UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

GEOPHYSICAL AND LITHOLOGIC LOGS OF 39 TEST HOLES DRILLED DURING 1978 IN THE COMO WEST AND ELMO QUADRANGLES, CARBON COUNTY, WYOMING

By Dan E. Hansen and David L. Schug

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INTRODUCTION

The U.S. Geological Survey drilled 39 test holes during 1978, on Federal lands in the Como West and Elmo Quadrangles, T. 22 and 23 N., R. 80, 81 and 82. W., Hanna coal field, Hanna basin, Carbon County, Wyo. as part of the Coal Exploratory Program. The purpose of the drilling was to explore for coal, facilitate correlation of coal beds, and evaluate their thickness, lateral extent, and quality. All of the drilling was done in the coal-bearing Paleocene Hanna Formation, which is as much as 7,250 feet thick. For information on previous drilling by the U.S. Geological Survey in the Hanna coal field see Blanchard and Pike (1977), Hettinger and Brown (1978), Hettinger (1978) and Schroder and Dronyk (1978).

Drilling was done by K and K Drilling, Inc., Montrose, Colo., under the supervision of the Geological Survey. Rotary holes were drilled by truck-mounted rigs using 4 1/4 to 5 1/8 inch tricone rock bits and three-way blade bits. Core holes were drilled using a 10-foot-long core barrel with a core diameter of 2.4 inch (HQ size), diamond-bit size of 3 7/8 inch; recovery was better than 95 percent. Drilling fluids used were air, air-water biodegradable foam, and mud. Most of the holes were filled with heavy mud upon completion and a surface plug of cement placed therein. Drill sites were then reclaimed. Drill-holes 25-E-B, 26-E, 32-E, 34-E, 5-CW, 6-CW, 23-CW, 18-CW, and 19-CW were completed as water observation wells and cased with 4 1/2 inch outside diameter perforated plastic casing by the Geological Survey, Cheyenne, Wyo.

The geophysical logging of 34 drill holes was done by Nuclear Logging Service Inc., Lafayette, Colo., and five drill holes by the Geological Survey, Lakewood, Colo. A general suite of logs consisting of gamma ray, gamma gamma (density)--focused and unfocused, resistivity, and caliper were run. A few of the holes closed immediately after being drilled and the gamma ray and gamma-gamma (density) logs were run through the drill pipe in these holes. Three drift surveys were completed. The results are discussed in a separate section of this report.

Holes 25-E-A, 31-E, and 12-CW were abandoned because of drilling problems. All were offset a short distance and completed. Hole 25-E-A was abandoned because of a large water flow from the surface alluvium and a subsurface sandstone; hole 31-E was abandoned because of lost circulation caused by surface fractures; and hole 12-CW was abandoned because of a large water flow from a subsurface sandstone.

The geophysical logs in this report were photographically reduced to 20 percent of the original size. The vertical scale is about 1 inch to 50 feet. All measurements on the geophysical logs are in feet; to convert to meters multiply by 0.3048. All logs but three were hand traced before reduction and are not photographic reproductions of the original logs. The entire geophysical log of drill-hole 27-E was not reproduced because a malfunction caused the gamma ray log to be almost useless at a reduced scale.

Lithologic logs are based on field examination of drill-hole cuttings collected at 5-foot intervals, and lithologic interpretations are adjusted to geophysical logs.

DRILL-HOLE SECTIONS AND PRELIMINARY CORRELATIONS

Several of the drill holes were located to penetrate coals mapped by Dobbin, Bowen, and Hoots (1929) and by Glass and Roberts (1979). A few coal beds were projected into unmapped areas by means of the geophysical and lithologic logs. Most of the correlations of coal beds shown on the drill-hole sections of figures 10-18 either involve the strata between coal beds or unknown coal beds. The strata shown on these sections are in the upper part of the Hanna Formation. This information will be used with other subsurface and surface information to construct composite lithologic columns, correlate strata and coal beds, and construct large cross sections. Information shown for the Como West Quadrangle will be used to make correlations across a fault system in the central part of the quadrangle.

The lithology shown on the drill-hole sections was plotted from lithologic descriptions adjusted to geophysical logs.

DRILL-HOLE DRIFT SURVEYS; LOGS AND ANALYSIS

The results of the drift surveys, run by Nuclear Logging Service, Inc., are shown in figures 19-22. Horizontal deviations were calculated and graphed originally by Nuclear Logging Service, Inc., and are shown in figures 19-21. Vertical deviations were derived from data as furnished by Nuclear Logging Service, Inc. The graphics of the horizontal and vertical drift both show the strong clockwise rotation of the direction of the drill holes. This clockwise, downward spiraling was caused primarily by the dip of the rocks. The relative differences in hardness of the layered rocks has some effect. The sandstones, generally the hardest strata, have the effect of causing a relatively greater deviation from the vertical.

The graphics of the vertical deviation, figure 22, show that the effect of the downward spiral in these three drill holes (11-CW, 12-CW, and 26-E) was to bring the drill pipe perpendicular to the dip of the strata. The azimuth of the drill-hole deviation generally coincides with the bearing of the angle of dip, but is measured in the opposite direction. This means that at depth the drill bit is generally penetrating the true stratigraphic thickness.

In summary, during the drilling of dipping strata in the Hanna Basin the drill pipe was short of the sought-after vertical depth but had penetrated more stratigraphic section than would have been penetrated by a vertical hole.

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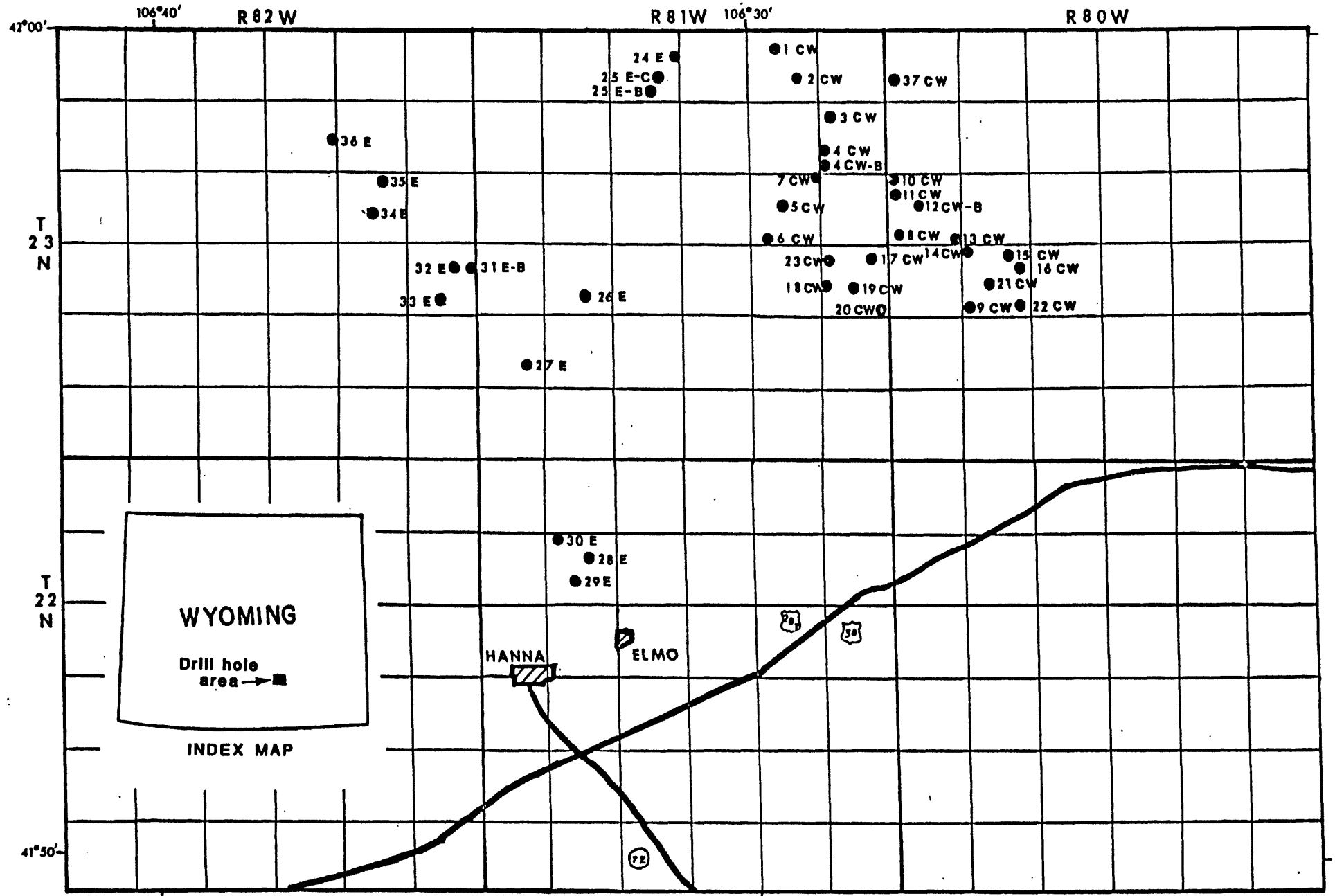


Figure 1.- Sketch map showing approximate locations of drill holes, Hanna coal field, Wyoming

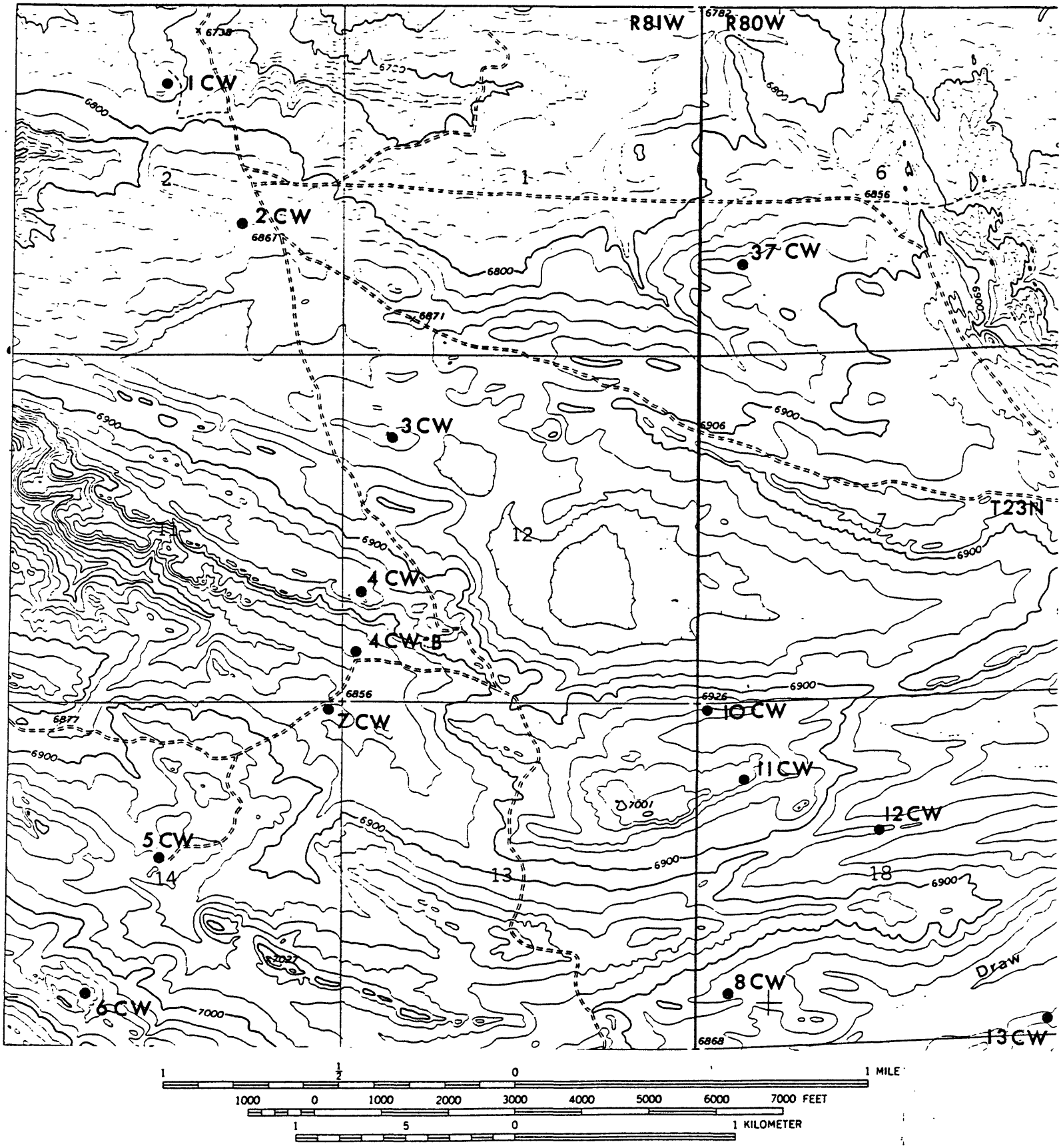


Figure 2.-Drill-hole location map, northwest part of Como West Quadrangle, Carbon County, Wyoming.

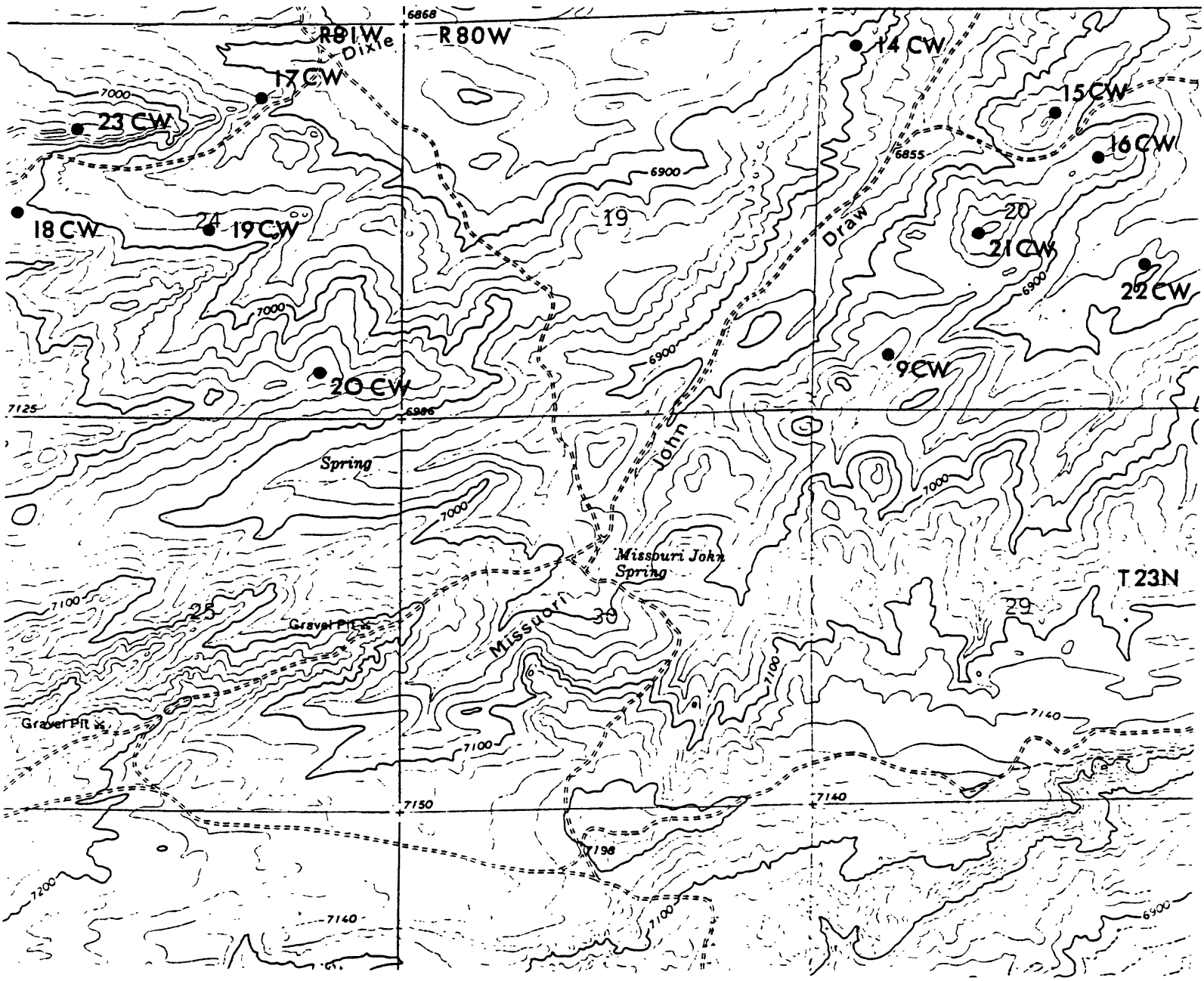


Figure 3.- Drill-hole location map, central part of Como West Quadrangle, Carbon County, Wyoming.

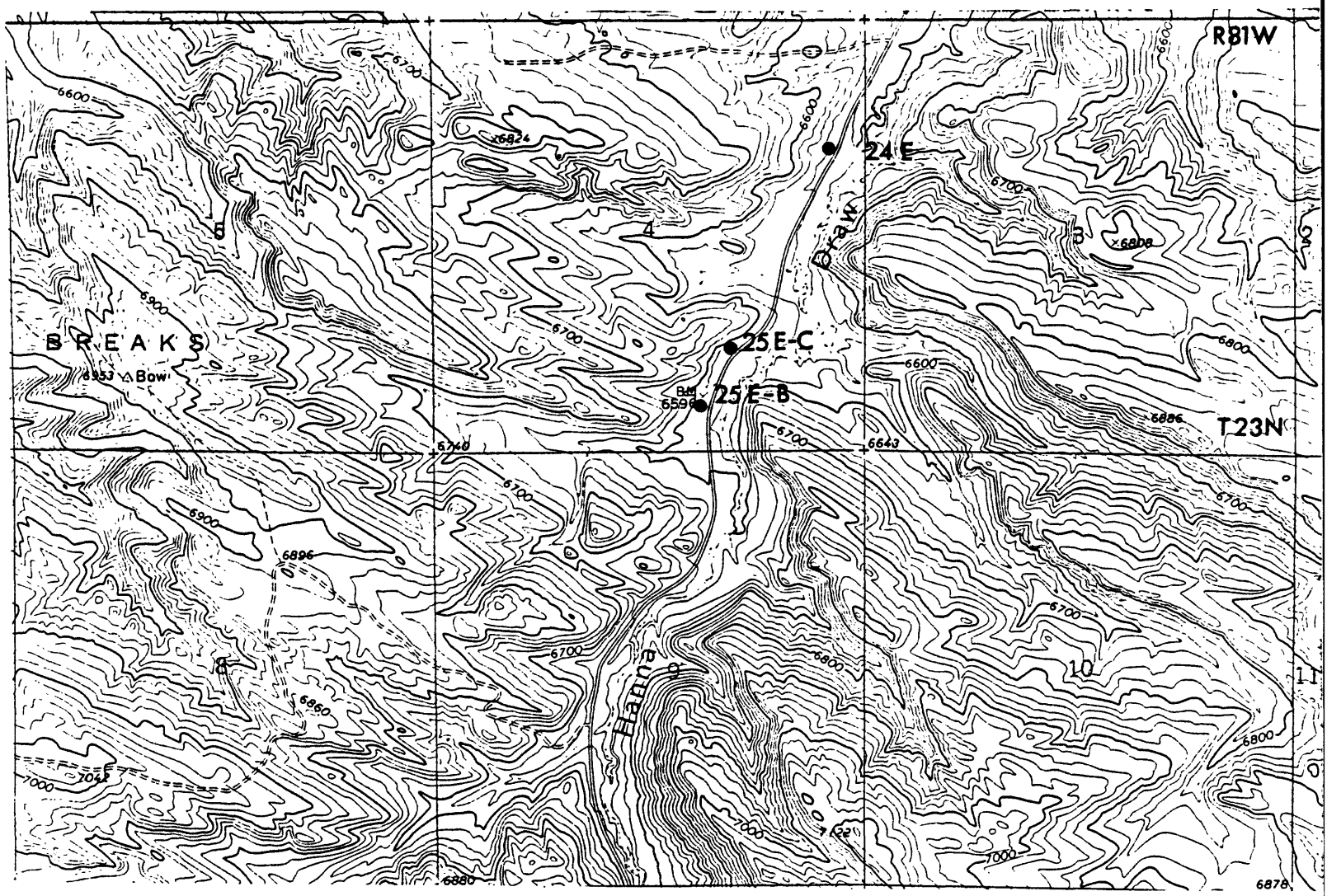


Figure 4.- Drill-hole location map, northeast part of Elmo Quadrangle, Carbon County, Wyoming.

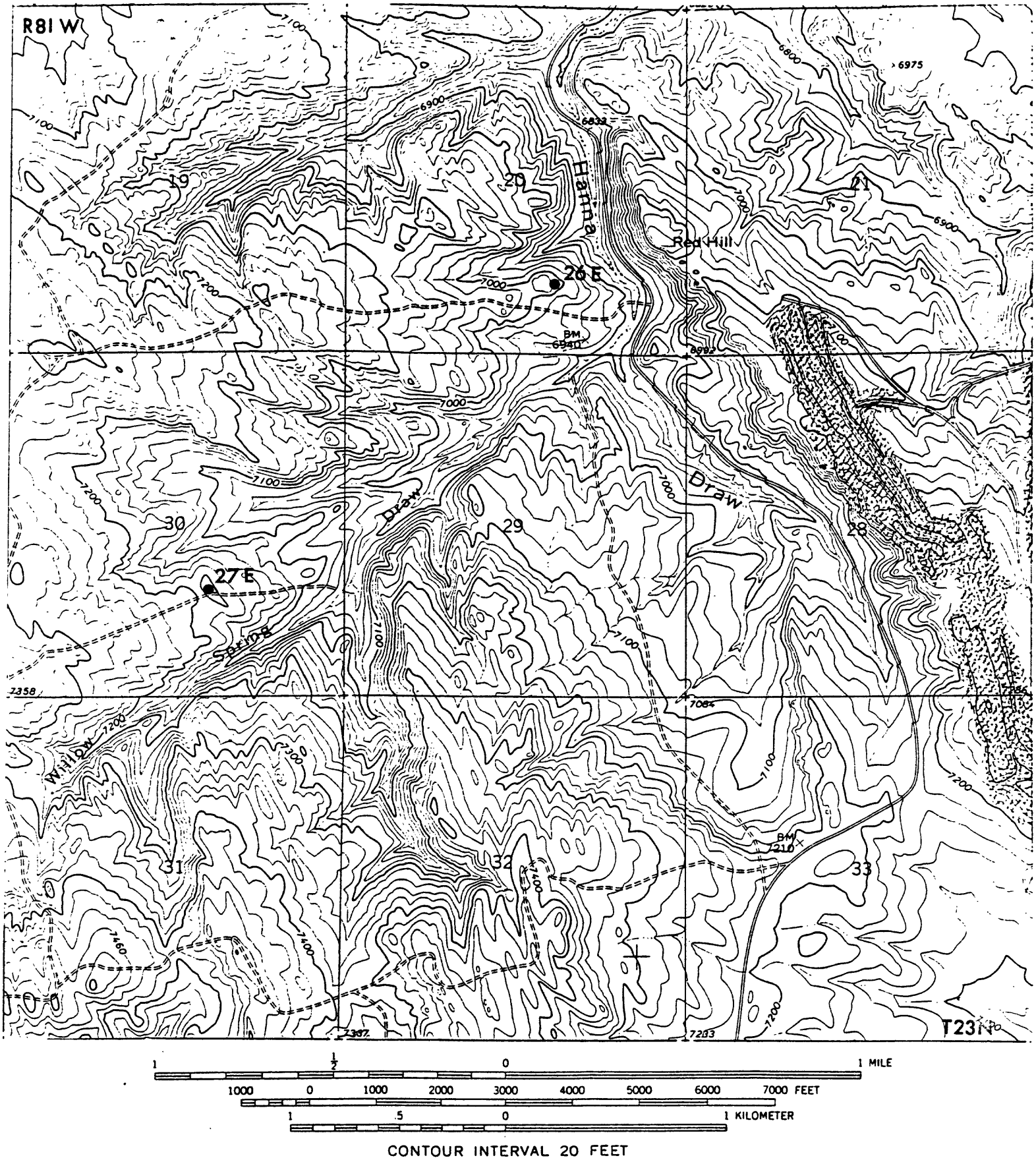


Figure 5.- Drill-hole location map, central part of Elmo Quadrangle, Carbon County, Wyoming.

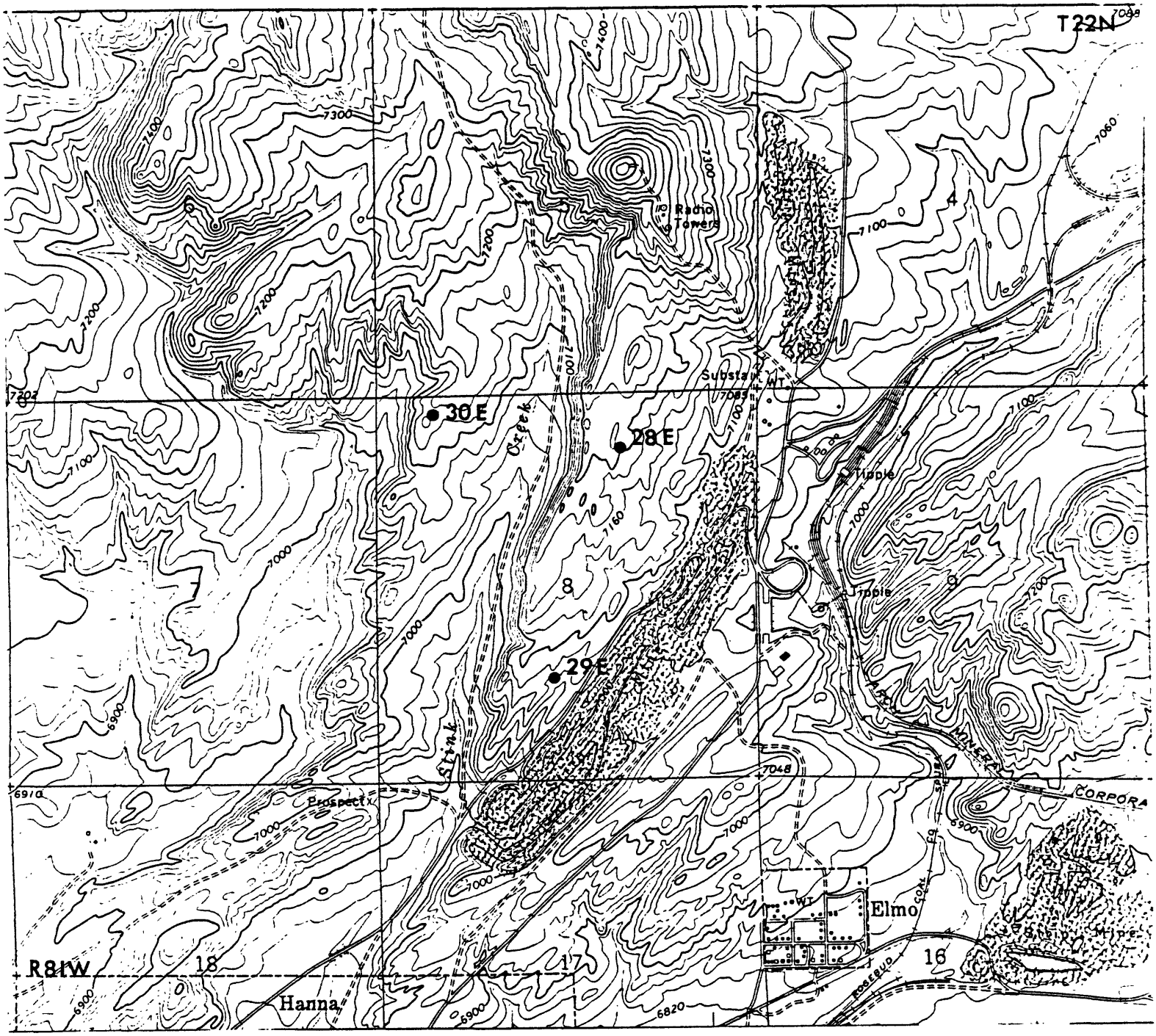


Figure 6.- Drill-hole location map, southeast part of Elmo Quadrangle, Carbon County, Wyoming.

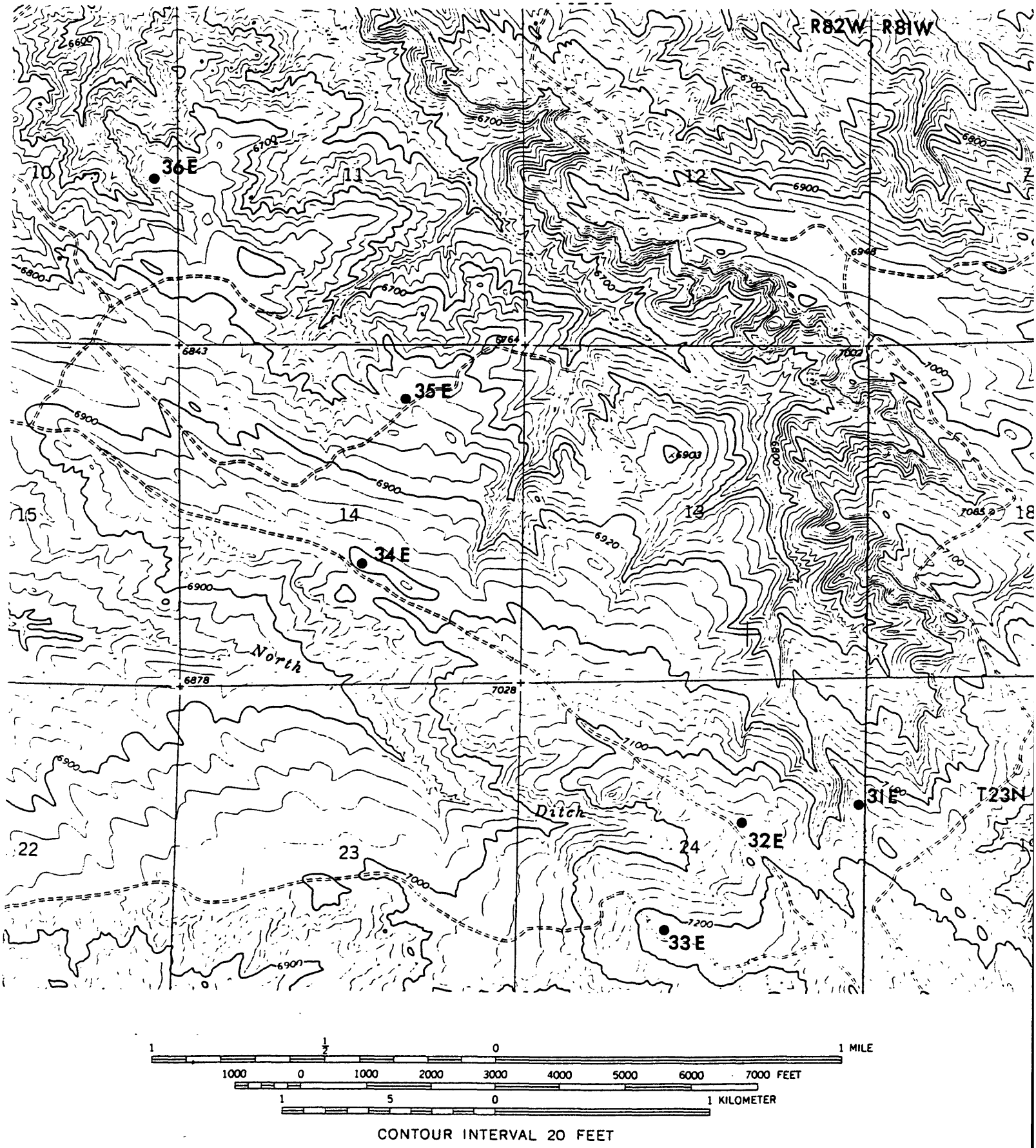


Figure 7.- Drill-hole location map, northwest part of Elmo Quadrangle, Carbon County, Wyoming.

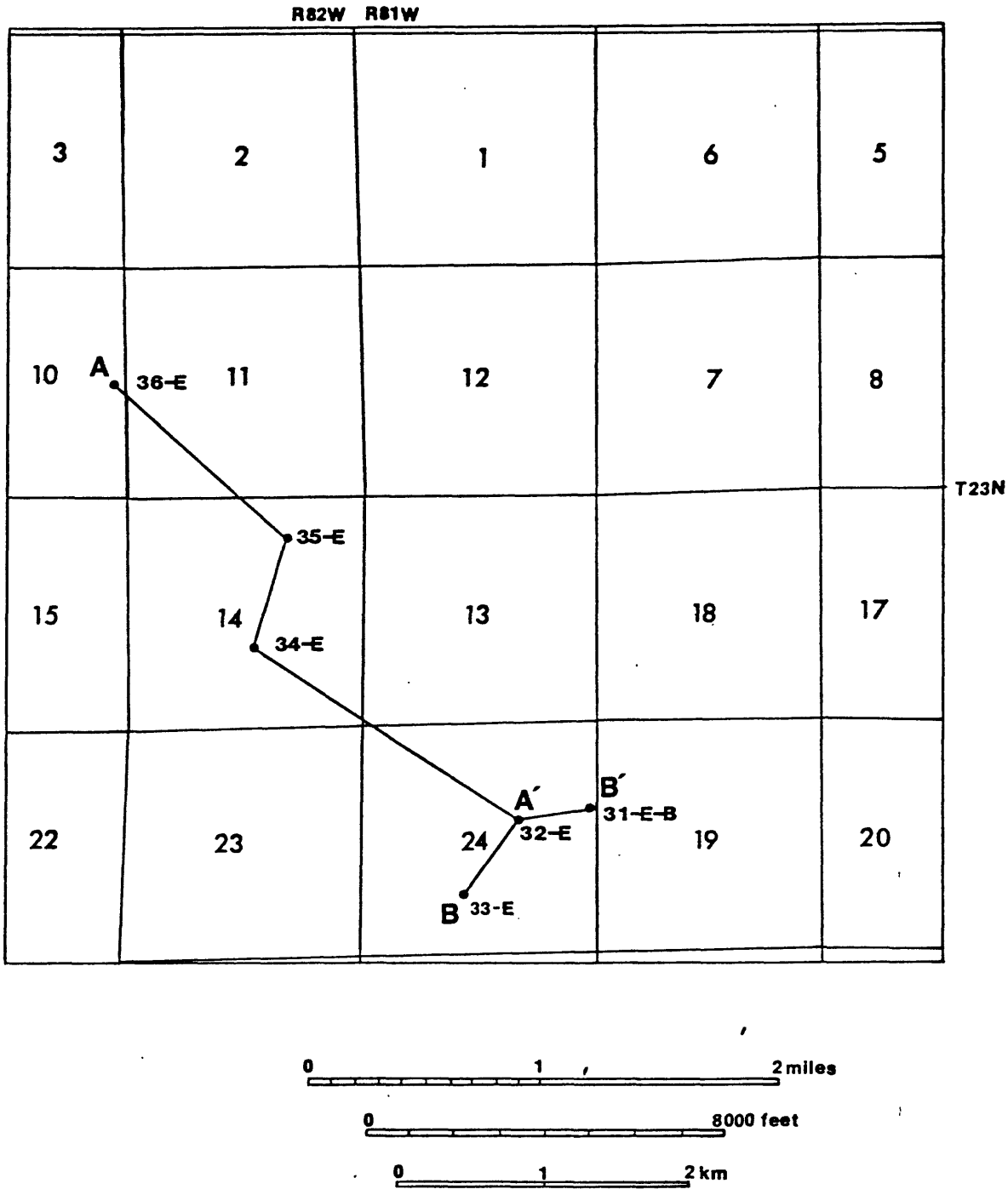


Figure 8.- Location map of correlated drill holes, northwest part of Elmo Quadrangle. Letters refer to correlated drill hole sections.

