170 Claystone, gray
170-173 Gaystone, dark-brown to black, carbonaceous
~ 173-176 Sandstone, olive-gray, very line grained
_ 176-178 Sandstone, greenish-gray, very fine grained,
silty
178-186 Sandstone, greenish-gray, very fine grained to _ fine-grained
"186-195 Claystone, dark-gray
195-200 Siltstone, gray
200-204 Gaystone, gray
"~ 204-207 Lignite
207-210 Siltstone, olive-gray
210-211 Lignite
211-215 Siltstone, gray, sandy
_ 215-225 Sandstone, light-gray, very fine grained, silty
225-232 Sandstone, greenish-gray, very fine grained to fine-grained
232-236 Liunite

- 0-0

-2C

ir " ~ - - - - _-. ^fc»j-» j--- - . j
. . ..._..... »---. - - . " - i. i " ' ""' !

so r~-~::rr:. ~.-;..-

, .. j:^.___...... . '

ErriiE ~---""'^f~~^- :r-^r j! |Q^

485

Hole number continued

L68

Lithology

Siltstone, grayish-green, clayey
Claystone, grayish-green
Siltstone, light-gray
Siltstone, dark-brown to black, carbonaceous Siltstone, light-gray
Claystone, gray
Claystone, light-grayish-green
Siltstone, light-gray
Lignite
Claystone, greenish-gray, silty
Siltstone, light-gray, clayey
Lignite
Siltstone, light-gray
Lignite
Claystone, light-olive-gray
Claystone, light-gray
Lignite
Claystone, gray
Lignite
Claystone, light-gray
Siltstone, light-green
Gaystone, grayish-green
Siltstone, grayish-green, clayey
Claystonc, dark-green
Siltstone, grayish-green
Lignite
Siltstone, daik-green
Claystone, light-grayish-green
Lignite
Siltstone, light-green
Siltstone, light-gray
Lignite
Claystone, light-gray
Siltstone, light-gray
Claystone, light-grayish-green
Sandstone, grayish-green, very fine grained to fine-grained
Sandstone, dark-brown, very fine grained
Sandstone, brown, very fine grained
Sandstone, light-gray, very fine grained
Lignite
Claystone, gray
Lignite
Claystone, dark-olive-gray
Claystone, grayish-green
Siltstone, gray

660-680 Siltstone, gray, clayey; poor samples

680-700 Sandstone, grayish-green, very fine grained to fine-grained

700-760 No samples

Gamma

T.C. __ 2. Rangr IQQcps

Recording speed 20 ft/mm

Logged depth 760 ft

Density

T.C..2_ Range 100 cps

Recording speed^H

Logged depth 756 ft

Ez - ±ir±ir^~I;

r-r ; ;-- V .
1 I IV-; i I U

Depth

« o

8

486

Hole number L 68

SP

Sens, setting _5Q_MV Recording speed 20 ft/ min Recordin

Resistivity
Sens, setting

I Logged depth __. _26.0.ft_

J

J

i

-i

ing speed-2Q ft/m in
Logged depth ...JZ.6.0 ft.._._

-r
*"1

I ; - __.'.. .; j.^L--

! T t V"J~ V
. . . tg
t ' i -^. ' ' . ~

- ' ' * - >M .- - ~~*

Depth

- 0-0

- 50

- 20,

- 40:

- 150

-200- 60

250 ! i
- 80'

- 300

- 100-

-35C

Hole number continued
L68

SP Resistivity Sens, setting _3.0 MV Sens, setting .50... Recording speed_2jQ.fyminiRccording spced20.fr/min Logged depth __7.6Q ft.

J

i

H

-

Logged depth . 760 ft

Depth!

u,

i , j-_ r *^~ :

- - 120 i
L-400 ;

450
- 140-

r

500

- - 160:
r

-550

- 180

r-600

- 650
: -200

- 700

-220

r-750

488

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:_...L_62__.__ M.ip: Tracy Mountain_ Date:._8-J8^7 State: _JNDL County: Billiniings _._.. __ Elcv.:_2,660_Ct__ Location: T.13&J5, R.lQlw , Sec. ...23_ , Tract:. .bbb.b. __ Drilled depth: __520_£t

"*" >E£t * A , (i Measured: 15.3. _Ct __ KSIX, .42 fL_*FWL, . FWLHole sze:ize 4 3A in._ Air L..J Water
Lignite beds:. JZ8-88L.255-261; 451-455 ...

Cored: Yes No

Remarks:

Lithology
Recorded hy: Randall Reichert

Geophysical logs
_ Geologists recorded by: . ._ Lecliner

Lithology

Gamma

T.C.-_2_ Range _10.Q_cps_

Recording speed 20 'tymin

Logged depth _.._5JJ>Jt_

Density

T.C. _1_ Range _l_QP_cps.

Recording speed 2Qft/ min

Logged depth _516 ft

Depth

tt.

_ 0- 14 Sandstone, gray, very fine grained -0-0

Clinker

Sandstone, gray, very fine grained
Claystone, yellowish-gray
Qaystone, gray
Sandstone, yellowish-gray, very fine grained to medium-grained
Sandstone, gray, very tine grained
Qaystone

14- 15
15- 24
24- 28
28- 35
35- 40

40- 44
44- 62

62- 64 Sandstone, gray, very fine grained
64- 78 Qaystone, gray, silty
78- 90 Lignite, black

90-96 Siltstone, gray, sandy
96- 99 Claystone, gray
99-100 Lignite, black
100-116 Sandstone, gray, very fine grained, silty 116-119 Claystone, green, silty
119-120 Lignite, black
120-136 Sandstone, gray, silty
136-140 Qaystone, gray, silty
140-147 Siltstone, gray, clayey
147-150 Qaystone,^gray, silty
150-153 Qaystone, brownish-gray, silty
153-155 Claystone, gray
155-156 Lignite, black
156-163 Siltstone, green, sandy
163-170 Qaystone, greenish-gray, silty
170-180 Claystone, gray
180-192 Sandstone, gray, very fine grained 192-194 Lignite, black
194-206 Sandstone, gray, very fine grained, silty 206-210 Siltstone, gray, sandy
210-213 Claystone, black
213-214 Lignite, black
214-220 Siltstone, gray, sandy
220 225 Sandstone, gray, very fine grained 225-236 Siltstone, gray
236-245 Qaystone, gray, silty
245-247 Siltstone, gray, sandy
247-255 Claystone, gray, silty
255-258 Siltstone, gray, sandy
258-265 Lignite, black
265-269 Siltstone, greenish-gray
269-274 Sandstone, white, vcr> fine grained to fine- grained
274-275 Siltstone, green, sandy
275-277 Sandstone, green, very fine grained 277-282 Siltstone, green
282-288 Sandstone, green, very fine grained to fine- grained
288-300 Siltstone, green
300-310 Sandstone, gray, very fine grained to fine- grained
310-315 Gaystonc, gray, silty

;"*^?=r-rrr^f&^-;^>

l"-s^L.^~ . i 7 n ' ~~ ~"~~ "' '~" ~

| » * \ 300
r .__, _f.. ll.__n_^ _% ^ __ _, _TT1

489

Hole number continued
L69

Lithology

iS-378 Claystone, green, silty
'8-394 Gaystone, gray, silty

14414 Siltstone, gray, clayey

4415 Lignite, black
.5428 Siltstone, gray, clayey
!8448 Gaystone, gray, silty

^449 Sandstone, white, limey
19473 Oaystone, gray, silty

73474 Lignite, black
74490 Claystone, gray, silty

90-520 Sandstone, gray, very fine grained to medium-grained

T.C.

