



WELL INFORMATION					
MWD Run Number	100	200	300		
Date run completed	28-Oct-13	29-Oct-13	31-Oct-13		
Rig Bit Number	2	3	4		
Bit Size (in)	8.750	8.750	8.750		
Tool Nominal OD (in)	6.750	6.750	6.750		
Log Start Depth (TVD, ft)	976.88	4,950.47	5,386.87		
Log End Depth (TVD, ft)	4,950.47	5,386.87	6,531.97		
Drill or Wipe	Drill	Drill	Drill		
Drill/Wipe Start Date and Time	27-Oct-13 21:45	29-Oct-13 05:30	29-Oct-13 17:30		
Drill/Wipe End Date and Time	28-Oct-13 12:30	29-Oct-13 09:30	30-Oct-13 15:45		
Min Inc (deg) @ Depth (TVD, ft)	.95 @ 1,271.84	6.60 @ 5,238.02	1.87 @ 5,709.82		
Max Inc (deg) @ Depth (TVD, ft)	21.80 @ 3,847.23	8.04 @ 5,049.58	81.75 @ 6,524.87		
Bit TFA(in2) / Bit Type	.91 / PDC	.98 / PDC	.98 / PDC		
Flow Rate (gpm)	596.30	562.00	555.85		
Max AV (fpm) / CV (fpm) @ MWD	470.0 / 255.0	462.0 / 355.0	434.4 / 255.0		
Fluid Type	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel		
Density (ppg) / Viscosity (spqt)	8.65 / 26.00	8.60 / 26.00	9.10 / 31.00		
Filtrate CL (ppm)	2,000.00	2,000.00	2,000.00		
pH / Fluid Loss (mptm)	8.60 / 36	8.10 / 36	8.30 / 8		
PV (cP) / YP (Ihf2)	4 / 1.00	4 / 1.00	7 / 4.00		
% Solids / % Sand	1.7 / 0.25	1.7 / .25	12 / 0.25		
% Oil / Oil:Water Ratio	0 / 0:95	0 / 0:95	0 / 0:95		
Rm @ Measured Temp (degF)	NA @ NA	NA @ NA	N/A @ N/A		
Rmf @ Measured Temp (degF)	NA @ NA	NA @ NA	N/A @ N/A		
Rmc @ Measured Temp (degF)	NA @ NA	NA @ NA	N/A @ N/A		
Max Tool Temp (deg F) / S	168.88 / PDM	146.84 / PDM	170.87 / PDM		

Max Tool Temp (degF) / Source	133.30 / PCM	146.84 / PCM	170.37 / PCM		
Rm @ Max Tool Temp (degF)	NA @ NA	NA @ NA	N/A @ N/A		
Lead MWD Engineer	Brett Vandergon	Brett Vandergon	Brett Vandergon		
Customer Representative	Johnny Sanchez	Johnny Sanchez	Johnny Sanchez		

SENSOR INFORMATION

Downhole Processor Information

Tool Type	PCM	PCM	PCM		
Software Version	5.84	5.84	5.84		
Sub Serial Number	11404301	11404301	11404301		
Insert Serial Number	11227514	11227514	11400840		
Date and Time Initialized	27-Oct-13 02:08	01-Jan-70 00:00	29-Oct-13 13:15		
Date and Time Read	29-Oct-13 16:30	29-Oct-13 16:36	31-Oct-13 02:15		
ECMB SW Version	N/A	N/A	N/A		

Directional Sensor Information

Tool Type	PCDC	PCDC	PCDC		
Distance From Bit (ft)	57.00	56.00	55.00		
Software Version	6.21	6.21	6.21		
Sub Serial Number	11404301	11404301	11404301		
Sonde Serial Number	12177530	12177530	11902117		
Sensor ID Number	N/A	N/A	N/A		
Toolface Offset (deg)	124.36	4.65	172.04		

Gamma Ray Sensor Information

Tool Type	PCG	PCG	PCG		
Distance From Bit (ft)	50.44	48.96	47.86		
Recorded Sample Period (sec)	10	10	10		
Software Version	8.15	8.15	8.15		
Sub Serial Number	11404301	11404301	11404301		
Insert/Sonde Serial Number	11579776	11579776	11579845		

REMARKS

1. All depths are true vertical bit depths, referenced to the Driller's pipe tally and are measured from the Drill Floor, unless otherwise specified.
2. No depth corrections have been made for pipe stretch or compression.
3. Critical annual velocities are calculated using the "Power Law" model for water based fluids and the "Bingham Plastic" model for oil and synthetic based fluids.
4. All data presented is recorded data unless otherwise specified.
5. The following smoothing parameters have been applied to the data:

PGRC (Corrected Gamma Ray):
Interval Resolution: 0.5 ft
Interval Distance: 0.6 ft
Gap Fill: 3.0 ft

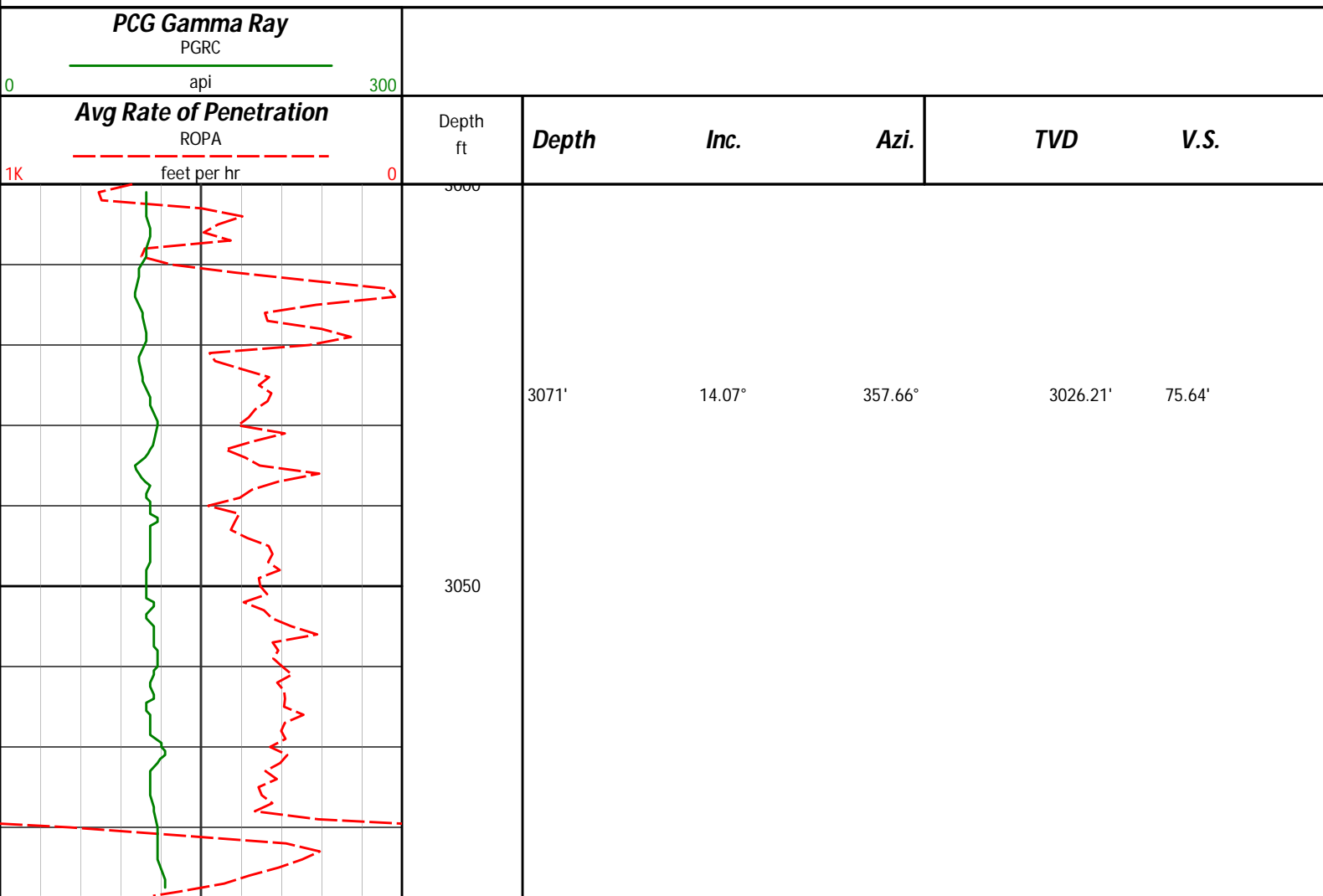
ROPA (Average Rate of Penetration)
Interval Resolution: 0.5 ft
Interval Distance: 1.2 ft
Gap Fill: 3.0 ft