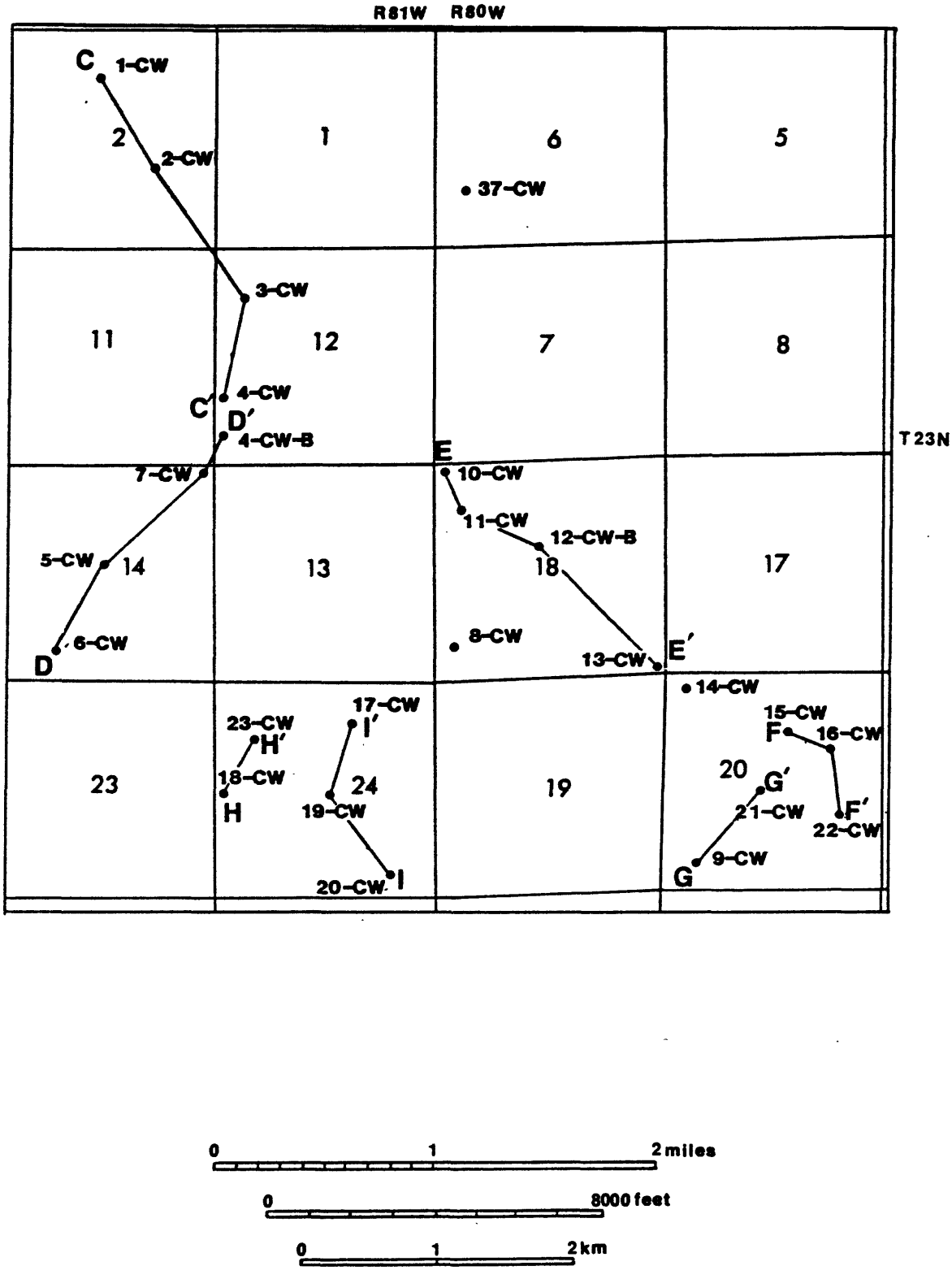


Figure 9.- Location map of correlated drill holes, northwest part of Como West Quadrangle. Letters refer to correlated drill hole sections.

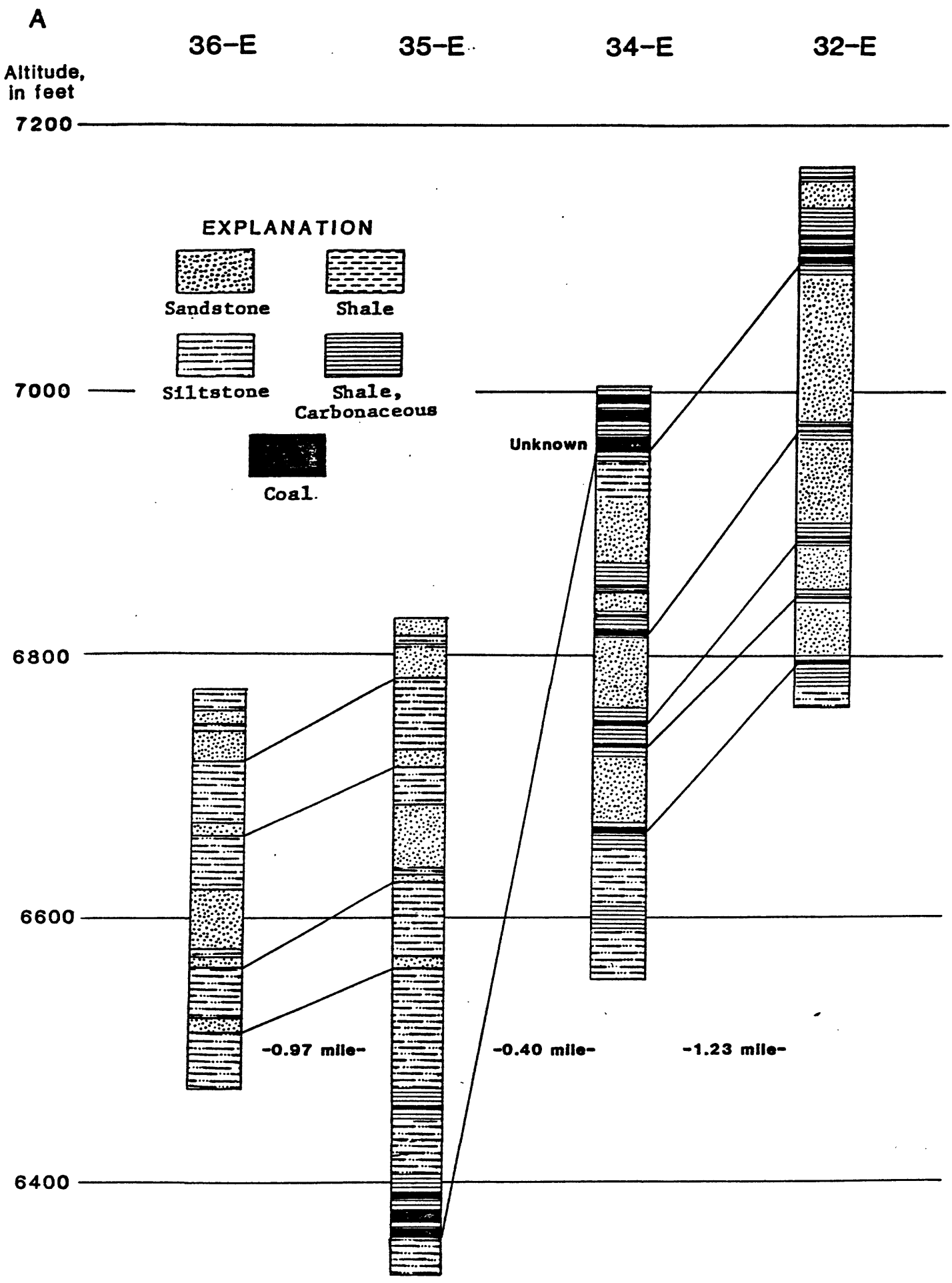


Figure 10.- Preliminary Correlation of Drill Holes in the Hanna Basin, section A-A' (fig. 8).

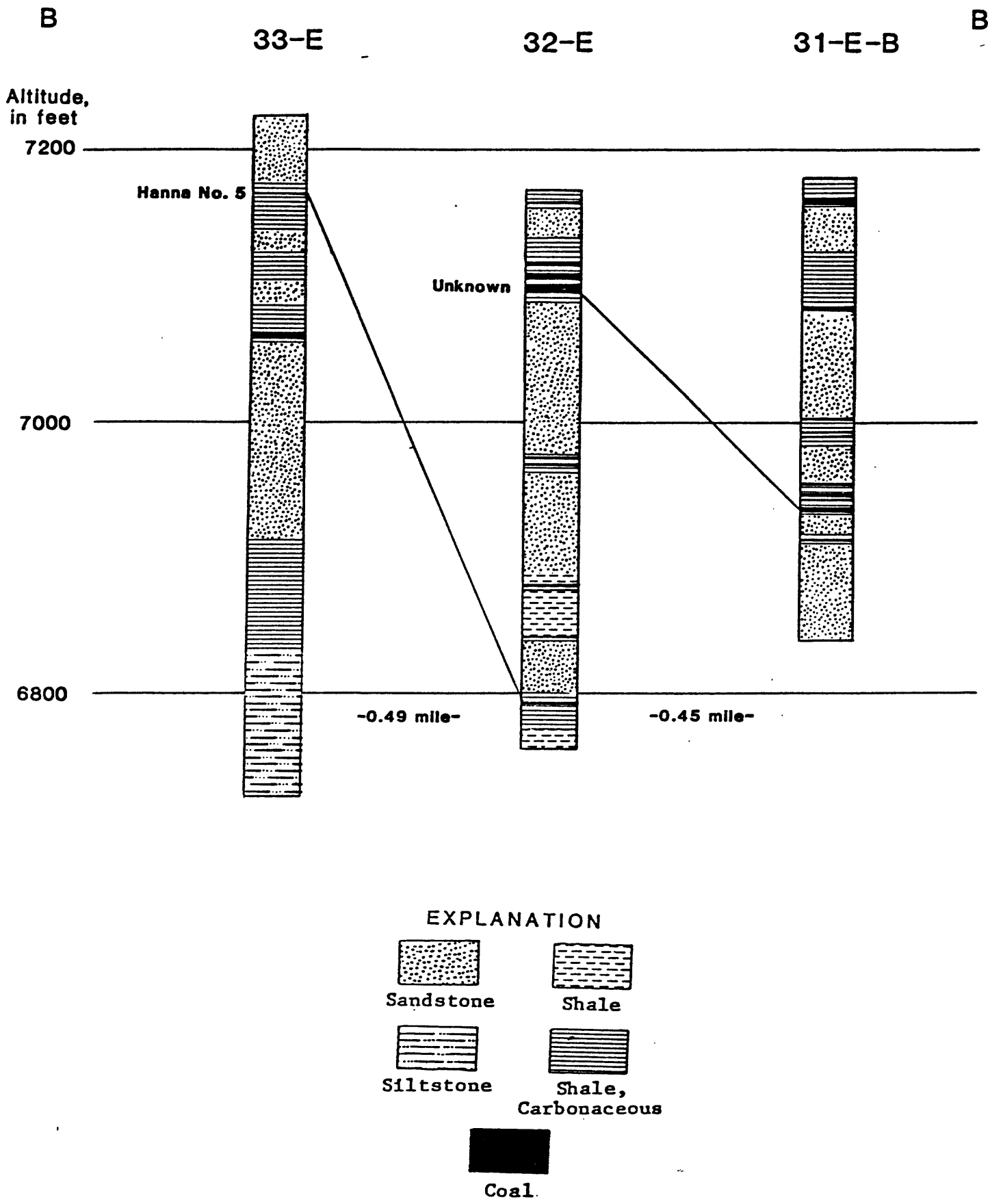


Figure 11.- Preliminary Correlation of Drill Holes in the Hanna Basin, section B-B' (fig. 8).

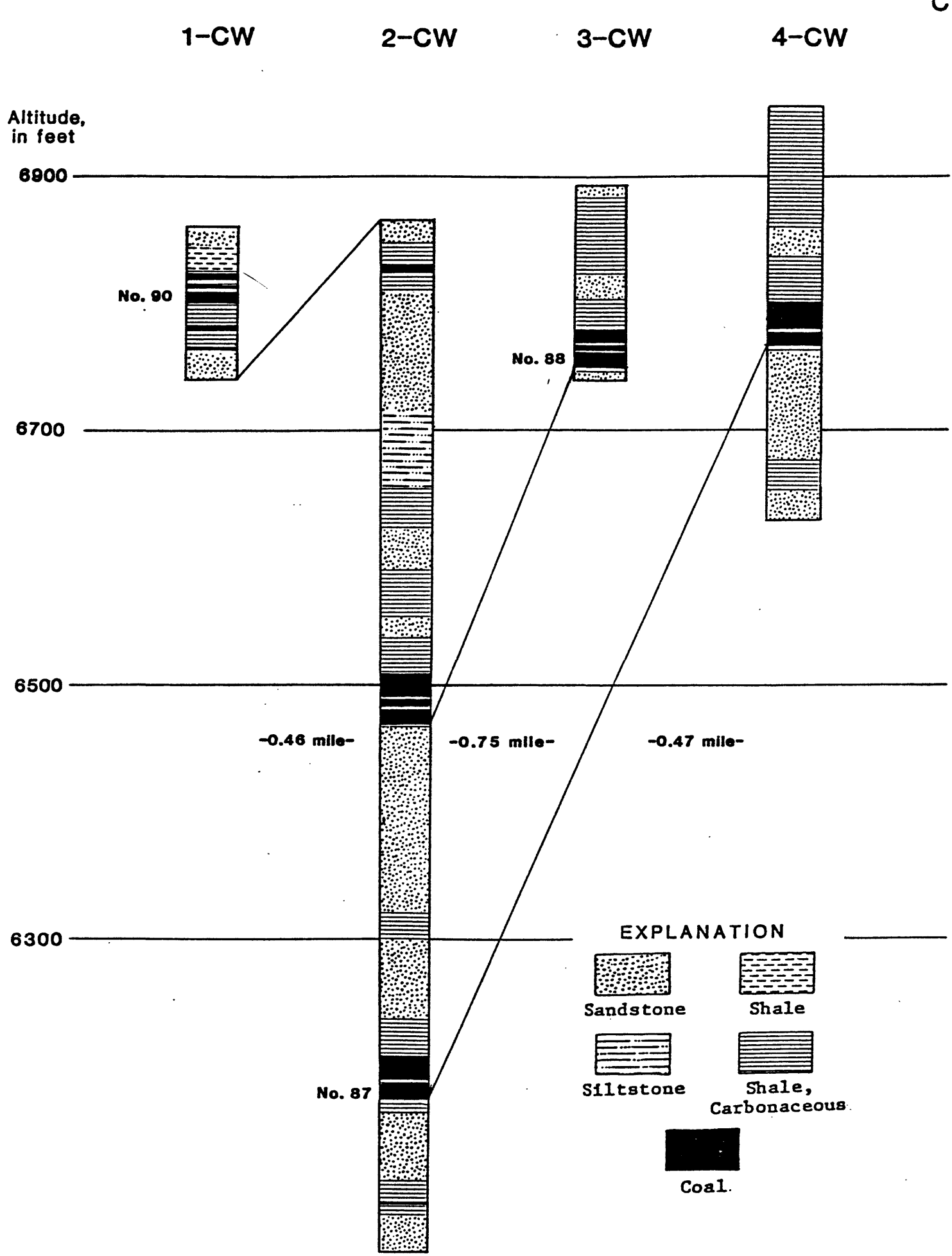


Figure 12.- Preliminary Correlation of Drill Holes in the Hanna Basin, section C-C' (fig. 9).

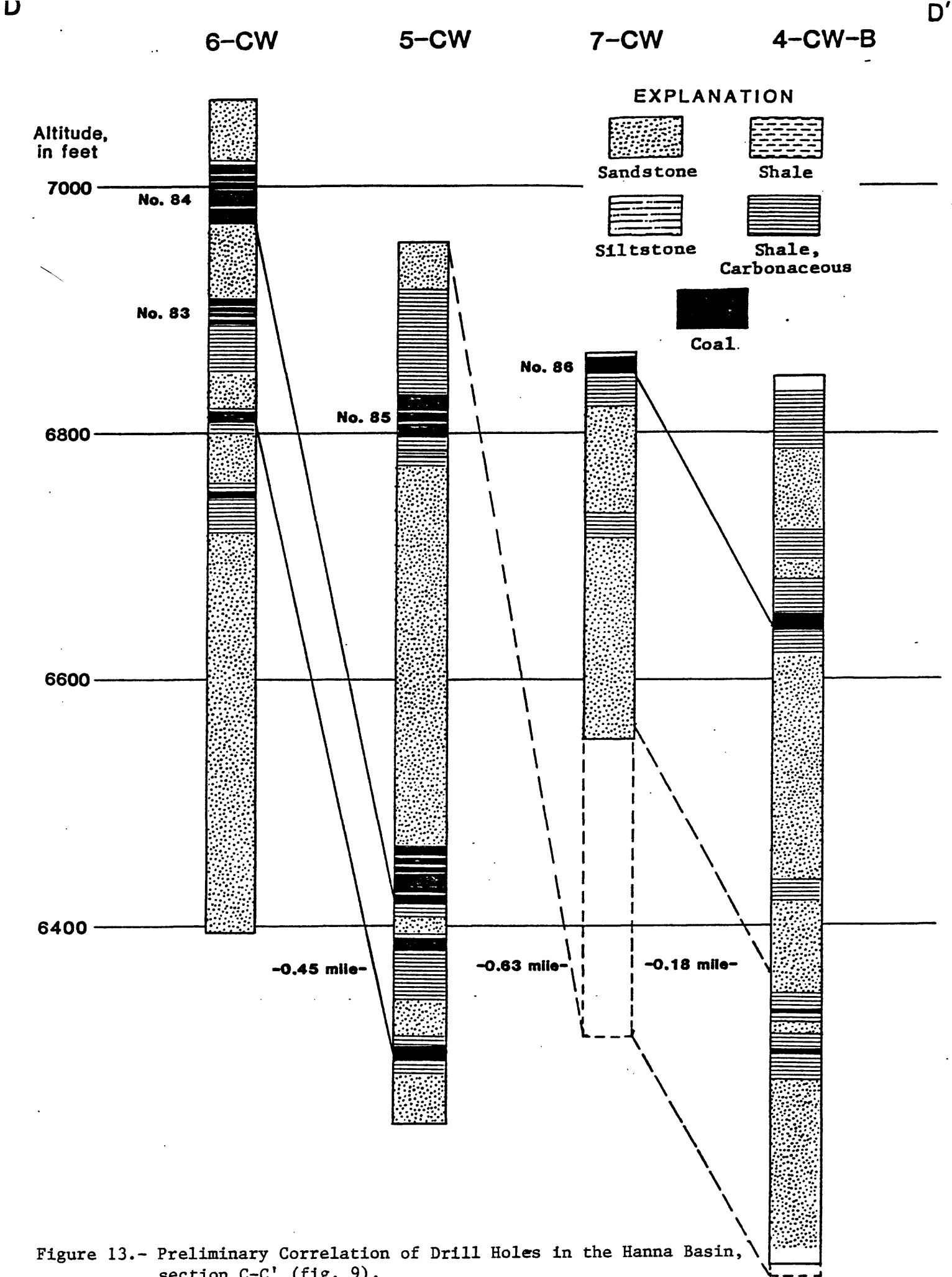


Figure 13.- Preliminary Correlation of Drill Holes in the Hanna Basin, section C-C' (fig. 9).

E

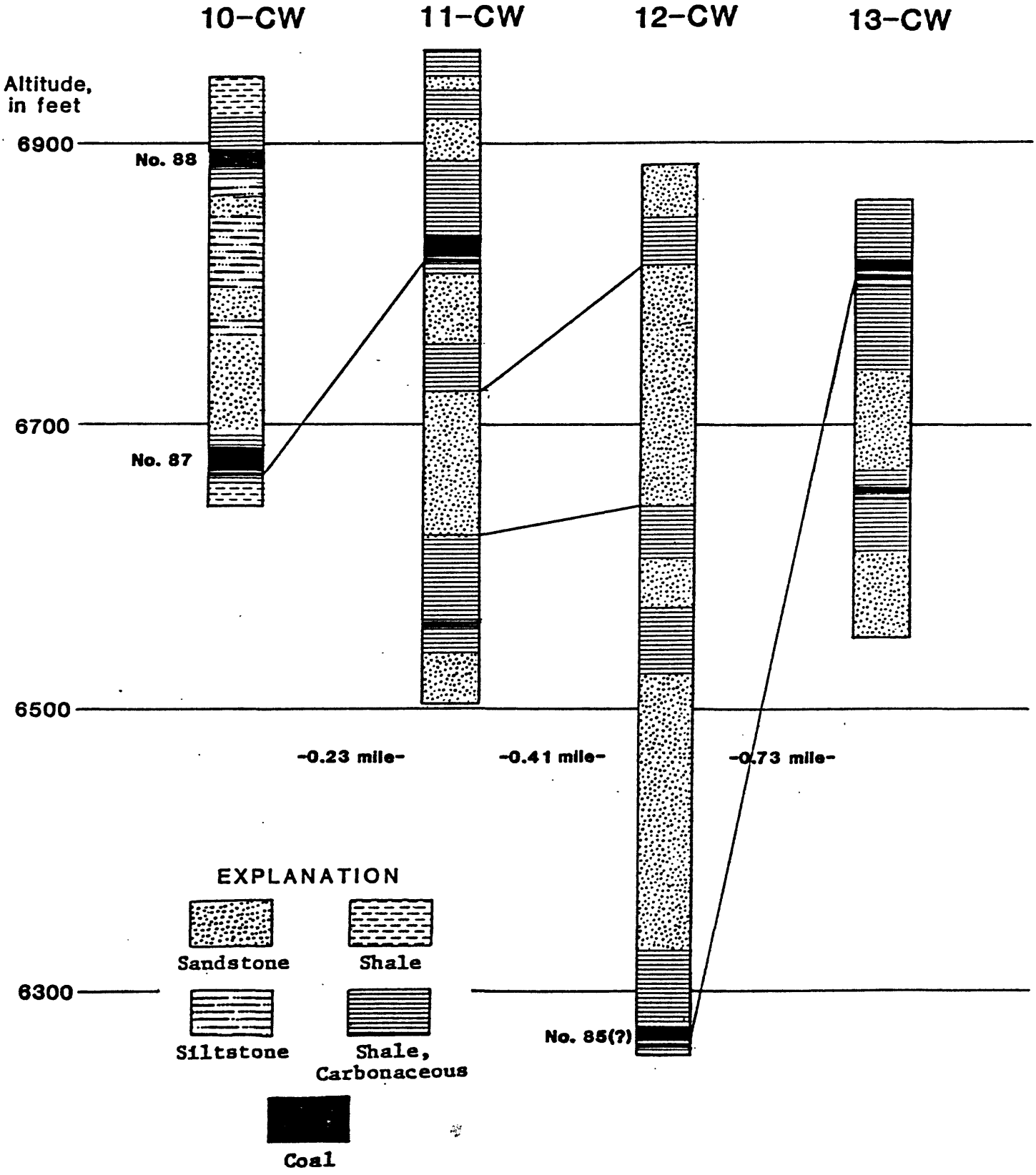


Figure 14.- Preliminary Correlation of Drill Holes in the Hanna Basin, section E-E' (fig. 9).

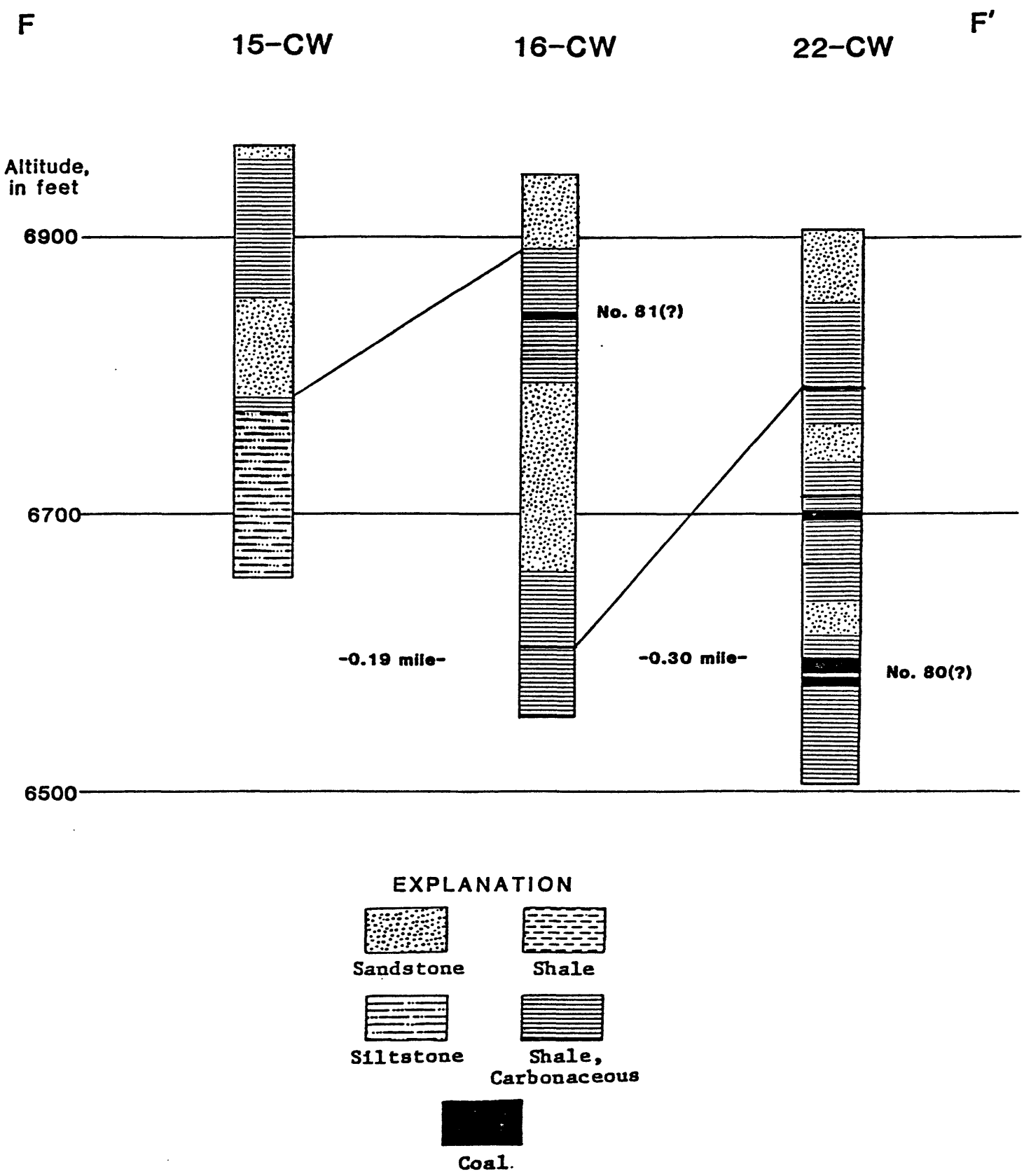


Figure 15.- Preliminary Correlation of Drill Holes in the Hanna Basin, section F-F', (fig. 9).

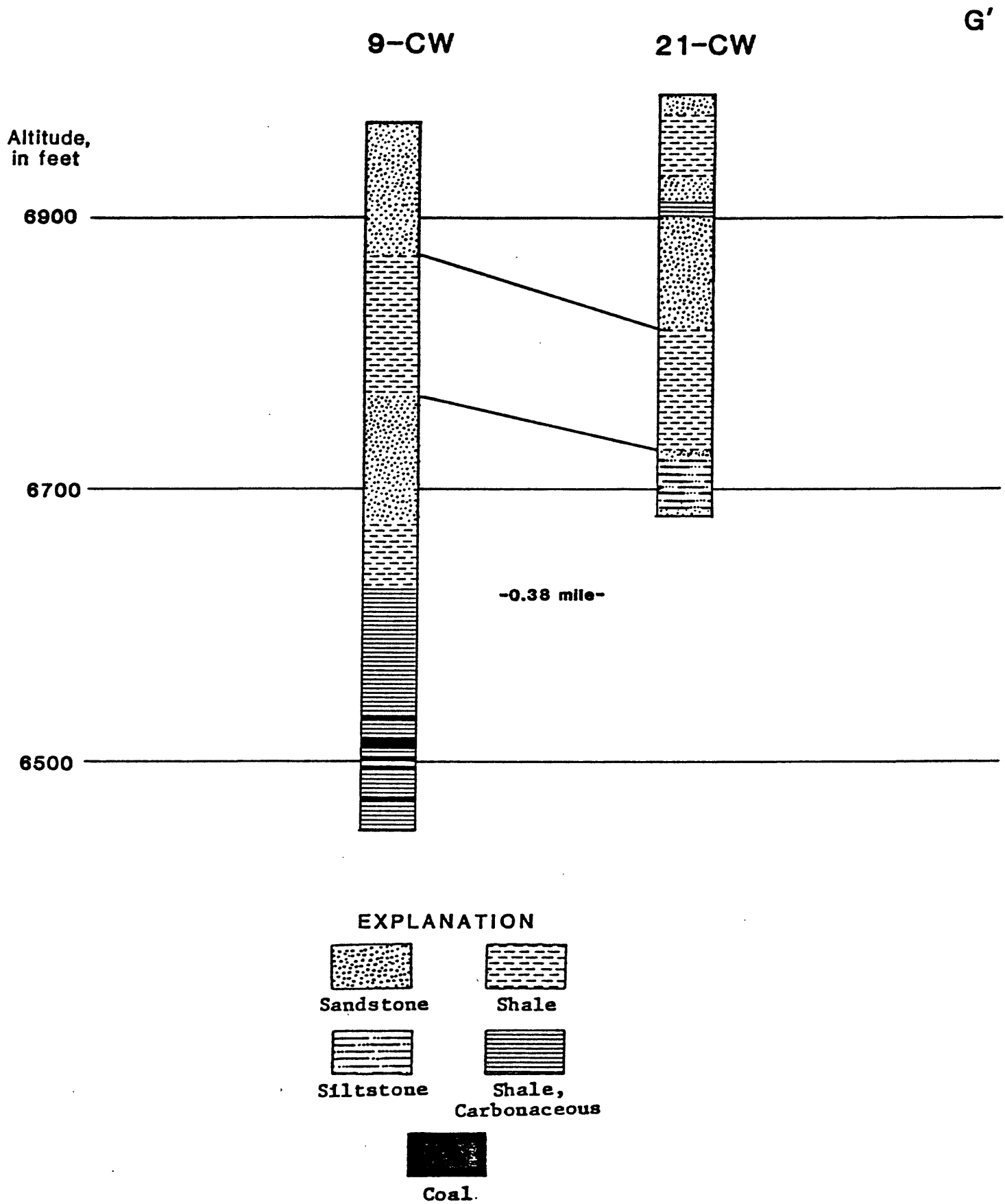


Figure 16.- Preliminary Correlation of Drill Holes in the Hanna Basin, section G-G', (fig. 9).