Gamma

Range 1QQ cps
Recording speed 20 fymin
Logged depth 516 ft

Density
T.C. _2_ Range 100 cps
Recording speed-2Qft/mi n
Logged depth 516 ft

Depth

«/J I*
t-> O O "
O 42

u, 2

- 160

-550

- - 180
- 600

- 700

- - 220

- 750

490

Hole number L69

SP
Sens, setting

50_ _ MV
Recording speed .20 ft/min Recording speed_20&/min Lo^ed depth _.. 516. ft_

-i

i

1

J

1

-1

Resistivity
Sens, setting 50.. _

Logged depth 51.6.. ft.. __

Depth

5 £

- 0-0

- 50

L

-20:

r- i
HOO ;
L i
L

f -40:

- 200-60

,-250
- - 80

- 300

- 100

t-350 (

491

Hole number continued
L69

SP Resistivity
Sens, setting SCLMy Sens, setting _ _5D . Recording speed_2Q.ft/min!Recording spced2Q.ft/rnin Logged depth _ 3.1.6 ft _ Logged depth .516 ft

Depth!

a,

1

-i
i

1

1

- - 120

^-400 ,

-450
-I40:

500

- 160!
I-

550

r

r-600 i

;- -220

[-750

492

NORTH DAKOTA GEOLOGICAL SURVEY

Hole No:__L70 __ Map: JylcdorallSE______ Date:._M9i77_ State: _ND__County :_BjlJings_.. _____ Elcv.: __23.620_ft_. Location: T. 138.5 , R.1Q2.W , Sec. .A_., Tract: ..cdbc _ Drillea depth: _4_QO_£t__ ..

Measured: 8QQ_£t__ FSL.lJiSQjJE'FWL. Hole size: 4 % in. Air [XJ Water Q Cored: Yes ["] No E

Lignite beds: ._132_L36l 220-222; 347-362;..364-368; 373-377 __ ____. .. ___________

Remarks:

Lithology
Recorded by: Michael Camara

Geophysical logs
^ I Y«» .11 ^ T 1 Geologist«s recorded by: .__. Lechnex......_...

Lithology

Gamma

T.C._2__ Range JLPO.c_>s_

Recording speed 2.0.'Vmin

Logged depthS&SJi___

Density

T.C. _2_ Range IPQ^ps.

Recording speed

Logged depth 386_ft

C*V t ^ -

Depth

0- 5 Sand, grayish-yellow, coarse-grained to fine-grained, silty
5- 10 Sand, grayish-yellow, medium-grained to fine-grained
10- 15 Sand, grayish-yellow, very coarse grained to fine-grained, pebbly
15- 20 Gravel, brownish-orange, medium-grained to coarse-grained
20- 43 Siltstone, light-yellowish-brown
43- 45 Qaystone, gray, silty
45- 48 Siltstone, black, clayey, carbonaceous
48- 51 Siltstone, light-brownish-gray
51- 59 Sandstone, light-brown, very fine grained, silty 59- 90 Claystone, gray

90-100 No samples

- 0-0

- 20

r60

i"** - I *" ' - p.r_"t~_"t n ..^r.;- _

250

r==ri=3- -80

L-300

493

Hole numoer concumcu
L70

Lithology

Gamma

T,C._2_ Range-IQQ.cps, Recording speed 20 ft/min Logged depth 389 ft

Density
T.C._2_ Range 100 cp Recording speed 2Qjt/min Logged depth 386 ft

Depth

if=^ 330" ~j=.

h450
- 140

^ o

500

- 160

h550

- 180
600

- 700

- -220

- 750

494

Hole number L 70

SP

Sens, setting .5Q_MV_._
Recording speed 20 ft/mi Logged depth ... .389 ft _

Resistivity
Sens, setting - 59
min Recording speed J^OWm in Logged depth ..JA9 (t..

:

Depth

- 0-0

-50 ;
-20.

I

r

HOO

-40'

L- ,

- 200-^'

I I

1-250
- . -80

-300

- 100

495

__ LJ71 __ . . __ Map:. .MedpralSE._. .__ Date:. . U0:7.1__ State: ___ND __ County : _._._..._. __ Elev.:-2»625_ft__ Location: T. 138 8 , R..102w , Sec. -2Z. , Tract: ... .daab_ Drilled depth: _30pjt __ .... __ _ Measured: 2,580. kjfst. .ISQitJswL. Hole size: 4 3A in. Air D Water S Cored: Yes ["] No [Xj Ugnitc beds:. --97-1041.242-253; 265-269... . ... ____ _ . __ ... .__

Remarks:

Lithology
Recorded by: Michael Camara _ . . Yes Geologist NX

(Geophysical
recorded by: Lechner

Lithology

Gamma

T.C. J2_ Range .lQQ_cps_

Recording speed 20."/min

Logged depth _2SL5_iJ;__

Density

T.C. _2_ Range lPQ_cp_s_

Recording speed IQ/Vmm

Logged depth _ 297 ft _

Depth

- 0-12 Siltstone, grayish-brown, clayey

- 12- 17 Gaystone, light-grayish-brown
17- 18 Claystone, orangish-brown; mixed with claystone, ~" black, carbonaceous
_ 18-24 Siltstone, light-grayish-brown
24- 30 Claystone, yellowish-brown
- 30-31 Sandstone, dark-grayish-brown, very fine grained
_ to fine-grained, cemented
31- 35 Claystone, yellowish-gray
_ 35- 38 Claystone, light-gray
38- 43 Claystone, brownish-gray
- 43- 45 Lignite
45- 52 Claystone, light-gray
~" 52-53 Lignite
- 53- 60 Siltstone, gray
60- 64 Claystone, gray, silty
~" 64- 65 Lignite
_ 65- 78 Clay stone, light-greenish-gray
78- 97 Siltstone, light-gray
~" 97-100 Lignite
_ 100-102 Claystone, light-grayish-green, silty
102-105 Lignite
- 105-108 Siltstone, dark-brown, clayey, carbonaceous
108-118 Siltstone, light-greenish-gray, clayey
- 118-119 Lignite
_ 119-125 Claystone, light-greenish-gray, silty
125-133 Siltstone, light-greenish-gray, sandy
- 133135 Lignite
135-138 Claystone, light-grayish-green, silty
~ 138-139 Lignite
_ 139-173 Claystone, light-greenish-gray
173-174 Siltstone, brown, clayey, carbonaceous
~~ 174-175 Siltstone, black; with lignite fragments
_ 175-185 Claystone, light-greenish-gray
~~ 185-192 Siltstone, lis;ht-grcenish-gray
- 192-193 Lignite
___ 193-205 Siltstone, light-gray
205-215 Claystone, light-gray
- 215-217 Claystonc, light-greenish-gray
217-220 Claystone, dark-brown, silty, carbonaceous "" 220-236 Siltstone, light-gray, clayey
_ 236-240 Lignite
240-242 Claystone, light-brownish-gray, silty
- 242-246 Claystone, linht-greenish-gray
_ 246-259 Lignit-;
259-262 Siltstone, brown, clayey, carbonaceous
- 262-269 Claystone, grayish-green
_ 269-273 Lignite
273-276 Siltstone, grayish-green
- 276-295 Claystone, light-green
295-300 No samples

- 0-0

- 20

(_ -^~"^' -

("" *~ *~ ~ ~71~"~ ~~^l 1 " - --- -
£_,_____ _____ _____-. .. ___ ^r, ___ _ - - -~- __ .-. __~" - ""
-

' " ""'~""*"*~~~*'~'~ ' "*~"*'

^^==^~-~-^^T 250

496

Hole number L 71

SP

Sens, setting 50_MV
Recording speed_2Q_ft/min Recording speed2Q_ft/min Logged depth -.295 ft._

1
1

-I-i

J

1

JI

Resistivity
Sens, setting ._. 5.0... _

Logged depth _ 295 ft ......

Depth

2

- o-o

-20
L

r f-
^-100
L

: -40

nso ;
i

i
r
- 200-60'

- 250 i
; i
- 80'

- 100

- 350

497

Hole No:._._.LJ72__ _ Map : _Mecl5ra_LSJE__.._ Date:. JL9£77 State: _J^._County:

Elcv.: -J.yifL-. Location: T. 138. X, R.JOJw , Sec. J.2 _. , Tract: ,aaab_. _ Drilled depth: __ 24_0jt___ __ Measured: 15ft «8L. 6_50_ft_|$i. Hole size:

Lignite beds: _144,L53; 210-212; 219-223. ...