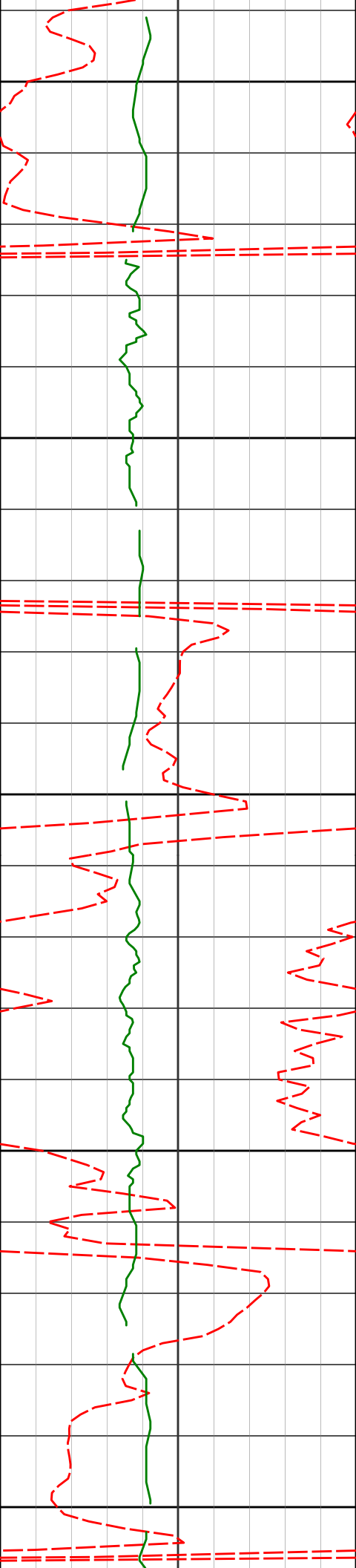
WARRANTY

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HALLIBURTONSperry Drilling Services**TVD Detail Log 1:240**

Noble Energy
Wells Ranch AE20-65HN
H&P 343
T6N-R62W





3100

3166'

14.97°

359.01°

3118.17'

79.99'

3150

3200

3261'

14.67°

2.24°

3210.01'

85.36'

3250

3300

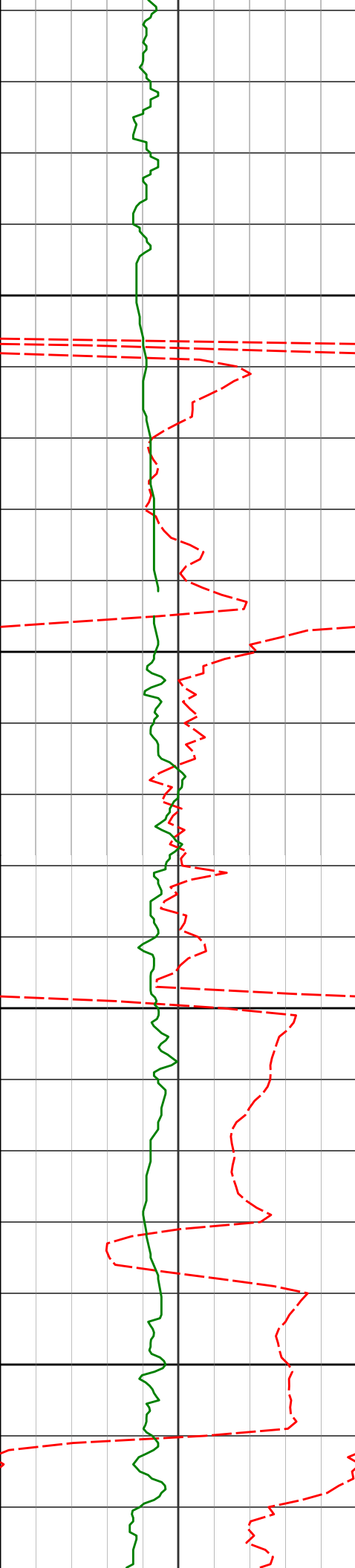
3356'

14.07°

359.26°

3302.04'

90.64'



3350

3400

3450

3500

3451'

13.37°

3.83°

3394.33'

95.95'

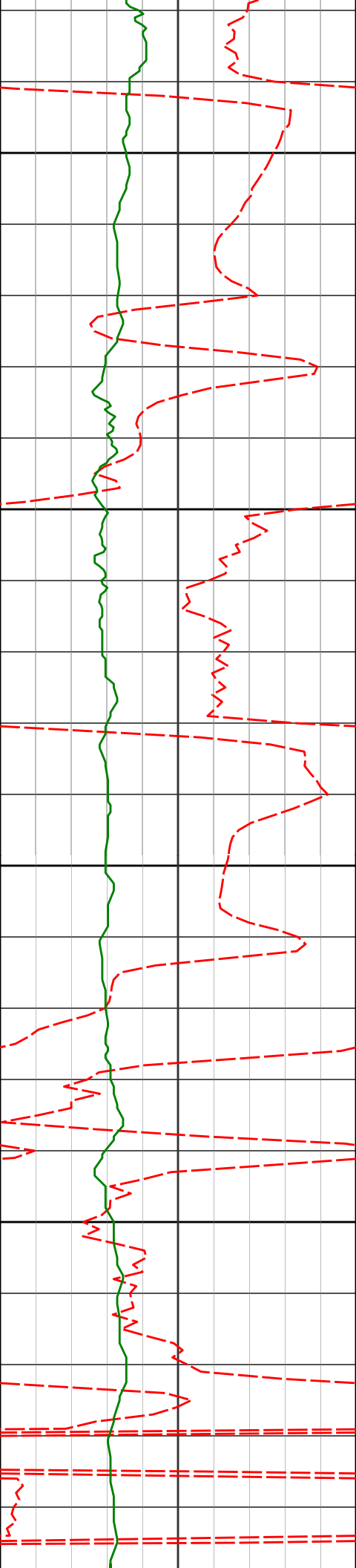
3545'

13.61°

5.23°

3485.74'

102.25'



3550

3640'

15.77°

5.66°

3577.63'

109.54'

3600

3650

3735'

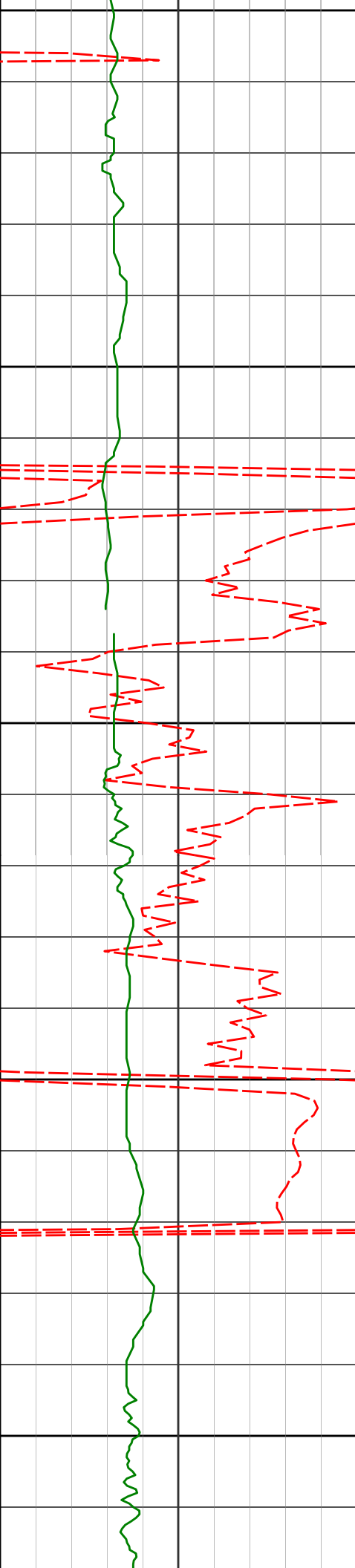
18.16°

4.20°

3668.49'