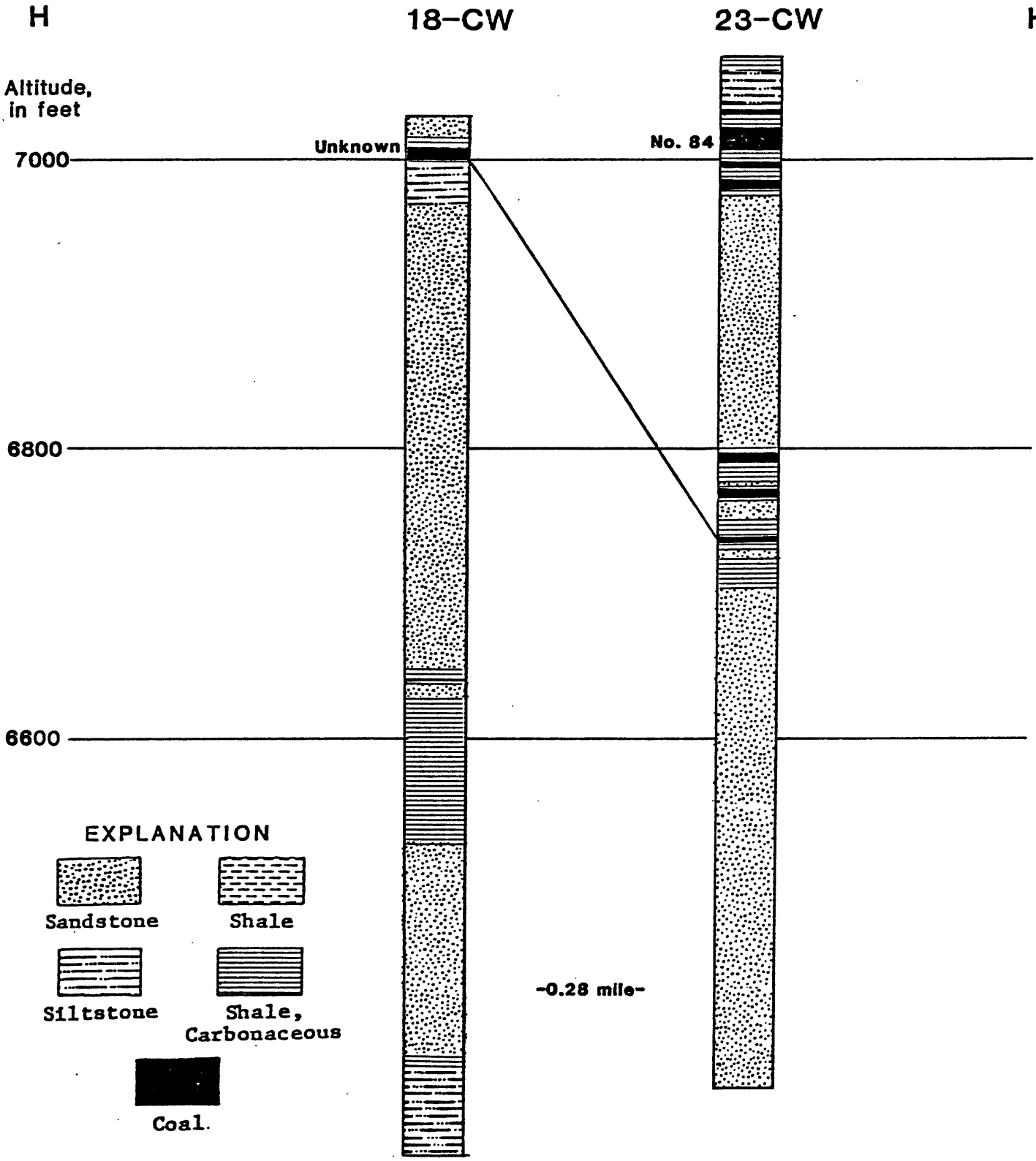


Figure 17.- Preliminary Correlation of Drill Holes in the Hanna Basin, section H-H', (fig. 9).

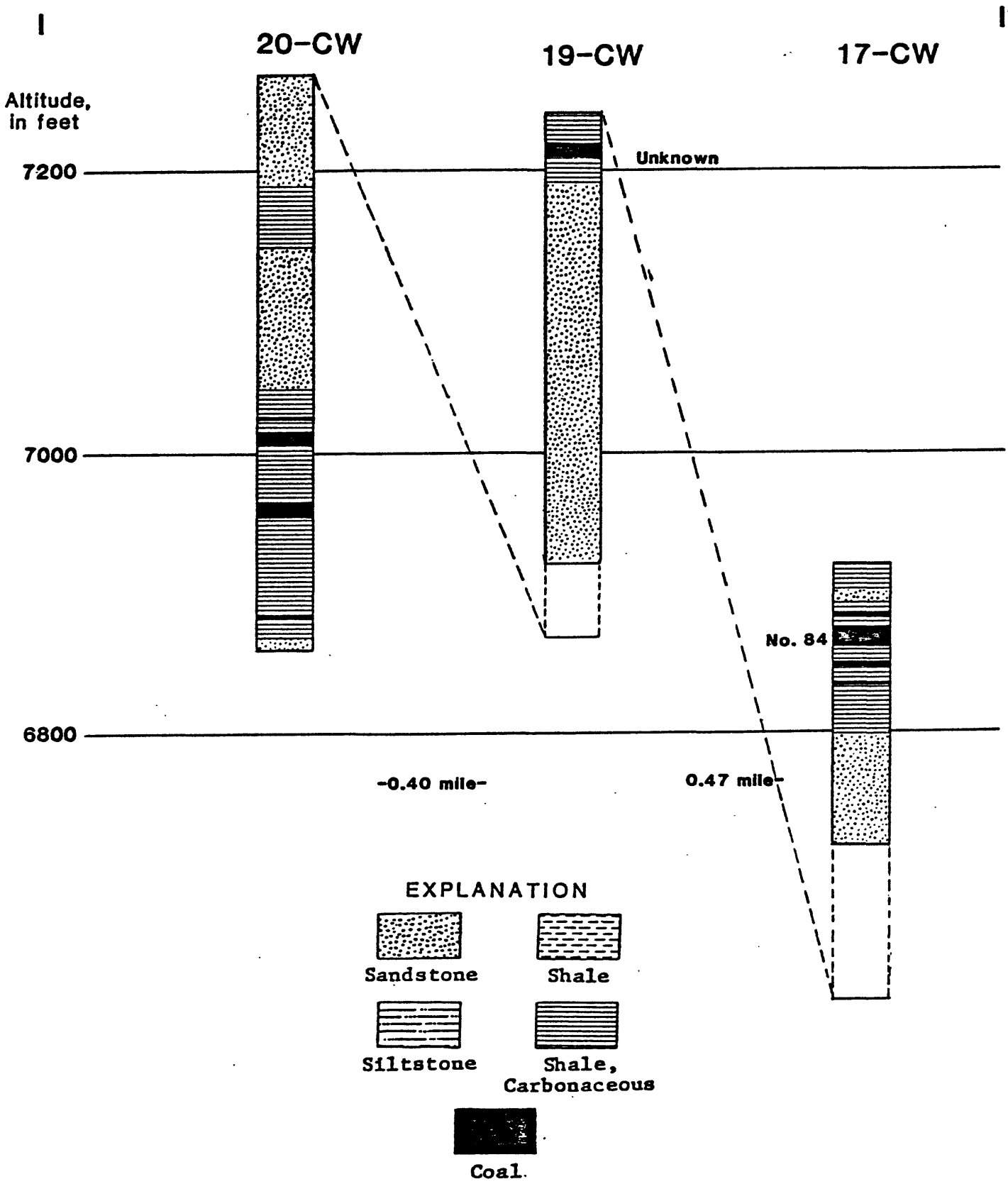
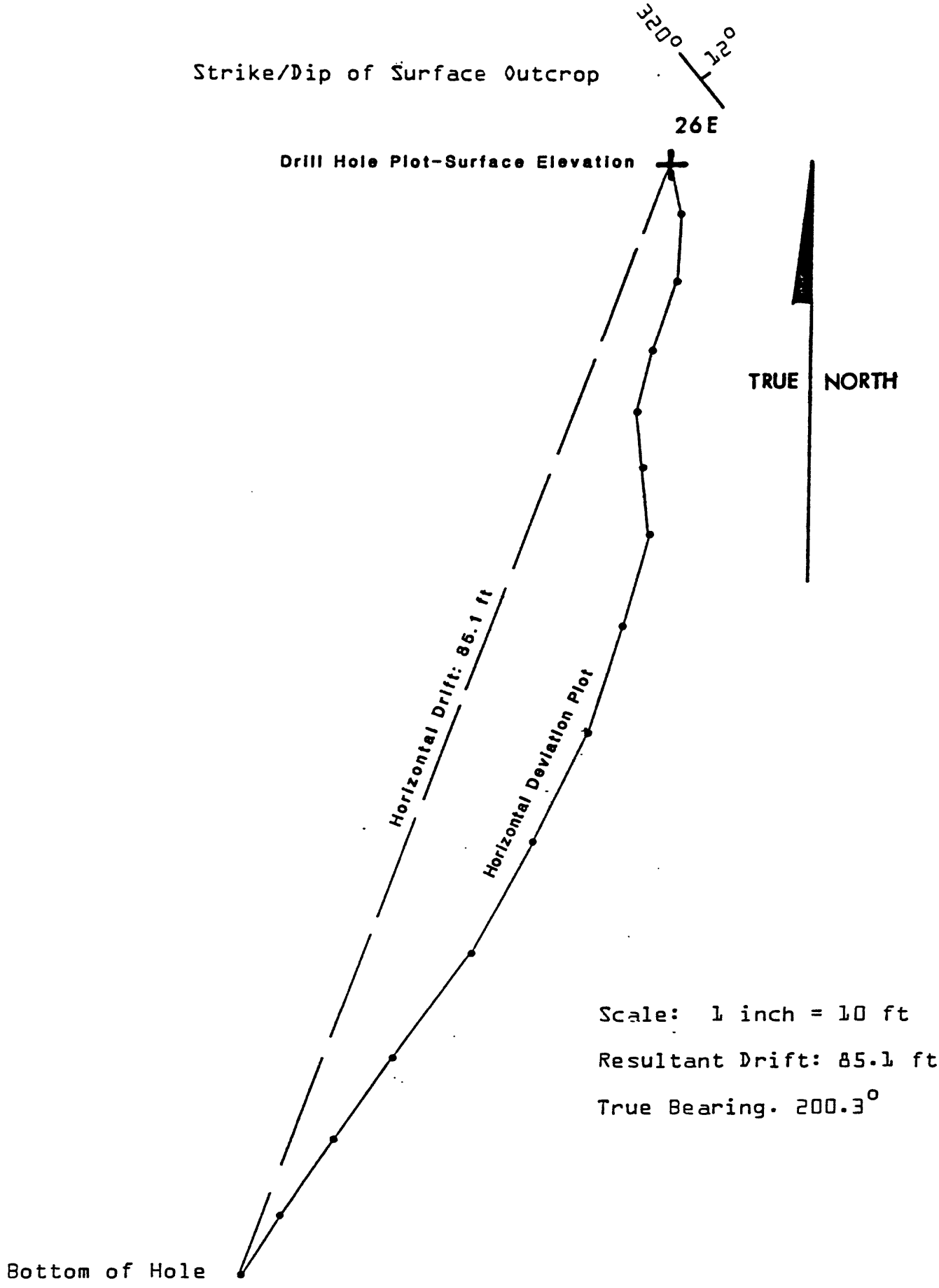
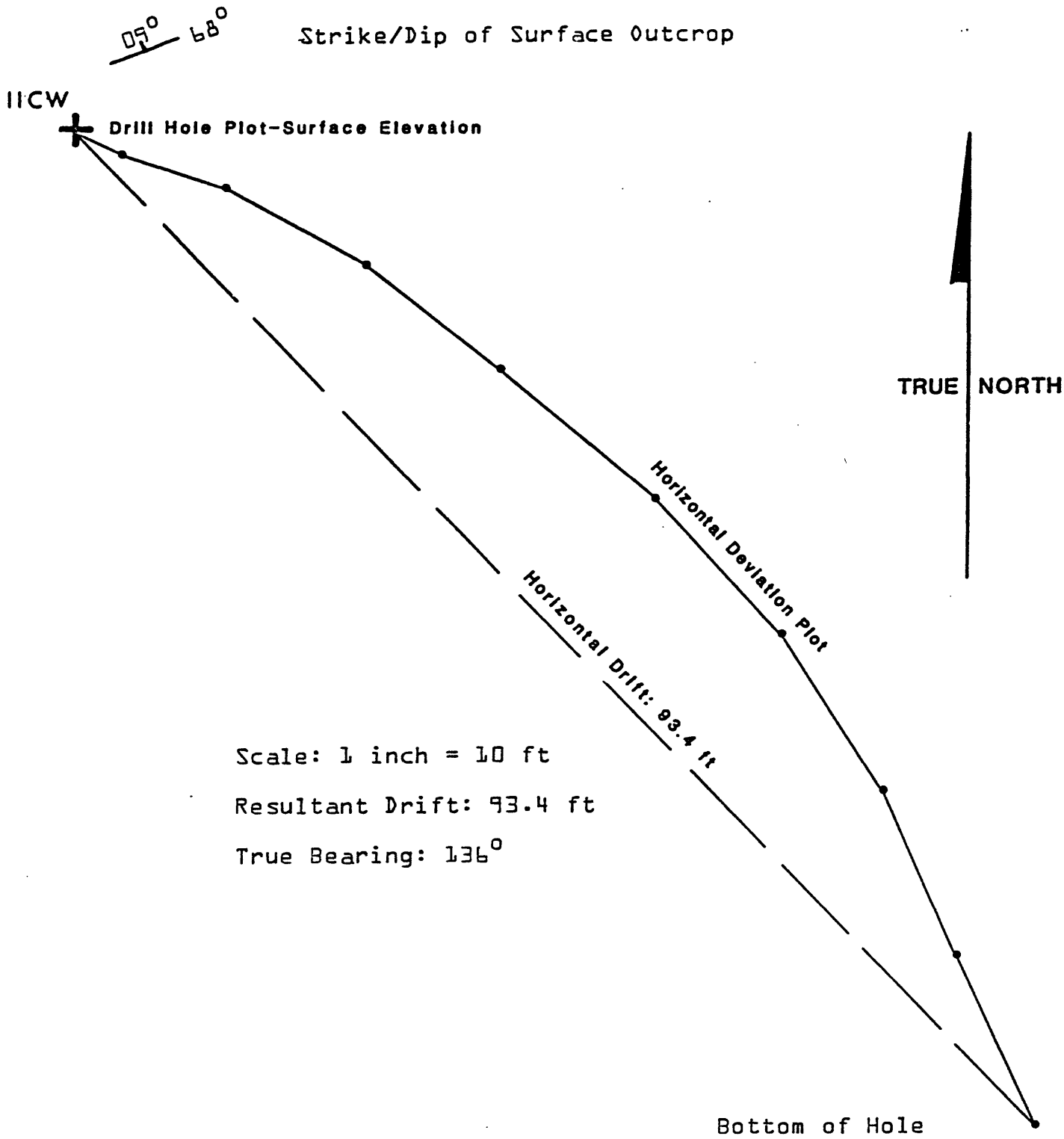


Figure 18.- Preliminary Correlation of Drill Holes in the Hanna Basin, section I-I', (fig. 9).



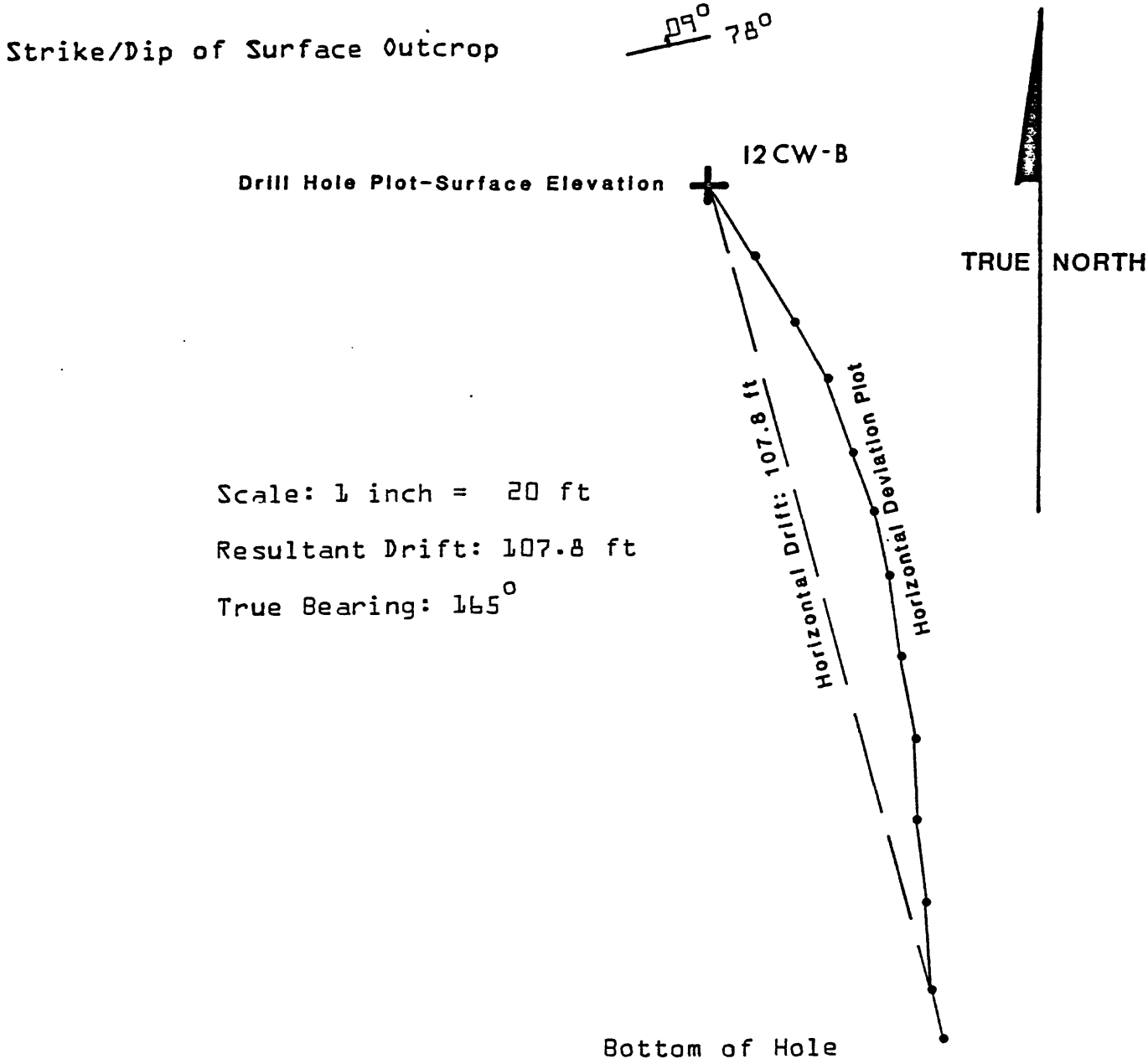
Plan View of Directional Drift Survey

Figure 19.- Drift survey: horizontal deviation of drill-hole 26-E.



Plan View of Directional Drift Survey

Figure 20.- Drift Survey: horizontal deviation of drill hole 11-CW.



Plan View of Directional Drift Survey

Figure 21.- Drift survey: horizontal deviation of drill-hole 12-CW-B.

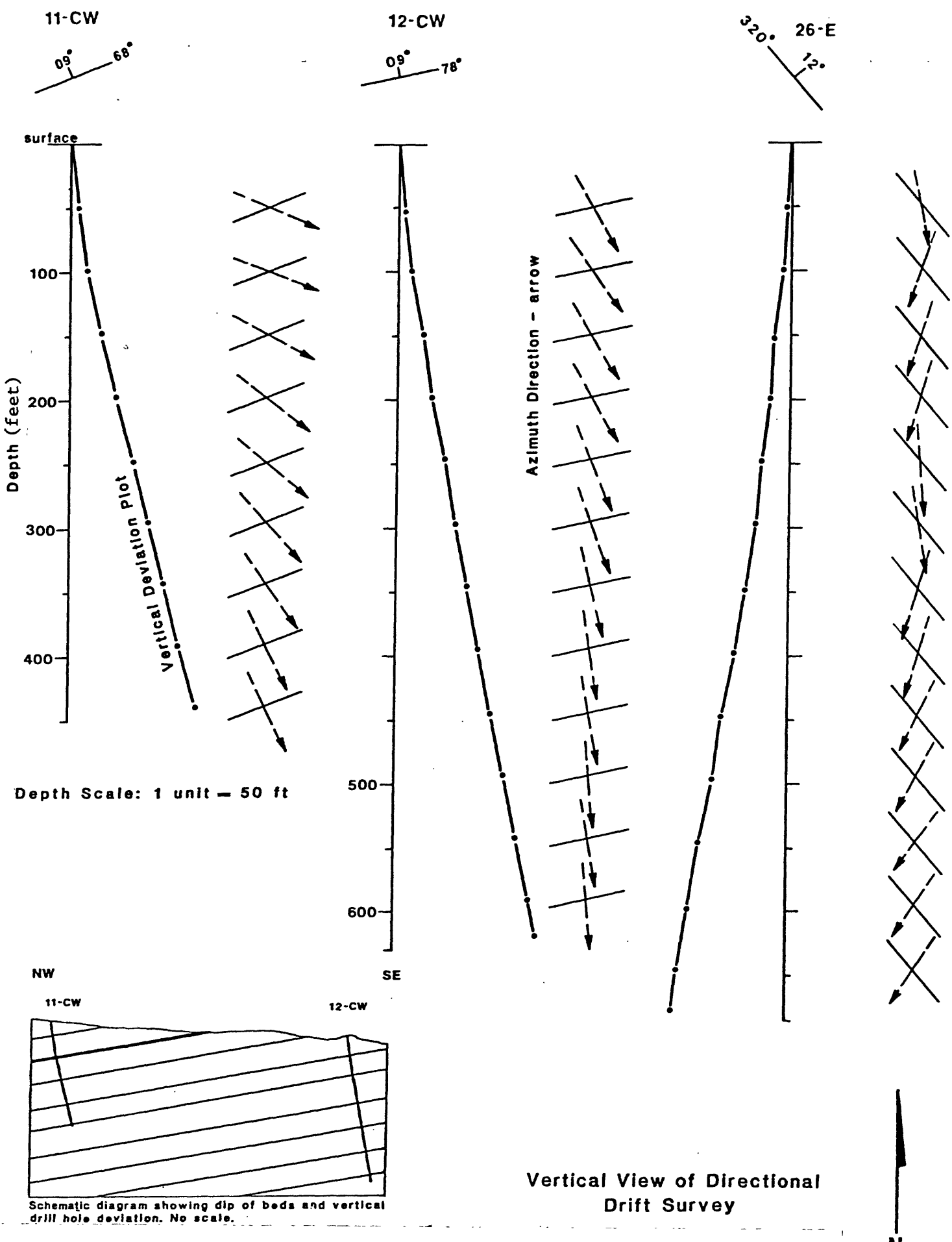


Figure 22.--Drift surveys; vertical deviation for drill holes 11-CW, 12-CW, and 26-E.

Table 1.--Summary of information for 39 drill holes in the Como West and Elmo Quadrangles, Carbon County, Wyo.

Drill hole	Location	Quadrangle	Depth drilled (ft)	Depth logged (ft)
1-CW*	SE 1/4 SE 1/4 NE 1/4 NW 1/4 sec. 2, T. 23 N., R. 81 W.	Como West	122.6	120
2-CW	NE 1/4 SE 1/4 NW 1/4 SE 1/4 sec. 2, T. 23 N., R. 81 W.	Como West	810	808
3-CW*	SW 1/4 SE 1/4 NW 1/4 NW 1/4 sec. 12, T. 23 N., R. 81 W.	Como West	152.4	152
4-CW*	SW 1/4 NW 1/4 NW 1/4 SW 1/4 sec. 12, T. 23 N., R. 81 W.	Como West	325	315
4-CW-B	SW 1/4 NW 1/4 SW 1/4 SW 1/4 sec. 12, T. 23 N., R. 81 W.	Como West	717.5	714
5-CW**	SE 1/4 SE 1/4 SE 1/4 NW 1/4 sec. 14, T. 23 N., R. 81 W.	Como West	717.5	713
6-CW**	SW 1/4 NW 1/4 SE 1/4 SW 1/4 sec. 14, T. 23 N., R. 81 W.	Como West	675.0	675
7-CW	NE 1/4 NE 1/4 NE 1/4 NE 1/4 sec. 14, T. 23 N., R. 81 W.	Como West	307.5	306
8-CW	SW 1/4 NW 1/4 SW 1/4 SW 1/4 sec. 18, T. 23 N., R. 80 W.	Como West	320	316
9-CW	SW 1/4 NE 1/4 SW 1/4 SW 1/4 sec. 20, T. 23 N., R. 80 W.	Como West	520	518
10-CW*	NW 1/4 NW 1/4 NW 1/4 NW 1/4 sec. 18, T. 23 N., R. 80 W.	Como West	297.6	295
11-CW	SE 1/4 SW 1/4 NW 1/4 NW 1/4 sec. 18. T. 23 N., R. 80 W.	Como West	460	460
12-CW	NE 1/4 SE 1/4 SE 1/4 NW 1/4 sec. 18, T. 23 N., R. 80 W.	Como West	630	630
13-CW	SE 1/4 SE 1/4 SE 1/4 SE 1/4 sec. 18, T. 23 N., R. 80 W.	Como West	310	306
14-CW	SE 1/4 NW 1/4 NW 1/4 NW 1/4 sec. 20, T. 23 N., R. 80 W.	Como West	270	265
15-CW	NW 1/4 NW 1/4 SW 1/4 NE 1/4 sec. 20, T. 23 N., R. 80 W.	Como West	310	300
16-CW	SE 1/4 NE 1/4 SW 1/4 NE 1/4 sec. 20, T. 23 N., R. 80 W.	Como West	390	386
17-CW	E 1/2 SW 1/4 NW 1/4 NE 1/4 sec. 24, T. 23 N., R. 81 W.	Como West	200	194
18-CW**	SW 1/4 SW 1/4 SW 1/4 NW 1/4 sec. 24, T. 23 N., R. 81 W.	Como West	717.5	715
19-CW**	Center sec. 24, T. 23 N., R. 81 W.	Como West	317	309
20-CW	NW 1/4 SW 1/4 SE 1/4 SE 1/4 sec. 24, T. 23 N., R. 81 W.	Como West	405	405
21-CW	NW 1/4 NE 1/4 NE 1/4 SW 1/4 sec. 20, T. 23 N., R. 80 W.	Como West	310	290
22-CW	NW 1/4 SW 1/4 NE 1/4 SE 1/4 sec. 20, T. 23 N., R. 80 W.	Como West	400	398
23-CW**	NW 1/4 NE 1/4 SW 1/4 NW 1/4 sec. 24, T. 23 N., R. 80 W.	Como West	717.5	715
24-E*	NW 1/4 NE 1/4 SE 1/4 NE 1/4 sec. 4, T. 23 N., R. 81 W.	Elmo	318.2	314
25-E-C*	NW 1/4 NE 1/4 SW 1/4 SE 1/4 sec. 4, T. 23 N., R. 81 W.	Elmo	232.4	225
25-E-B**	NE 1/4 SW 1/4 SW 1/4 SE 1/4 sec. 4, T. 23 N., R. 81 W.	Elmo	710	696
26-E**	NE 1/4 NW 1/4 SW 1/4 SE 1/4 sec. 20, T. 23 N., R. 81 W.	Elmo	717.5	690
27-E	NE 1/4 SW 1/4 NW 1/4 SE 1/4 sec. 30, T. 23 N., R. 81 W.	Elmo	758.5	595
28-E*	NW 1/4 SE 1/4 NW 1/4 NE 1/4 sec. 8, T. 22 N., R. 81 W.	Elmo	102.3	98
29-E*	SE 1/4 SE 1/4 NE 1/4 SW 1/4 sec. 8, T. 22 N., R. 81 W.	Elmo	200	200
30-E	NW 1/4 NE 1/4 NW 1/4 NW 1/4 sec. 8, T. 22 N., R. 81 W.	Elmo	722	684
31-E	SE 1/4 NE 1/4 SE 1/4 NE 1/4 sec. 24, T. 23 N., R. 82 W.	Elmo	340	337
32-E**	NW 1/4 SE 1/4 SW 1/4 NE 1/4 sec. 24, T. 23 N., R. 82 W.	Elmo	410	405
33-E	SW 1/4 SE 1/4 NE 1/4 SW 1/4 sec. 24, T. 23 N., R. 82 W.	Elmo	500	477
34-E**	NW 1/4 SW 1/4 NW 1/4 SE 1/4 sec. 14, T. 23 N., R. 82 W.	Elmo	450	445
35-E	N 1/2 NE 1/4 NW 1/4 NE 1/4 sec. 14, T. 23 N., R. 82 W.	Elmo	500	500
36-E	N 1/2 NE 1/4 NE 1/4 SE 1/4 sec. 10, T. 23 N., R. 82 W.	Elmo	300	298
37-CW	SE 1/4 SW 1/4 NW 1/4 SW 1/4 sec. 6, T. 23 N., R. 80 W.	Como West	307	306

*Core holes.
**Water observation well.

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 1-CW DATE 10/13/78 SURFACE ELEVATION(ft) 6860

LOCATION NE¼NW¼ Sec. 2 T. 23 N. R. 81 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 122.6

CORED YES [X] NO [ ] INTERVAL(s) 12-122.6'

DRILLING MEDIUM: [ ] AIR [ ] FOAM [X] MUD [ ] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs
0.0- 13.0	Sandstone, light-brown, fine-grained		0	0	Gamma Den Res
13.0- 16.0	Siltstone, light-gray to brown, sandy				
16.0- 19.0	Shale and sandstone, interbedded. Shale is medium gray and sandstone is light gray to light brown, very fine grained		50	10	
19.0- 23.0	Shale, medium-gray and olive-gray			20	
23.0- 34.0	Shale, dark-gray to black, carbonaceous		100	30	
34.0- 38.8	Shale and siltstone, interbedded, medium-gray to brown				
38.8- 42.2	Coal, shaly			40	
42.2- 44.0	Shale, black, carbonaceous, coaly		150		
44.0- 46.0	Coal, shaly			50	
46.0- 51.0	Shale, black, carbonaceous, coaly				
51.0- 58.5	Coal, partly shaly			60	
58.5- 61.8	Shale, black, carbonaceous, coaly		200		
61.8- 66.0	Coal and shale, interbedded. Shale is black carbonaceous, coaly			70	
66.0- 72.0	Coal, shaly				
72.0- 81.0	Shale and coal, interbedded. Shale is black, carbonaceous				
81.0- 85.2	Coal, partly shaly				
85.2- 90.0	Shale and coal, interbedded. Shale is black, carbonaceous				
90.0- 93.0	Coal, very shaly				
93.0-100.3	Shale, black, carbonaceous, partly coaly		250		

Lithology	Strip Log	Depth		Geophysical Logs		
		ft	m	Gamma	Den	Res
100.3-106.0 Sandstone, light-gray, very fine-grained, shaly and silty, irregular bedding, convolutions 106.0-122.6 Siltstone and sandstone, interbedded, light- to medium-gray. Some interlaminations of gray mudstone and shale. Partly fractured						

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 2-CW DATE 10/27/78 SURFACE ELEVATION(ft) 6865

LOCATION NW¼SE¼ Sec. 2 T. 23 N. R. 81 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 810

CORED YES [ ] NO [X] INTERVAL(s)

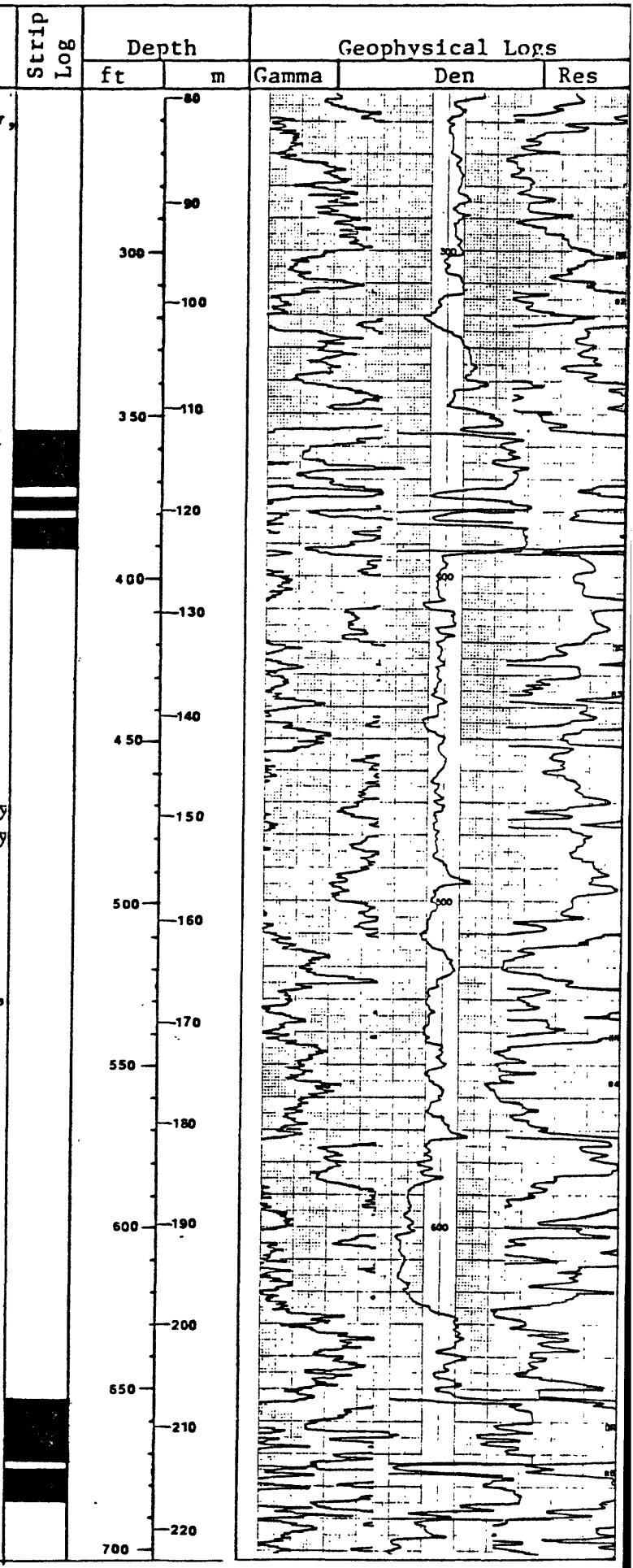
DRILLING MEDIUM: [X] AIR [X] FOAM [ ] MUD [ ] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