4 % in._ Air D Water B Cored: Yes Q No

Remarks:

Lithology
Recorded by: -JEUndalLRekheil..

Geophysical logs
Geologist NOX recorded by: _._ Lechner

Lithology

Gamma

T.C. _2_ Range 100 cps_

Recording speed ZQ'Vmin

Logged depth 240ft

Density

T.C. _2_ Range J.QP_cgs

Recording speed 2£L*V

Logged depth 240

Depth

u O

0-2 Clay stone, gray, silty
2-3 Qaystone, yellow, silty
3-10 Clays tone, gray
10-15 Claystone, grayish-green
15 - 16 Claystone, light-gray
16 - 25 Siltstone, light-yellowish-brown 25 - 39 Claystone, gray, silty
' 39 - 39.5 Siltstone, yellow, clayey
. 39.5- 43 Claystone, gray
43 - 43.5 Lignite, black
. 43.5- 50 Claystone, greenish-gray, silty
50 - 53 Claystone, gray, silty
53 - 55 Lignite, black
55 - 57 Siltstone, olive
57-64 Siltstone, green, clayey
64 - 66 Sandstone, green, fine-grained
66 - 80 Siltstone, green, sandy
80 - 87 Claystone, green, silty
87 -112 Siltstone, gray, clayey
112 -115 Siltstone, green, clayey
115 -121 Claystone, gray, silty
.121 -134 Claystone, green, silty
134 135 Claystone, gray, silty
135 -140 No samples
140 -150 Lignite, black
150 -155 Claystone, greenish-gray, silty
155 -171 Sandstone, greenish-gray, very fine grained

171 -171.5 Sandstone, brownish-yellow, limey 171.5-180 Sandstone, greenish-gray, very fine grained 180 -185 Sandstone, grayish-green, limey, very fine grained
185 -200 Siltstone, grayish-green, clayey
'200 -206 Siltstone, gray, clayey
.206 -210 Lignite, black
210 -215 Siltstone, brown
215 -232 Siltstone, gray, clayey
232 -240 Claystone, green, silty

- 0-0

- 50

- 20

t" .*~J~J. JL.."_.-1 - "7.J" ~ ~ -""",. ~~""-T ."' .' .." - S"-^"" "T-^

r~ ~"T" ~"-"~*T"""^'~~" " T~"~" """""""""*"" ^^" ' **"~"~"*

r-100

_

- 300

_ -100

-350

498

Hole number L 72

SP

I Sens, setting iO_M.V
Recording speed _2£L ft/min Recording speed_2Qft/min

Resistivity
Sens, setting 50.

Logged depth _24.0 .fi

-J

j

1

n

j

!

J

i
J
i
I

J

!

-i

i

H

J

d depth 24.Q .&._

- IT. -. -.-: - /= - - ^^S^'

Depth

- s
Si S
u- 2

Lo-o

h

L :

T -40!

^-150 ;

i

i :
r

- 200-60'

-250 '
- - 80

- 300

-ioo;

- 350

499

Hole No:__ L 7JL _ ._ Map:_Medoxa.4 NW___ Date: .__8-lQrZI State: NH__ County: £_ddeji_Yalle.y__

Vf .TA.

Elcv.:_.2,a(HL£t_. Location: T. J3& Sc, R. JL03w , Sec. ..3.CL , Tract:. ._cccd _ Drilled depth: __.__60_Qjt_.... .. ._ Measured: _10_£t__ F§L! 500 £t_ &L. Hole size: __4j4in._ Air [j Water S Cored: Yes D No CS Lignite beds:. .-5.5:5&_17.kl72; 181-185; 292-298; 326-328; 496=49?;!68_-570_._ ____ _ ___

Remarks:

Lithology
Recorded by: --Michacl-Camaca-

Yc9

Geophysical logs
_.. ... ____ Geologist BCJC recorded by: .._._L.cchner__

Lithology

Gamma

T.C. _2_ Range .100 jcps_

Recording speed ZQ'V

Logged depth _59_5_ft

T.C.

Density

Range _lQO_cps

Recording speed 2Q_"/min

Logged depth 594 ft

Depth

0- 6 Siltstone, light-grayish-yellow, clayey 6- 7 Lignite
7-10 Claystone, light-yellowish-brown
10- 13 Qaystone, brown
13- 15 Qaystone, light-gray
15- 17 Siltstone, light-yellowish-gray, clayey 17- 22 Siltstone, brownish-yellow
22- 24 Claystone, light-gray
24- 25 Lignite
25- 26 Claystone, dark-gray
26- 35 Qaystone, grayish-green, silty
35- 36 Lignite
36- 37 Qaystone, dark-gray
37-52 Siltstone, gray, clayey
52-53 Lignite
53- 55 Claystone, olive-gray; with lignite fragments 55-57 Lignite
57-61 Sandstone, grayish-white, very fine grained 61-67 Claystone, grayish-white
67- 77 Sandstone, light-gray, very fine grained 77- 83 Siltstone, grayish-white
83- 85 Claystone, grayish-white, silty
85-86 Lignite
86- 90 Qaystone, grayish-green
90- 95 Siltstone, grayish-green, sandy
95-100 Sandstone, light-gray, very fine grained 100-103 Claystone, grayish-green
103-113 Siltstone, light-gray; with lignite fragments 113-115 Sil tstone, grayish-green, clayey
115-120 Siltstone, light-greenish-gray, clayey 120-124 Siltstone, grayish-white, sandy
124-125 Lignite
125-147 Siltstone, grayish-white, sandy
147-158 Qaystone, grayish-white
. 158-165 Siltstone, grayish-white
165-166 Siltstone, light-gray, clayey
166-167 Qaystone, dark-brown to black
167-172 Lignite
"172-175 Qaystone, light-gray
175-180 Siltstone, light-gray, clayey
180-185 Lignite
185-191 Claystone, light-grcenish-gray
191-195 Qaystone, grcenisli-gray
195-200 Siltstone, greenish-gray
200-217 Siltstone, light-gray
217-220 Sandstone, light-gray, silty
220-221 Siltstone, dark-brown to black, clayoy; with lignite fragments
221-223 Qaystonc, gray
223-224 Qaystone, black to dark-brown; with lignite fragments
224-225 Claystone, light-gray
225-228 Qaystone, grayish-brown
228-230 Qaystone, light-grayish-green
230-231 Lignite
231-235 Siltstone, dark-brown to black, clayey; with lignite fragments
235-237 Sandstone, grayish-green, silty, very fine grained. 237-238 Siltstone, dark-brown; with lignite fragments

- 0-0

-50

- 20

- 100

-40

^E=- -100

Hole number continued L 73

Lithology

_238-244 Siltstone, light-gray
~244-250 Gaystone, grayish-green
-250-264 Siitstone, gray, clayey
264-280 Claystone, light-gray
""280-285 Siltstone, light-gray
_285-288 Claystone, dark-brown to black, silty; with lignite fragments
-288-290 Lignite
290-305 Siltstone, gray
"305-307 Siltstone, gray, sandy
_307-308 Lignite
308-210 Siltstone, gray, sandy
"310-315 Siltstone, dark-grayish-green, clayey _315-317 Gaystone, gray
317-320 Lignite
- 320-321 Claystone, gray
_321-323 Siltstone, greenish-gray, sandy
"323-325 Siltstone, gray
_ 325-340 Sandstone, light-greenish-gray, silty, very fine
grained
"340-345 Siltstone, light-gray
_ 345-347 Siltstone, dark-olive-gray
347-350 Lignite
- 350-359 Claystone, dark-brown to black; with lignite
fragments
"" 359-383 Sandstone, grayish-green, very fine grained
_ 383-385 Sandstone, white, very fine grained to fine-
grained, cemented
- 385-485 Sandstone, grayish-green, very fine grained to fine-
_ grained
485-486 Siltstone, greenish-gray
_4S6-487 Lignite
487-495 Sandstone, gray, silty
-495-497 Claystone, gray
_ 497-501 Lignite
"~ 501-510 Claystone, greenish-gray, silty
- 510-515 Sandstone, grayish-green, very fine grained to
fine-grained
515-520 No samples
- 520-540 Gaystone, dark-greenish-gray, silty; poor samples
540-548 Gaystone, gray
""548-549 Lignite
__ 549-563 Siltstone, dark-gray, sandy
563-565 Lignite
- 565-567 Gaystone, dark-brown
567-570 Gaystone, dark-olive-gray
~~ 570-574 Siltstone, dark-gray
-574-575 Lignite
575-578 Siltstone, dark-brown
- 578-580 Siltstone, dark-greenish-gray