117.66'

3700



3750

3830'

19.61°

3.89°

3758.37'

126.24'

3800

3850

3925'

21.80°

4.39°

3847.23'

135.67'

3900

4020'

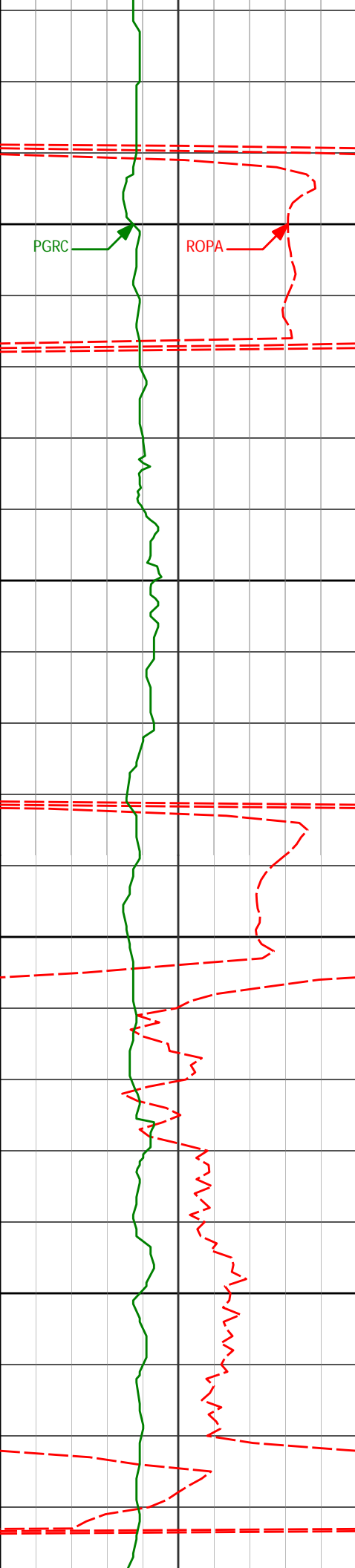
20.15°

0.71°

3935.94'

144.34'

3950



4000

4050

4100

4150

4115'

17.37°

358.13°

4025.88'

150.52'

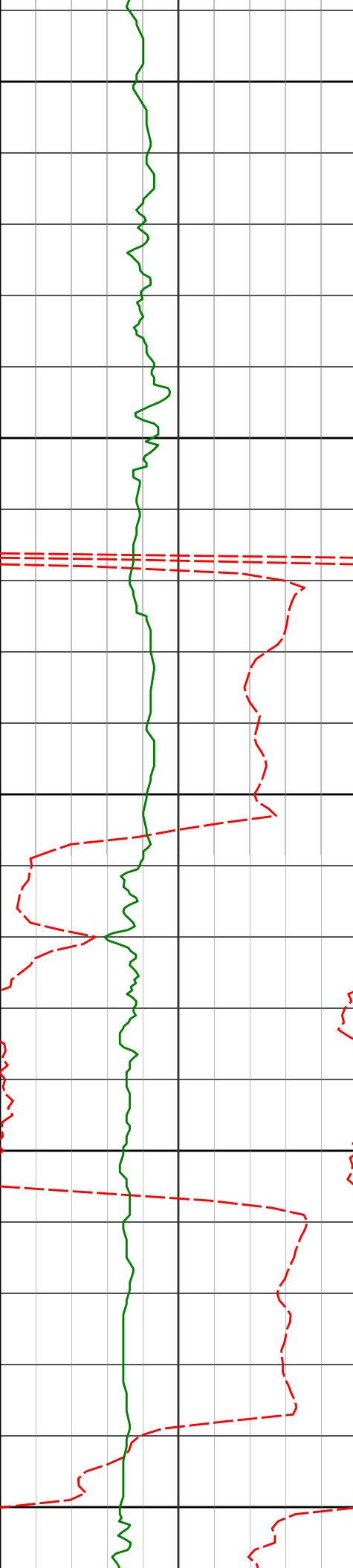
4210'

14.00°

354.38°

4117.33'

154.36'



4200

4250

4300

4350

4400

4305'

11.02°

354.80°

4210.07'

156.77'

4399'

11.45°

352.80°

4302.27'

158.67'

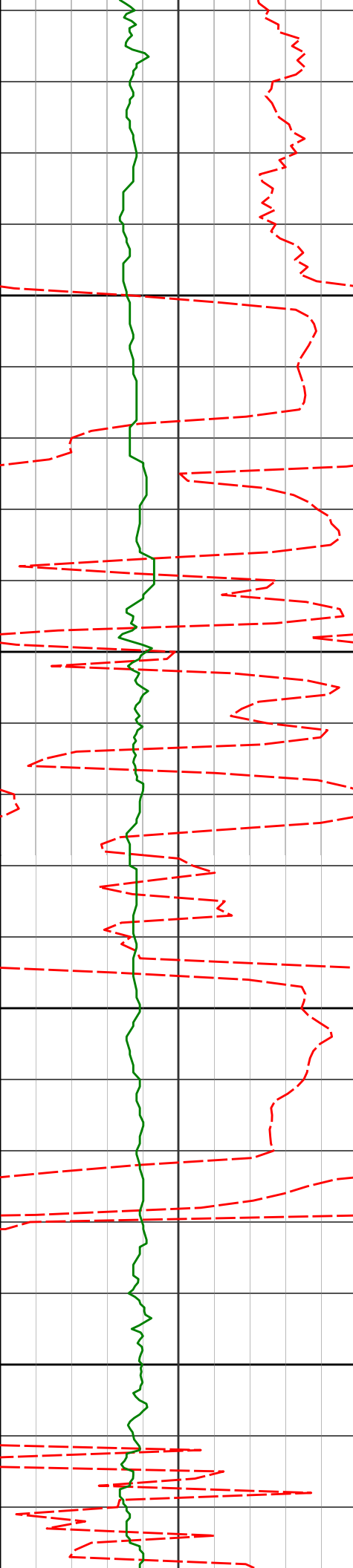
4494'

12.93°

353.11°

4395.12'

160.46'



4450

4500

4550

4600

4589'

10.78°

347.64°

4488.09'

161.41'