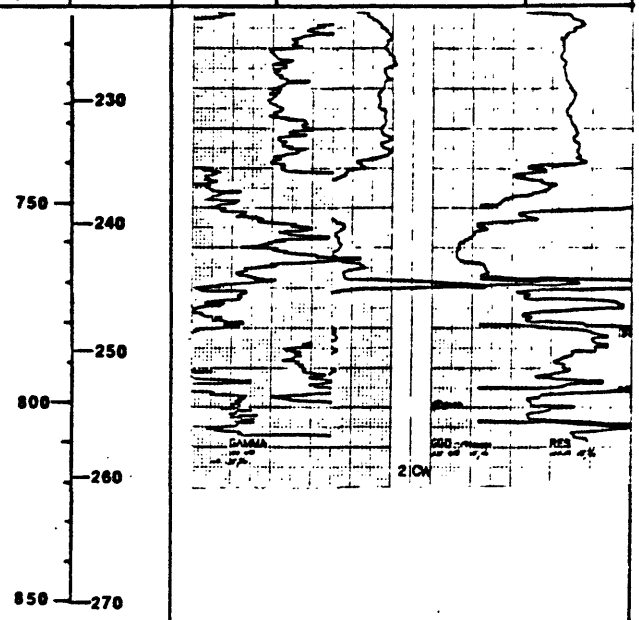
Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs
0.0- 15.0	Sandstone, grayish-orange, fine-grained. A few thin beds of grayish-brown, fine-grained sandstone		0	0	Gamma / Den / Res
15.0- 23.0	Shale, moderate- to grayish-brown, partly carbonaceous				
23.0- 36.8	Shale, dark-gray to black, interbedded carbonaceous and coaly shales		50	10	
36.8- 41.0	Coal, shaly with coaly shale top and bottom			20	
41.0- 48.0	Shale, medium-dark-gray to olive-gray		100	30	
48.0- 63.1	Sandstone, light-gray and grayish-orange, fine-grained			40	
63.1- 76.0	Shale, medium-dark-gray to dark-gray, partly carbonaceous		150	50	
76.0- 80.0	Siltstone, light-gray, partly shaly				
80.0- 86.6	Claystone, light-gray, silty			60	
86.6-101.6	Sandstone, grayish-orange, fine-grained, well cemented		200		
101.6-106.0	Claystone, light-gray, silty			70	
106.0-115.0	Sandstone, light-gray, fine-grained				
115.0-116.0	Shale, medium-gray, silty				
116.6-120.4	Siltstone, light- to medium-gray				
120.4-124.8	Shale, medium-gray				
124.8-126.0	Siltstone, light- to medium-gray				
126.0-131.5	Shale, dark-gray, carbonaceous, silty		250		

Lithology	
131.5-143.7	Sandstone and siltstone, light-gray, hard
143.7-156.1	Siltstone and shale, light- to medium-gray, sandy
156.1-190.3	Siltstone, light- to medium-gray, shaly and sandy
190.3-193.2	Shale, medium-gray
193.2-203.0	Siltstone, medium-gray, sandy
203.0-210.0	Sandstone, light-gray, very fine-grained
210.0-238.0	Siltstone and shale, light- to medium-gray
238.0-259.0	Sandstone, light-gray, fine-grained
259.0-272.1	Siltstone, medium-dark-gray, shaly
272.1-311.4	Shale, dark-gray to black, carbonaceous
311.4-320.0	Siltstone, medium-gray
320.0-325.1	Sandstone, light- to medium-gray, silty
325.1-339.8	Shale, dark-gray to black, carbonaceous
339.8-354.7	Shale, black, carbonaceous, with streaks of coal
354.7-372.1	Coal
372.1-375.0	Shale, black, carbonaceous
375.0-379.2	Coal
379.2-382.8	Shale, black, carbonaceous and coaly
382.8-391.2	Coal, upper part is moderately shaly
391.2-392.8	Shale, dark-gray, carbonaceous
392.8-406.8	Siltstone, medium-gray, sandy. Interbedded with light-gray, very fine- to fine-grained sandstone and medium-gray shale
406.8-420.0	Sandstone, light-gray, fine-grained, silty
420.0-437.0	Siltstone, medium-gray, sandy
437.0-438.8	Shale, medium-gray, silty
438.8-445.0	Sandstone and siltstone, sandstone, medium-gray, very-fine-grained, silty
445.0-452.8	Shale, medium-gray, silty, very fine- to fine-grained, hard
452.8-490.0	Sandstone, light-gray, very silty, very fine- to fine-grained, hard
490.0-499.2	Sandstone, light-gray, very fine-grained
499.2-514.8	Siltstone, medium-gray, sandy. Grades upward into sandstone
514.8-525.2	Shale, dark-gray, carbonaceous
525.2-544.0	Siltstone, medium-gray, sandy
544.0-572.2	Shale, dark-gray to black, carbonaceous
572.2-587.0	Sandstone, light-gray, fine- to medium-grained



Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
587.0-595.0	Sandstone and siltstone, light- to medium-gray. Sandstone is very fine grained				
595.0-601.2	Siltstone, medium-gray, shaly				
601.2-609.4	Sandstone, light-gray, fine- to medium-grained				
609.4-625.8	Siltstone and sandstone, light- to medium-gray. Sandstone is very fine grained				
625.8-654.0	Shale, black, carbonaceous; thin coal partings and streaks				
654.0-673.2	Coal. Middle of bed is partly shaly				
673.2-677.0	Shale, black, carbonaceous; thin bed of shaly coal				
677.0-686.0	Coal, thin coaly shale partings in upper part				
686.0-691.0	Coal and shale, black, carbonaceous; interbedded				
691.0-702.4	Shale, dark gray to black, carbonaceous; few thin shaly coal beds				
702.4-740.0	Sandstone, light-gray, fine- to medium-grained				
740.0-751.2	Siltstone, medium-gray, sandy				
751.2-768.0	Shale, dark-gray to black, carbonaceous				
769.0-771.0	Coal, very shaly				
771.0-780.2	Siltstone and shale, medium-gray				
780.2-797.0	Sandstone, light-gray, very fine-grained				
797.0-805.0	Shale, dark-gray, carbonaceous				
805.0-810.0	Sandstone, light-gray, very fine-grained				



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 3-CW DATE 10/19/78 SURFACE ELEVATION(ft) 6845

LOCATION NW¼NW¼ Sec. 12 T. 23 N. R. 81 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 152.4

CORED YES [X] NO [ ] INTERVAL(s) 14.5-136.3'

DRILLING MEDIUM: [ ] AIR [ ] FOAM [X] MUD [ ] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	3	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs
0.0- 5.0	Surface material		0	0	Gamma Den Res
5.0- 11.0	Shale, brown to olive-gray				
11.0- 15.0	Shale, dark-brown				
15.0- 17.0	Claystone, dark-brown				
17.0- 49.0	Shale, brown to brown-gray, fractured				
49.0- 73.0	Shale, light-olive-gray to dark-gray, gastropods at 59.8 ft		50	10	
73.0- 75.5	Siltstone, light-gray, sandy				
75.5- 77.0	Sandstone, light-gray, very fine-grained, with interbeds of siltstone		100	20	
77.0- 82.5	Siltstone, medium- to light-gray with very thin interbeds of very fine-grained sandstone			30	
82.5- 84.4	Interbedded siltstone and medium-gray shale		150	40	
84.4- 92.0	Shale, medium- to dark-gray, partly carbonaceous, slightly silty			50	
92.0- 97.6	Shale, dark-gray, carbonaceous				
97.6-103.9	Shale, dark-gray with medium-gray shale interbeds		200	60	
103.9-106.3	Siltstone, medium-gray, shaly				
106.3-114.8	Interbedded dark-gray carbonaceous shale and medium-gray siltstone			70	
114.8-115.8	Coal, bright		250		
115.8-116.2	Siltstone, light-gray, shaly				
116.2-122.4	Coal, bright, fractured, partly boney				

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma	Den	Res
122.4-123.2 Shale, carbonaceous with coal stringers						
123.2-127.9 Coal, bright, broken, partly boney						
127.9-129.0 Shale, dark-gray to black, carbonaceous, with traces of coal						
129.0-134.5 Coal with interbedded bone coal and carbonaceous shale						
134.5-138.4 Coal, shaly						
138.4-142.0 Coal with thin interbeds of carbonaceous shale						
142.0-144.0 Shale, carbonaceous						
144.0-144.8 Mudstone, greenish-gray						
144.8-148.1 Siltstone, medium-gray, sandy, gradational contact with basal sandstone						
148.1-152.0 Sandstone, light-gray, fine-grained, fractured						

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 4-CW DATE 11/6/78 SURFACE ELEVATION(ft) 6955

LOCATION NW¼SW¼ Sec. 12 T. 23 N. R. 81 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 325

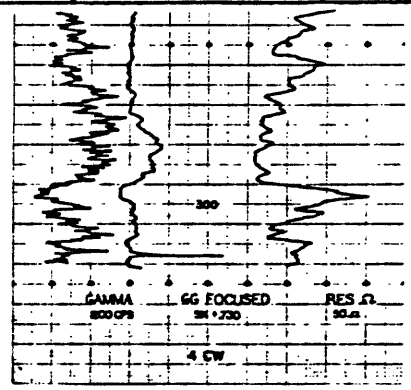
CORED YES [X] NO [ ] INTERVAL(s) 160-210'

DRILLING MEDIUM: [ ] AIR [ ] FOAM [X] MUD [ ] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 8.0	Surface material		0	0	
8.0- 12.0	Shale, brown to brownish-gray, silty				
12.0- 15.7	Sandstone, brown, very fine-grained				
15.7- 29.4	Shale, medium- to dark-gray, carbonaceous			10	
29.4- 31.2	Sandstone, brown, very fine-grained		50		
31.2- 32.3	Shale, dark-gray, carbonaceous				
32.3- 34.5	Sandstone, medium-gray, very fine-grained			20	
34.5- 51.2	Shale, medium- to dark-gray, slightly carbonaceous				
51.2- 72.0	Shale, medium-gray, silty		100	30	
72.0- 94.4	Shale, dark-gray, carbonaceous				
94.4-107.0	Sandstone, brownish-gray, very fine grained			40	
107.0-114.0	Siltstone, medium-gray, partly sandy		150		
114.0-123.0	Shale, medium-gray, silty			50	
123.0-133.0	Shale, medium-gray, slightly carbonaceous				
133.0-157.0	Shale, medium-dark-gray to black, carbonaceous			60	
157.0-173.0	Coal, dull black with vitrinite-banding, minor pyrite		200		
173.0-176.5	Shale, dark-gray, carbonaceous			70	
176.5-183.0	Coal, dull with vitrinite banding and minor pyrite				
183.0-190.0	Shale, carbonaceous, dark dull brown with few vitrinite bands		250		

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
190.0-190.2 Sandstone, light-gray, very fine-grained with carbonaceous laminations 190.2-190.6 Shale, carbonaceous, medium-gray 190.6-192.5 Mudstone, dark gray with carbonaceous clasts 192.5-192.8 Sandstone, light-gray, very fine-grained with carbonaceous clasts 192.8-198.0 Siltstone, light- to medium-gray with medium-grained sandstone clasts 198.0-251.0 Sandstone, light-gray, fine- to medium-grained. Carbonaceous shale, clasts throughout 251.0-273.4 Sandstone is interbedded with siltstone and siltstone is interbedded with shale in ascending order 273.4-295.5 Shale, medium- to dark-gray 295.5-304.2 Sandstone, light-gray, fine- to very coarse-grained 304.2-310.0 Shale, medium- to dark-gray 310.0-325.0 Sandstone, medium-gray, fine-grained, partly silty		300 350 400 450 500 550 600 650 700	90 100 110 120 130 140 150 160 170 180 190 200 210 220	

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 4-CW-B DATE 11/8/78 SURFACE ELEVATION(ft) 6845

LOCATION SW¼SW¼ Sec. 12 T. 23 N. R. 81 N. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 717.5

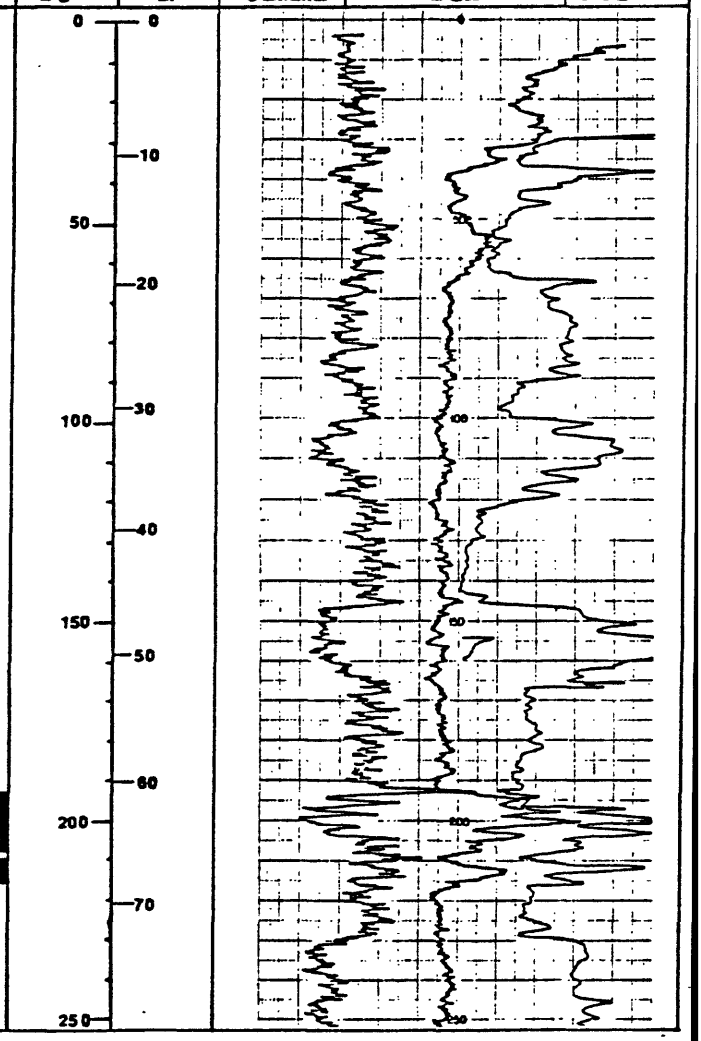
CORED YES ☐ NO ☒ INTERVAL(s) _____

DRILLING MEDIUM: ☒ AIR ☒ FOAM ☐ MUD ☐ WATER OBSERVATION WELL

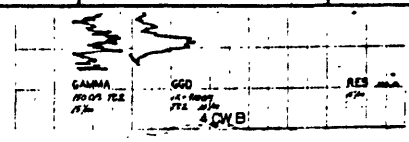
GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs
0.0- 10.0	Colluvium, loam, yellow-brown, sandy				
10.0- 19.0	Colluvium, clay and silt, brown-gray				
19.0- 30.0	Siltstone and shale, interbedded, medium-gray. Brown weathering				
30.0- 36.5	Shale, brown-gray, silty				
36.5- 42.0	Siltstone, medium-gray, very sandy, hard				
42.0- 45.0	Shale, medium-gray, silty				
45.0- 48.3	Siltstone, medium-gray, shaly				
48.3- 65.0	Shale, medium-dark-gray to dark-gray; middle part carbonaceous with coal streaks				
65.0- 90.8	Siltstone and sandstone, interbedded, light- to medium-gray. Sandstone is very fine grained, silty				
90.8- 95.0	Siltstone, medium-gray				
95.0-100.0	Shale, medium-gray, silty				
100.0-112.0	Sandstone, light-gray, fine grained, friable				
112.0-120.0	Siltstone and sandstone, interbedded, medium-gray				
120.0-145.4	Shale, medium-gray to black, partly carbonaceous				
145.4-161.0	Sandstone, light-gray, fine grained, friable				
161.0-165.0	Siltstone, light-gray, sandy				
165.0-190.6	Shale, dark-gray to black, mostly carbonaceous				
193.6-195.1	Coal, shaly				



Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
195.1-196.0	Shale, dark-gray, carbonaceous				
196.0-198.0	Coal				
198.0-198.8	Shale, black, coaly				
198.8-201.8	Coal				
201.8-202.5	Shale, black, coaly				
202.5-204.0	Coal, shaly				
204.0-210.0	Shale, dark-gray to black, carbonaceous, coal traces				
210.0-214.0	Coal, very shaly				
214.0-225.3	Shale, dark-gray to black, carbonaceous				
225.3-230.0	Siltstone, medium-dark-gray, shaly				
230.0-302.0	Sandstone, light-gray, fine-grained, carbonaceous laminations; thin interbeds of medium-gray siltstone				
302.0-321.0	Shale and claystone, dark-gray, carbonaceous coal fragments				
321.0-324.0	Claystone, dark-gray, silty				
324.0-349.0	Siltstone, medium-gray; some medium-dark-gray silty shale interbedding				
349.0-365.4	Sandstone, light-gray, very fine- to fine-grained				
365.4-378.0	Siltstone, light- to medium-gray, sandy				
378.0-384.0	Shale, dark-gray, carbonaceous				
384.0-402.0	Sandstone, light-gray, fine grained				
402.0-417.0	Shale, medium-dark-gray, silty				
417.0-443.0	Siltstone, medium-gray to olive-gray, sandy				
443.0-450.0	Sandstone, fine-grained, silty				
450.0-455.0	Siltstone and shale, interbedded, olive-gray and medium-dark-gray				
455.0-476.0	Sandstone, light-gray, fine-grained				
476.0-484.0	Siltstone, olive-gray, sandy				
484.0-489.0	Claystone, dark-gray, waxy				
489.0-505.0	Siltstone, medium-gray, sandy				
505.0-512.7	Shale, medium-dark-gray				
512.7-518.0	Shale, dark-gray to black, carbonaceous				
518.0-521.0	Coal				
521.0-523.0	Shale, dark-gray				
523.0-535.0	Sandstone, light-gray, fine-grained				
535.0-543.0	Shale, dark-gray to black, carbonaceous				
543.0-547.5	Coal, very shaly				
547.5-571.0	Shale, dark-gray, carbonaceous				
571.0-714.0	Sandstone, light-gray, fine- to medium-grained; some coarse sand and granules; a few shale pebbles				

Lithology	Strip Log	Depth		Geophysical Logs		
		ft	m	Gamma	Den	Res
			230			
		750	240			
			250			
		800	260			
			270			
		850				

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 5-CW DATE 11/4/78 SURFACE ELEVATION(ft) 6955

LOCATION SE¼NW¼ Sec. 14 T. 23 N. R. 81 W Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 717.5

CORED YES [ ] NO [X] INTERVAL(s)

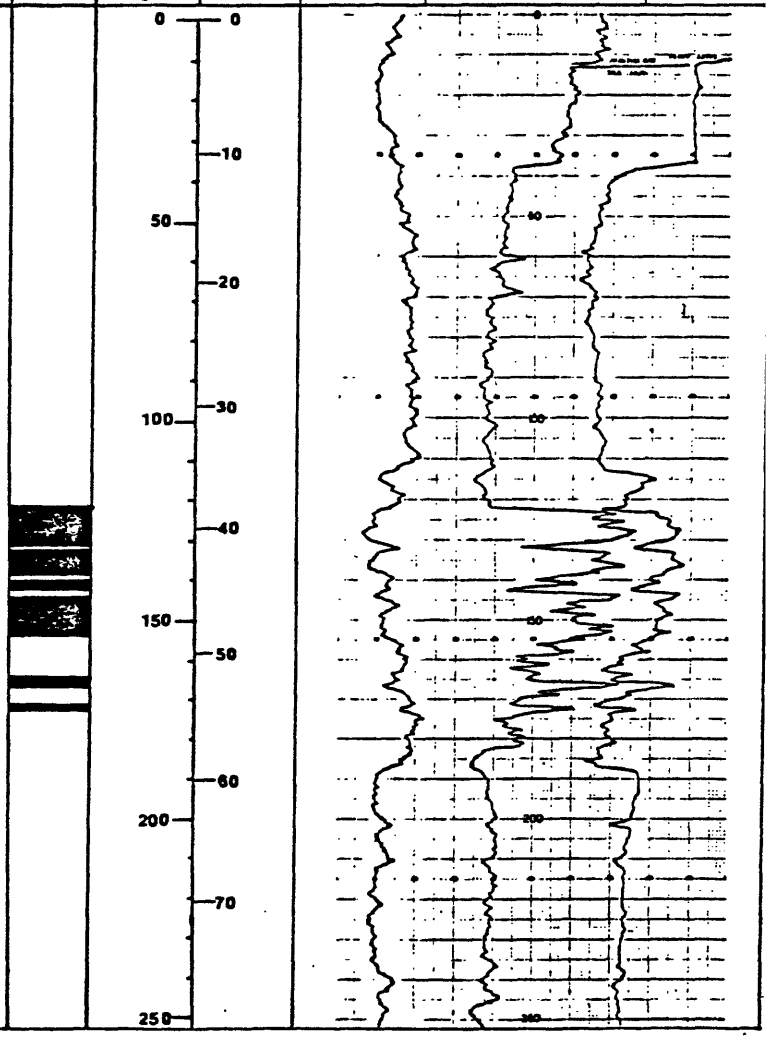
DRILLING MEDIUM: [X] AIR [X] FOAM [ ] MUD [X] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

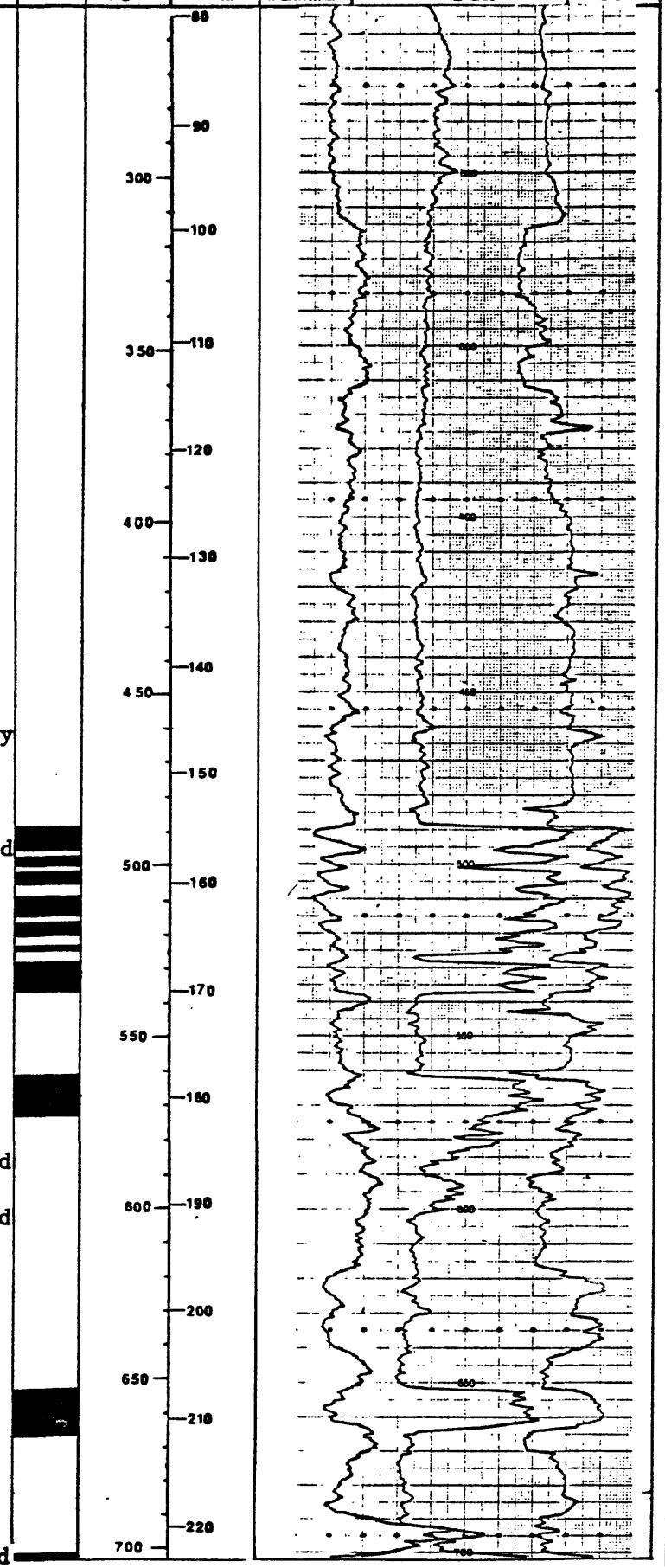
Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

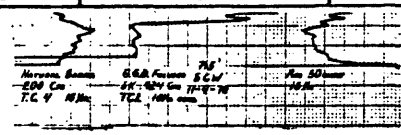
Lithology	
0.0- 5.0	Sandstone, light-brown-yellow, fine- to very coarse-grained to granular
5.0- 9.0	Sandstone, light-yellowish-gray, medium- to coarse-grained
9.0- 28.5	Sandstone, light-yellowish-gray, fine- to medium-grained
28.5- 38.0	Siltstone, medium-gray and light-olive-gray, very sandy
38.0- 53.0	Siltstone, medium-gray, shaly
53.0-112.3	Shale, medium-gray, silty
112.3-118.0	Sandstone, light-gray, fine-grained, silty
118.0-122.0	Shale, medium-gray and dark-gray, carbonaceous
122.0-131.0	Coal
131.0-132.3	Shale, medium-gray
132.3-138.0	Coal
138.0-140.0	Shale, black, coaly
140.0-142.0	Coal, shaly
142.0-143.0	Shale, dark-gray to black, carbonaceous
143.0-155.5	Coal, shaly
155.5-166.0	Shale, dark-gray to black, coaly
166.0-168.3	Coal
168.3-172.0	Shale dark-gray, carbonaceous
172.0-173.0	Coal, shaly
173.0-182.3	Shale, dark-gray to black, carbonaceous
182.3-187.0	Shale, medium-gray, silty
187.0-300.0	Sandstone, light-gray, fine- to medium-grained, friable

Strip Log



Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
300.0–315.3	Sandstone, light-gray, coarse-grained, granular				
315.3–336.3	Shale, light-gray, very silty				
336.3–350.4	Siltstone, light-gray				
350.4–361.5	Shale, light-gray, silty				
361.5–375.0	Sandstone, light-gray, very fine grained, very silty				
375.0–415.0	Siltstone, light-gray				
415.0–421.2	Sandstone, light-gray, very fine grained				
421.2–430.0	Siltstone, medium-gray, shaly				
430.0–456.0	Siltstone, medium-gray, sandy				
456.0–484.5	Sandstone, light- to medium-gray, very fine-grained, silty				
484.5–488.3	Shale, medium-gray, silty				
488.3–494.0	Coal				
494.0–497.0	Shale, black, coaly				
497.0–500.0	Coal				
500.0–502.0	Shale, dark-gray to black, carbonaceous				
502.0–506.4	Coal				
506.4–508.0	Shale, black, very coaly				
508.0–515.0	Coal				
515.0–516.0	Shale, black, coaly				
516.0–520.4	Coal				
520.4–525.3	Coal, shaly and shale, black, coaly				
525.3–528.3	Shale, medium-dark-gray				
528.3–537.5	Coal, shaly				
537.5–542.5	Shale, medium-dark-gray				
542.5–560.5	Sandstone, light-gray, fine-grained				
560.5–562.0	Shale, dark-gray, carbonaceous				
562.0–573.0	Coal, shaly				
573.0–577.3	Shale, dark-gray to black, carbonaceous, coal stringers				
577.3–582.3	Shale, dark-gray to black, coaly				
582.3–587.0	Shale, dark-gray, carbonaceous				
587.0–591.0	Shale, medium-gray, silty				
591.0–601.0	Shale, medium-dark-gray, carbonaceous				
601.0–617.0	Shale, medium-dark-gray, silty				
617.0–626.0	Sandstone, light-gray, fine-grained				
626.0–631.0	Siltstone, medium-gray, sandy				
631.0–643.0	Sandstone, light-gray, fine-grained				
643.0–652.0	Shale, medium-dark-gray				
652.0–662.6	Coal, shaly				
662.6–671.0	Shale, medium-dark-gray, silty				
671.0–690.0	Sandstone, light-gray, fine- to medium-grained; upper part is shaly and silty.				
690.0–701.0	Shale, dark-gray to black, carbonaceous				
701.0–704.3	Coal, shaly				
704.3–708.0	Shale, dark-gray, carbonaceous				
708.0–712.0	Siltstone, medium-gray, shaly				
712.0–715.0	Sandstone, light-gray, fine-grained				



Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
		750	230	
			240	
			250	
		800		
			260	
		850	270	

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 6-CW DATE 11/5/78 SURFACE ELEVATION(ft) 7070

LOCATION SE¼SW¼ Sec. 14 T. 23 N. R. 81 N. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 675

CORED YES [ ] NO [X] INTERVAL(s) _____

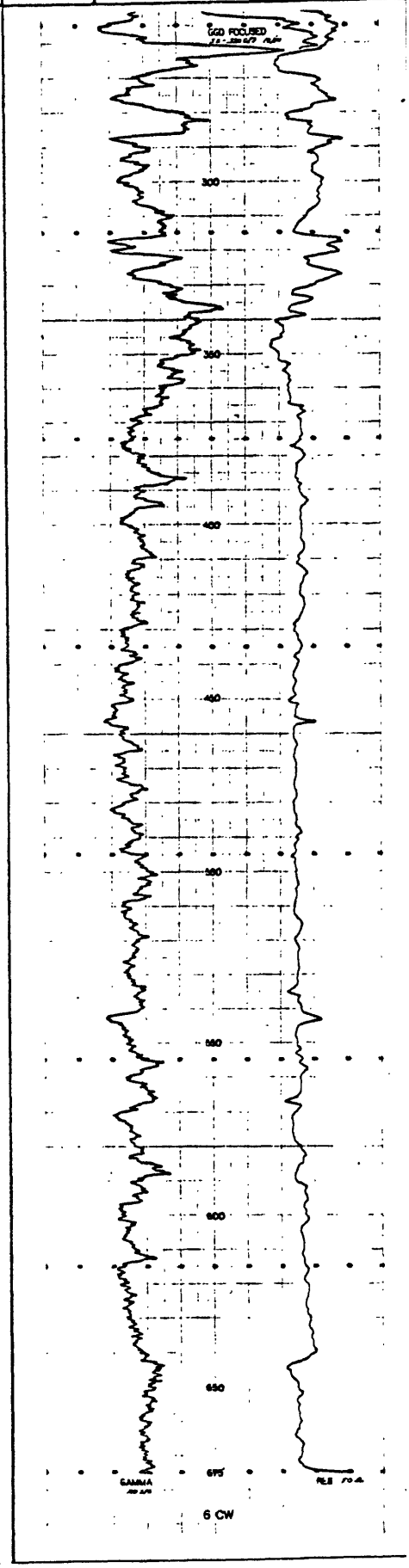
DRILLING MEDIUM: [X] AIR [X] FOAM [ ] MUD [X] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	;	Scale 10 f/in	Logging Speed	15	fpm
Gamma Gamma	;	Scale 10 f/in	Logging Speed	10	fpm
Resistivity	;	Scale 10 f/in	Logging Speed	15	fpm
Caliper	;	Scale 10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 12.5	Sandstone, yellow- to red-brown, fine-grained		0	0	
12.5- 17.8	Siltstone, medium-gray				
17.8- 24.3	Sandstone, light-yellow, fine-grained				
24.3- 26.9	Siltstone, medium-gray, shaly				
26.9- 29.5	Sandstone, light-gray, fine-grained		50	10	
29.5- 31.0	Siltstone, medium-gray				
31.0- 47.0	Sandstone, light-gray, fine-grained		100	20	
47.0- 53.0	Shale, medium-gray, silty				
53.0- 58.5	Coal				
58.5- 61.5	Interbedded coal and shale, dark-gray		150	30	
61.5- 62.6	Coal				
62.6- 64.0	Shale, black, carbonaceous				
64.0- 67.8	Coal		200	40	
67.8- 68.8	Shale, black, carbonaceous				
68.8- 74.6	Coal				
74.6- 76.7	Coal with interbedded carbonaceous shale		250	50	
76.7- 80.3	Coal				
80.3- 86.0	Coal and shale, carbonaceous		300	60	
86.0- 88.0	Shale, black, carbonaceous				
88.0- 89.7	Coal		350	70	
89.7- 96.0	Coal and shale, carbonaceous				
96.0- 97.2	Claystone, dark-gray				
97.2-155.0	Sandstone, light- to medium-gray, fine-grained, friable, argillaceous				
155.0-159.0	Siltstone, medium-gray				
159.0-162.0	Shale, black				

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
162.0-168.0	Coal				
168.0-170.2	Shale, black, carbonaceous				
170.2-171.0	Coal				
171.0-172.5	Shale, black, carbonaceous				
172.5-174.0	Coal				
174.0-176.0	Shale, black, carbonaceous				
176.0-176.8	Coal				
176.8-178.2	Shale, black, carbonaceous				
178.2-180.0	Coal				
180.0-182.5	Shale, black, very coaly				
182.5-194.5	Shale, black, carbonaceous				
194.5-197.0	Shale, medium-dark-gray				
197.0-203.2	Siltstone, medium-gray				
203.2-218.7	Shale, dark-gray, silty				
218.7-228.2	Siltstone, medium-gray, sandy				
228.2-248.8	Sandstone, light-gray, fine-grained				
248.8-250.5	Shale, black, carbonaceous				
250.5-261.0	Coal				
261.0-268.4	Shale, black, carbonaceous				
268.4-279.0	Sandstone, medium-gray, fine-grained, argillacious				
279.0-286.0	Shale, black, carbonaceous				
286.0-289.0	Coal				
289.0-291.3	Shale, black				
291.3-307.5	Interbedded fine-grained sandstone				
307.5-315.5	Shale, dark-gray				
315.5-320.7	Coal				
320.7-325.0	Shale, dark-gray, silty				
325.0-327.2	Sandstone, light-gray, fine-grained				
327.2-328.9	Siltstone				
328.9-337.5	Shale, black				
337.5-339.0	Siltstone, medium-gray, silty				
339.0-350.5	Interbedded shale and siltstone				
350.5-364.0	Siltstone, medium-gray, sandy				
364.0-642.0	Sandstone, light-gray, fine-grained, friable, partly-coarse-grained to granular				
642.0-675.0	Sandstone, light-gray, fine- to medium-grained, argillaceous				



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 7-CW DATE 11/5/78 SURFACE ELEVATION(ft) 6865

LOCATION NE¼NE¼ Sec. 14 T. 23 N. R. 81 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 307.5