Gamma

T.C..2__ Range 100 cps

Recording speed 20 ft/min

Logged depth 595ft

Density Depth

T.C._2__ Range 100 cp:

Recording speed HO-tymin

Logged depth _52il£

*j O
S

650 -200

- 700

- - 220

- 750

501

Hole number L 73

SP

Sens, setting -§P_MV. Recording speed 2Q_ ft/mi Logged depth

I

4

Resistivity
Sens, setting _... .50_...._ Recording speed-2Qft/m in Logged depth j>95_ft.._

Depth

11

- 0-0

-26

-100

L
L

f-

1-150
I
r

L

k

-80

r

H

- 100:

- 350 '

r

502

Hole number continued
L73

SPar j Resistivity resistivity
Sens. setting__50_MV.__ .Sens, setting_.__50_ Recording speed _2Q_fc/mia;Rccording spced20/t/j I Logged depth ... 595 ft __ i Logged depth 5.95 ft

mm

Depth

w O

h-450! -wo;

- 500

- - 160:

p-550

_ -180:
L600 '

u

-650 j -200

700

~ -220.

503

. __

__ L^ 74 _ __ Map : Medora 2 SE ___ Date : . JbL7jT7_ S ta te : ND County : _Qolden_Val ley ^ _
Elev.:-_ 2ja8_£tL_. Location: T.L3&-L RlQ4_w, Sec. 8____ , Tract: ._cccc. ._ Drilled depth: _5.Q.QJL_... _. _ Measured: _252ft_ BP. -£3_£t_ Fm, Hole size: __ fL3/4Jru_ Air [j Water H Cored: Yes L~J No Q Lignite beds: . _.37^1j_5.8^2; 194-202L266_-273; 3.77-382; 442-445; 4.54-456 .. ____ . ____ ...

Remarks:

Lithology
Recorded by:

Geophysical logs
.___ Geologist NR* recorded by: ..__Lechner_ _

Lithology

Gamma

T.C. _2_ Range _lOO-cps-

Recording speed 2Q."/min

Logged depth _50Qlt_

Density

T.C. _2_ Range _LOiLcp.s

Recording speed 20."/min

Logged depth _497 ft

Depth

0- 8 Sandstone, yellow, very fine grained 8-11 Claystone, yellow, silty
11-26 Sittstone, yellow, clayey
26- 27 Siitstone, orangish-yellow
27- 29 Siitstone, brownish-gray, clayey
29- 30 Claystone, gray
30- 33 Siitstone, gray
33- 38 Sandstone, gray, very fine grained
38- 39 Lignite, black
39- 40 Claystone, gray, silly
40-53 Siitstone, gray, clayey
53- 55 Lignite, black
55- 58 Claystone, greenish-gray
58- 63 Lignite, black
63- 67 Siitstone, greenish-gray, clayey
67- 70 Claystone, gray
70- 72 Lignite, black
72- 75 Claystone, greenish-gray
75- 77 Sandstone, gray, very fine grained
77- 78 Lignite, black
78- 83 Claystone, gray
83- 87 Siitstone, gray, sandy
87- 90 Sandstone, gray, very fine grained
90-100 Claystone, gray
100-105 Sandstone, gray, very fine grained 105-106 Lignite, black
106-112 Sandstone, white, very Fine grained 112-128 Gaystone, gray
128-171 Gaystone, greenish-gray
171-174 Limestone, gray
174-197 Claystone, gray, silty
197-203 Lignite, black
203-205 Claystone, gray, silty
205-215 Claystone, dark-gray, silty
215-234 Claystone, greenish-gray, silty

_ 234-260 Sandstone, whitish-gray, very fine grained

260-263 Lignite, black
263-267 Sandstone, gray, very fine grained
267-272 Claystone, greenish-gray
272-280 Lignite, black
280-292 Siitstone, dark-gray, clayey
292-317 Claystonc, greenish-gray

317-335 Claystone, gray

335-348 Sandstone, gray, very fine grained to fine-grained

348-379 Sandstone, greenish-gray, very fine grained

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-50

- 20

r>- i -

^-300

IOO

350

Hole number-continued
L74

Lithology

. 379-383 Lignite, black
_ 383-392 Sandstone, greenish-gray, very fine grained
392^400 Claystone, gray
_ 400-103 Lignite, black
403-420 Siltstone, grayish-green, sandy

_ 420-440 Claystone, greenish-gray

440-442 Sandstone, greenish-gray, very fine grained 442-450 Claystone, gray
450-152 Lignite, black
452-500 Claystone, dark-gray, silty

Gamma

T.C. 2 Range IQOcps.
Recording speed _2Q_» Vmin
Logged depth 50f) ft

Density
T.C. 2 Range IQOcps
Recording speed J^Lfyrnin
Logged depth 4Q7 ft

Dcpth

8 1 It, 2

- 160

- 550

. -180
- 600

- 650 -200

- 700

_

- - 220

S-750

505

Hole number L 74

SP
Sens, setting __5P_MV Recording speed 20 ft/ mj Logged depth SQQjt

Resistivity
Sens, setting . 5(L_._ minRecording speed.2(m/min Logged depth _5QQ_ft._

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J

-i

1

Depth i

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.. ^. ^~ ' *. ' J ^ . _J T . "-"-*?

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i-
-200-60

^250 i

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L -100:

350

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506

Hole number continued
L74

SP | Resistivity
Sens, setting 50 MV__ IScns. setting___?0_ _ Recording speed 2Q_ fr/miniRccording speed2H' c/rnin Logged depth _.500 ft Logged depth .500ft

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i

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- 1

Depthl

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8

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r !
L- i

!-500

- 160!

r

1-550

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i

- 1
J

L -180.
i-SOO :

r-650 ;
! -200.

- 700

- 220.

r-750

507

Hole No:_L 75 _ ._Map:.Arnjdpn S£ ._ Date: 9-4-77 State: ND .County: Bowman Elev.:_3>Q52_ft ...Location: T. 132,3 , R. 101 w*. Sec. 10 , Tract: cccb
Measured: JOOjt._ BK 155JL FWL, Hole size: _L34.in,._. Air
Surface ownership:
Lignite beds:_2I^

-' _ VA'lllllV Jfc^V¥Tl««

Drilled depth: 220 ft
.. [55 Water Q Cored: Yes ["] No (X) Coal ownership: ________

Lithology
Recorded by:

Geophysical logs
Geologist NO recorded by: ___

Lithology

Gamma

T.C.2__. Range lQP.cps_
Recording speed 20 rt/,n in
Logged depth _22d ft. _

Density
T.C. 1... Range 1QO cps_
Recording speed 20.'t/inin
Logged depth __220jt__

Depth

No samples -0-0

-20

508

Hole number * 75

| Resistivity
Sens, setting 5P..MY jSens. setting setting AV Recording speed _20_ft/min Recording speedlQ. ft/ Logged depth _22?A__ Logged depth -220 f

_j

-... *^JJ -' ~"" TT ',~"~ 3, ^^^ ~ "_I" 'J^ ~
_ L ,_ _ __ -*» _ ,_
. - : . ^ . .___ ^* . .

! _ P-- fe'

5$

Depth

CJ V

u, S

- 0-0

r50

h

riOO

-40!