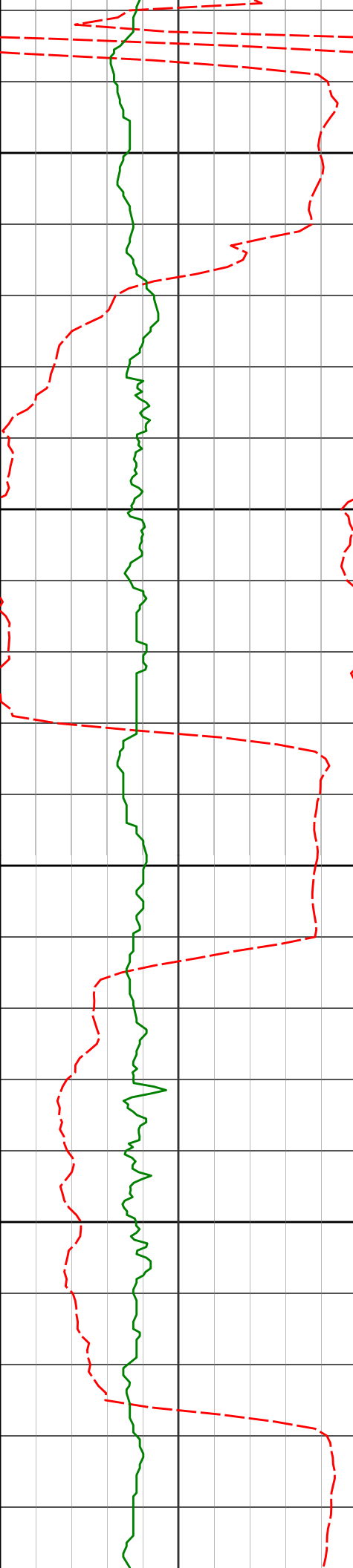
4684'

8.94°

358.55°

4581.69'

162.75'



4650

4700

4750

4800

4779'

7.66°

353.09°

4675.70'

164.70'

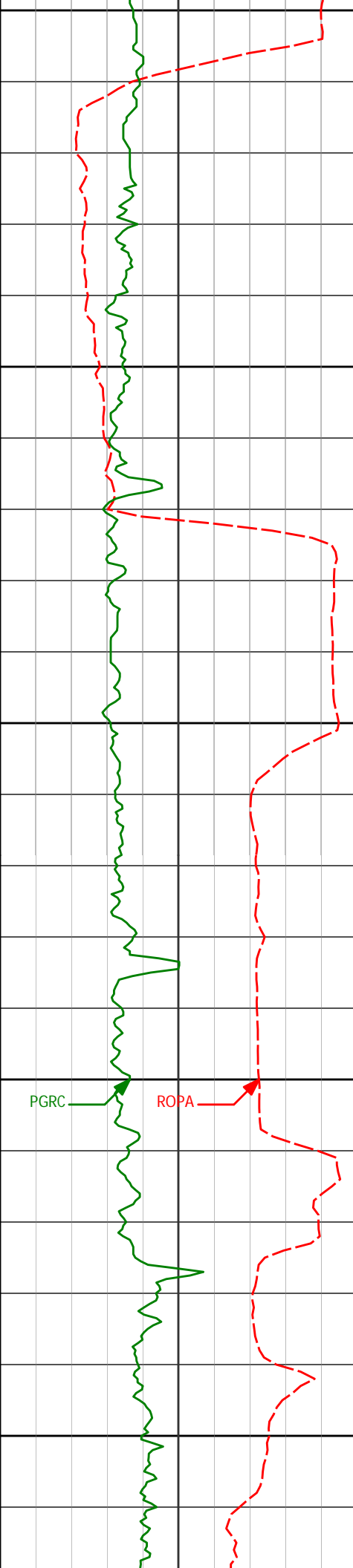
4874'

7.28°

351.47°

4769.89'

165.66'



4850

4969'

7.04°

355.03°

4864.15'

166.77'

4900

4950

Run 200

5061'

7.30°

352.59°

4955.43'

167.96'

5000

PGRC

ROPA

5050

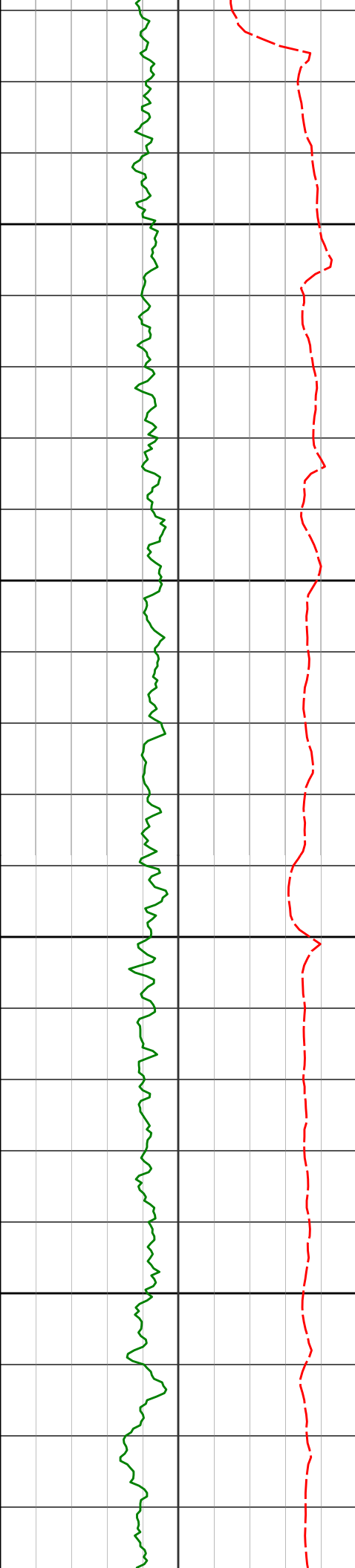
5156'

8.04°

356.65°

5049.58'

169.48'



5100

5150

5200

5250

5251'

7.36°

354.93°

5143.73'

171.24'

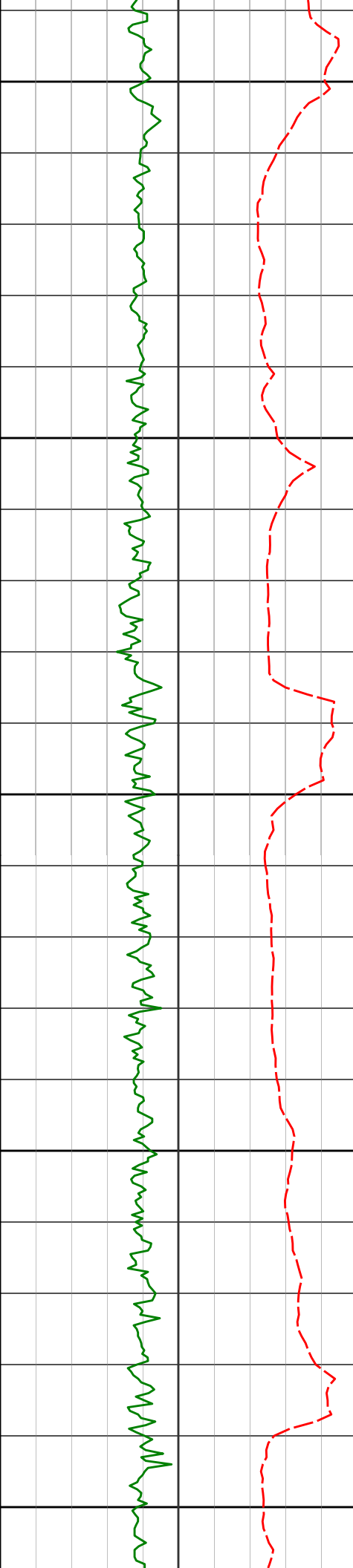
5346'

6.60°

354.58°

5238.02'

172.64'



Run 300

5300

5350

5400

5450

5500

5440'

7.58°

356.44°

5331.30'

174.20'