CORED YES ☐ NO ☒ INTERVAL(s) _____

DRILLING MEDIUM: ☒ AIR ☒ FOAM ☐ MUD ☐ WATER OBSERVATION WELL

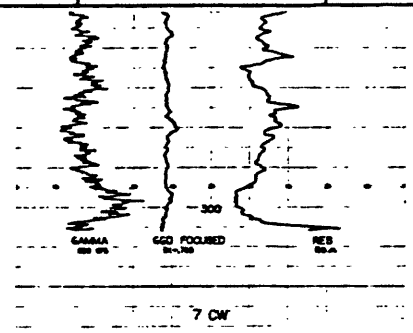
GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 4.0	Loam, brown		0	0	
4.0- 6.0	Coal, shaly, weathered				
6.0- 8.0	Shale, dark-brown, coaly				
8.0- 17.0	Coal, very shaly				
17.0- 20.0	Shale, black, carbonaceous				
20.0- 29.8	Shale and sandstone; shale is brown to medium gray; sandstone is pale brown, very fine grained		50	10	
29.8- 31.0	Shale, black, carbonaceous				
31.0- 33.0	Coal, very shaly				
33.0- 36.0	Shale, black, carbonaceous				
36.0- 40.0	Shale, medium-gray, silty				
40.0- 46.5	Siltstone, medium-gray, shaly		100	30	
46.5- 79.0	Sandstone and siltstone; interbedded sandstone is light gray, very fine grained, silty; siltstone is light to medium gray				
79.0-109.0	Sandstone, yellow-gray and light- to medium-gray, fine-grained				
109.0-132.0	Sandstone, light-gray, fine-grained		150	50	
132.0-154.0	Shale, medium- to dark-gray				
154.0-162.7	Siltstone, medium-gray				
162.7-171.0	Sandstone, medium-gray, fine-grained, silty				
171.0-194.0	Siltstone, medium-dark-gray and olive-gray, sandy		200	60	
194.0-199.0	Shale, medium-gray				
199.0-204.0	Siltstone, medium-dark-gray, sandy				
204.0-216.0	Sandstone, light-gray, silty				
216.0-246.0	Siltstone, medium-gray, shaly				
246.0-252.0	Sandstone, medium-gray, silty		250	70	

7-CW

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
252.0-264.0 Siltstone, medium- to dark-gray, shaly				
264.0-271.0 Siltstone and shale, interbedded, medium- to dark-gray				
271.0-284.0 Siltstone and sandstone, interbedded, medium- to dark-gray				
284.0-291.0 Siltstone, medium- to dark-gray				
291.0-304.0 Shale, medium-dark-gray and dark-gray				
304.0-307.0 Siltstone, medium-gray				



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 8-CW DATE 9/12/78 SURFACE ELEVATION(ft) 6875

LOCATION SW¼SW¼ Sec. 18 T. 23 N. R. 80 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 320

CORED YES ☐ NO ☒ INTERVAL(s) _____

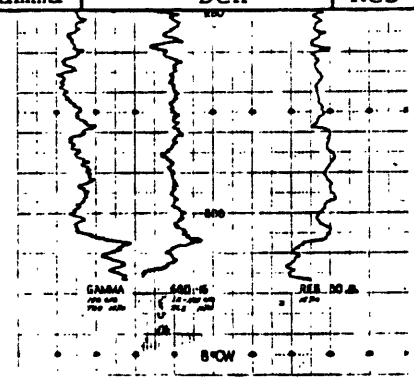
DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 5.0	Clay, loam, sandy		0	0	
5.0- 23.0	Sandstone, light-brown, medium-grained				
23.0- 46.0	Sandstone, light-brown, medium- to coarse-grained, argillaceous		50	10	
46.0- 53.8	Shale, medium-dark-gray, muddy				
53.8- 60.0	Siltstone, dark-olive-gray, shaly				
60.0- 66.3	Shale, medium-gray, muddy			20	
66.3- 73.0	Siltstone, dark-olive-gray, very sandy				
73.0- 76.0	Shale, medium-gray				
76.0- 79.0	Siltstone, dark-olive-gray, shaly				
79.0- 90.0	Shale, dark-gray to black, carbonaceous, coal stringers		100	30	
90.0-115.0	Shale-clay; medium-dark-gray, few coal stringers				
115.0-117.5	Siltstone, dark-gray, shaly			40	
117.5-124.3	Coal				
124.3-127.3	Shale, dark-gray to black carbonaceous		150		
127.3-133.0	Coal; laminations and thin lenses of carbonaceous shale			50	
133.0-136.5	Shale, dark-gray to black carbonaceous				
136.5-140.0	Coal, laminations of carbonaceous shale			60	
140.0-146.0	Shale and shaly coal, interbedded. Shale is dark gray to black, carbonaceous		200		
146.0-153.0	Shale, dark-gray to black carbonaceous, coal stringers			70	
			250		

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs
153.0-165.0	Claystone, dark-gray, partly shaly				Gamma / Den / Res
165.0-171.0	Claystone, medium-gray, slightly silty				
171.0-191.0	Siltstone, medium-gray				
191.0-233.0	Sandstone, gray, very fine-grained, partly silty				
233.0-260.0	Sandstone, light-gray, fine- to coarse-grained				
260.0-298.0	Sandstone, light-gray, coarse-grained and granular				
298.0-307.0	Sandstone, light-gray, fine-grained				
307.0-320.0	Claystone, light- to medium-gray, silty				



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 9-CW DATE 9/10/78 SURFACE ELEVATION(ft) 6970

LOCATION SW¼SW¼ Sec. 20 T. 23 N. R. 80 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 520

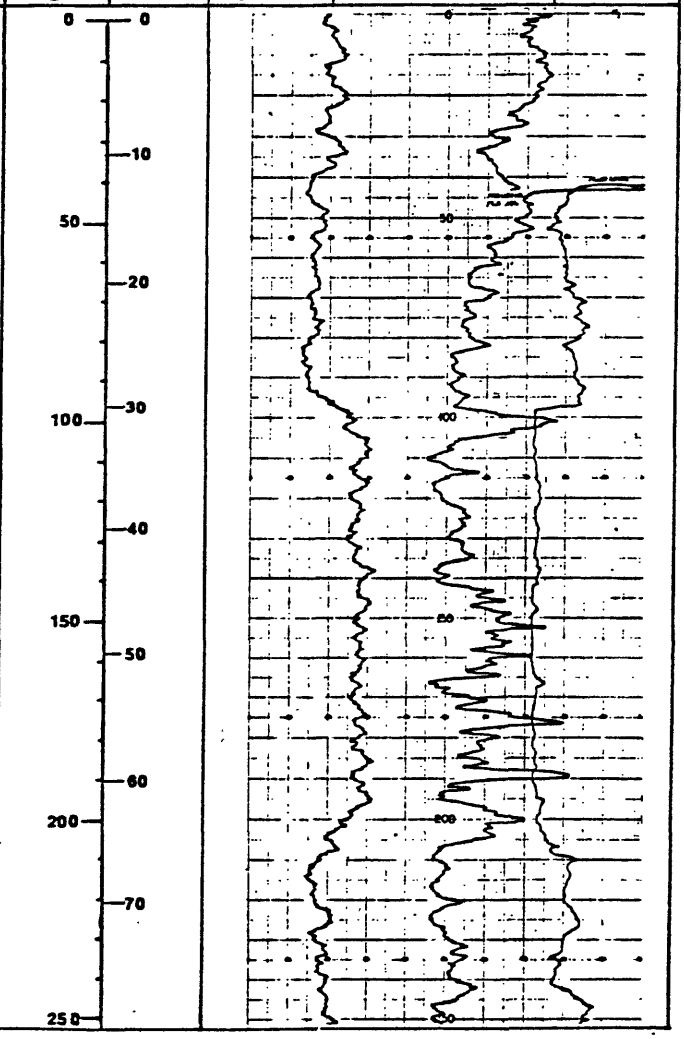
CORED YES [ ] NO [X] INTERVAL(s) _____

DRILLING MEDIUM: [ ] AIR [ ] FOAM [X] MUD [ ] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs
0.0- 5.0	Surface material				
5.0- 97.5	Sandstone, yellowish-brown to light-gray, fine- to coarse-grained, some granules				
97.5-142.0	Mudstone, light- to medium-gray, with interbedded dark-gray shale				
142.0-201.0	Interbedded shale and mudstone, gray				
201.0-259.5	Sandstone, light-gray, medium- to coarse-grained				
259.5-264.0	Siltstone, medium-gray				
264.0-290.0	Sandstone, light-gray, medium- to coarse-grained				
290.0-319.0	Interbedded dark-gray shale and dark-gray mudstone				
319.0-326.0	Sandstone, light-gray medium-grained				
326.0-335.0	Shale, dark-gray				
335.0-340.0	Siltstone, medium-gray				
340.0-431.5	Shale, medium- to dark-gray, partly silty				
431.5-434.5	Shale, black, carbonaceous				
434.5-441.0	Coal				
441.0-447.0	Shale, black, carbonaceous				
447.0-448.5	Coal				
448.5-451.0	Shale, black, carbonaceous				
451.0-456.5	Coal				
456.5-459.0	Shale, black, carbonaceous				
459.0-466.0	Shale, medium-gray				
466.0-467.0	Coal				
467.0-473.0	Shale, black, carbonaceous				
473.0-474.0	Coal				
474.0-477.0	Mudstone, brownish-gray				



Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
477.0-494.0 Shale, dark-gray 494.0-495.5 Coal 495.5-511.5 Shale and claystone, interbedded, dark-gray 511.5-520.0 Sandstone, light-gray, fine-grained		300, 350, 400, 450, 500, 550, 600, 650, 700	90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220	

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 10-CW DATE 10/11/78 SURFACE ELEVATION(ft) 6945

LOCATION NW¼NW¼ Sec. 18 T. 23 N. R. 80 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 297.6

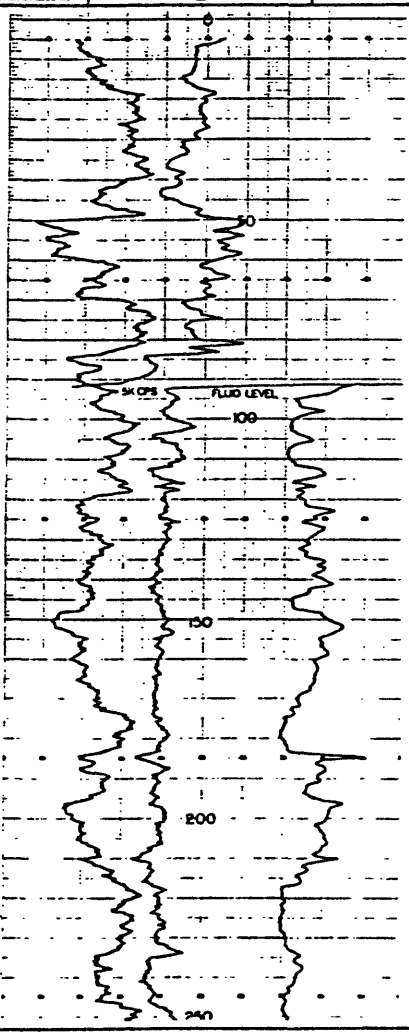
CORED YES [X] NO [ ] INTERVAL(s) 40-70.5; 252.4-297.6'

DRILLING MEDIUM: [ ] AIR [ ] FOAM [X] MUD [ ] WATER OBSERVATION WELL

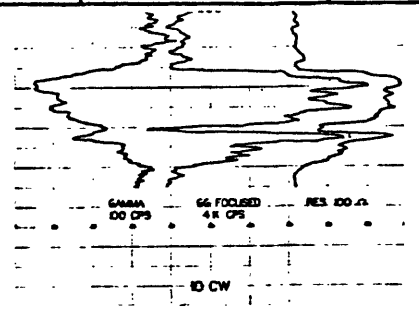
GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs
0.0- 5.0	Surface material				
5.0- 10.0	Sandstone, light-brown, fine-grained				
10.0- 12.5	Siltstone, buff, calcareous				
12.5- 25.0	Claystone, medium-gray to brown, slightly calcareous and silty				
25.0- 48.0	Shale and mudstone, interbedded with scattered coal stringers. Mudstone is dark gray to brown gray and is partly silty. Shale is dark gray and commonly carbonaceous				
48.0- 50.0	Shale, black, carbonaceous				
50.0- 60.0	Coal, mostly bright, partly dull, cleated, with very thin carbonaceous shale partings				
60.0- 70.0	Coal, carbonaceous shale, and interbedded mudstone				
70.0- 84.0	Mudstone, light- to dark-gray				
84.0-100.0	Siltstone, and very fine grained sandstone, interbedded light-gray, pyritic				
100.0-104.0	Mudstone, dark-gray with carbonized plant remains				
104.0-117.0	Siltstone and claystone, interbedded carbonized plant imprints common				
117.0-118.0	Coquina, light-brown, composed of snail and clam fragments				
118.0-148.0	Siltstone, claystone and very thin beds of fine-grained sandstone, interbedded, all light- to dark-gray				



Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
148.0–169.0	Sandstone, light-gray, very fine-grained, partly silty				
169.0–174.3	Siltstone, medium-gray				
174.3–184.5	Shale, dark-gray to black, fossiliferous, (gastropod fragments)				
184.5–219.0	Sandstone, light-gray, thin bedded, cross-laminated, carbonaceous clasts, with very thin interbeds of gray claystone and siltstone				
219.0–235.0	Shale, dark- to light-gray, partly carbonaceous, commonly fossiliferous (clam and gastropod fragments)				
235.0–242.0	Siltstone, medium-gray				
242.0–265.0	Shale, medium- to dark-gray, carbonaceous				
265.0–280.0	Coal, mostly bright, pyritic				
280.0–291.0	Coal and carbonaceous shale, interbedded				
291.0–294.5	Mudstone, dark-gray				
294.5–298.0	Shale, greenish-gray, pyritic				



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 11-CW DATE 10/6/78 SURFACE ELEVATION(ft) 6965

LOCATION NW¼NW¼ Sec. 18 T. 23 N. R. 80 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 460

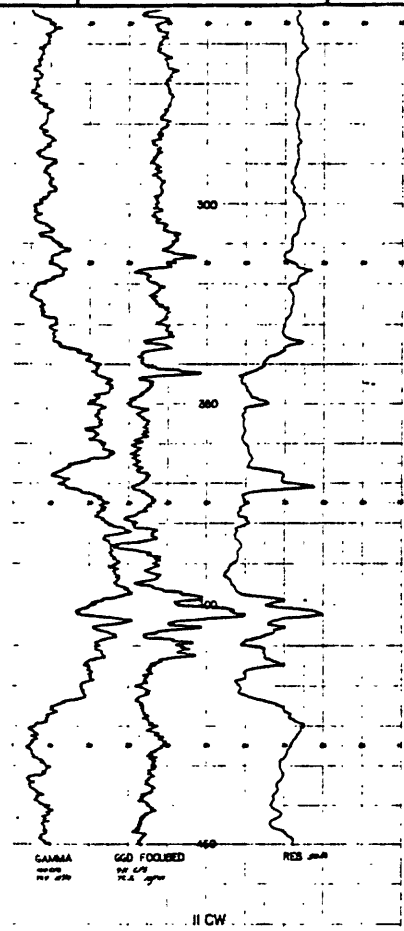
CORED YES [ ] NO [X] INTERVAL(s) _____

DRILLING MEDIUM: [X] AIR [X] FOAM [ ] MUD [ ] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0- 18.0	Shale, brown-gray; slightly silty, with a few intervals of light brownish-gray siltstone		0	0	
18.0- 25.0	Sandstone, light-brownish-gray, slightly silty			10	
25.0- 39.0	Shale, yellow-brownish, silty		50		
39.0- 45.0	Shale, medium-gray, partly carbonaceous			20	
45.0- 49.0	Shale, medium-gray				
49.0- 57.5	Sandstone, light-gray, fine-grained				
57.5- 63.0	Shale, medium-gray				
63.0- 75.0	Siltstone, light-medium-gray				
75.0-132.0	Shale, dark-gray to black, carbonaceous		100	30	
132.0-144.0	Coal				
144.0-147.5	Shale, black, carbonaceous			40	
147.5-150.5	Coal				
150.5-161.0	Shale, black, carbonaceous		150		
161.0-167.3	Mudstone, dark-gray			50	
167.3-205.3	Siltstone, medium-gray, grading to fine-grained sandstone				
205.3-210.5	Shale, dark-gray, carbonaceous				
210.5-220.0	Mudstone, bluish-gray, silty			60	
220.0-338.7	Sandstone, light-gray, fine- to medium-grained		200		
338.7-398.0	Shale, medium-gray, partly carbonaceous			70	
398.0-399.0	Coal				
400.0-401.3	Shale, black, carbonaceous				
401.3-403.7	Coal				
403.7-405.0	Shale, black, carbonaceous		250		

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
405.0–406.0 Coal 406.0–423.0 Shale, black, carbonaceous, with very thin interbeds of coal 423.0–460 Siltstone, medium-gray, with interbedded dark-gray shale		300 350 400 450 500 550 600 650 700	90 100 110 120 130 140 150 160 170 180 190 200 210 220	

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 12-CW DATE 10/5/78 SURFACE ELEVATION(ft) 6885

LOCATION SE¼NW¼ Sec. 18 T. 23 N. R. 80 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 630

CORED YES ☐ NO ☒ INTERVAL(s) _____

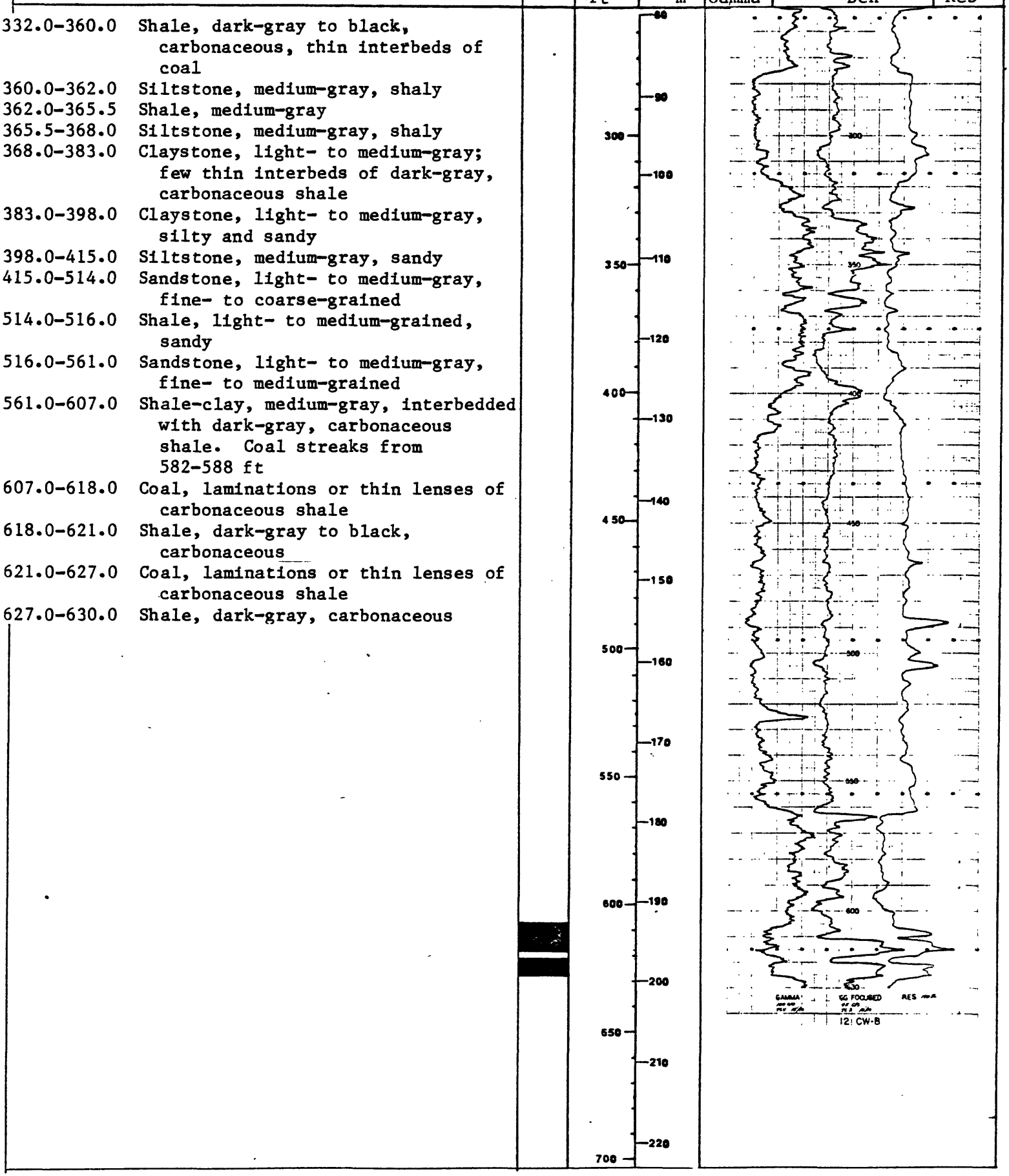
DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 26.0	Siltstone, light-yellow-gray, sandy		0	0	
26.0- 37.0	Sandstone, light-yellow, very fine- to fine-grained, silty				
37.0- 42.0	Shale-clay, medium- to dark-brown, carboniferous, gypsiferous			10	
42.0- 48.0	Shale, dark-gray, carbonaceous		50		
48.0- 60.0	Shale, dark-gray to black, carbonaceous coal stringers			20	
60.0- 74.0	Shale-clay, medium-gray, silty				
74.0-108.0	Sandstone, light-gray, fine- to medium-grained				
108.0-111.0	Shale, medium- to brown-gray, silty		100	30	
111.0-148.0	Sandstone, light-gray, fine- to coarse-grained; very thin, gray, shaly interbeds				
148.0-155.0	Siltstone and shale, light- to medium-gray			40	
155.0-186.0	Sandstone, light- to medium-gray, very fine- to coarse-grained. Coal clasts from 175-185 ft.		150	50	
186.0-190.0	Shale, medium-gray, silty				
190.0-232.0	Sandstone, light- to medium-gray, medium- to coarse-grained			60	
232.0-249.5	Shale, medium- to dark-gray		200		
249.5-251.6	Sandstone, light-gray, fine-grained			70	
251.6-276.0	Shale, medium- to dark-gray, carbonaceous, few coal stringers				
276.0-318.0	Sandstone, light-gray, fine- to medium-grained				
318.0-326.0	Shale, medium-gray, silty				
326.0-332.0	Siltstone, medium-gray, shaly		250		

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
332.0-360.0 Shale, dark-gray to black, carbonaceous, thin interbeds of coal				
360.0-362.0 Siltstone, medium-gray, shaly				
362.0-365.5 Shale, medium-gray				
365.5-368.0 Siltstone, medium-gray, shaly				
368.0-383.0 Claystone, light- to medium-gray; few thin interbeds of dark-gray, carbonaceous shale				
383.0-398.0 Claystone, light- to medium-gray, silty and sandy				
398.0-415.0 Siltstone, medium-gray, sandy				
415.0-514.0 Sandstone, light- to medium-gray, fine- to coarse-grained				
514.0-516.0 Shale, light- to medium-grained, sandy				
516.0-561.0 Sandstone, light- to medium-gray, fine- to medium-grained				
561.0-607.0 Shale-clay, medium-gray, interbedded with dark-gray, carbonaceous shale. Coal streaks from 582-588 ft				
607.0-618.0 Coal, laminations or thin lenses of carbonaceous shale				
618.0-621.0 Shale, dark-gray to black, carbonaceous				
621.0-627.0 Coal, laminations or thin lenses of carbonaceous shale				
627.0-630.0 Shale, dark-gray, carbonaceous				



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 13-CW DATE 8/29/78 SURFACE ELEVATION(ft) 6860

LOCATION SE¼SE¼ Sec. 18 T. 23 N. R. 80 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 310

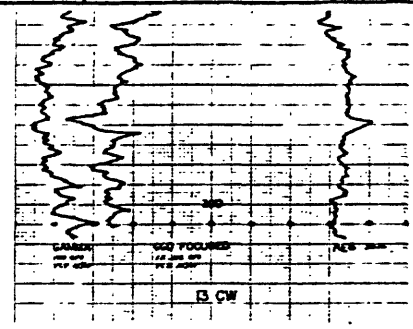
CORED YES [ ] NO [X] INTERVAL(s) _____

DRILLING MEDIUM: [ ] AIR [ ] FOAM [X] MUD [ ] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	;	Scale 10 f/in	Logging Speed		fpm
Gamma Gamma	;	Scale 10 f/in	Logging Speed	10	fpm
Resistivity	;	Scale 10 f/in	Logging Speed	15	fpm
Caliper	;	Scale 10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0- 5.0	Surface material		0	0	
5.0- 43.0	Shale, olive-gray, with some interbedded carbonaceous shale			10	
43.0- 49.0	Coal, contains some carbonaceous shale laminations		50		
49.0- 52.0	Shale, Black, carbonaceous			20	
52.0- 55.0	Coal				
55.0- 57.5	Shale, black, carbonaceoos				
57.5- 59.2	Coal, laminations and thin lenses of carbonaceous shale		100	30	
59.2- 62.0	Shale, black, carbonaceous				
62.0- 63.0	Coal				
63.0-120.0	Interbedded dark-gray shale and carbonaceous shale, with coal stringers			40	
120.0-179.2	Sandstone, light-gray, medium- to coarse-grained		150		
179.2-189.0	Mudstone, dark-gray with carbonaceous clasts			50	
189.0-202.0	Mudstone and interbedded carbonaceous shale, dark-gray				
202.0-206.0	Coal, laminations of carbonaceous shale			60	
206.0-210.0	Shale, black, carbonaceous		200		
210.0-212.0	Coal, laminations or thin lenses of carbonaceous shale			70	
212.0-250.0	Shale, carbonaceous with coal stringers				
250.0-309.0	Sandstone, light-gray, medium- to very coarse-grained		250		

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
		300	90	
		350	100	
		400	110	
		450	120	
		500	130	
		550	140	
		600	150	
		650	160	
		700	170	
			180	
			190	
			200	
			210	
			220	

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 14-CW DATE 9/7/78 SURFACE ELEVATION(ft) 6920

LOCATION NW¼NW¼ Sec. 20 T. 23 N. R. 80 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 270

CORED YES ☐ NO ☒ INTERVAL(s)

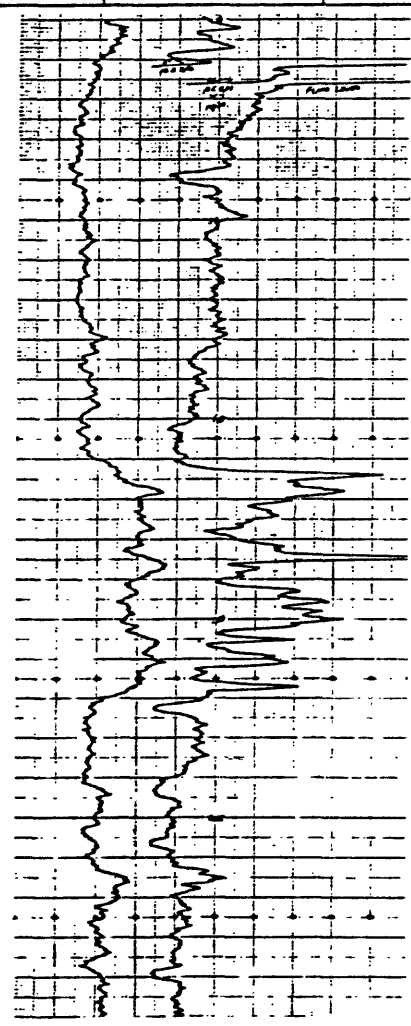
DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

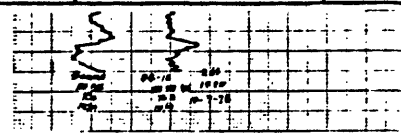
Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity *	; Scale		Logging Speed		fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

*Logged through drill rod

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 11.5	Surface material		0	0	
11.5- 18.0	Shale, olive-gray				
18.0-100.4	Sandstone, light-gray, fine-grained		50	10	
100.4-134.0	Shale, dark-gray				
134.0-135.0	Coal				
135.0-143.0	Shale, dark-gray to black, carbonaceous		100	30	
143.0-151.0	Interbedded coal and carbonaceous shale (coal thickness less than 1 ft)				
151.0-171.3	Shale, black, carbonaceous		150	50	
171.3-195.0	Sandstone, medium-gray, coarse-grained				
195.0-265.0	Sandstone, medium- to coarse-grained with interbedded shale and siltstone, gray		200	70	
			250		



14-CW

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
			80	
			90	
		300		
			100	
			110	
		350		
			120	
		400		
			130	
			140	
		450		
			150	
		500		
			160	
			170	
		550		
			180	
		600		
			190	
			200	
		650		
			210	
			220	
		700		

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 15-CW DATE 8/31/78 SURFACE ELEVATION(ft) 6965

LOCATION NW¼NE¼ Sec. 20 T. 23 N. R. 80 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 310

CORED YES ☐ NO ☒ INTERVAL(s)

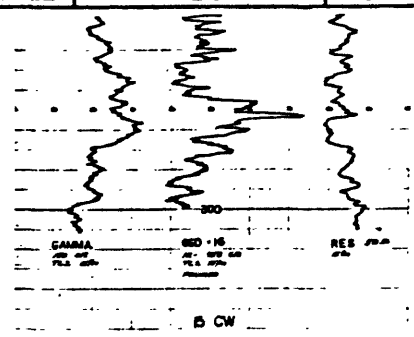
DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 10.0 Sandstone, reddish-brown to light-brown, very coarse-grained; granules and small pebbles; silty		0	0	
10.0- 19.0 Siltstone and clay-shale, light-gray to light-yellowish-brown			10	
19.0- 31.0 Clay-shale, medium-dark-gray, partly carboniferous		50		
31.0- 34.4 Siltstone and shale, medium-gray			20	
34.4- 60.0 Shale, medium-gray, partly silty				
60.0- 71.0 Shale, medium-gray				
71.0-100.0 Shale, medium-gray, silty		100	30	
100.0-109.0 Siltstone, medium-gray, shaly				
109.0-119.0 Sandstone, light-gray, coarse- to very coarse-grained				
119.0-121.5 Siltstone, light-gray, sandy				
121.5-127.0 Sandstone, light-gray, medium- to coarse-grained			40	
127.0-130.5 Sandstone, light-gray, very fine-grained		150		
130.5-147.0 Siltstone, light-gray, sandy			50	
147.0-150.3 Sandstone, light-gray, coarse-grained				
150.3-156.0 Siltstone, light-gray, sandy				
156.0-166.5 Sandstone, light-gray, coarse-grained			60	
166.5-172.0 Sandstone, light-gray, very fine- to coarse-grained		200		
172.0-183.0 Sandstone, light-gray, very fine-grained			70	
		250		

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
183.0-189.0	Claystone, light-gray to light-bluish-gray, particles of pyrite				
189.0-201.0	Claystone, medium-gray				
201.0-211.0	Claystone, dark-gray, partly carbonaceous				
211.0-235.0	Claystone, medium-gray				
235.0-266.0	Siltstone, medium-light-gray, sandy				
266.0-269.0	Claystone, medium-gray				
269.0-277.0	Claystone, medium-gray, very silty, traces carbonaceous material				
277.0-283.5	Claystone, medium-gray				
283.5-298.0	Siltstone, medium-gray, sandy				
298.0-309.0	Sandstone, medium-light-gray, fine-grained				



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 16-CW DATE 9/7/78 SURFACE ELEVATION(ft) 6945

LOCATION SW¼NE¼ Sec. 20 T. 23 N. R. 80 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 390

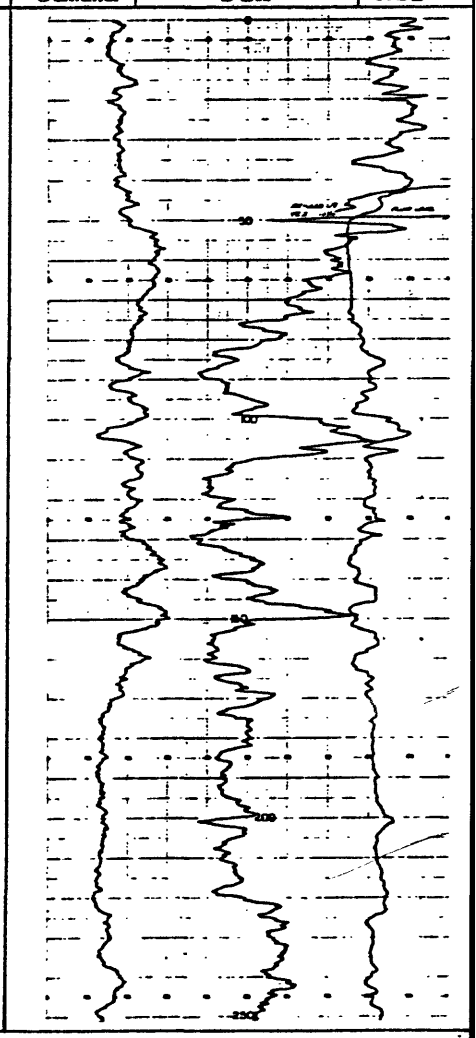
CORED YES ☐ NO ☒ INTERVAL(s)