- 200-60'

~ '

27° '

L- -80

^-300

r
-100;

r350

509

Hole No: _ .IX76._._ __ Map:_Iaib. Bj!t?e __ Date: _9_-5-77_._ State: __NJ2 County :_Bowman__ Elev.: _3,OS2 ft ..... Location: T. 132.3 , R. IQlw , Sec. ..20.. , Tract: . ._4_<Ua_ Drilled depth: _2£Q_ft __ ... . _

Measured: 1,200 £t_ FSL, ^Sit_jl«t. Hole size: 4 3A in. Air S3 Water D Cored: Yes D No Lignite beds:. _10QJJLOil59-177 .

Remarks: .

Litbology
Recorded by: *

logs
Geologist NO* recorded by: __ Lechner. _ .. .._. __ .

Lithology

Gamma

T.C JL_ Range _l_QO_cp_s_
Recording speed 20. ty
Logged depth 200ft

T.C.

Density
2 Range _!P.O_cps_
Recording speed 2Q.fr/min
Logged depth 200ft

Depth

- 0- 5 Sandstone, yellowish-gray, very fine grained to fine-grained
5- 10 Lignite, black
10- 15 Sandstone, yellowish-gray, silty, very fine grained 15- 20 Siltstone, yellowish-gray
20- 23 Claystone, yellowish-gray, silty
23- 30 Claystone, greenish-gray
30- 37 No samples
37- 40 Siltstone, yellowish-gray
40-200 No samples

0-0

- 20

- 250

f- -80

-300

_ -100

- 350

510

Hole number L 76

SPsr Resistivity KesisEivicy Depth;
Sens, setting 50JMV Sens, setting _ J^L. , j
Recording speed Jf^fymin Recording speed J2Qft/m in j ~ <u j Logged depth _200 ft. _ jLoggcd depth __2QOft__ j £ | |

J

J

1
H

0-0

50

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- 40!

150

-ZOO"60

-25G

- - 80

- 300

._ -iOOi

- 350

511

rlole
Elcv.:

L77 __ Map- Amidon SE Date: 9-5-77 State: ND County: Slope .2>2Z6-£t_ Location: r

PNL. ^£t Measured: 50 ft pst* _3!fL"FWL. Hole size:
Lignite beds: .-J7^0i42^52; 127-130L165-183

Remarks: .

Lithology
Recorded by:

3c t R. 101 w , Sec. _2_6_ , Tract:
4 3A in. _ Air

bbbb__ Drilled depth: 200ft
Water Q Cored: Yes Q No

Geophysical logs
Geologist NO recorded by: .__ Lechner

Lithology

Gamma

T.C. 2 Range.
Recording speed
Logged depth _

100 cps

Density
T.C. _2_ Range _100_CES a f
Recording speed -2Dtt/min
Logged depth 200 ft

Depth

0-3 Sandstone, yellow, very fine grained
3- 11 Claystone, yellow
"11- 16 Claystone, dark-brown, carbonaceous _ 16- 18 Lignite, black
18- 21 Claystone, yellowish-brown
- 21- 35 Claystone, light-gray
35-200 No samples

512

-E50
~ -80

-300

. -100

-350

SP

Hole number L 77

Resistivity
Sens, setting - .5Q.M\L_ Sens, setting -50
f ^ C

Recording .speed 20 ft/min Recording speed20.it/min | Lodged depth ._.. .200 ft._
[: -A -_ ...... -..- . - -

~i

Logged depth _. 200 ft.. ._

Depth

*J O

8 a

h-o-o

L

- 20

- 100

-40

-200~ GO

- 300

- 100;

-350

513

L78 __Map; Amidon SE Date:.J>zi-ZZ_State: ND County:__S]o£e
\ ft- T--..:_. T 1^2 D 101 £ Q*/- 26 TV.*-*- daad FVilW ^^nrK- 220ft

- ^Q[g 1NO«_____ l~' ' J _ 1VI«1IJ. « »»iitv»»^'« ^ t^CiVW . ,__^_at_ J l __»*»».»». _ ___ ~ /

£icv.: _2,920 ft_ Location: T. JJ3x f R.IPJ_W. Sec. __26_ , Tract: ._d.aad_ Drilled depth: _J20____ Measured: 2.100 ft FS£ _8QJi Kwk Hole size: 4 % in. Air S Water Q Cored: Yes D No ^ Lignite beds: 54^7J.10>106; 133-l45a86:198 ...._...._... ... _________._ ...

Cicophysical logs
Geologist NO recorded by: .__ JLcchner... ...._..

Lithology

Gamma
T.C. __2_ Range
Recording speed 2H"/min
Logged depth _

Density
T.C. 2_ Range 100 cps
Recording speed?^."/min
Logged depth 218 ft

Depth

w O

2

No samples

^~

Hole number 78

SP Resistivity
».- ^««*«»« ?* v tintr LAJ It 50 - - MV - - - <wS»»i Sens 1*3* setting tjlw L I.U1{L - - 50- -

c ' c Recording speed _2Q it/ min Recording speed2Q.tt/min
Logged depth _. 22_0.ft _ Logged depth -. 220. ft......

Depth

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-\ r~ /-g ^3^~
-- ^ _ -
: ~~ ,_ . ; . *!* . ^ ._

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. .. ._, -_ :

*

- 0-0

L

j-50
i

L

-2O

- 100
L

- 40

- 200-60

--250 :

- - 80

- 300

515

Hole Nn: L79--__Map; Stewart Lake Date: 9-3-77 State: ND_ County: Sloge_____ 2,980 IL_ Location: T. 133 *, R. IQlw, Sec._JQ , Tract: _J?.ba_a _Drilled depth: _ JOO ft _ Measured: _ Hole size: 4 3A in. _ Air LJ Water (3 Cored: Yes (1 No Lignite beds:.

SK. L3.l(L&m.
110-138; 165-176

Remarks:.
Lithology
Recorded by: Richard

(tcophystcul
. Geologist sue recorded by: Lcchncr

Lithology

Gamma

T.C. _2_ Range 100 cp§_
Recording speed 2D"/min
Logged depth 200ft

Density
T.C. JL Range JLOO cps
Recording speed 2£L**lmin
Logged depth 200ft

Depth

«-. O

II

0- 8 Sandstone, yellowish-gray
8-12 Siltstone, yellowish-brown
12- 24 Claystone, brown, mottled
24- 32 Qaystone, brown
32- 41 Claystone, gray
41- 54 Lignite, black
54- 66 Qaystone, grayish-green, silty
66- 70 Qaystune, brown, carbonaceous
70-114 Qaystone, gray

- 114-139 Lignite, black

- 139-146 Qaystone, gray
- 146-147 Lignite, black
147-159 Qaystone, gray
- 159-176 Lignite, black

- 176-185 Qaystone, grayish-brown
- 185-195 Qaystone, brown
- 195-196 Lignite, black
196-200 Qaystone, gray

-0-0

- 20

ZOO"60

-250
- -80

- 300

_ -100

- 350

516

Hole number L 79

SP
Sens, setting _.._50_MV
Recording speed 2iL ^/min Recording speedJWft/min Logged depth _]2i)0.ft._

1

J

Resistivity
Sens, setting ^Q.

Logged depth ._30.QA. ..._

J

Depth

t
- 40'

1-150

| .

-250 :
:

- - 80'

- ICO.

i-350

r

517

-iole Nn: L80 Map: StewarJL-Lak£-_._ Date:_2=3rZ7 State: NP County:__.______ Bicv.: 2,980 ft_Location: T..112* , R._101w , Sec.-_32_ , Tract:_.Jbbbb_Drilled depth: __2QOfc___... _ Measured: 195ft vsk _10fl_fJw£ Hole size: 4 34 iiu._ Air Q Water H Cored: Yes Q No Lignite beds: ^S^SiJ 8,106; 136-146 .... _....___.._._.. .. ______..___...

lemarks: .