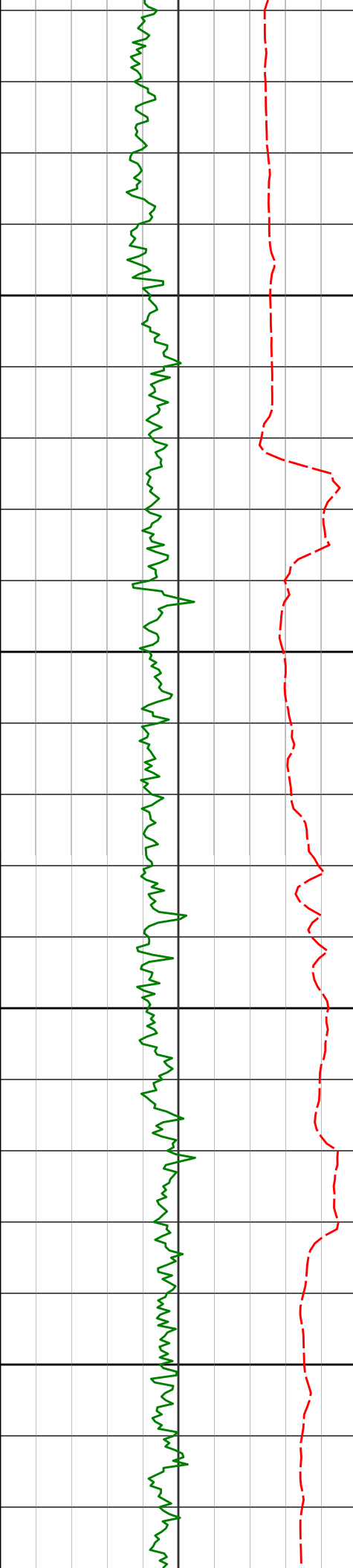
5535'

6.08°

355.39°

5425.62'

175.80'



5550

5600

5650

5700

5630'

5.09°

355.83°

5520.17'

177.04'

5725'

3.21°

346.81°

5614.92'

177.58'

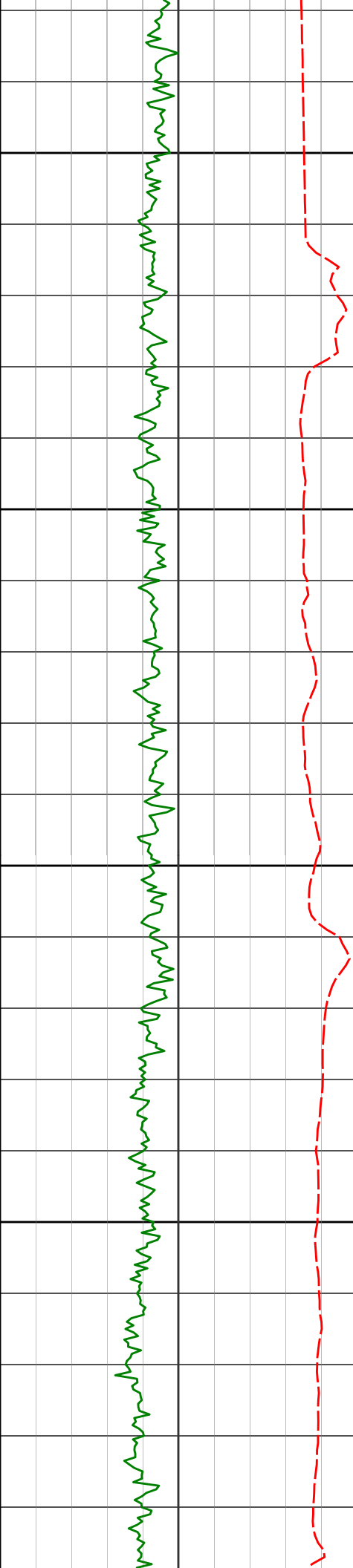
5820'

1.87°

357.77°

5709.82'

177.80'



5750

5800

5850

5900

5915'

2.22°

23.36°

5804.77'

179.14'

6010'

7.54°

82.73°

5899.43'

186.42'

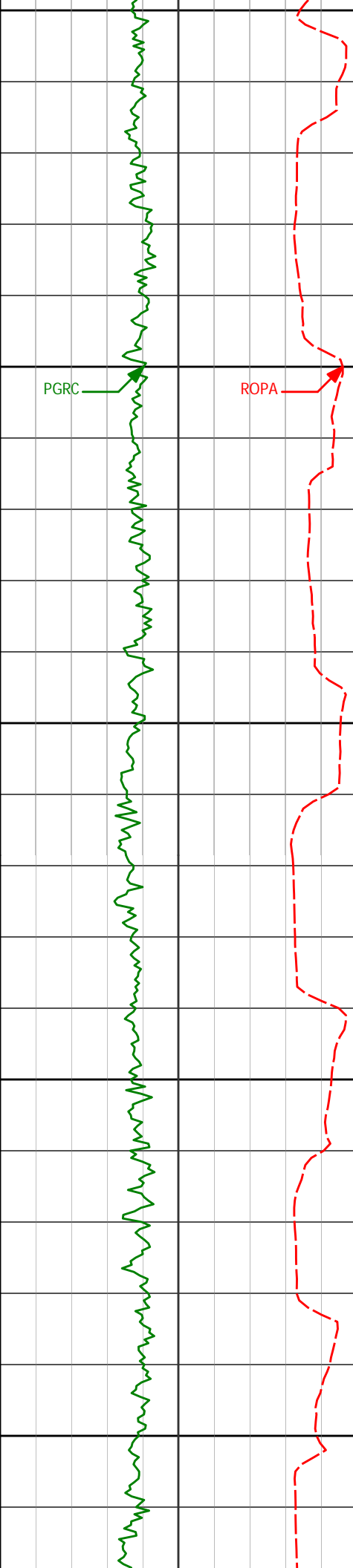
6057'

13.79°

87.85°

5945.59'

195.02'



5950

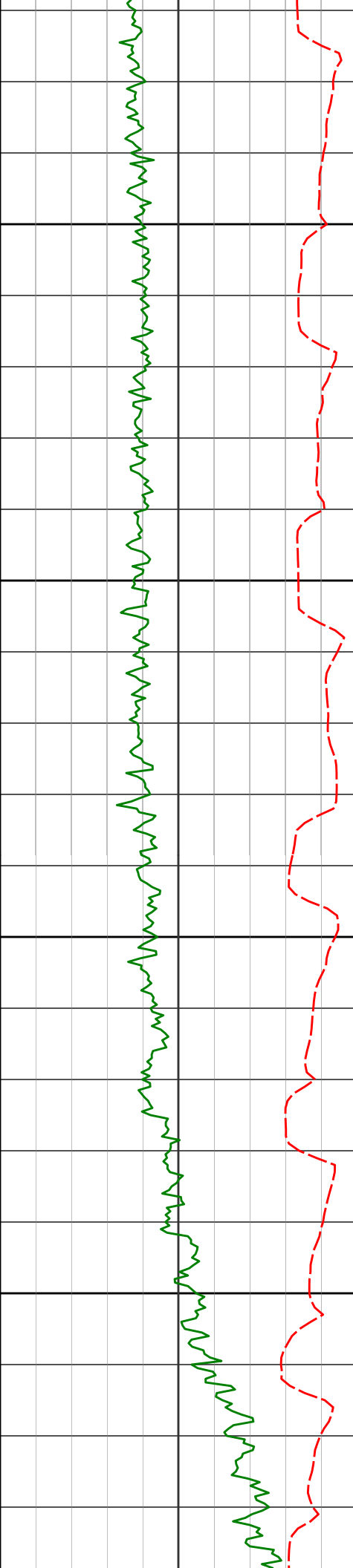
6000

6050

6100

6150

6105'	16.26°	90.01°	5991.95'	207.23'
6152'	18.74°	90.13°	6036.77'	221.04'
6200'	20.65°	91.37°	6081.96'	236.80'
6247'	23.25°	91.69°	6125.55'	253.87'