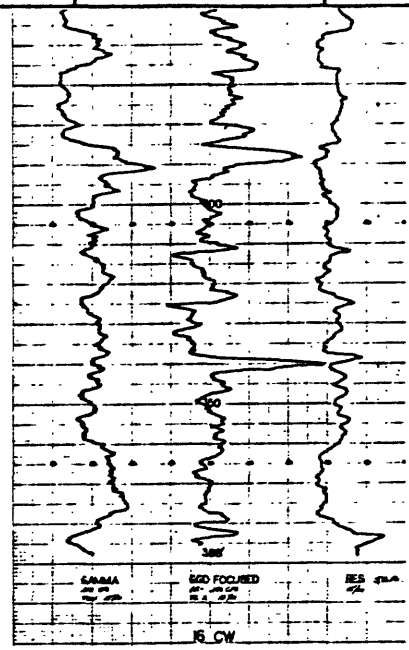
DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed		fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 48.0	Sandstone, light-brown to reddish-brown		0	0	
48.0- 70.0	Shale, medium- to dark-gray, silty				
70.0- 84.0	Mudstone, dark-gray, silty				
84.0- 86.0	Sandstone, light-gray, very fine-grained		50	10	
86.0- 90.5	Mudstone, dark-gray silty				
90.5- 92.7	Sandstone, light-gray, very fine-grained			20	
92.7- 99.3	Interbedded dark-gray shale and mudstone		100	30	
99.3-105.3	Coal with very thin carbonaceous shale partings				
105.3-114.0	Shale, dark-gray, partly carbonaceous			40	
114.0-120.0	Siltstone, dark-gray with coaly material		150	50	
120.0-123.4	Shale, medium- to dark-gray				
123.4-125.0	Coal			60	
125.0-137.5	Mudstone and shale, interbedded, gray; with thin black coaly stringers		200		
137.5-145.6	Sandstone, light-gray, very fine-grained			70	
145.6-152.0	Shale, medium- to dark-gray				
152.0-257.5	Sandstone, medium-gray, fine-grained, partly silty		250		
257.5-266.9	Mudstone, dark-gray, silty				
266.9-285.9	Sandstone, medium-gray, fine-grained, partly silty				



Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
285.9–323.5 Interbedded dark-gray shale and black, carbonaceous shale with thin coaly stringers 232.5–326.0 Sandstone, light-gray, very fine-grained 326.0–338.0 Mudstone, light-blue-gray 338.0–340.3 Coal, laminations or thin lenses of carbonaceous shale 340.3–382.0 Shale, medium- to dark-gray 382.0–390.0 Mudstone, dark-gray		300 350 400 450 500 550 600 650 700	90 100 110 120 130 140 150 160 170 180 190 200 210 220	

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 17-CW DATE 9/14/78 SURFACE ELEVATION(ft) 6930

LOCATION NW¼NE¼ Sec. 24 T. 23 N. R. 81 W. Quad. Como West 7½'

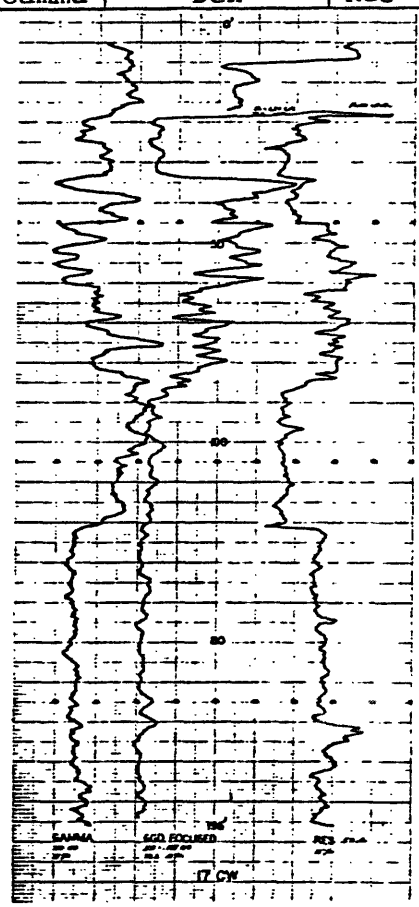
COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 200

CORED YES ☐ NO ☒ INTERVAL(s) _____

DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 17.0 Shale, medium-olive-gray 17.0- 26.0 Sandstone, light-gray, fine-grained 26.0- 32.5 Mudstone, medium-gray 32.5- 37.0 Coal, laminations of carbonaceous shale 37.0- 46.0 Shale, black, coaly 46.0- 60.7 Coal, shaly with thin carbonaceous shale partings (less than 1 ft thick) 60.7- 84.3 Shale, black, carbonaceous with interbedded coal (less than 1 ft thick) 84.3-121.0 Shale, dark-gray to black 121.0-200.0 Sandstone, light-gray, very fine- to coarse-grained		0 50 100 150 200 250	0 10 20 30 40 50 60 70	

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 18-CW DATE 9/27/78 SURFACE ELEVATION(ft) 7030

LOCATION SW¼NW¼ Sec. 24 T. 23 N. R. 81 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 717.5

CORED YES [ ] NO [X] INTERVAL(s) _____

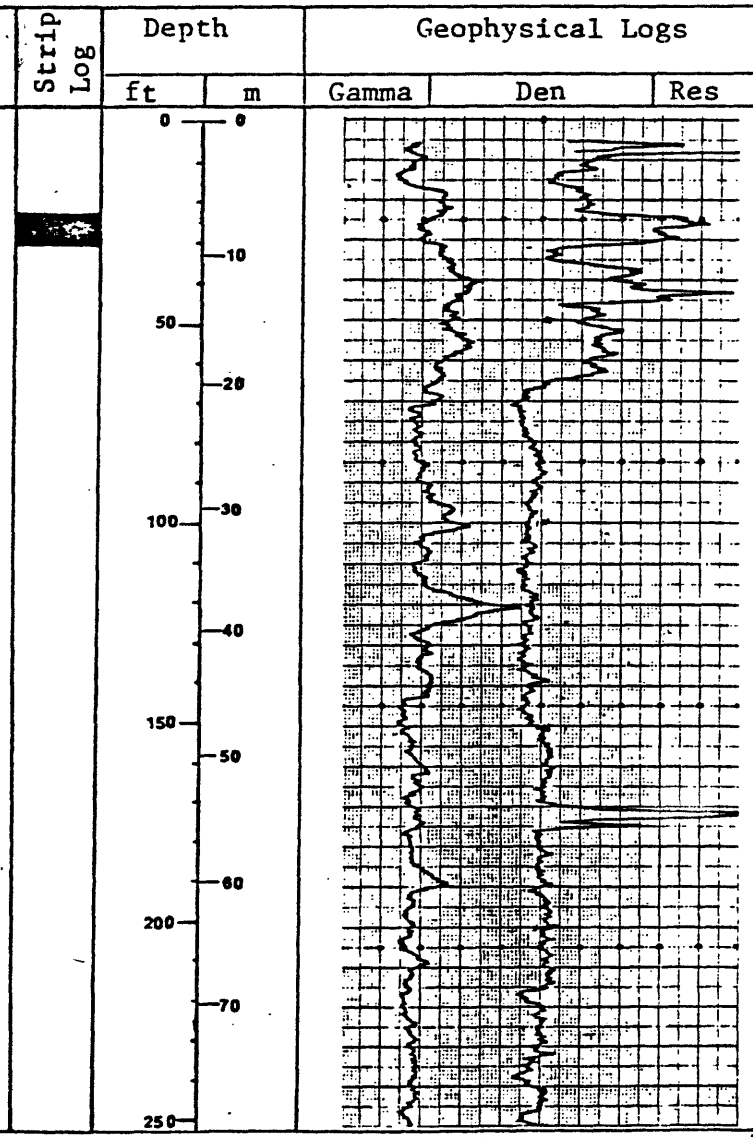
DRILLING MEDIUM: [X] AIR [X] FOAM [ ] MUD [X] WATER OBSERVATION WELL

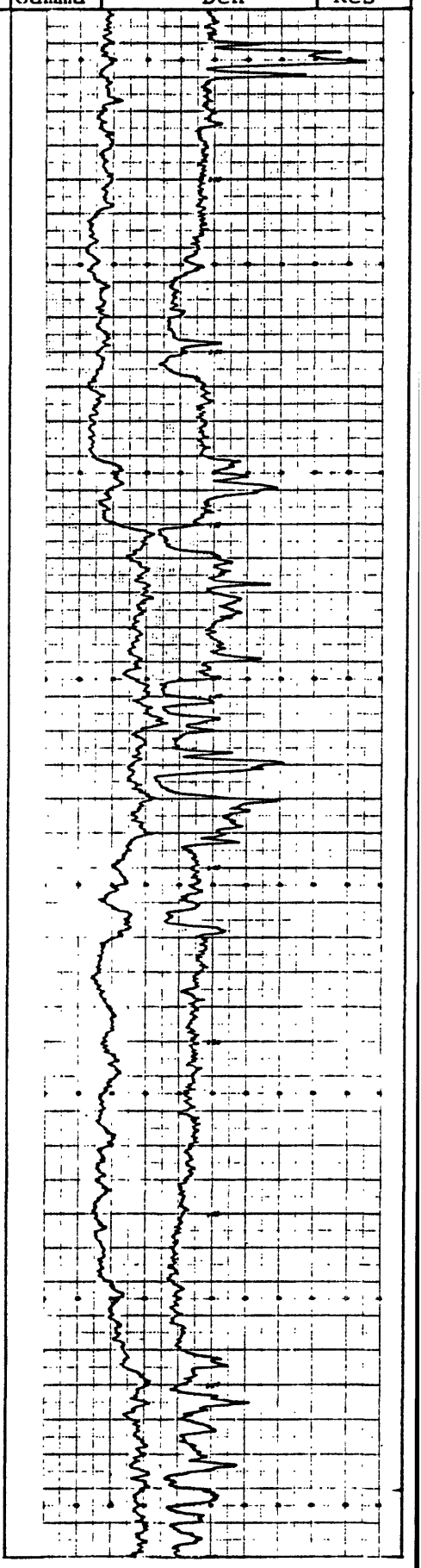
GEOPHYSICAL LOGS:

Natural Gamma	;	Scale 10 f/in	Logging Speed	15	fpm
Gamma Gamma	;	Scale 10 f/in	Logging Speed	10	fpm
Resistivity *	;	Scale	Logging Speed		fpm
Caliper *	;	Scale	Logging Speed		fpm

*Logged through drill rod

Lithology	
0.0- 17.0	Sandstone, light-yellowish-gray, fine- to coarse-grained
17.0- 24.0	Shale, dark-gray
24.0- 31.0	Coal, with black carbonaceous shale partings
31.0- 35.0	Siltstone, medium-gray
35.0- 57.0	Mudstone, medium- to dark-gray, silty
57.0- 63.5	Siltstone, medium-gray
63.5- 95.5	Sandstone, light-gray, fine- to coarse-grained
95.5-100.7	Mudstone, dark-gray, silty
100.7-115.9	Sandstone, light-gray, fine- to coarse-grained with carbonaceous clasts
115.9-122.5	Mudstone, dark-gray, silty
122.5-185.0	Sandstone, light- to medium-gray, fine- to medium-grained, with some chert pebbles
185.0-189.0	Mudstone
189.0-381.0	Sandstone, light- to medium-gray, medium- to coarse-grained, with some chert pebbles
381.0-388.8	Shale, brown, coaly
388.8-391.0	Coal, shaly
391.0-401.0	Sandstone, light-gray, very fine-grained
401.0-458.0	Shale, dark-gray to dark-brown, silty



Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
458.0-479.0 Interbedded shale and siltstone, gray 479.0-504.0 Siltstone, light- to medium-gray, shaly 504.0-511.0 Sandstone, light-gray, fine- to medium-grained 511.0-516.0 Shale, dark-gray 516.0-619.0 Sandstone, light-gray, fine- to medium-grained, with some interbedded siltstone, and minor pyrite 619.0-645.0 Siltstone, light-gray 645.0-654.0 Shale, medium-gray 654.0-717.0 Interbedded shale and siltstone. Shale is medium-brown and partly carbonaceous. Siltstone is light-greenish-gray and partly sandy		300 350 400 450 500 550 600 650 700	80 90 100 110 120 130 140 150 160 170 180 190 200 210 220	

Lithology	Strip Log	Depth		Geophysical Logs		
		ft	m	Gamma	Den	Res
		750	230			
			240			
			250			
		800				
			260			
		850	270			

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 19-CW DATE 9/23/78 SURFACE ELEVATION(ft) 6980

LOCATION Center Sec. 24 T. 23 N. R. 81 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 304

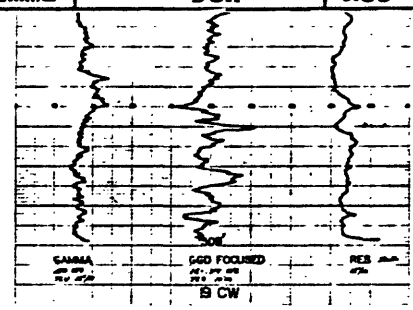
CORED YES [ ] NO [X] INTERVAL(s)

DRILLING MEDIUM: [X] AIR [X] FOAM [ ] MUD [X] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 3.7	Surface material		0	0	
3.7- 7.3	Claystone, light-yellow-gray				
7.3- 14.0	Sandstone, light-yellow, very fine-grained				
14.0- 18.0	Claystone, yellow-brown			10	
18.0- 21.0	Shale, black, carbonaceous		50		
21.0- 26.7	Coal, dull black			20	
26.7- 29.5	Coal, laminations and thin lenses of carbonaceous shale				
29.5- 35.9	Shale, thin lenses or lamnations of coal		100	30	
35.9- 41.0	Claystone, medium gray				
41.0- 53.0	Shale, medium- to dark-gray			40	
53.0- 55.5	Claystone, light- to medium-gray, silty		150		
55.5-309.0	Sandstone, light- to dark-gray, very fine- to coarse-grained, micaceous, subrounded, partly interbedded with siltstone			50	
				60	
			200		
				70	
			250		

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
			80	
			90	
		300		
			100	
			110	
		350		
			120	
		400		
			130	
			140	
		450		
			150	
		500		
			160	
			170	
		550		
			180	
		600		
			190	
			200	
		650		
			210	
			220	
		700		

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 20-CW DATE 10/5/78 SURFACE ELEVATION(ft) 7085

LOCATION SE¼SE¼ Sec. 24 T. 23 N. R. 81 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 405

CORED YES ☐ NO ☒ INTERVAL(s) _____

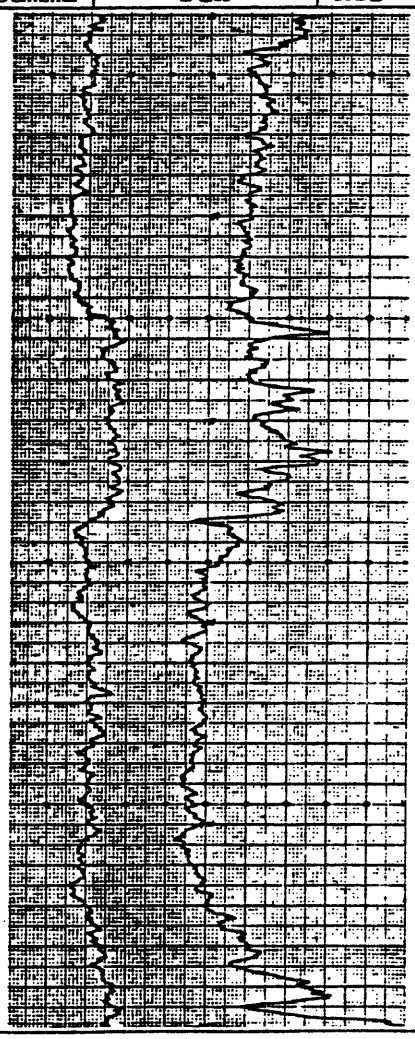
DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma*	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma *	; Scale		Logging Speed	10	fpm
Resistivity	; Scale		Logging Speed		fpm
Caliper**	; Scale	10 f/in	Logging Speed	15	fpm

*Logged through drill rod. **Caliper from 0-281.

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 4.0	Sandstone, yellowish-brown to brownish-gray, fine- to coarse-grained		0	0	
74.0- 78.8	Shale, medium- to dark-gray, partly carbonaceous			10	
78.8- 91.0	Shale, olive-gray		50		
91.0- 92.5	Shale, black, carbonaceous			20	
92.5-105.0	Shale, medium- to olive-gray				
105.0-110.0	Shale, black, carbonaceous				
110.0-118.0	Shale, medium- to olive-gray				
118.0-123.0	Shale, black, carbonaceous				
123.0-219.0	Sandstone, light-gray, very fine- to fine-grained, partly silty		100	30	
219.0-225.0	Interbedded sandstone and siltstone				
225.0-230.0	Shale, dark-gray				
230.0-233.0	Shale, black, carbonaceous			40	
233.0-240.0	Shale, dark-gray, partly carbonaceous		150		
240.0-243.0	Coal, laminations and lenses of carbonaceous shale			50	
243.0-249.0	Shale, medium- to dark-gray				
249.0-257.0	Coal				
257.0-261.0	Coal, laminations and lenses of carbonaceous shale			60	
261.0-297.5	Shale, dark-gray		200		
297.5-311.0	Coal and carbonaceous shale, interbedded			70	
311.0-329.0	Shale, dark-gray				
329.0-333.0	Shale, black, carbonaceous		250		



Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs
333.0-337.0 Shale, dark-gray 337.0-343.0 Shale, black, carbonaceous 343.0-345.5 Shale, dark-gray 345.5-349.0 Shale, black, carbonaceous 349.0-376.5 Shale, dark-gray, partly carbonaceous 376.5-380.5 Coal 380.0-391.0 Shale, dark-gray, partly carbonaceous 391.0-405.0 Sandstone, light-gray, fine-grained		300 350 400 450 500 550 600 650 700	90 100 110 120 130 140 150 160 170 180 190 200 210 220	Gamma Den Res

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 21-CW DATE 9/1/78 SURFACE ELEVATION(ft) 6990

LOCATION NE¼SW¼ Sec. 20 T. 23 N. R. 80 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 310

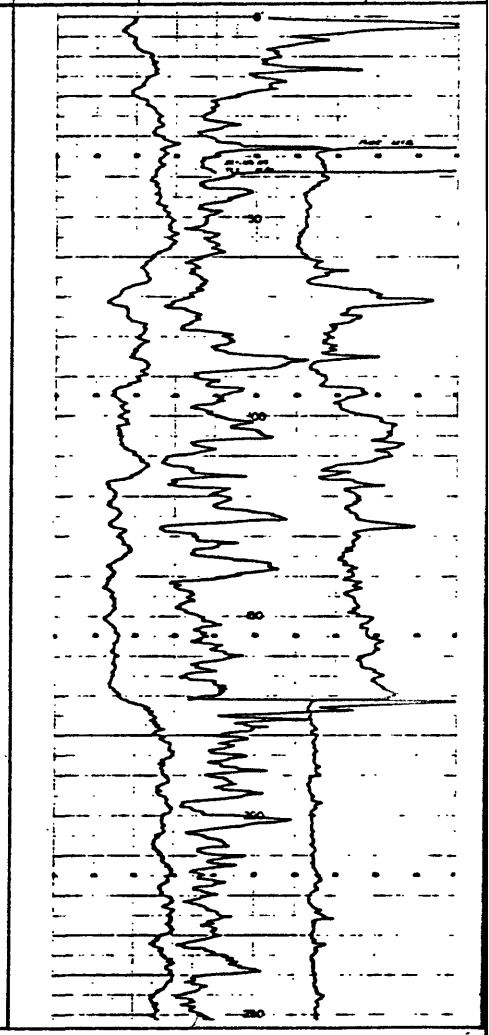
CORED YES ☐ NO ☒ INTERVAL(s) _____

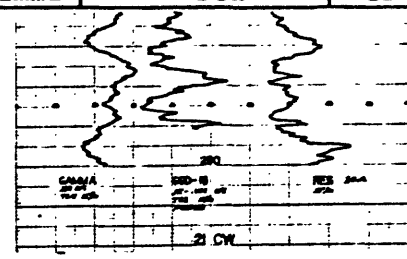
DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0– 5.0	Sandstone, grayish-orange, medium- to coarse-grained		0	0	
5.0– 9.0	Siltstone, grayish-orange, very sandy				
9.0– 14.0	Claystone, gray- to dark-brown			10	
14.0– 21.0	Siltstone, gray, very sandy		50		
21.0– 35.0	Claystone, medium-gray			20	
35.0– 43.5	Claystone, dark-gray to brown, carbonaceous				
43.5– 61.0	Claystone, medium-gray		100	30	
61.0– 66.5	Claystone, dark-gray, silty				
66.5– 72.0	Sandstone, light-gray, very fine-grained, sandy			40	
72.0– 76.0	Siltstone, medium-gray, sandy		150		
76.0– 86.0	Siltstone and claystone, dark-gray, traces carbonaceous material			50	
86.0– 92.5	Siltstone, dark-gray, shaly				
92.5–112.0	Sandstone, light-gray, coarse-grained; silty			60	
112.0–116.0	Siltstone and claystone, dark-gray		200		
116.0–128.0	Sandstone, light-gray, very fine-grained, shaly			70	
128.0–136.0	Siltstone, medium-gray, very sandy				
136.0–163.0	Sandstone, light-gray, fine-grained				
163.0–172.0	Sandstone, light-gray, fine- to medium-grained				
172.0–255.5	Claystone, medium-gray, partly silty				
255.5–263.0	Siltstone, medium-gray, very sandy		250		



Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
263.0-273.0 Claystone, brown to black, some carbonaceous material 273.0-279.0 Claystone, dark-gray, silty 279.0-285.0 Siltstone, medium-gray 285.0-310.0 Sandstone, light-gray, medium- to coarse-grained, very silty		300 350 400 450 500 550 600 650 700	90 100 110 120 130 140 150 160 170 180 190 200 210 220	

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 22-CW DATE 9/9/78 SURFACE ELEVATION(ft) 6895

LOCATION NE¼SE¼ Sec. 20 T. 23 N. R. 80 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 400

CORED YES ☐ NO ☒ INTERVAL(s)

DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 13.0	Sandstone, light-brown, medium- to very coarse-grained		0	0	
13.0- 21.0	Sandstone, light-brown, fine- to coarse-grained				
21.0- 31.0	Sandstone, brownish-gray to red-brown, fine- to medium-grained			10	
31.0- 43.0	Sandstone, yellowish-brown, fine grained		50		
43.0- 51.5	Sandstone, brownish-gray to red-brown, fine- to coarse-grained			20	
51.5- 62.0	Shale, dark-gray, trace coal				
62.0- 65.0	Shale-clay, medium-gray				
65.0- 76.0	Siltstone, medium-gray, sandy		100	30	
76.0- 94.0	Siltstone, medium-gray, shaly				
94.0- 98.5	Shale, medium-gray, partly silty				
98.5-101.0	Sandstone, light-gray, fine grained			40	
101.0-111.0	Siltstone, medium-gray, sandy		150		
111.0-115.0	Shale, medium-gray			50	
115.0-117.0	Coal, black, carbonaceous shale lenses and laminations				
117.0-125.0	Sandstone, light-gray, fine-grained				
125.0-131.0	Siltstone, light-gray, sandy				
131.0-146.0	Shale, medium- to dark-gray, partly silty			60	
146.0-155.0	Siltstone, medium- to dark-gray		200		
155.0-158.0	Sandstone, medium-gray, fine-grained, silty				
158.0-162.0	Shale, medium-gray			70	
162.0-166.0	Siltstone, medium-gray				
166.0-173.0	Sandstone, light-gray, fine-grained				
173.0-184.0	Shale, medium- to dark-gray		250		

Lithology	
184.0–187.0	Shale, dark-gray
187.0–189.0	Shale, black, thin lenses or laminations of coal
189.0–192.0	Coal
192.0–197.0	Shale and claystone. Shale is medium-gray and claystone is brownish-gray
197.0–202.0	Shale, black, carbonaceous
202.0–208.5	Coal, some thin lenses and laminations of shale
208.5–211.0	Shale, dark-gray
211.0–227.0	Siltstone, medium-gray, sandy
227.0–231.0	Shale, black, thin lenses or laminations of coal
231.0–234.0	Coal, laminations of black carbonaceous shale
234.0–239.0	Shale, black, carbonaceous, coal laminations
239.0–244.4	Coal, laminations or lenses of carbonaceous shale
244.4–248.0	Shale, black, carbonaceous
248.0–251.0	Shale, medium-gray, silty
251.0–260.5	Shale, dark-gray, carbonaceous
260.5–278.0	Sandstone, light-gray, fine-grained
278.0–288.0	Siltstone, medium-gray
288.0–300.0	Shale, medium-gray, silty
300.0–306.0	Claystone, dark-gray to black
306.0–312.7	Shale, black, carbonaceous
312.7–319.7	Coal
319.7–321.5	Shale, dark-gray to black, carbonaceous
321.5–327.7	Coal
327.7–333.8	Coal, some lenses and laminations of carbonaceous shale
333.8–344.0	Shale, medium-gray, silty
344.0–348.0	Siltstone, medium-gray, sandy
348.0–356.5	Shale, medium-gray, silty
356.5–360.0	Siltstone, medium-gray, sandy
360.0–365.0	Sandstone, light-gray, fine-grained, silty
365.0–372.0	Shale, medium-gray, silty
372.0–378.0	Shale, medium-gray
378.0–383.0	Shale, medium-gray, silty
383.0–390.0	Shale, medium-gray
390.0–396.0	Siltstone
396.0–400.0	Sandstone, light-gray, fine-grained

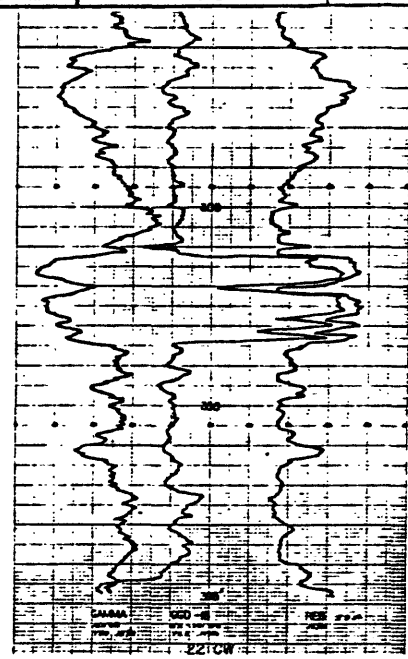
Strip Log

Depth

ft	m
	80
	90
300	
	100
	110
350	
	120
400	
	130
	140
450	
	150
500	
	160
	170
550	
	180
600	
	190
	200
650	
	210
	220
700	

Geophysical Logs

Gamma | Den | Res



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 23-CW DATE 11/7/78 SURFACE ELEVATION(ft) 7060

LOCATION SW¼NW¼ Sec. 24 T. 23 N R. 81 W Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 717.5

CORED YES [ ] NO [X] INTERVAL(s)

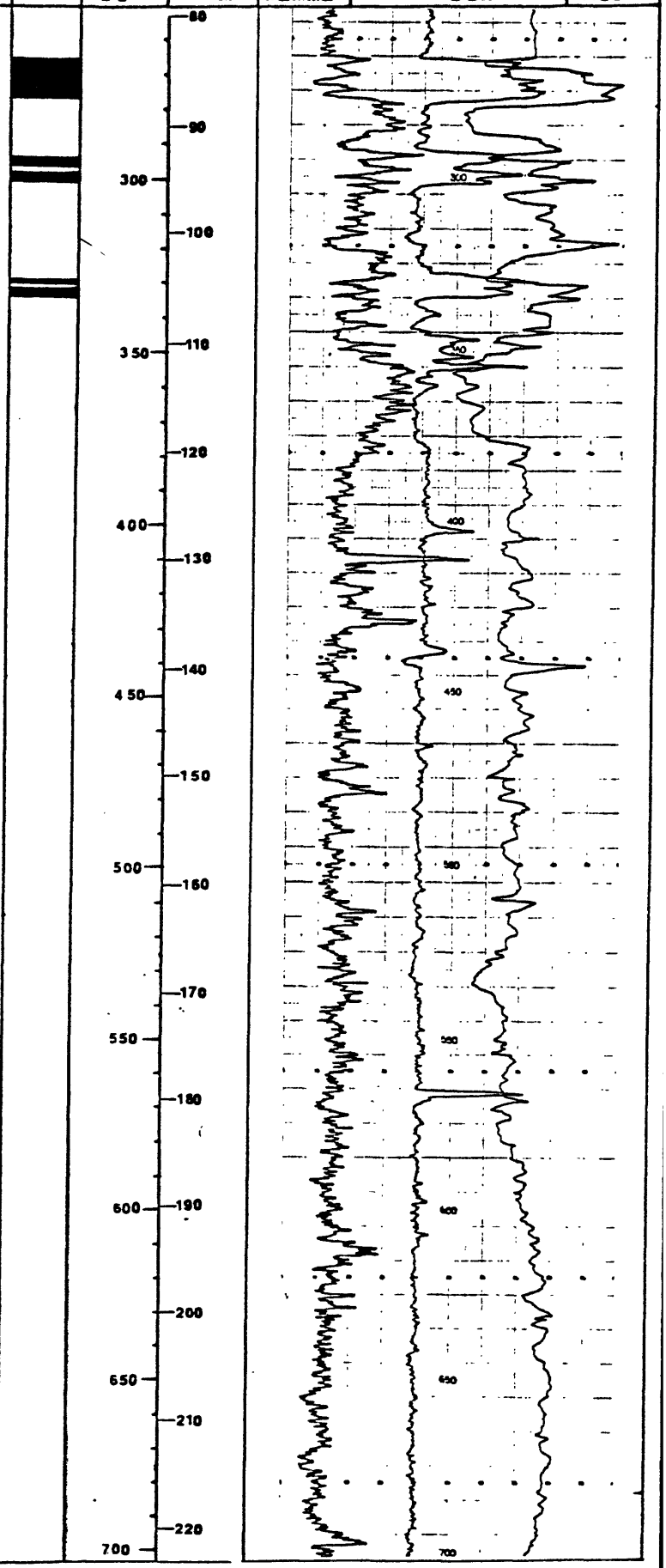
DRILLING MEDIUM: [X] AIR [X] FOAM [ ] MUD [X] WATER OBSERVATION WELL

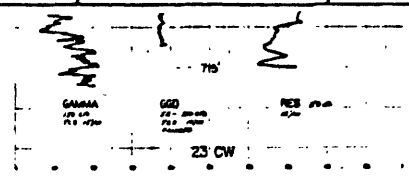
GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 3.0	Sandstone and siltstone, interbedded, light-brownish-gray. Sandstone is fine-grained		0	0	
3.0- 8.0	Siltstone, grayish-brown				
8.0- 13.0	Shale, grayish-brown			10	
13.0- 15.0	Siltstone, grayish-brown				
15.0- 20.0	Shale, medium-gray, silty		50		
20.0- 23.5	Siltstone, light- to medium-gray			20	
23.5- 25.5	Sandstone, light-gray				
25.5- 32.0	Siltstone, light- to medium-gray, sandy				
32.0- 36.0	Shale, black, carbonaceous		100	30	
36.0- 42.0	Coal				
42.0- 46.0	Shale, black, carbonaceous, thin coal lenses			40	
46.0- 51.0	Coal				
51.0- 53.0	Shale, black, carbonaceous		150		
53.0- 58.0	Coal			50	
58.0- 61.0	Shale, thin coal lenses or laminations				
61.0- 64.5	Coal			60	
64.5- 66.0	Shale, black, carbonaceous		200		
66.0- 69.0	Coal, laminations and lenses of black shale and claystone			70	
69.0- 72.0	Shale, black, carbonaceous				
72.0- 74.0	Coal				
74.0- 78.0	Coal and shale, interbedded. Shale is black, coal lenses and laminations				
78.0- 82.0	Shale, black, carbonaceous		250		

Lithology	
82.0- 88.0	Shale, black, coal lenses and laminations
88.0- 96.0	Shale, medium-dark-gray and black, carbonaceous
96.0-101.0	Shale, medium-gray, silty
101.0-118.0	Siltstone and shale, interbedded, medium-gray
118.0-136.5	Siltstone, medium-gray, sandy
136.5-161.0	Sandstone, light- to medium-gray, fine-grained, silty
161.0-213.0	Sandstone, light-gray, fine- to very coarse-grained; few granules and pebbles
213.0-266.0	Sandstone, light-gray, fine-grained, friable
266.0-278.0	Coal, thin carbonaceous shale lenses or laminations
278.0-287.0	Shale, dark-brown to black, carbonaceous
287.0-293.0	Sandstone and siltstone, light-gray. Sandstone is very fine grained.
293.0-295.0	Shale, medium-gray
295.0-302.5	Coal and carbonaceous shale, interbedded. Shale is black, coal lenses and laminations
302.5-318.0	Siltstone and shale, interbedded, medium-gray, sandy
318.0-322.0	Sandstone, light-gray, fine-grained
322.0-330.0	Shale, dark-gray to black, carbonaceous
330.0-336.0	Coal, shaly
336.0-339.0	Shale, medium-gray, silty
339.0-346.0	Sandstone, light-gray, fine-grained
346.0-352.0	Shale, dark-gray to black, carbonaceous
352.0-366.0	Shale, medium-gray silty
366.0-369.0	Siltstone, medium-gray
369.0-379.0	Siltstone, medium-gray, sandy
379.0-405.0	Sandstone, light-gray, fine- to very coarse-grained, granules
405.0-407.0	Shale, medium-gray
407.0-424.0	Sandstone, light-gray, fine to very coarse-grained, granules, shaly and silty
424.0-425.0	Shale, medium-gray
425.0-525.0	Sandstone, light-gray, fine- to very coarse-grained, and granules
525.0-550.0	Sandstone, light- to medium-gray, fine-grained silty and shaly
550.0-715.0	Sandstone, light-gray, fine- to medium-grained; some very coarse grained



Lithology	Strip Log	Depth		Geophysical Logs		
		ft	m	Gamma	Den	Res
			230			
		750	240			
			250			
		800				
			260			
		850	270			

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 24-E DATE 8/1/78 SURFACE ELEVATION(ft) 6535

LOCATION SE¼NE¼ Sec. 4 T. 23 N. R. 81 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 318.2