Jthology
Recorded by: Richard Scattolini _ . . Geologist Y«»

C Geophysical logs
lit recorded by: .__ Lechner

Lithology

Gamma

T.C. _1_ Range
Recording spee
Logged depth _.20Q ft

Density

T.C. _2_ Range J,QO_cps
Recording speed 20.
Logged depth 200ft

Depth

0- 5 Siltstone, yellow, mottled
5- 10 Claystone, yellow
10- 16 Claystone, brown
16- 19 Claystone, yellowish-brown, silty
19- 26 Siltstone, yellowish-brown, clayey
26- 42 Claystone, yellowish-brown, silty
42- 44 Siltstone, yellowish-brown, clayey
44- 51 Claystonc, brownish-yellow, silty
51- 55 Siltstone, yellowish-brown, clayey
55- 63 Claystone, gray
63- 75 Lignite, black
75- 80 Claystonc, gray, silty
80-105 Lignite, black

105-110 Gaystone, gray
110-122 Sandstone, very fine grained
122-135 Claystone, light-gray, silty

135-138 Lignite, black
138-150 Sandstone, gray, very fine grained

150-155 Qaystone, brown
155-165 Sandstone, very fine grained
165-170 Gaystone, greenish-gray, silty
170-182 Gaystone, gray
182-183 Lignite, black
183-196 Claystone, greenish-gray
196-200 Gaystone, brown, carbonaceous; sandstone

- L-o-0

- 50

- 20 r~\r^r~"ji < -T_._ ^»^. _ _ 1. * ." ~.~_

180 "~. _;::i^__::...

_ -100

-350

518

SP
Sens, setting 50_MV Sens.
Recording speed 20- w min Recording speed_20tt/min Logged depth . .. .2.00. ft._

H
-J

Hole number L 80

Resistivity

Logged depth-.200 ft

___~ ~i_ii"i " r ~ >.r^ir^~' ^ "^r^ i^-T <L =

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i r f- - S -- ---^^

Depth j

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Lo-o i

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i

L i

r
LiOO

-40

- 150

r- 250
L-. -80

- 300

- 350 '

519

Hole No:___L.8JL___Map:_AinidDn_SE_ ___Date:.JLftZl_ State: __NJ1_County:_Slope £lcv.:_3^025. £t_ Location: T. 112.5 , R.lOLw , Sec. _34_ , Tract: bcbc . _ Drilled depth: _ 20.0 ft Measured:^l-r^ZQJiyak SOiL. FWL, Hole size: _lMJn..._ Air B Water D Cored: Yes Q No Lignite beds: ._29J2L82190; 164-190.. ... ...

Cioophysical logs
.Geologist NO recorded by: ___ _Lechner_

Lithology

Gamma

T.C. 2_ Range
Recording speed 2D"/min
Logged depth __

Density
T.C. _1_ Range JOCLcgs
Recording speed 2Q."/min
Logged depth 200 ft

Pepth

No samples u-o-0

.. "". ^- "T* " f^ ' ~ ' .* r_i" '' *~^. ~. n!r

"7. ^ «. ..^L _ .'^ ^TJL 1._ - . .

100

-40

150

520

- 250
~ -80

- 300

_ -100

-350

Hole number L 81

SP Resistivity Sens, setting ._5Q.MV__ Sens, setting. ..-.SO Recording speed _2H_&/m in Recording speed2Q_fc/min Logged depth .._.. 200..ft._ Logged depth ._20D.ft......

Depth
2

- 0-0

- 20

L

L

- 40.

^200-60

250
- 80

- 300

_J

- 100'

- 35C

521

Hole No:___L.82..- Mip'__Amidon Date: _9-15iZ?_State: JND_ County: Slo£e_ Eiev.:_2J60L£L. Location: T. 121*, R.LQI.W. Sec. .4_ , Tract: _aaaa_._ Drillea depth: _280jt_ Measured: 65ft *&. _J5$Jt Hi. Hole size: __4Jd_in._ Air D Water H Cored: Yes G Lignite beds: .-154=1581173-200 ...._........_._._... ...

No

Remarks: .

Lithology
Recorded by: Richard Scattoijni Geologist

Geophysical logs
recorded by: .. . Lechner,

Lithology

Gamma

T.C._2_ Range JLOQ_cps_
Recording: speed 2i}fymin

Logged depth ^271 ft

T.C.

Density
2 Range 100 cps Depth

Recording speed

Logged depth 272ft

0- 2 Siltstonc, yellowish-brown
2- 5 Claystone, light-brown
5-12 Claystonc, yellowish-brown; with clinker 12-65 Sandstone, yellowish-gray

- 0-0

65-120 No samples

-50

- 20

120-151 Claystonc, medium-gray, silty

- 151-157 Liunite, black
157-163 Claystone, greenish-gray
""163-164 Lignite, black
_ 164-173 Qaystone, grayish-green
173-197 Lignite, black

- 197-203 Claystone, brown, carbonaceous
~ 203-219 Claystone, greenish-medium-gray, silty

~ 219-23 2 Clay stone, pale-green

- 232-259 Claystonc, grayish-brown

-259-261 Lignite, black

"261-266 Claystonc, medium-gray
_ 266-267 Lignite, black
267-270 Claysrone, gray
-270-271 Lignite, black
271-275 Claystone, brown, carbonaceous
~ 275-277 Lignite, black
- 277-280 Guystone, green

. -100

-350

522

Hole number L 82

SP
Sens, setting _ 50_MV...__. Recording speed .2_Q_ fr/min i Logged depth __. ._27.1 ft_

Resistivity
Sens, setting - 50... Recording speed _2Qft/m in Logged .depth - .-271 ft..._

Depth I

"* ^ .---- . . ^ - - -. -. . ~1_*^_7^" - ~j

""".rzsL:"" '^^^^i^^^1

- 0-0

(.

h

h50

L

-20;

r-

MOO

L

- 40.

- 150

T-250
- - 80

- 300

- 550

523

Ho|c No: __._LJL_.._Map- Black Butte ^ Date: 9-14-77 State: NO County:_Slope ... Eicv.:__? J£8 JL_ Location: T. 134.8 , R.JLQiw , Sec. &_ , Tract: __§.a_aa.__ Driliea depth: __._492_ft_____ _ _ Measured:_10j|__^,-13.^iL W Hole size: 4 Kin.. Air D Water B Cored: Yes Q No Q Lignite beds:

Remarks: .

Lithoiogy
Recorded by :

.. 1314671230-234;

Reichert

Geophysical logs
Geologist sac recorded by: JLe_chner_.

Lithology

Gamma

T.C. _2_ Range 100 cps.

Recording speed 2J1'

Logged depth __422Jk

Density

T.C. _2_ Range _100 cp.s

Recording speed 20. ! min

Logged depth 492 ft

Depth

u,

0- 2 Sandstone, yellow, very fine grained
2-21 Siltstone, grayish-yellow, clayey

21- 32 Gravel, yellowish-orange, fine grained to medium-grained
32- 55 Sandstone, yellowish-gray, very fine grained

- 55-110 Claystone, medium-gray, silty

L-o-0

~:-=r-Lt£>O

110-119 Siltstone, medium-gray, clayey
1 !9-l28 Claystone, medium-gray, clayey
'128-165 Lignite, black

165-177 Claystone, brownish-gray, carbonaceous

177-195 Claystone, greenish-gray

195-197 Claystone, brownish-gray, carbonaceous 197-200 Lignite, black
200-209 Siltstone, medium-gray
. 209-212 Claystone, medium-gray, silty
212-215 Claystone, blackish-gray, carbonaceous 215-221 Claystone, medium-gray
.221-225 Lignite, black
225-229 Siltsfone, medium-gray, clayey
229-236 Lignite, black
236-241 Claystone, greenish-gray, silty
' 241-252 Siltstone, medium-gray, clayey
, 252-281 Sandstone, greenish-gray, very fine grained

281 -286 Sandstone, greenish-gray, very fine grained, cemented

286-305 Sandstone, greenish-gray, very fine grained 305-320 No samples

320-332 Siltstona, medium-gray, sandy

332-333 Lignite, black
333-345 Siltstone, medium-gray, clayey
345-348 Claystone, greenish-gray, silty
348-350 Sandstone, greenish-gray, very fine grained 350-352 No samples
352-353 Lignite, black