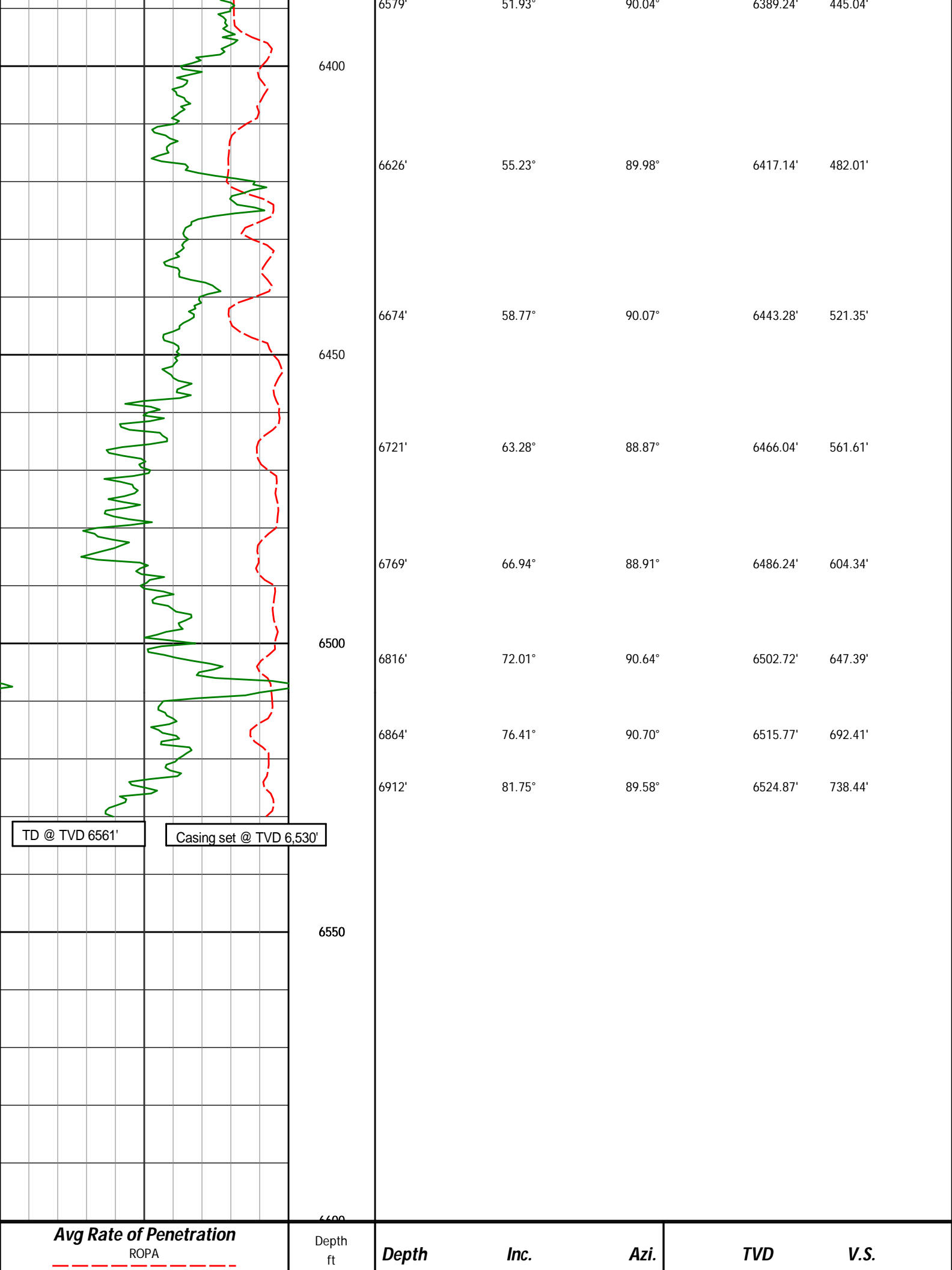
6200

6250

6300

6350

6295'	26.35°	91.44°	6169.12'	273.43'
6342'	29.84°	90.88°	6210.57'	294.96'
6390'	33.77°	89.57°	6251.36'	319.67'
6437'	37.71°	89.51°	6289.50'	346.55'
6485'	42.85°	88.98°	6326.11'	376.96'
6532'	48.11°	89.35°	6359.05'	409.80'



TD @ TVD 6561'

Casing set @ TVD 6,530'