CORED YES [X] NO [ ] INTERVAL(s) 37.5-318.2

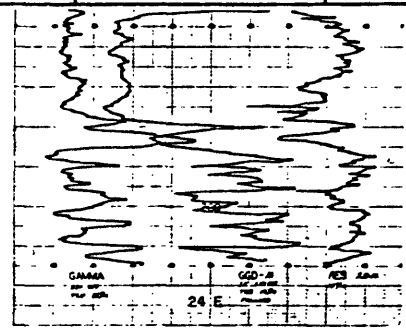
DRILLING MEDIUM: [ ] AIR [ ] FOAM [X] MUD [ ] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 17.5	Surface material: yellowish-gray sand and silt		0	0	
17.5- 26.5	Silty shale, brownish-gray				
26.5- 30.0	Sandstone, brownish-gray, fine-grained		50	10	
30.0- 32.5	Mudstone, silty with coal traces				
32.5- 37.0	Sandstone, brownish-gray, fine- to medium-grained		100	20	
37.0- 40.2	Mudstone, medium- to dark-gray, with interbedded carbonaceous shale, leaf and stem imprints, minor pyrite		150	30	
40.2- 40.7	Sandstone, light-gray, very fine-grained, carbonaceous banding				
40.7- 42.8	Sandstone, medium-gray, claystone stringers, stem and leaf imprints, carbonaceous mottling		200	40	
42.8- 44.0	Sandstone, light-gray, very fine-grained, silty, carbonaceous banding		250	50	
44.0- 59.0	Sandstone, light- to dark-gray, very fine- to fine-grained, carbonaceous banding, stem and leaf impressions		300	60	
59.0- 64.0	Mudstone, dark-gray, stem imprints				
64.0- 64.9	Coal, stem imprints		350	70	
64.9- 65.2	Carbonaceous shale				
65.2- 66.0	Coal				
66.0- 68.0	Carbonaceous shale with coal stringers				
68.0- 69.0	Carbonaceous shale				

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs
69.0- 70.0	Carbonaceous shale and interbedded coal				
70.0- 71.8	Coal				
71.8- 74.5	Carbonaceous shale with coal stringers				
74.5- 78.3	Coal with thin carbonaceous shale partings				
78.3- 80.0	Carbonaceous shale with thin interbedded mudstone				
80.0- 82.5	Coal				
82.5- 83.5	Carbonaceous shale				
83.5- 87.0	Coal				
87.0- 88.5	Carbonaceous shale				
88.5- 91.0	Coal				
91.0- 92.0	Carbonaceous shale				
92.0- 93.0	Coal				
93.0- 94.3	Carbonaceous shale				
94.3- 97.0	Coal				
97.0- 99.0	Carbonaceous shale with very thin interbeds of coal				
99.0-103.0	Coal, boney				
103.0-105.0	Mudstone, dark-gray, carbonaceous banding				
105.0-112.3	Siltstone, medium-gray, very muddy, with carbonaceous clasts				
112.3-113.3	Carbonaceous shale				
113.3-114.5	Coal, shaly				
114.5-118.0	Carbonaceous shale				
118.0-120.0	Coal with thin carbonaceous shale partings				
120.7-122.0	Carbonaceous shale				
122.0-126.0	Coal				
126.5-127.0	Carbonaceous shale				
127.5-129.0	Coal				
129.0-130.5	Carbonaceous shale				
130.5-135.5	Coal, with minor carbonaceous shale partings				
135.5-137.5	Mudstone, light- and medium-gray banded, carbonaceous clasts				
137.5-143.0	Sandstone, light-gray, very fine-grained, mineralization along fracture				
143.0-144.0	Shale, dark-gray				
144.0-150.5	Sandstone, light-gray, very fine-grained, laminated with carbonaceous material				
150.5-157.0	Mudstone, very silty, minor carbonaceous shale bands				
157.0-159.0	Mudstone, dark-gray				
159.0-169.0	Sandstone, light- to medium-gray, very fine-grained				
169.0-170.1	Mudstone and siltstone, medium-gray, carbonaceous				
170.1-183.0	Sandstone, light- to medium-gray, very fine- to fine-grained				



Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Geophysical Logs Den	Geophysical Logs Res
183.0-184.5 Siltstone, medium-gray						
184.5-189.2 Sandstone, ligbt- to medium-gray, very fine- to fine-gralned						
189.2-192.3 Siltstone, medium-gray						
192.3-200.0 Carbonaceous shale with coal stringers						
200.0-202.0 Coal, with minor carbonaceous shale partings						
202.0-204.0 Carbonaceous shale						
204.0-205.0 Interbedded coal and carbonaceous shale						
205.0-208.0 Carbonaceous shale with coal stringers						
208.0-211.0 Coal						
211.0-212.5 Carbonaceous shale, coaly						
212.5-214.0 Coal, shaly						
214.0-221.0 Shale with coal stringers						
211.0-226.0 Coal, transitional to shaly coal at base						
226.0-233.0 Carbonaceous shale with interbedded coal lenses and stringers						
233.0-234.0 Shaly coal						
234.0-237.0 Carbonaceous shale and coal						
237.0-242.5 Carbonaceous shale						
242.5-246.8 Coal, shaly						
246.8-247.6 Carbonaceous shale, coaly						
247.6-251.5 Coal, partly shaly						
251.5-268.0 Interbedded fine-grained sandstone and siltstone with carbonaceous banding						
268.0-272.0 Mudstone, dark-gray with carbonaceous banding						
272.0-273.5 Interbedded coal and carbonaceous shale						
273.5-278.0 Sandstone, ligbt-gray, very fine-grained						
278.0-279.3 Coal, shaly						
279.3-281.5 Shale, dark-gray						
281.5-286.0 Shale, black, carbonaceous and thin coal lenses						
286.0-290.6 Coal, carbonaceous shale laminations						
290.6-295.0 Carbonaceous shale and shaly coal						
295.0-296.0 Coal						
296.0-301.0 Shale, with thin coal interbeds						
301.0-304.0 Coal						
304.0-305.3 Shale, coaly						
305.3-310.0 Coal, partly shaly						
310.0-312.0 Carbonaceous shale						
312.0-315.0 Coal shaly						
315.0-318.2 Carbonaceous shale and coal interbeds						

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 25-E-C DATE 8/18/78 SURFACE ELEVATION(ft) 6580

LOCATION SW¼SE¼ Sec. 4 T. 23 N. R. 81 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 232.4

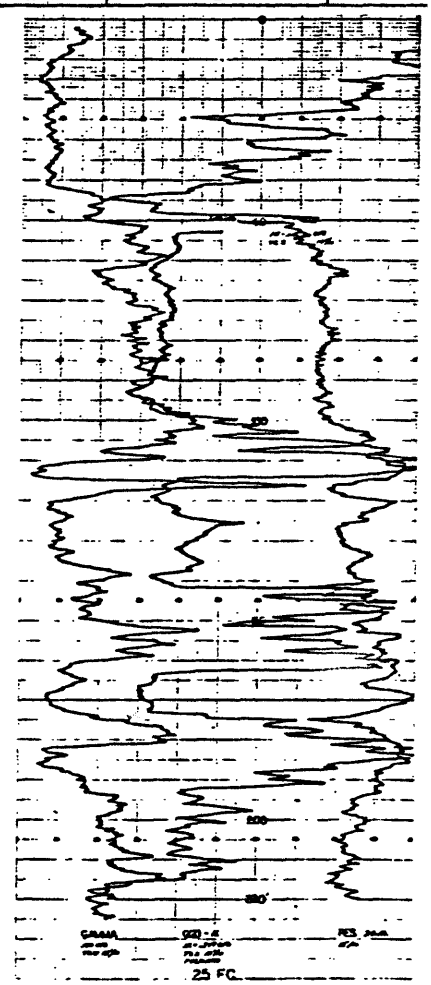
CORED YES [X] NO [ ] INTERVAL(s) 46.4-232.4

DRILLING MEDIUM: [ ] AIR [ ] FOAM [X] MUD [ ] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 49.0	Alluvium and weathered material		0	0	
49.0-101.0	Shale, dark-gray, and carbonaceous shale, dull dark-gray to black, with thin interbeds of mudstone and siltstone			10	
101.0-101.5	Carbonaceous shale with vitrinite banding		50		
101.5-102.5	Shale, dark-gray			20	
102.5-105.0	Coal and bone coal				
105.0-106.0	Carbonaceous shale with vitrinite bands				
106.0-108.5	Coal and bone coal			30	
108.5-110.0	Carbonaceous shale		100		
110.0-115.0	Coal, thin interbeds of bone coal				
115.0-119.0	Mudstone, light gray			40	
119.0-142.0	Sandstone, light-gray, fine- to medium-grained, very porous, fractured in places, many carbonaceous clasts basal		150		
142.0-150.0	Coal, very bright black, conchoidal fracture, moist, with thin bone coal partings, less than 0.5 ft thick			50	
150.0-154.0	Carbonaceous shale and bone coal with vitrinite banding				
154.0-160.0	Coal, bright to dull black with thin carbonaceous shale interbeds		200	60	
160.0-165.0	Coal, bright to dull black, very hard, pyritic			70	
			250		



Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma	Geophysical Logs: Den	Geophysical Logs: Res
165.0-176.0 Sandstone, light-gray, very fine-grained, laminated, carbonaceous clasts common; with some thin mudstone interbeds						
176.0-181.0 Alternating carbonaceous shale, mudstone, and core lenses and stringers						
181.0-189.5 Coal, bright to dull black, moist, concoidal fracture, pyritic						
189.5-217.0 Alternating carbonaceous shale, shale, mudstone, and then lenses and stringers of coal						
217.0-232.0 Interbedded sandstone, very fine- to fine- grained, and siltstone. Convolute laminations and carbonaceous material common						

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 25-E-B DATE 8/28/78 SURFACE ELEVATION(ft) 6600

LOCATION SW¼SE¼ Sec. 4 T. 23 N. R. 81 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 710

CORED YES [ ] NO [X] INTERVAL(s)

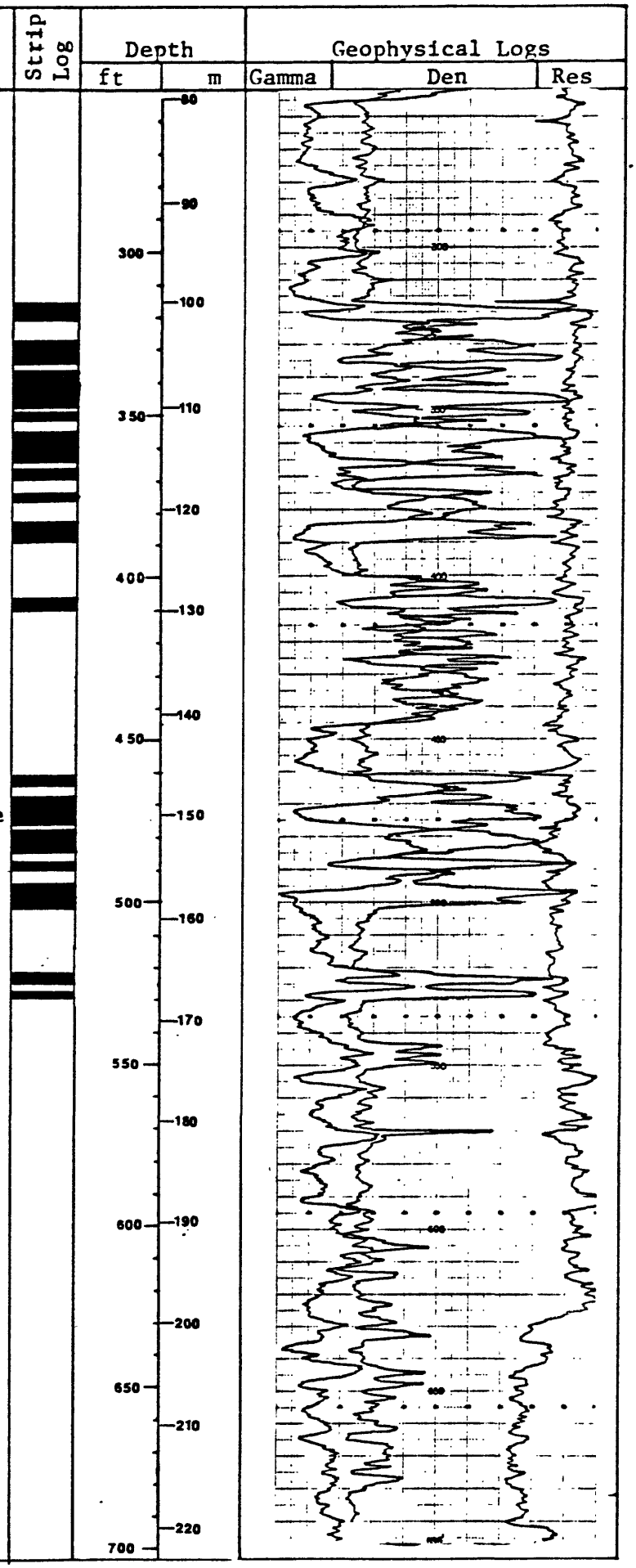
DRILLING MEDIUM: [X] AIR [X] FOAM [X] MUD [ ] WATER OBSERVATION WELL

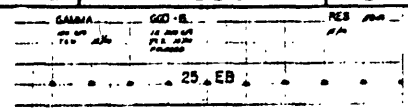
GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 35.0	Alluvium and weathered material		0	0	
35.0- 38.0	Shale; light-gray with coal traces				
38.0- 51.0	Coal and interbedded carbonaceous shale			10	
51.0- 73.0	Sandstone, light-gray, very fine-grained		50		
73.0- 80.0	Siltstone grading into shale			20	
80.0- 89.0	Coal with minor carb-shale partings				
89.0- 91.5	Carbonaceous shale parting				
91.5- 92.5	Coal				
92.5- 97.5	Siltstone, light-gray				
97.5-100.5	Carbonaceous shale				
100.5-111.5	Siltstone, light-gray, grading into mudstone, dark gray		100	30	
111.5-114.5	Carbonaceous shale				
114.5-137.0	Interbedded shale and dark-gray mudstone grading into light gray siltstone			40	
137.0-148.0	Sandstone, light- to dark-gray, fine-grained, laminated		150	50	
148.0-183.0	Interbedded coal and carbonaceous shale, dull black			60	
183.0-199.0	Interbedded dark-gray mudstone, shale, and carbonaceous shale		200		
199.0-207.0	Coal, with minor carbonaceous shale partings			70	
207.0-221.5	Interbedded shale, carbonaceous shale, and coal				
221.5-237.0	Coal with small carbonaceous shale partings		250		

Lithology	
237.0–249.5	Interbedded shale, siltstone and minor coal
249.5–255.5	Mudstone, dark-gray grading into siltstone
255.5–316.5	Alternating very fine-grained sandstone and siltstone
316.5–370.0	Alternating coal, carbonaceous shale, and interbedded coal and carbonaceous shale
370.0–375.0	Sandstone, light-gray, fine-grained
375.0–377.0	Coal
377.0–382.0	Mudstone, dark-gray
382.0–389.5	Coal with thin carbonaceous shale partings
389.5–400.5	Sandstone, light-gray, very fine-grained
400.5–445.0	Alternating coal and carbonaceous shale
445.0–461.0	Sandstone, light-gray to medium-gray, very fine- to fine-grained
461.0–479.0	Alternating coal and carbonaceous shale
479.0–487.0	Mudstone and siltstone
487.0–502.0	Coal and carbonaceous shale, minor siltstone interbeds
502.0–521.0	Sandstone, light-gray, very fine-grained, and interbedded siltstone
521.0–530.0	Coal with minor carbonaceous shale partings
530.0–710.0	Interbedded very fine- to fine-grained sandstone and siltstone



Lithology	Strip Log	Depth		Geophysical Logs		
		ft	m	Gamma	Den	Res
			230			
		750	240			
			250			
		800	260			
		850	270			

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 26-E DATE 9/1/78 SURFACE ELEVATION(ft) 7020

LOCATION SW¼SE¼ Sec. 20 T. 23 N. R. 81 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 717.5

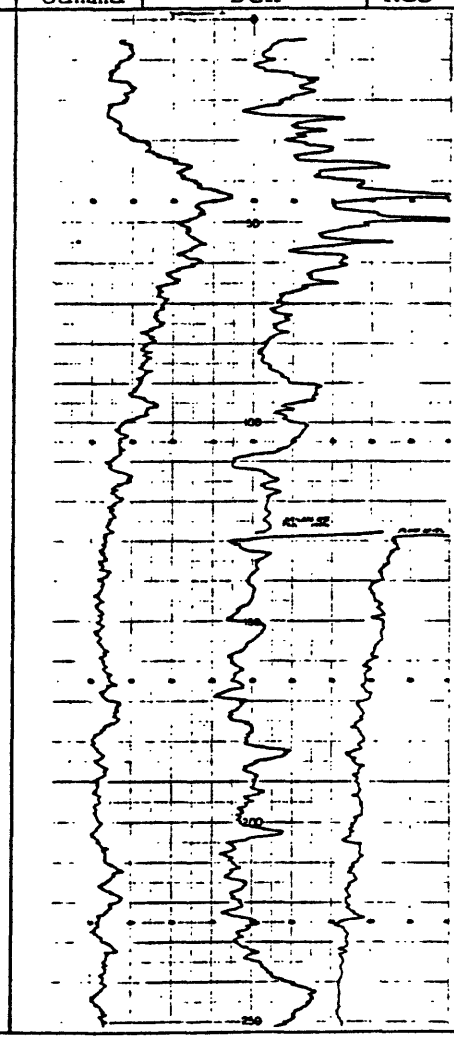
CORED YES ☐ NO ☒ INTERVAL(s) _____

DRILLING MEDIUM: ☒ AIR ☒ FOAM ☐ MUD ☒ WATER OBSERVATION WELL

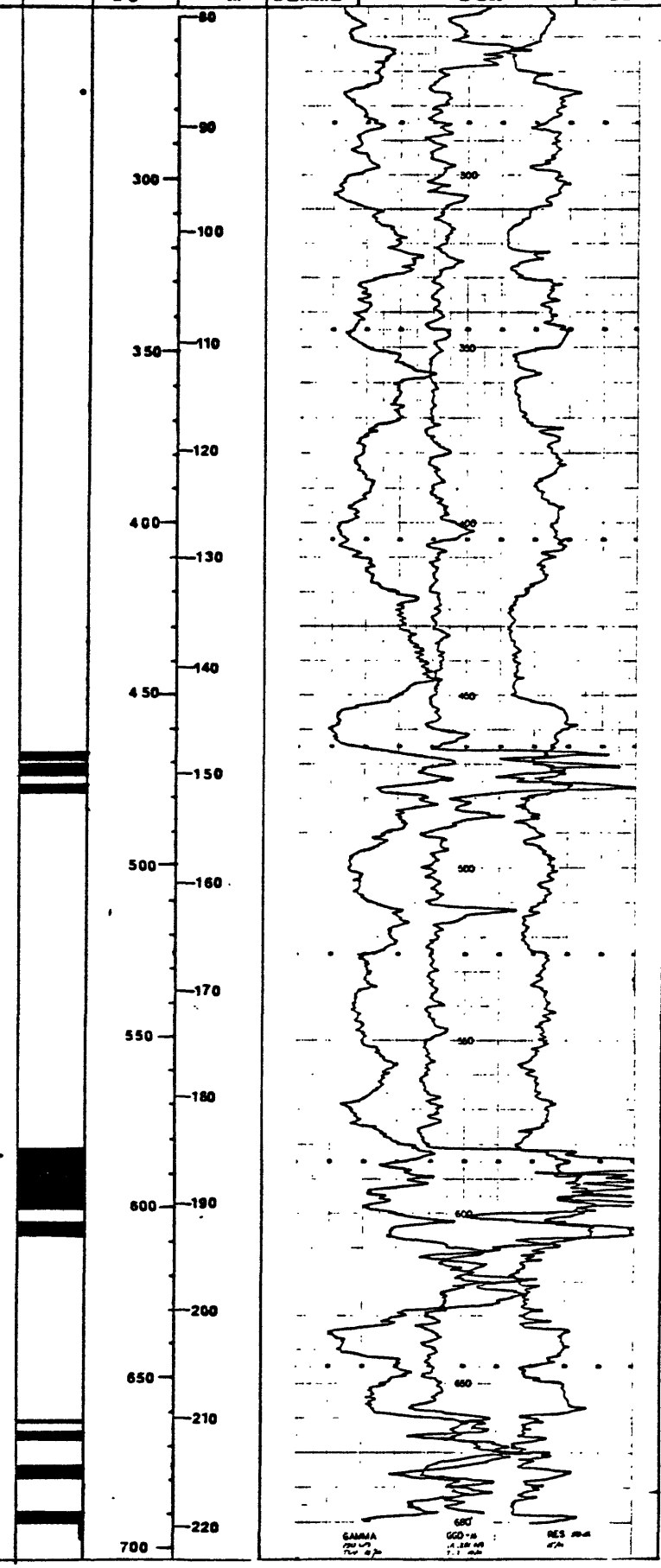
GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 4.0	Surface material				
4.0- 9.0	Shale, light-brown				
9.0- 14.5	Sandstone, light-yellow, fine-grained				
14.5- 19.2	Siltstone, medium-gray				
19.2- 33.0	Sandstone, light-yellow-gray, fine-grained				
33.0- 75.0	Shale, medium- to dark-gray, partly carbonaceous with coal traces				
75.0- 85.0	Sandstone, light-yellow, fine-grained				
85.0- 99.0	Siltstone, olive-gray, with interbedded medium-gray shale				
99.0-254.0	Sandstone, light-gray to tan, fine-grained with coarse-grained lenses, partly silty				
254.0-310.0	Interbedded siltstone and claystone				
310.0-330.0	Claystone, dark-brown to black				
330.0-350.0	Sandstone, dark-gray, very fine-grained				
350.0-372.0	Claystone, dark-brown				
372.0-378.0	Sandstone, dark-gray, very fine-grained				
387.0-395.0	Claystone, dark-brown to black				
395.0-408.0	Sandstone, medium-gray, fine-grained				
408.0-453.0	Claystone, dark-brown to black, slightly silty				
453.0-459.9	Sandstone, light-gray, fine-grained				
459.9-465.0	Claystone, black				
465.0-467.3	Shale, black, carbonaceous				
467.3-468.0	Coal				



Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
468.0–469.5	Shale, black, carbonaceous				
469.5–473.0	Coal				
473.0–475.0	Shale, black, carbonaceous				
475.0–478.0	Coal				
478.0–485.6	Shale, black, very coaly				
485.6–489.9	Claystone, black, to dark-brown				
489.9–511.0	Sandstone, light-gray, fine-grained				
511.0–523.0	Siltstone, dark-gray, sandy				
523.0–576.0	Sandstone, light-gray, very fine-grained				
576.0–582.0	Claystone, dark-gray				
582.0–588.0	Coal				
588.0–589.0	Shale, black, carbonaceous				
589.0–595.4	Coal				
595.4–596.0	Shale, black, carbonaceous				
596.0–601.0	Coal				
601.0–603.0	Shale, black, carbonaceous				
603.0–608.0	Coal				
608.0–609.0	Shale, black, carbonaceous				
609.0–610.0	Coal				
610.0–628.0	Claystone, dark-gray to black, partly carbonaceous				
628.0–659.0	Sandstone, dark-gray, very fine-grained partly silty				
659.0–661.0	Claystone, dark-gray				
661.0–662.0	Coal				
662.0–670.5	Interbedded claystone and shale				
670.5–671.7	Coal				
671.7–676.0	Claystone, dark-brown to black				
676.0–678.0	Coal				
678.0–680.0	Shale, black, carbonaceous				
680.0–684.0	Claystone, dark brown				
684.0–688.0	Shale, black, carbonaceous				
688.0–689.0	Coal				



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 27-E DATE 9/10/78 SURFACE ELEVATION(ft) 7205

LOCATION NW¼SE¼ Sec. 30 T. 23 N. R. 81 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 758.5

CORED YES [ ] NO [X] INTERVAL(s)

DRILLING MEDIUM: [X] AIR [X] FOAM [ ] MUD [ ] WATER OBSERVATION WELL

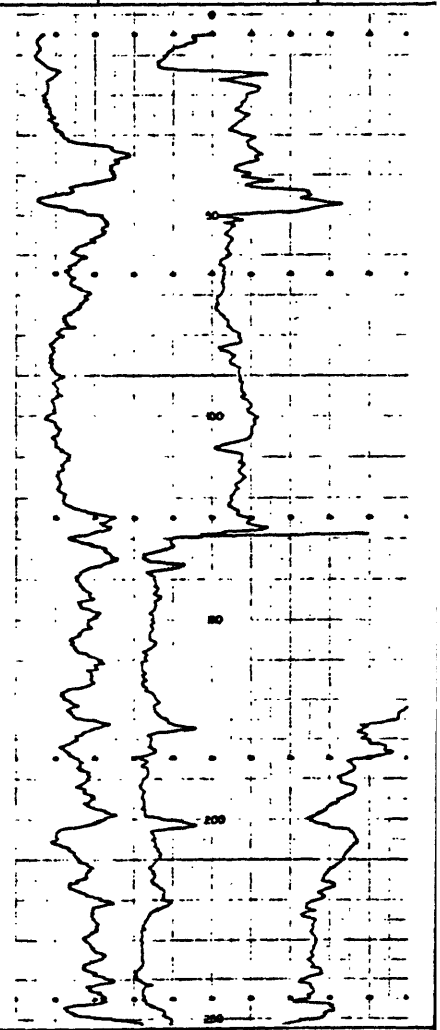
GEOPHYSICAL LOGS:

Natural Gamma*	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma*	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity**	; Scale	10 f/in	Logging Speed	15	fpm
Caliper**	; Scale	10 f/in	Logging Speed	15	fpm

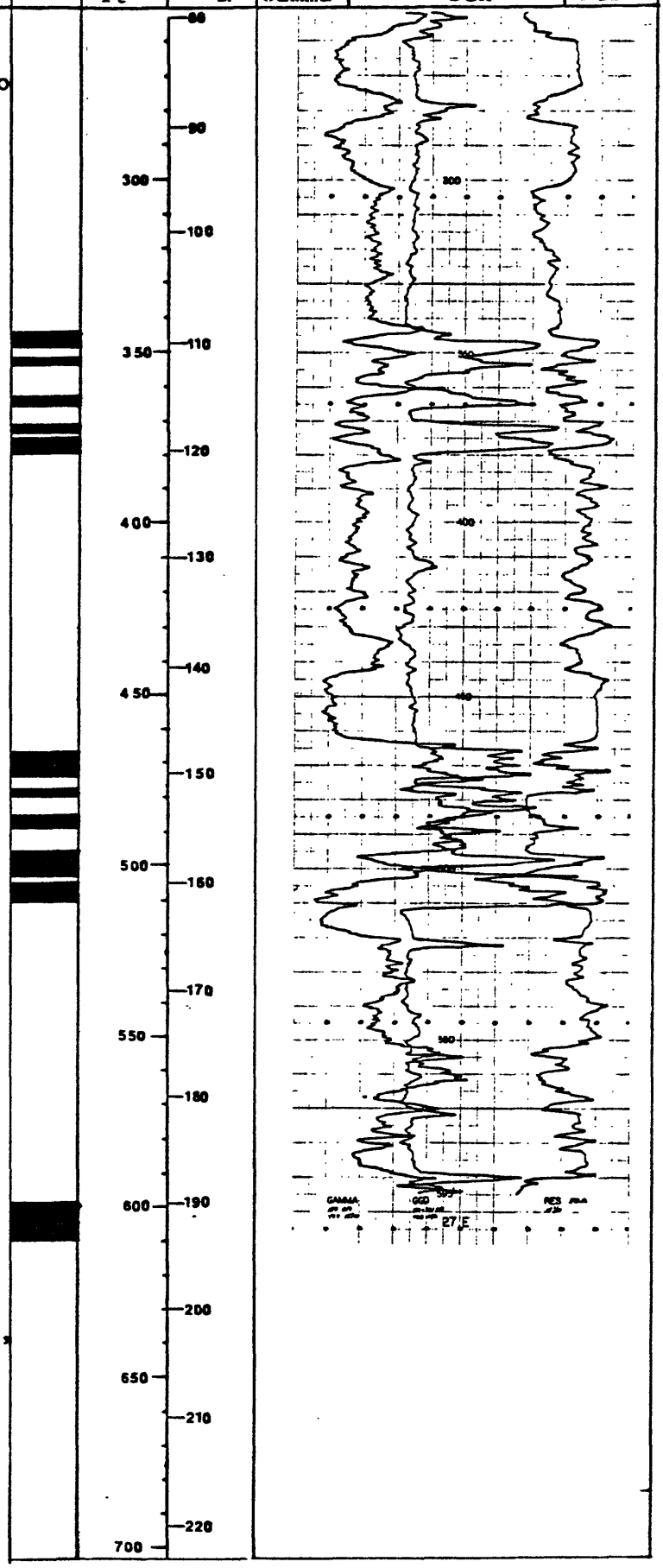
*Logged through drill rod to 755 ft.

**Logged from 0-59 ft.

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 32.0 Sandstone, light-yellowish-gray to light-gray, fine- to medium-grained		0	0	
32.0- 43.0 Shale, brown-gray, carbonaceous				
43.0- 49.0 Coal				
49.0- 57.2 Shale, medium-gray, silty and sandy		50	10	
57.2- 75.0 Siltstone, medium-gray, sandy				
75.0-123.0 Sandstone, light-gray, fine-grained		100	20	
123.0-129.0 Siltstone, medium-gray				
129.0-131.0 Sandstone, light-gray, fine-grained, silty				
131.0-154.0 Siltstone, light- to medium-gray, very sandy		150	30	
154.0-158.0 Sandstone, light-gray, fine-grained, silty				
158.0-167.0 Siltstone, light- to medium-gray, sandy		200	40	
167.0-175.0 Sandstone, light-gray, very fine grained, silty				
175.0-179.0 Siltstone, medium-gray, sandy		250	50	
179.0-185.0 Sandstone, light-gray, fine-grained				
185.0-202.0 Siltstone, medium-gray, sandy				
202.0-218.0 Sandstone, light-gray, very fine grained. Grades downward into siltstone				
218.0-247.0 Siltstone, medium- to medium dark-gray, sandy and shaly				
247.0-250.0 Sandstone, light-gray, very fine-grained, silty				



Lithology	
250.0-259.0	Shale, medium-dark-gray, partly silty, slightly carbonaceous
259.0-274.5	Sandstone, light-gray, very fine- to fine-grained, silty
274.5-283.0	Shale, medium-dark-gray, silty, carbonaceous
283.0-301.0	Sandstone, light-gray, medium-grained, grades downward into fine-grained sandstone and into siltstone
301.0-342.0	Siltstone, medium-dark-gray and olive-gray, shaly
342.0-346.0	Shale, dark-gray, carbonaceous
346.0-349.0	Coal, very shaly
349.0-351.0	Shale, dark-gray, carbonaceous
351.0-353.0	Coal, very shaly
353.0-356.3	Shale, black, coaly
356.3-359.3	Siltstone, medium-gray
359.3-362.5	Shale, dark-gray
362.5-365.0	Coal, shaly
365.0-366.0	Shale, black, carbonaceous
366.0-368.0	Siltstone, medium-gray
368.0-370.0	Shale, black, carbonaceous
370.0-372.0	Coal
372.0-373.5	Shale, black, carbonaceous
373.5-378.0	Coal
378.0-383.0	Shale, dark-gray, carbonaceous
383.0-390.5	Sandstone, light-gray, very fine-grained, silty
390.5-403.0	Siltstone, medium-gray, sandy
403.0-422.0	Sandstone and siltstone, interbedded, medium-gray
422.0-432.0	Sandstone, medium-gray, very fine-grained, silty
432.0-442.5	Shale, medium-dark-gray
442.5-463.0	Sandstone, light-gray, fine-grained
463.0-470.0	Shale, dark-gray, carbonaceous
470.0-472.0	Coal, very shaly
472.0-475.3	Shale, black, coaly
475.3-478.3	Coal, shaly
478.3-495.0	Shale, dark-gray, carbonaceous, partly coaly
495.0-499.5	Coal, shaly
499.5-503.0	Shale, black, carbonaceous
503.0-510.0	Coal
510.0-511.0	Shale, dark-gray
511.0-520.0	Sandstone, light-gray, fine-grained, coal clasts
520.0-537.0	Siltstone, medium-gray, shaly
537.0-552.0	Sandstone, light-gray, medium- to coarse-grained, very silty and shaly
552.0-565.0	Shale, medium-dark-gray, partly carbonaceous
565.0-568.5	Siltstone, medium-gray



Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Geophysical Logs Den	Geophysical Logs Res
568.5-571.0 Shale, medium-dark-gray						
571.0-589.0 Siltstone, medium-gray						
589.0-595.0 Siltstone, medium-gray, sandy						
595.0-599.0 Shale, black, carbonaceous						
599.0-610.0 Coal, shaly						
610.0-628.0 Siltstone, medium-gray, sandy						
628.0-692.0 Claystone and siltstone, interbedded, medium- to dark-gray						
692.0-704.0 Sandstone, light-gray, fine-grained						
704.0-711.0 Shale, dark-gray						
711.0-717.0 Sandstone, light-gray, fine-grained						
717.0-734.0 Claystone, dark-gray						
734.0-740.4 Sandstone, light-gray,, fine-grained						
740.4-750.0 Claystone, medium-gray, silty						
750.0-758.0 Sandstone, light-gray, fine-grained, silty						

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 28-E DATE 10-21-78 SURFACE ELEVATION(ft) 7205

LOCATION NW¼NE¼ Sec. 8 T. 22 N. R. 81 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 102.3

CORED YES [X] NO [ ] INTERVAL(s) 11-102.3

DRILLING MEDIUM: [ ] AIR [ ] FOAM [X] MUD [ ] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

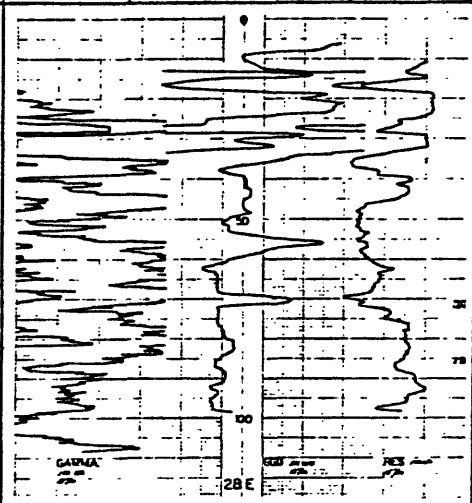
Lithology	
0.0- 9.0	Surface material
9.0- 14.0	Sandstone, tan to brown, fine-grained
14.0- 14.5	Mudstone, light- to medium-gray
14.5- 16.0	Coal
16.0- 19.0	Interbedded carbonaceous shale and dark-gray mudstone
19.0- 25.5	Coal, bright black with thin interbeds of carbonaceous shale, dull black
25.5- 33.5	Interbedded carbonaceous shale, coal, and mudstone
33.5- 41.0	Mudstone and shale, gray
41.0- 46.0	Sandstone, light-gray to light-greenish-gray, very fine- to fine-grained, with shale inclusions
46.0- 73.0	Thin, alternating carbonaceous shales, gray mudstones and very thin coal beds
73.0-102.0	Interbedded sandstone and siltstone. Sandstone is light-gray, fine- to medium-grained and convoluted.