-50

-20

-100

CT 3^"~r~i~r - ' " ' ~ _

_ on OU j 5,-. :._..: -. :.v ~* v cr^-nT. - --_ r. .-: jvr--:^---.- ."".: ._ -

Hole number continued
L83

Lithology

353-406 Sandstone, greenish-gray, very fine grained, silty

406-412 Siltstone, brownish-gray, carbonaceous, clayey 412-115 Siltstone, medium-gray, clayey
415-492 Sandstone, dark-gray, silty

Gamma

T.C. 2 Range IQOcps
Recording speed 20 ft/min
Logged depth 492ft

Density
T.C._1_Range 1.00 cps
Recording speed 20_ft/min
Logged depth _122jt__

Depth

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O **

r« -C u, 2

_ T . ^ _ ^_ _ ._____ r -~_ --5. ~ ~ "rt^_i^i __"_ tri JT^ VrV, ~ " .r"' -~i "C." -~

T^'"~T~^-_Z_ V-Z^/^T^'. "___.""*'"V * ^-'_^--T-*rJ" "" I fc w

^ ::.... . not

-550

160

. -180
-600

650 -200

L 700

- -220

75C

525

Hole number L 83

SP

Sen*, setting $(LMY
Rec

Logged depth _..422.ft ._

Resistivity
Sens, setting .SP.
ording speed .20- ^/min Recording speed _2Qft/m in Logged depth . J9%.ft_

»- jfl * """ "

*^^ ^^^ ___ H

. ("\"" "Z-2%ZZ

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Depth

g ** §

-50

- 20:

HOO :
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L

f -40;

r

- - 80

-300

__ -100'

526

Hole number continued
L83

SP i Resistivity Depths Sens, setting _SO MV __ iSens. setting _._ ...5Q_ ._._ £ i Recording speed 20_ ft/min Recording spced20.it/niin j £ £ ! Logged depth __492 ft. .. Logged depth 492 ft j u, 2 ' !__ _ .... _.i _ i
I " " " " "

- 1

-

(20
h-ioo

[--450
! --I4O

h

h-

r500

-t>50

I

L -180,
'r-600 i

..J

-650 ; - -200!

700

- 220

527

Hole No:__-LJL4 .__ M^p"JBlack Butte Date: Q-14-77 State: NO County: Slo

Elev.:. 2J47 £t__ Location: T.JLJ4.Sc, R.LQJLw, Sec. __18., Tract: __ aaaa_ Drilled depth: 240ft ___

Measured: 75 ft FNL __- f PEL

£. -2_OQ JL KWK Hole size: 4 % in. Air D Water [H Cored: Yes D No

Lignite beds:. -83JL1JJ. JL66-168;190-193._

Remarks: .

Lithology
Recorded by: Rar\dall Reichert____.

(Geophysical logs
Geologist xac recorded by: .____Lc.chner.__.. ..__.__

Lithology

Gamma

T.C. _2_ Range _LGQ_cps_
Recording speed 20*

Logged depth 240ft

Density

T.C. _JL Range 100 cps
Recording speed2-Q_* t/min

Logged depth 240ft

Depth

k> O

0-10 Sandstone, yellow, very fine grained

~ 10- 11 Siltstone, yellow
11-12 Clinker

12-20 Siltstone, yellow, sandy
- 20- 25 Sandstone, yellow, very fine grained
25- 39 Siltstone, yellow
~ 39- 77 Qaystone, medium-gray

77-121 Lignite, black

- 0-0

- 20

121-131 Claystone, greenish-gray, silty

'131-132 Siltstone, ereenish-gray
132-134 Lignite, black
134-145 Qaystone, greenish-gray, silty
145-148 Qaystone, brown, carbonaceous
148-153 Qaystone, greenish-gray
153-156 Qaystone, brownish-black, carbonaceous 156-163 Qaystone, greenish-gray, silty
'163-166 Lignite, black
. 166-183 Siltstone, greenish-gray, clayey
183-188 Qaystone, medium-gray, silty
188-195 Lignite, black
,195-215 Qaystone, green

215-240 Sandstone, greenish-gray, very fine grained

528

Hole number L 84

SP

Sens, setting - .J?i).MY__ Recording speed_20_
Logged depth _. 240. ft__

- I

Resistivity
r ^0 Sens, setting ..--J.U - _ ^/minRecording speed2Q_ft/mi n Logged depth ...240 ft .._..

Depth

p' ' " ' '_^_ ^"_~~

- 0-0

-50

- 20'

IOO

- 40'

- 150

h

- 200-60

p-250 :
:- -so-

'-300

_ - ioo,

-350

529

Hole No:___LJL5_- __ Map: Black But te Date: 9-14-77 State: _N£L__ County; Slope _ _ _ Elcv.: _ .Z3DSL&L Location: T.JL21*, R.UU-W, Sec. __6__. , Tract: ..._..bccb_Drillea depth: __ 3jDOft Measured: 2,032 ft ¥SK, _13iffwL Hole size: 4 K in. Air S Water D Cored: Yes Q No Lignite beds: ._ ^^11P;_154-169; 236:241 ...._..._.. ...

Lithology
Recorded by: Richard Scattolmi

Geophysical logs
Geologist^* recorded by: .___Lechncr_ _ _

Lithology

Gamma

T.C. _2_ Range o lQO_cgs _
Recording speed IQ
Logged depth 300ft

Density
T.C. JL Range JLO_Q_c£s
Recording speed^iL
Logged depth 300ft

Depth

0- 5 Claystone, yellowish-gray
5- 12 Siltstone, yellowish-gray, clayey
12- 18 Siltstone, yellowish-brown, clayey
18- 27 Claystone, brown, carbonaceous
27- 49 Sandstone, yellowish-brown, fine grained

49- 58 Claystone, yellowish-gray
58- 88 Claystone, light-gray

_ 88-110 Siltstone, light-gray, clayey

110-113 Lignite, black
113-114 Claystone, brown, carbonaceous
114-127 Oaystone, greenish-gray; wood fragments 127-150 Lignite, brownish-black

150-152 Gaystone. medium-gray
152-160 No samples

-0-0

-20

i _ _ . n-T»u»- _._.-.. __, _ ,r L ^^- - ^_ j-u- f) g *%

530

SP
Sens, setting . .50MV__ Recording speed 20 rt/mjn Lo^ed depth ... 3DO. ft._

Hole number L 85

Resistivity
Sens, setting 50 .... Recording speed_2Qft/min Logged depth ..3.00. ft.. _

1

Depth

~~."-~^- "^"VTTu^"- ^ ^ ~_: / ^^*^ir^~ _,_ _ j__r._._v--

- 0-0
I

r
L

- 20.

- 40

- 150

- 200r60

250
- 80

- 300

- 350

531

Hole NQ!_ ,L.86._.__M^p- Rocky Ridge Dace :__^16rZ7-State: ND County: .Slope___._ : _MIS ft_ Location: T.135.S, RjQiw. Sec. __8__., Tract:. _d.ddd_ Drilled depth: _JQOjt__.._ Measured: ^.lOJl-FSL, JJJL. Sfe Hole size: 4% in.... Air D Water (2 Cored: Yes [j No Lignite beds:._ 165=H2;J16-23J

Remarks: .

Lithology
Recorded by; Richard ScattQlini _ . . Y«« Geologist we

Geophysical logs
recorded by: .. :hner_.. ..

Lithology

Gamma

T.C. _1_ Range 100 cps.