Avg Rate of Penetration
ROPA

Depth
ft

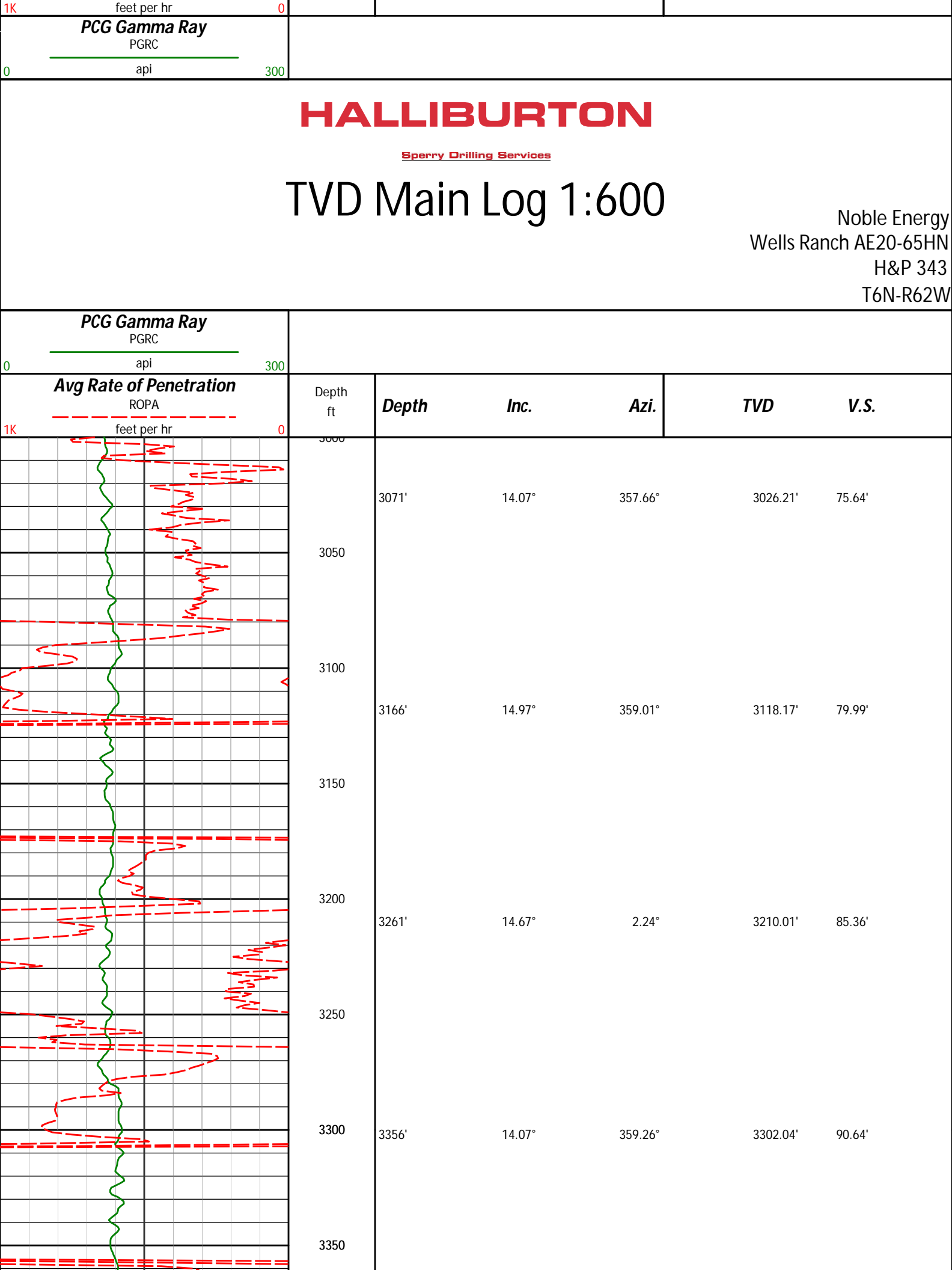
Depth

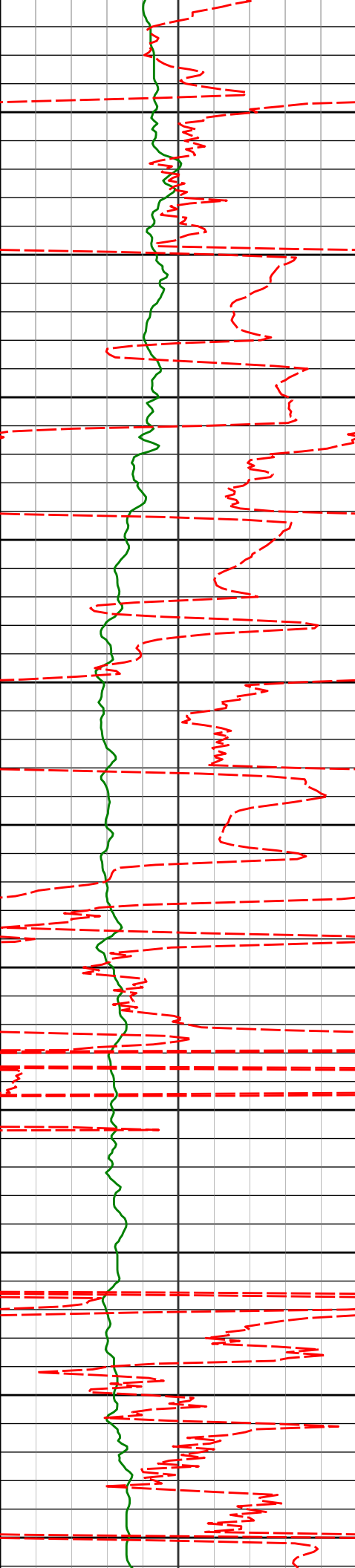
Inc.

Azi.

TVD

V.S.





3400

3450

3500

3550

3600

3650

3700

3750

3800

3850

3900

3451'

13.37°

3.83°

3394.33'

95.95'

3545'

13.61°

5.23°

3485.74'

102.25'

3640'

15.77°

5.66°

3577.63'

109.54'

3735'

18.16°

4.20°

3668.49'

117.66'

3830'

19.61°

3.89°

3758.37'

126.24'

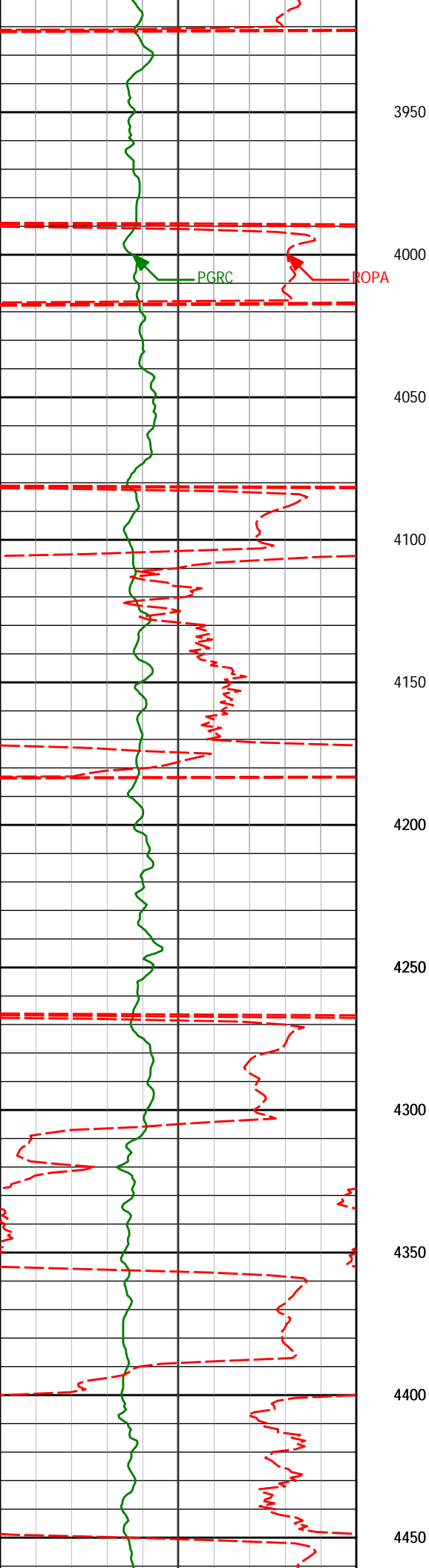
3925'

21.80°

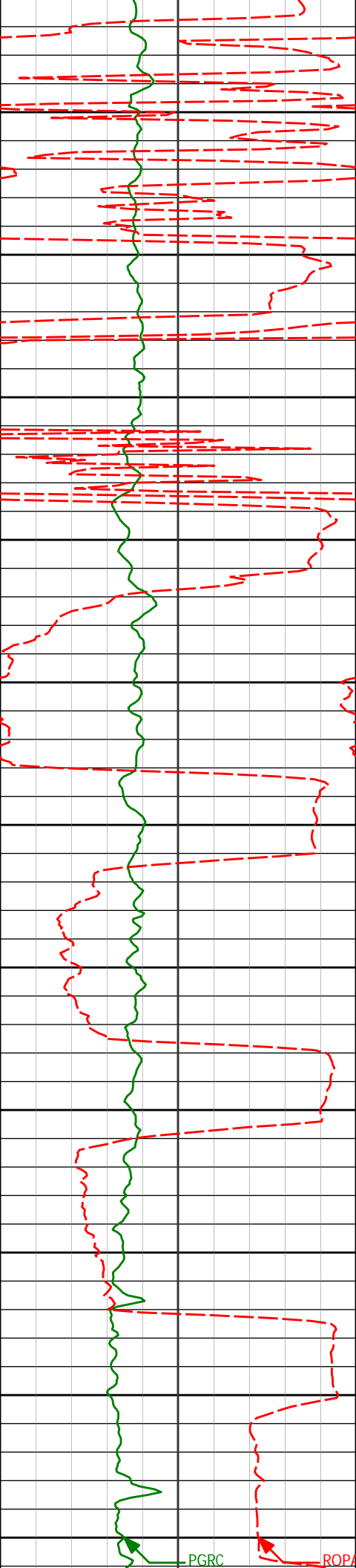
4.39°

3847.23'

135.67'



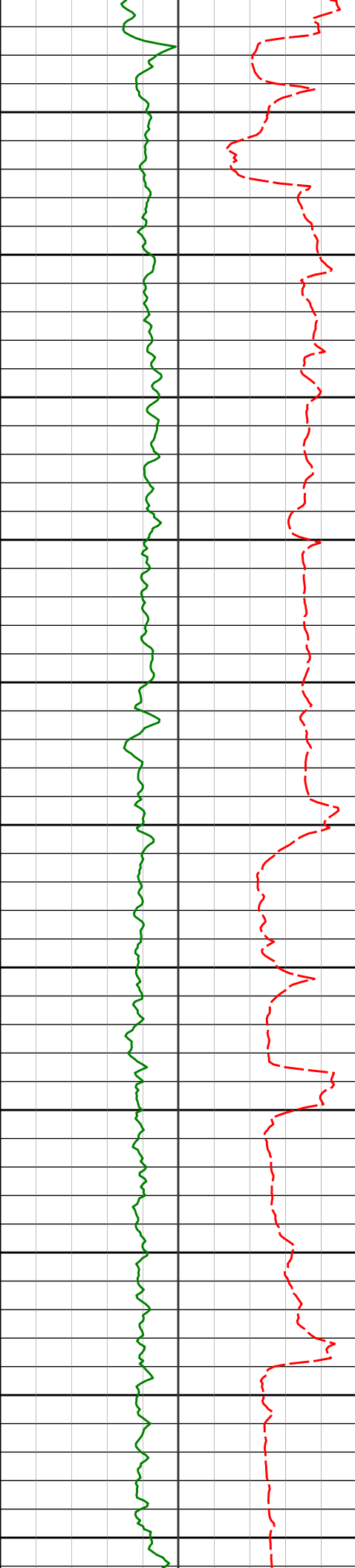
4020'	20.15°	0.71°	3935.94'	144.34'
3950				
4000				
4115'	17.37°	358.13°	4025.88'	150.52'
4050				
4100				
4210'	14.00°	354.38°	4117.33'	154.36'
4150				
4200				
4305'	11.02°	354.80°	4210.07'	156.77'
4250				
4300	4399'	11.45°	352.80°	4302.27'
4350				
4400	4494'	12.93°	353.11°	4395.12'
4450				
160.46'				