Strip Log

Depth

ft	m
0	0
	10
50	20
100	30
	40
150	50
	60
200	70
250	

Geophysical Logs



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 29-E DATE 10/25/78 SURFACE ELEVATION(ft) 7070

LOCATION NE¼SW¼ Sec. 8 T. 22 N. R. 81 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 200

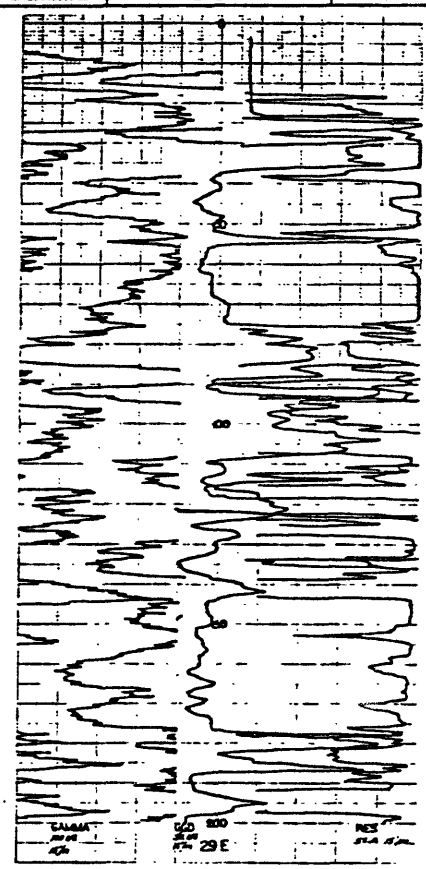
CORED YES [X] NO [ ] INTERVAL(s) 11-200

DRILLING MEDIUM: [ ] AIR [ ] FOAM [X] MUD [ ] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs
0.0- 11.0	Surface material		0	0	Gamma Den Res
11.0- 14.0	Carbonaceous shale				
14.0- 16.0	Coal, bright black				
16.0- 26.0	Carbonaceous shale with thin bands of coal		50	10	
26.0- 30.0	Coal with thin carbonaceous shale partings				
30.0- 37.0	Interbedded carbonaceous shale and mudstone		100	20	
37.0- 53.0	Sandstone and siltstone, sandstone is light-gray, very fine-grained, siltstone is medium-gray			30	
53.0- 54.0	Claystone		150	40	
54.0- 55.0	Coal				
55.0- 75.0	Interbedded sandstone and siltstone. Sandstone is light-gray, fine-grained and contains carbonaceous material. Siltstone is medium-gray with thin interbeds of dark-gray shale		200	50	
75.0- 85.0	Coal, mostly bright black, pyritic, with thin carbonaceous shale partings (less than 0.5 ft thick)			60	
85.0- 89.0	Mudstone, dark-gray, and shale		250	70	
89.0- 92.0	Siltstone and sandstone, as above				
92.0- 94.0	Coal				
94.0-101.0	Shale, medium-gray, with thin siltstone interbeds				



Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs Gamma	Geophysical Logs Den	Geophysical Logs Res
101.0-115.0 Sandstone, light-gray, very fine-grained, with interbedded siltstone, dark-gray						
115.0-125.0 Carbonaceous shale						
125.0-140.0 Interbedded mudstone and siltstone, cross-laminated, with carbonaceous stringers						
140.0-165.0 Sandstone, light-gray, fine-grained, cross-laminated						
165.0-177.0 Interbedded sandstone and siltstone, sandstone is light- to medium-gray, very fine- to fine-grained						
177.0-181.0 Coal, dull black with vitrinite banding						
181.0-183.0 Carbonaceous shale with coal stringers						
183.0-185.0 Coal, bright black						
185.0-200.0 Alternating gray siltstone and dark gray mudstone						

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 30-E DATE 9/12/78 SURFACE ELEVATION(ft) 7135

LOCATION NW¼NW¼ Sec. 8 T. 22 N. R. 81 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 722

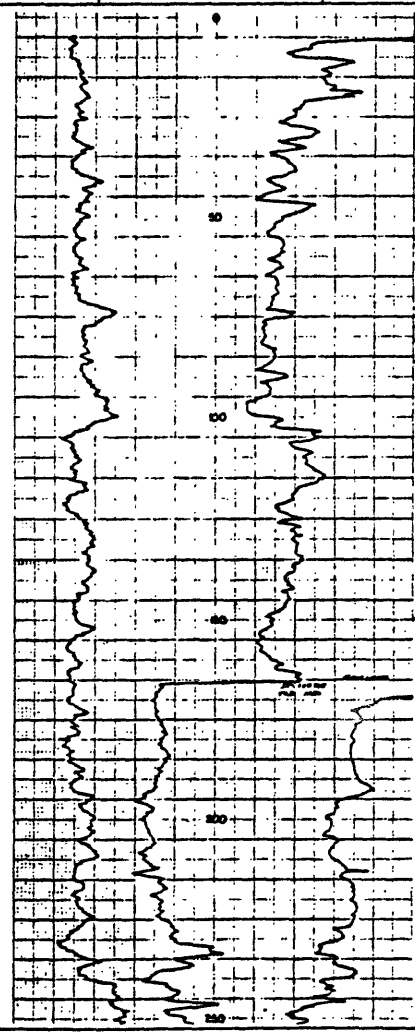
CORED YES [ ] NO [X] INTERVAL(s) _____

DRILLING MEDIUM: [X] AIR [X] FOAM [ ] MUD [ ] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed		fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 5.0	Surface material		0	0	
5.0- 71.0	Sandstone, light-gray to tan, fine- to medium-grained, commonly cross-bedded, with coal clasts				
71.0- 76.0	Claystone, light-gray			10	
76.0- 95.0	Siltstone, light- to medium-gray		50		
95.0-240.0	Alternating sandstone and siltstone. Sandstone is light- to medium-gray, very fine- to fine-grained			20	
240.0-249.0	Carbonaceous shale, dark-gray				
249.0-259.0	Carbonaceous shale and mudstone				
259.0-296.0	Sandstone, light-gray, very fine-grained		100	30	
296.0-317.0	Shale, sandy, medium- to light-gray				
317.0-363.0	Alternating sandstone and siltstone; sandstone is light-gray, very fine- to fine-grained, commonly cross-bedded			40	
363.0-365.0	Coal and carbonaceous shale		150		
365.0-405.0	Sandstone and interbedded siltstone, as above			50	
405.0-407.0	Carbonaceous shale				
407.0-410.0	Coal			60	
410.0-413.0	Carbonaceous shale, coaly		200		
413.0-420.0	Coal				
420.0-422.0	Carbonaceous shale			70	
422.0-425.0	Coal				
425.0-432.0	Carbonaceous shale				
432.0-440.0	Coal				
440.0-441.0	Carbonaceous shale		250		



Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
441.0–460.0	Sandstone, light-gray, very fine-grained				
460.0–474.0	Interbedded coal and carbonaceous shale				
474.0–505.0	Shale, medium-gray				
505.0–507.0	Coal				
507.0–537.0	Shale, gray, with thin interbeds of coals and carbonaceous shales				
537.0–560.0	Alternating shale, mudstone, and siltstone, gray				
560.0–578.0	Sandstone, medium-gray, fine-grained				
578.0–580.0	Coal				
580.0–596.0	Shale grading to mudstone, gray				
596.0–610.0	Sandstone, light-gray, fine-grained with carbonaceous clasts				
610.0–618.0	Interbedded carbonaceous shale and mudstone				
618.0–620.0	Coal				
620.0–645.0	Sandstone, dark-gray, very fine-grained				
645.0–673.0	Interbedded gray shale and mudstone with very thin coals				
673.0–680.0	Sandstone, medium-gray, fine- to medium-grained				
680.0–685.0	Sandstone, medium-gray, fine-grained, silty				
685.0–695.0	Siltstone, medium- to dark-gray, sandy				
695.0–710.0	Shale, dark-gray to dark-brown, sandy				
710.0–722.0	Sandstone, gray, fine- to medium-grained, silty				

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 31-E DATE 8/25/78 SURFACE ELEVATION(ft) 7170

LOCATION SE¼NE¼ Sec. 24 T. 23 N. R. 81 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 340

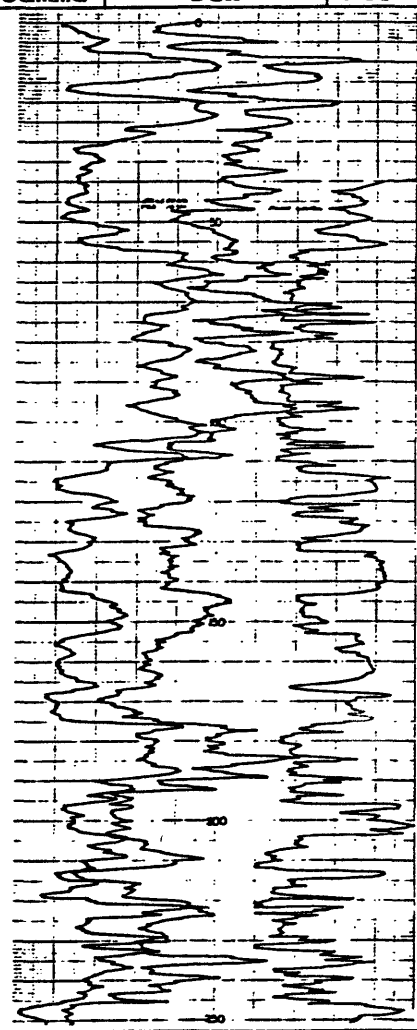
CORED YES ☐ NO ☒ INTERVAL(s) _____

DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

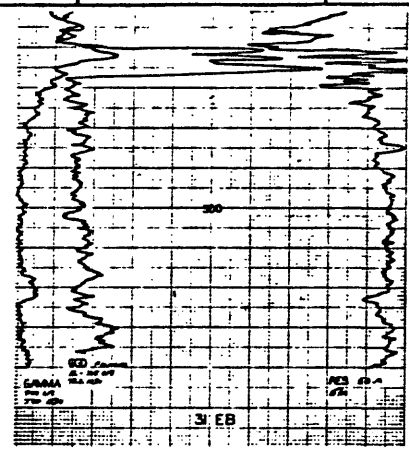
GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed		fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 7.0	Surface material		0	0	
7.0- 13.0	Shale, dark-gray, carbonaceous, weathered				
13.0- 19.5	Coal, shaly				
19.5- 25.0	Shale, carbonaceous			10	
25.0- 28.5	Shale, dark-gray, silty				
28.5- 57.0	Sandstone, light-gray, fine-grained, partly silty		50		
57.0- 70.0	Shale, dark-gray to black, partly carbonaceous and partly interbedded with very thin coals			20	
70.0- 71.0	Coal				
71.0- 71.7	Shale, black, carbonaceous		100	30	
71.7- 73.0	Coal				
73.0- 74.0	Shale, black, carbonaceous				
74.0- 75.0	Coal			40	
75.0- 77.4	Shale, black, carbonaceous				
77.4- 79.5	Coal, shaly				
79.5- 89.0	Shale, black, carbonaceous		150	50	
89.0- 90.3	Coal				
90.3- 94.5	Shale, black, coaly				
94.5- 99.3	Coal, shaly				
99.3-102.0	Shale, dark-gray			60	
102.0-110.0	Siltstone, medium-gray, sandy		200		
110.0-118.5	Sandstone, light-gray, very fine-grained				
118.5-124.0	Shale, dark-gray to black			70	
124.0-128.0	Sandstone, light-gray, very fine-grained				
128.0-132.0	Shale, dark-gray		250		



Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
132.0-143.0	Sandstone, light-gray, fine-grained with very coarse-grained lenses				
143.0-153.0	Mudstone, dark-gray				
153.0-176.0	Sandstone, light-gray, very coarse-grained				
176.0-177.0	Shale, dark-gray				
177.0-179.0	Coal				
179.0-181.0	Shale, black, carbonaceous				
181.0-181.5	Coal				
181.5-184.0	Shale, black, carbonaceous				
184.0-185.5	Coal				
185.5-189.0	Shale, black, coaly				
189.0-191.0	Coal				
191.0-196.0	Shale, dark-olive-gray				
196.0-204.7	Sandstone, light-gray, very coarse-grained				
204.7-220.2	Interbedded dark-gray mudstone and medium-gray siltstone				
202.2-221.8	Shale, dark-gray				
221.8-223.0	Coal				
223.0-224.0	Shale, black, carbonaceous				
224.0-225.8	Coal, shaly				
225.8-229.0	Shale, black, carbonaceous				
229.0-231.0	Coal				
231.0-233.3	Shale, black, carbonaceous				
233.0-237.0	Coal				
237.0-239.0	Shale, black, coaly				
239.0-241.4	Coal				
241.4-246.0	Shale, black, coaly				
246.0-255.0	Sandstone, light-gray, very fine-grained				
255.0-257.0	Siltstone, medium-gray				
257.0-260.0	Sandstone, light-gray, very fine-grained				
260.0-266.0	Shale, dark-gray to black				
266.0-340.0	Sandstone, light-gray, fine- to medium-grained with thin interbeds of dark-gray mudstone				



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 32-E DATE 8-9-78 SURFACE ELEVATION(ft) 7175

LOCATION SW¼NE¼ Sec. 24 T. 23 N. R. 82 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 410

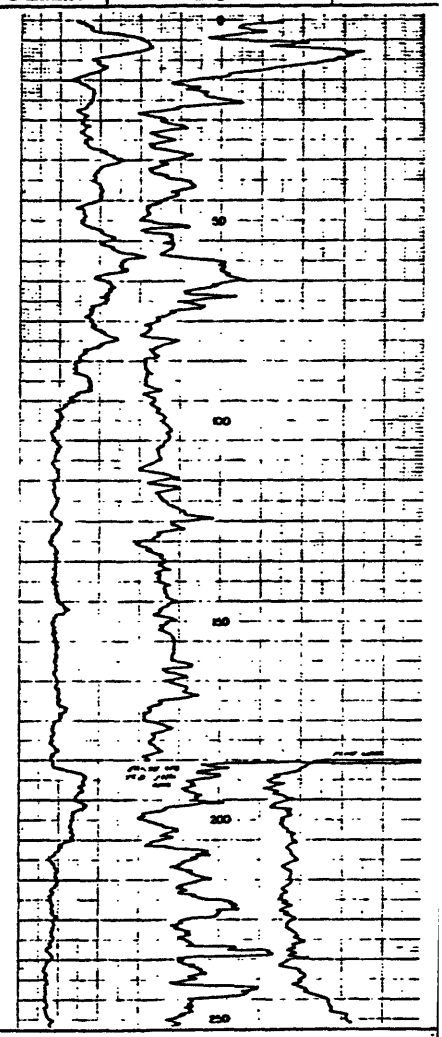
CORED YES [ ] NO [x] INTERVAL(s) _____

DRILLING MEDIUM: [ ] AIR [ ] FOAM [x] MUD [x] WATER OBSERVATION WELL

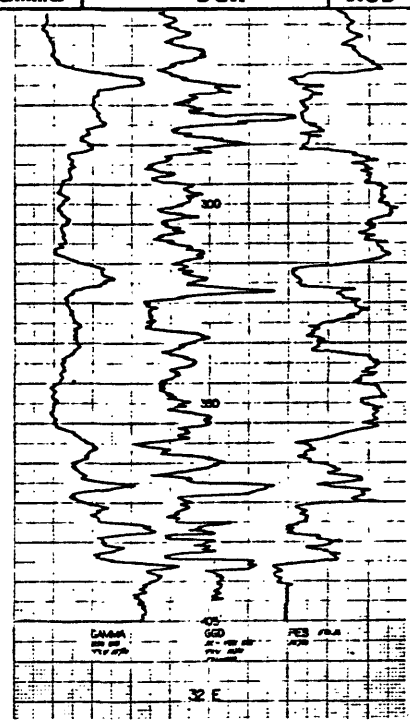
GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs
0.0- 5.0	Surface material				
5.0- 12.5	Shale, black, carbonaceous, with very thin, weathered, coal interbeds				
12.5- 32.0	Sandstone, tan, fine-grained				
32.0- 80.0	Shale, medium- to dark-gray with interbedded carbonaceous shale and very thin coals				
80.0- 88.0	Sandstone, light-gray, fine-grained				
88.0- 93.0	Siltstone, medium-gray				
93.0-189.0	Sandstone, light-gray, very fine- to coarse-grained				
189.0-205.0	Shale, dark-gray				
205.0-267.0	Sandstone, light-gray, fine- to medium-grained with coarse-grained to granular lenses				
267.0-278.5	Shale, medium- to dark-gray with thin interbeds of coal				
278.5-279.8	Coal				
279.8-284.5	Shale, black, carbonaceous				
284.5-285.7	Coal				
285.7-287.0	Shale, dark-gray				
287.0-315.0	Sandstone, light-gray, fine-grained partly silty				
315.0-321.0	Shale, medium- to dark-gray				
321.0-359.0	Sandstone, light-gray, fine-grained				
359.0-364.0	Shale, dark-gray				
364.0-370.0	Sandstone, light-gray, fine-grained, silty				



Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs
370.0-372.0 Shale, dark-gray to black, partly carbonaceous 372.0-405.0 Granules, partly conglomoratic		300 350 400 450 500 550 600 650 700	90 100 110 120 130 140 150 160 170 180 190 200 210 220	Gamma | Den | Res



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 33-E DATE 8/26/78 SURFACE ELEVATION(ft) 7225

LOCATION NE¼SW¼ Sec. 24 T. 23 N. R. 82 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 500

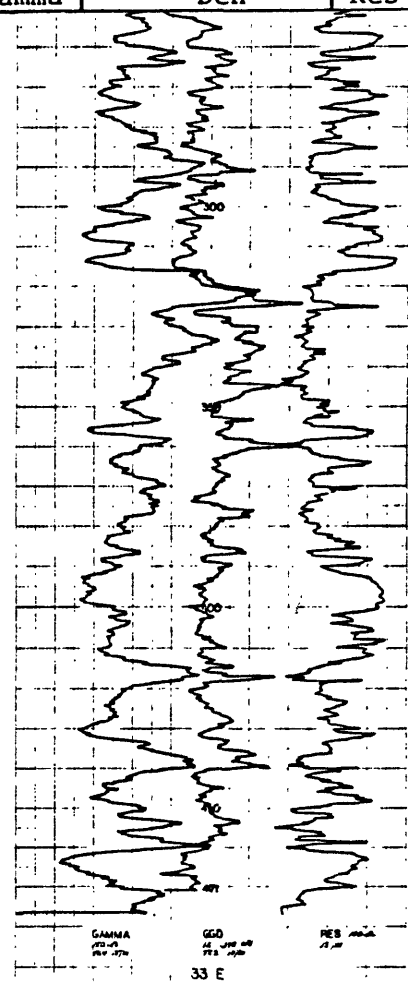
CORED YES ☐ NO ☒ INTERVAL(s) _____

DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 8.0	Surface material		0	0	
8.0- 44.0	Sandstone, light-brown, fine- to medium-grained				
44.0- 66.0	Shale, dull-dark-brown, carbonaceous, weathered			10	
66.0- 84.0	Shale, dark-brown to black, very coaly		50		
84.0- 93.0	Sandstone, light-gray, fine-grained			20	
93.0- 97.5	Siltstone, medium-gray				
97.5-118.0	Shale, dark-gray				
118.0-152.0	Sandstone, light- to medium-gray, very fine-grained			30	
152.0-153.0	Coal		100		
153.0-156.2	Shale, black, coaly				
156.2-160.0	Coal, with very thin carbonaceous shale partings			40	
160.0-165.0	Shale, dark-gray to black, partly carbonaceous				
165.0-173.0	Sandstone, light-gray, very fine grained		150	50	
173.0-179.4	Siltstone, medium-gray				
179.4-310.0	Interbedded sandstone and siltstone; sandstone is light-gray, fine- to coarse-grained. Siltstone is medium-gray			60	
310.0-392.0	Shale, medium- to dark-gray, partly carbonaceous		200		
392.0-401.0	Sandstone, light-gray, medium- to coarse-grained			70	
401.0-418.0	Interbedded siltstone and mudstone				
418.0-429.7	Shale, medium- to dark-gray		250		

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
429.7-433.0 Sandstone, light-gray, coarse-grained 433.0-462.0 Interbedded siltstone and mudstone 462.0-477.0 Sandstone, light-gray, medium- to coarse-grained		300 350 400 450 500 550 600 650 700	90 100 110 120 130 140 150 160 170 180 190 200 210 220	

33 E

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 34-E DATE 8/12/78 SURFACE ELEVATION(ft) 7005

LOCATION NE¼SE¼ Sec. 14 T. 23 N. R. 82 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 450

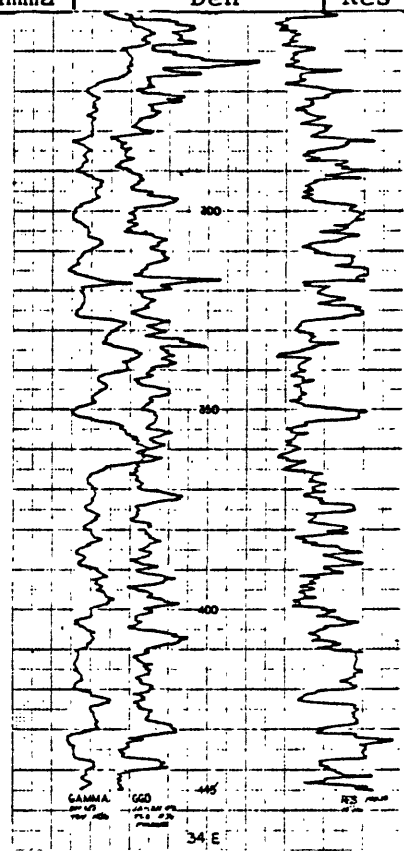
CORED YES [ ] NO [X] INTERVAL(s)

DRILLING MEDIUM: [X] AIR [ ] FOAM [X] MUD [X] WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 20.0	Shale, dark-brown, carbonaceous, weathered		0	0	
20.0- 25.0	Coal, dull black, slightly bony				
25.0- 40.0	Shale, carbonaceous, black with vitrinite banding			10	
40.0- 45.0	Coal and shale, carbonaceous, black		50		
45.0- 60.0	Mudstone, dark-gray, grading into siltstone			20	
60.0- 67.5	Siltstone, light-gray				
67.5- 73.0	Carbonaceous shale, dark-gray				
73.0- 86.5	Mudstone grading into siltstone				
86.5- 97.5	Sandstone, coarse- to very coarse-grained		100	30	
97.5-103.0	Siltstone, light-gray				
103.0-134.5	Sandstone, coarse-grained to granular sub-angular			40	
134.5-138.0	Shale, dull dark-brown, carbonacoues				
138.0-143.0	Sandstone, light-gray, fine grained				
143.0-150.0	Shale, carbonaceous, black, with traces of coal		150	50	
150.0-174.0	Sandstone, light-gray, fine- to coarse-grained				
174.0-200.5	Interbedded shale and siltstone with thin beds of carbonaceous shale			60	
200.5-252.0	Alternating fine-grained sandstone and siltstone with thin interbeds of dark-gray mudstone		200		
252.0-273.0	Shale, carbonaceous, black, with thin coal beds (<0.5 ft thick) grading into dark-gray shale			70	
			250		

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
273.0-328.0 Alternating sandstone, siltstone and mudstone. Sandstone is fine- to coarse-grained 328.0-348.5 Shale, carbonaceous, black, with thin coal stringers 348.5-353.0 Sandstone, very coarse-grained 353.0-363.0 Mudstone and siltstone, gray 363.0-445.0 Alternating sandstone and siltstone with thin interbedded carbonaceous shales and very minor coal stringers. Sandstone is fine- to coarse-grained		300 350 400 450 500 550 600 650 700	90 100 110 120 130 140 150 160 170 180 190 200 210 220	

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 35-E DATE 8/17/78 SURFACE ELEVATION(ft) 6830

LOCATION NW¼NE¼ Sec. 14 T. 23 N. R. 82 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 500

CORED YES ☐ NO ☒ INTERVAL(s)

DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 3.0	Sandstone, light-brown, coarse-grained		0	0	
3.0- 17.0	Sandstone, pale-brown to light-gray, very fine grained				
17.0- 23.0	Sandstone, yellowish-gray, fine-grained, silty			10	
23.0- 33.0	Sandstone, yellow-gray, to light-brown, very coarse-grained		50		
33.0- 37.0	Sandstone, light-brown, fine- to medium-grained			20	
37.0- 47.0	Sandstone, yellowish-brown, very coarse-grained and granular		100		
47.0- 52.0	Siltstone, medium-gray, sandy, some carbonaceous material			30	
52.0- 69.0	Sandstone, medium-gray, fine-grained, silty			40	
69.0- 80.0	Sandstone, light- to medium-gray, fine- to coarse-grained		150		
80.0- 93.0	Sandstone, medium-gray, fine-grained, silty			50	
93.0-101.0	Siltstone, medium-gray, very sandy				
101.0-112.0	Sandstone, light-medium-gray, coarse-grained			60	
112.0-126.0	Siltstone, dark-gray, shaly, and very sandy		200		
126.0-150.0	Sandstone, light-gray, very coarse-grained upper part silty and shaly			70	
150.0-179.0	Sandstone, light-gray, fine-grained, very silty		250		

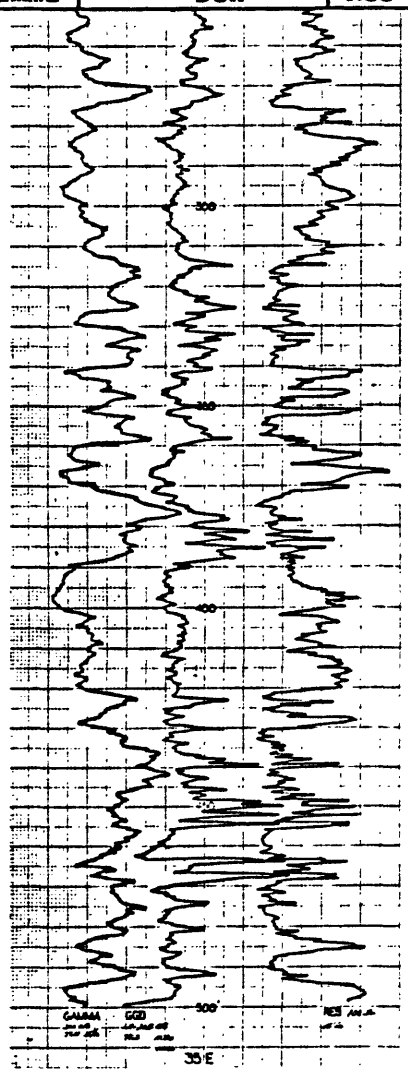
Lithology	
179.0-270.0	Sandstone, light-gray, very coarse-grained, silty and shaly
270.0-274.0	Shale, medium-gray
274.0-312.0	Sandstone, light-gray, very coarse-grained
312.0-326.0	Shale, dark-gray, carbonaceous
326.0-331.0	Sandstone, light-gray, coarse-grained
331.0-340.5	Shale, dark-gray, carbonaceous
340.5-344.0	Sandstone, light-gray, coarse-grained
344.0-351.0	Siltstone, medium-gray, shaly
351.0-353.0	Sandstone, medium-gray, fine-grained, silty
353.0-359.5	Shale, dark-gray, carbonaceous
359.5-371.5	Sandstone, light-gray, coarse-grained
371.5-388.0	Shale, dark-gray, carbonaceous, a number of coal stringers
388.0-401.0	Sandstone, medium-gray, fine-grained
401.0-421.0	Sandstone, medium- to olive-gray, very fine grained, silty
421.0-425.0	Shale, dark-gray, coaly stringers
425.0-431.0	Sandstone, light-gray, fine-grained, silty
431.0-449.0	Shaly, dark-gray, carbonaceous, very thin coal bands
449.0-451.0	Coal, shaly
451.0-452.0	Shale, black, coaly
452.0-453.0	Coal, shaly
453.0-454.2	Shale, dark-gray
454.2-456.0	Coal, shaly
456.0-464.0	Shale, dark-gray, carbonaceous
464.0-466.0	Coal
466.0-467.0	Shale, black, coaly
467.0-469.0	Coal
469.0-482.0	Shale, dark-gray, carbonaceous, silty
482.0-487.0	Sandstone, medium-gray, fine-grained
487.0-494.0	Siltstone, medium-gray to dark olive-gray, sandy and shaly
494.0-500.0	Sandstone, medium-gray, fine-grained

Strip Log

Depth

ft	m
	80
	90
300	100
	110
350	120
	130
400	140
	150
450	160
	170
500	180
	190
550	200
	210
600	220
650	
700	

Geophysical Logs



LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 36-E DATE 8/15/78 SURFACE ELEVATION(ft) 6770

LOCATION NE¼SE¼ Sec. 10 T. 23 N. R. 82 W. Quad. Elmo 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 300

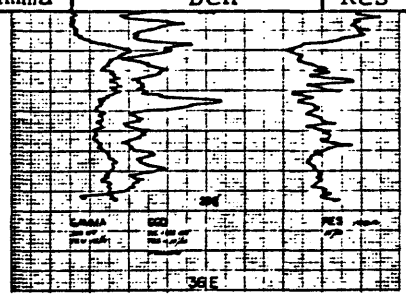
CORED YES ☐ NO ☒ INTERVAL(s) _____

DRILLING MEDIUM: ☐ AIR ☐ FOAM ☒ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	10	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs
0.0- 6.0 Sandstone, light-brown, coarse grained to granular 6.0-100.0 Interbedded siltstone and sandstone. Siltstone is medium gray. Sandstone is light gray, very fine grained with granules 100.0-110.0 Sandstone, light-gray, very coarse-grained 110.0-150.0 Interbedded sandstone and siltstone, as above 150.0-195.0 Sandstone, light-gray, coarse-grained to granular with carbonaceous clasts 195.0-248.0 Interbedded sandstone and siltstone, as above 248.0-259.0 Sandstone, light-gray, very coarse-grained 259.0-300.0 Siltstone, medium-gray, shaly		0 50 100 150 200 250	0 10 20 30 40 50 60 70	Gamma Den Res

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
			80	
			90	
		300		
			100	
		350	110	
			120	
		400		
			130	
			140	
		450		
			150	
		500		
			160	
			170	
		550		
			180	
		600	190	
			200	
		650		
			210	
			220	
		700		

LITHOLOGIC AND GEOPHYSICAL LOGS

LOCATION NUMBER 37-CW DATE 10/24/78 SURFACE ELEVATION(ft) 6885

LOCATION NW¼SW¼ Sec. 6 T. 23 N. R. 80 W. Quad. Como West 7½'

COUNTY Carbon STATE Wyoming TOTAL DEPTH(ft) 307

CORED YES ☐ NO ☒ INTERVAL(s) _____

DRILLING MEDIUM: ☒ AIR ☒ FOAM ☐ MUD ☐ WATER OBSERVATION WELL

GEOPHYSICAL LOGS:

Natural Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Gamma Gamma	; Scale	10 f/in	Logging Speed	15	fpm
Resistivity	; Scale	10 f/in	Logging Speed	15	fpm
Caliper	; Scale	10 f/in	Logging Speed	15	fpm

Lithology		Strip Log	Depth ft	Depth m	Geophysical Logs: Gamma / Den / Res
0.0- 13.0	Sandstone and gravel, yellow-brown and yellow-orange		0	0	
13.0- 17.2	Claystone, light-olive-gray				
17.2- 39.2	Shale, dark-brown, carbonaceous			10	
39.2- 53.0	Siltstone, light-brown-gray and medium-gray, sandy		50		
53.0- 70.0	Shale, medium- to medium dark-gray, silty, fossiliferous			20	
70.0- 78.0	Shale-clay, medium- to medium-dark-gray, fossiliferous				
78.0- 84.0	Sandstone, gray-orange to light-gray, fine-grained		100	30	
84.0-101.0	Siltstone, light-gray, sandy				
101.0-127.0	Shale, dark-brown-gray, carbonaceous			40	
127.0-131.0	Shale, medium-gray, slightly silty		150		
131.0-145.0	Sandstone, light-gray, fine-grained			50	
145.0-160.5	Siltstone, medium-gray, slightly sandy				
160.5-168.0	Shale, medium-gray, silty			60	
168.0-173.0	Coal, shaly		200		
173.0-174.3	Shale, black, carbonaceous			70	
174.3-177.3	Coal, shaly				
177.3-178.4	Shale, black, coaly				
178.4-185.0	Coal				
185.0-186.0	Shale, black, coaly				
186.0-194.0	Coal				
194.0-195.4	Shale, black, coaly				
195.4-198.0	Coal, shaly				
198.0-222.0	Shale black, carbonaceous				
222.0-230.0	Siltstone, medium-gray, sandy		250		

37-CW

Lithology	Strip Log	Depth ft	Depth m	Geophysical Logs
230.0-243.0 Sandstone, light-gray, fine- to medium-grained, partly silty 243.0-247.7 Shale, dark-gray, carbonaceous 247.7-252.5 Coal, shaly 252.5-258.0 Siltstone, medium-gray 258.0-264.0 Siltstone, medium-light-gray, sandy 264.0-270.5 Shale, dark-gray to dark-brown-gray, carbonaceous 270.5-273.0 Coal, shaly 273.0-280.0 Shale, dark-brown-gray, carbonaceous 280.0-292.0 Siltstone and sandstone, interbedded, light-gray. Sandstone is fine-grained 292.0-294.0 Sandstone, light-gray, fine-grained 294.0-307.0 Sandstone and siltstone, interbedded, light-gray and light-olive-gray. Sandstone is very fine grained		300 350 400 450 500 550 600 650 700	90 100 110 120 130 140 150 160 170 180 190 200 210 220	Gamma | Den | Res