Recording speed 2flfymin

Logged depth __299 ft_

Density

T.C. __2. Ran

Recording speed 2Q."/min

Logged depth 300ft

Depth

II

0- 7 Siltstone, yellowish-brown
7- 9 Lignite, brown, powdery
9-15 Gay stone, brownish-gray
15-17 Lignite, brownish-black, woody
17- 26 Qaystone, brownish-gray, silty
26- 27 Lignite, black
27- 30 Qaystone, medium-gray
30- 32 Claystone, brown, carbonaceous
32- 51 Claystone, greenish-gray
51-52 Lignite, black
52- 82 Claystone, greenish-gray, silty

- 82- 93 Siltstone, greenish-gray, clayey

- 93- 97 Sandstone, green, glauconitic, very fine grained
97-101 Siltstone, grayish-green
""101-137 Sandstone, greenish-gray, glauconitic, very
- fine grained

137-138 Lignite, black
_ 138-146 Claystone, light-green, slightly silty
146-163 Qaystone, liglit-grayish-green

163-170 Lignite, black

170-183 Claystone, yellowish-gray, silty

183-184 Lignite, black
184-211 Claystone, greenish-gray; plant fragments

-211-212 Qaystone, dark-brown, carbonaceous _212-213 Lignite, black
~213-215 Claystone, dark-brown, carbonaceous -215-234 Lignite, black
234-260 Siltstone, light-gray, clayey

-260-300 Claystone, light-greenish-gray, clayey

-0-0

-20

^=££".-£====1 80

- -~- -^ L_

-350

532

SP
Sens, setting . 5D_M.V__ Recording speed 20 ft/min Logged depth -299 ft. __

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-1
J

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i

Hob number L 86

Resistivity
Sens, setting -50-- Recording speed 20. ft/min Logged depth ...299. ft ._._

Depth

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- 20:

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t-ioo ;
I

-40

- 200-60

r~ i

- 250 :

L -80

r-soo

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- 35C

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533

-lole No:
ilev.:

_ .L_8_Z.._.__Map:. _ Bkc.kJ3uttc___ _Date:.JLlTiZjLState: _ND_ County :_Sio£e_
2t8.18.fL. Location:' T.135 g , R.IOLw , Sec. _20_ , Tract: __4daa _ Drilled depth: _26Q_fL Measured:J,1 2Mil^SL',_J.QO_£tFwk H^le <ige: 4 3/d in. Air fl Water H Cored: Yes Q No Lignite beds: ._156il84; 250-254.

Remarks: .

Lithology
Recorded by; ijdJkat.tQJini . _ . .

Geologist

Geophysical logs
recorded by:

Lechner

Lithology

Gamma

T.C. -1 Rangel.OQcps
Recording speed
Logged depth 259 fr

Density
T.C. _2_ Range 100 cps

O £

Recording speed 20.**}mm
Logged depth 260 ft

Depth

0-15 Sandstone, yellowish-brown
15- 30 SUtstone, yclloxvish-brown, clayey

30- 45 Sandstone, yellowish-gray
45- 47 Cbystone, yellowish-brown
47- 60 Chystone, light-gray

60- 95 Sandstone, yellowish-gray

95- 97 Siltstone, yellowish-brown, clayey
97- 99 Lignite, black
99-102 Claystone, brownish-gray
102-103 Claystone, dark-brown, carbonaceous 103 104 Lignite, black
104-106 Claystone, light-gray
106-107 Claystone, brown, carbonaceous
107-1J 6 Claystone, light-gray, slightly silty 116-117 Lignite, black
117-155 Claystone, light-gray
155-182 Lignite, black

182-195 Claystone, greenish-gray
195-206 Siltstone, greenish-gray, clayey
206-211 Sandstone greenish-gray
211-248 Claystone, light-green, silty

248-256 Lignite, black
256-260 Claystone, light-green

-0-0

}-50

- 20

534

- _

rrgl

r-250
- - 80

. -100

SP
Sens, setting __5Q.MV___. Recording speed_20_ it/min Logged depth .. 259.ft._

Hole number L 87

i ;

Resistivity Depth j
Sens, setting _ .50..... M |
Recording speed20.it/min j Logged depth -.259. ft..

_:_-v-_ __.__...____; r=v _ _ __. A . __ ,.._ _T7t_. _ __ .. -... _,.. ,,. . ^*>
r"*~ _' \ ..~r."" ~"~,J."""~.T_;-~ " "" ^._rr~- "^ .

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i

- 100

r-150

-200-60

- - 80-

- 300

- 100'

- 350

535

Hole No:.___LJL8__.._Map:__3kckJkLtie_ _ Date :_M5:Z7 State: __ND__ County:_Slope £iev.:_2J_6Q_h_ Location: T. 135 S , R.JCQw . Sec. _^Q_ t Tract: _. aaaa _ Drilled depth: 160 ft Hole size: 4 % in. Air D Water S Cored: Yes Q No

Lignite beds:.._.-

Remarks: .

Lithology
Recorded by; Richard ScattolinL

Cioophysical K>gs
Geologist N« recorded by: Lechner

LitKology

Gamma

T.C. _2_ Range .100 ops.

Recording speed 2Q"/min

Logged depth 160 ft_

Density

T.C. _jL Range _LQP_c£s

Recording speed 20. "/min

Logged depth 160 ft

Depth

o «

u, 2

0- 1 Sand, brown
1- 4 Clay, brown, carbonaceous
4-12 Gravel
12-17 Siltstone, brownish-yellow, clayey
17-19 Siltstone, yellow, siliceous
19- 30 Siltstone, yellow, very fine grained
30- 60 Lignite, black

60- 65 Claystcnc, greenish-gray
65- 80 Sandstone, gray

80- 86 Gaystone, pale-green
86- 90 Siltstone, brown
90- 95 Siltstone, pale-green, clayey
95-102 Claystone, pale-greenish-gray
102-103 Lignite, black
103-115 Claystone, pale-greenish-gray
115-116 Qaystone, dark-gray, carbonaceous 116-139 Claystone, light-green
139-146 Lignite, black

146-148 Claystone, dark-gray, carbonaceous 148-156 Claystone, pale-green
156-158 Lignite, black
158-160 Siltstone, tan, siliceous

- 250

~ -80

r300

_ -100

-350

536

Hole number L88

SP

Sens, setting _ .2QMV_ Recording speed 2.Q_n:/ min Recording Logged depth .._..16Q_ft _

Resistivity Depth
Sens, setting 50.._ w speed IQft/m in ! ~ £

1

Logged depth ...160.ft

ho-o

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- 50

L

-20

100

- 40

- 150

- 200r60

250
-80

r-300

"--350

537

lole No:___LJ15L- _.__ Ma p! Black Buttc __ Dace:__2JJbZZState: ND County: Slope____. rlcv.:__2*760 .(L Location: T. 135 * , R.1Q1* , Sec. _3Q__, Tract: ._dddd_ Drilled depth: 160ft vieasured: JiifL- FSL. -J5JL Hfc Hole size: 4 3/4 in. _ Air D Water H Cored: Yes Q No Lignite beds:.__ 27AU,36-66; 14Q-145.... .... ._....__....__.. ... . . .

Remarks: .

Lithology
Recorded by: Richard ScattolinL

Cioophysical
Geologist swc recorded by: _Le_chncr__.. . _ _.,

Lithology

Gamma

T.C. _2_ Range 100 cps_
Recording speed 20."/min

Logged depth _160 ft

Density

T.C. _2_ Range 100 cps

V £ *

Recording speed 2Q_*V min

Logged depth 160 ft

Depth
VI

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8
tu

- 0-14 Claystone, yellowish-brown
- 14-16 Gravel

16- 26 Claystone, gray
~" 26- 30 Lignite, black
- 30- 34 Claystone, light-gray
34- 35 Claystone, brown, carbonaceous
~ 35-62 Lignite, black

- 62-81 Claystone, palc-greenish-gray to medium-gray

81-82 Silts tone, gray, siliceous
82- 91 Qaystone, medium-gray
91- 98 Qaystone, pale-greenish-gray
98-101 Siltstone, greenish^gray, siliceous
101-114 Qaystone, grayish-brown
114-123 Claystone, light-green
123-131 Claystone, light-gray

131-137 Claystone, medium-gray
137-145 Lignite, black
145-160 Claystone, grayish-green

- 0-0

- 20

- 100

-20Cl 60

-250

- - 80

- 300

_ -100

-350

538

Hole number L 89

SP Resistivity Sens, setting -20M\L_ Sens, setting ..-.50_.__._ Recording speed.2£L ft/min Recording speed_2Qit/min Logged depth __. .160. ft._ Logged depth _ _160.ft_._

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Depth

c/> >- * » o
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1-50

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~ 40

1-150

- 200-60

^-250
'- -80

J -300

- 100

-350

I-

539