4589'	10.78°	347.64°	4488.09'	161.41'
4500				
4550				
4684'	8.94°	358.55°	4581.69'	162.75'
4600				
4650				
4779'	7.66°	353.09°	4675.70'	164.70'
4700				
4750				
4874'	7.28°	351.47°	4769.89'	165.66'
4800				
4850				
4969'	7.04°	355.03°	4864.15'	166.77'
4900				
4950				
Run 200				
5061'	7.30°	352.59°	4955.43'	167.96'

PGRC

ROPA



Run 300

5050	5156'	8.04°	356.65°	5049.58'	169.48'
5100					
5150	5251'	7.36°	354.93°	5143.73'	171.24'
5200					
5250	5346'	6.60°	354.58°	5238.02'	172.64'
5300					
5350	5440'	7.58°	356.44°	5331.30'	174.20'
5400					
5450	5535'	6.08°	355.39°	5425.62'	175.80'
5500					
5550	5630'	5.09°	355.83°	5520.17'	177.04'



5600

5725'

3.21°

346.81°

5614.92'

177.58'

5650

5700

5820'

1.87°

357.77°

5709.82'

177.80'

5750

5800

5915'

2.22°

23.36°

5804.77'

179.14'

5850

5900

6010'

7.54°

82.73°

5899.43'

186.42'

5950

6057'

13.79°

87.85°

5945.59'

195.02'

6000

6105'

16.26°

90.01°

5991.95'

207.23'

6050

6152'

18.74°

90.13°

6036.77'

221.04'

6100

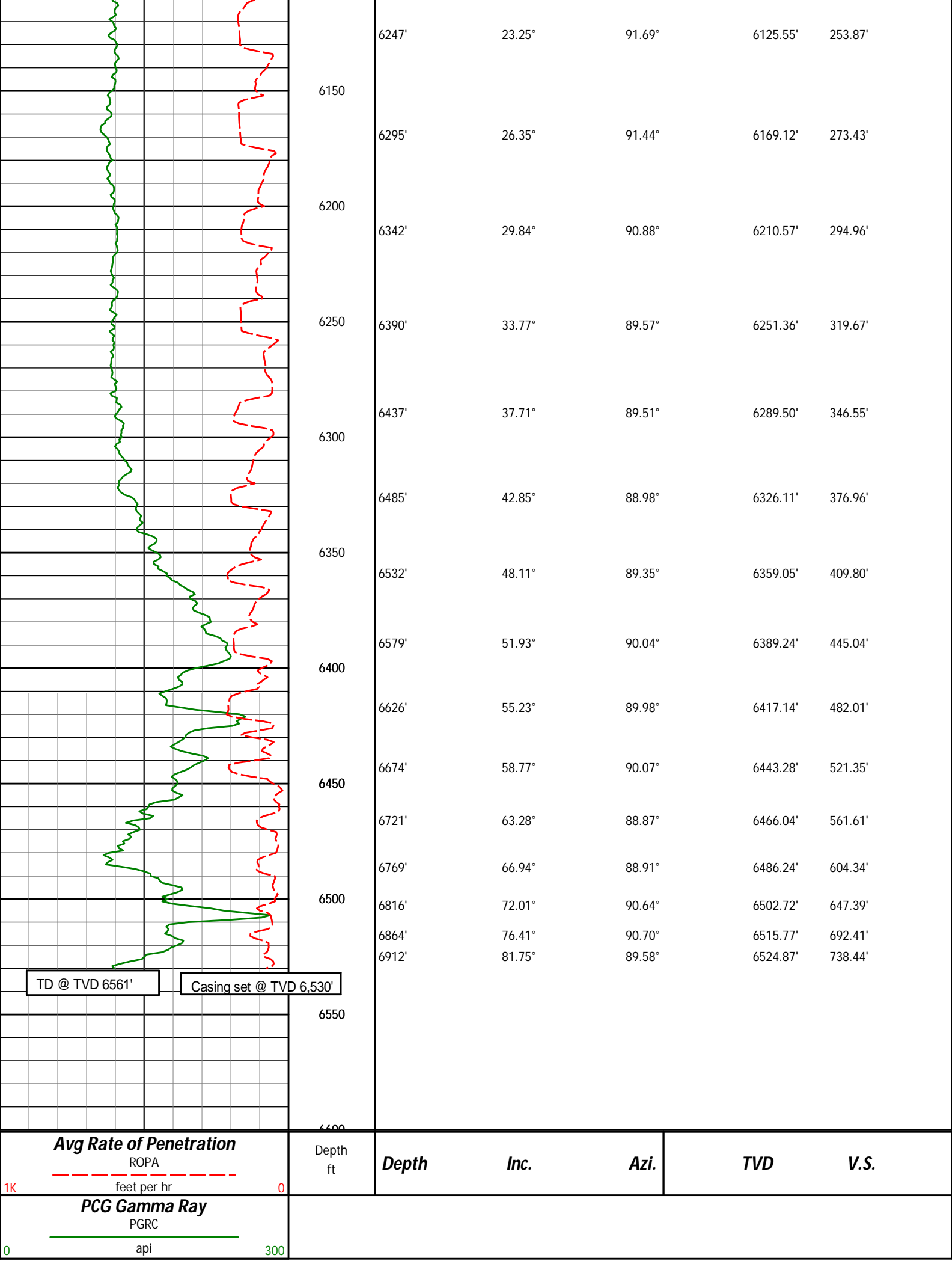
6200'

20.65°

91.37°

6081.96'

236.80'





HALLIBURTON

DIRECTIONAL SURVEY REPORT

Noble Energy
Wells Ranch AE20-65HN
Wattenberg
Weld Colorado
USA
CA-XX-0900829268

Surveys are tied into three non-Halliburton surveys at MD 352', 631', and 943' taken with a gyro while drilling surface hole.

<i>Measured Depth (feet)</i>	<i>Inclination (degrees)</i>	<i>Direction (degrees)</i>	<i>Vertical Depth (feet)</i>	<i>Latitude (feet)</i>	<i>Departure (feet)</i>	<i>Vertical Section (feet)</i>	<i>Dogleg (deg/100ft)</i>
0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
352.00	0.10	353.02	352.00	0.30 N	0.04 W	0.03	0.03
631.00	1.60	190.82	630.97	3.28 S	0.80 W	-1.47	0.61
943.00	1.00	175.82	942.88	10.27 S	1.42 W	-3.55	0.22
1086.00	1.05	152.00	1085.86	12.67 S	0.71 W	-3.37	0.30
1179.00	1.29	206.16	1178.85	14.37 S	0.77 W	-3.78	1.17
1272.00	0.95	67.52	1271.84	15.01 S	0.52 W	-3.67	2.26
1364.00	2.52	31.33	1363.80	12.99 S	1.23 E	-1.53	2.00
1457.00	4.33	7.57	1456.63	7.76 S	2.76 E	1.06	2.43
1552.00	6.94	2.60	1551.16	1.53 N	3.49 E	3.74	2.79
1647.00	8.61	354.64	1645.29	14.34 N	3.09 E	6.04	2.09
1742.00	8.89	1.38	1739.19	28.76 N	2.60 E	8.60	1.12
1837.00	10.13	2.18	1832.88	44.45 N	3.10 E	12.39	1.31
1931.00	12.00	359.65	1925.13	62.48 N	3.35 E	16.44	2.05
2026.00	13.07	355.38	2017.86	83.06 N	2.43 E	19.87	1.49
2121.00	13.39	359.83	2110.34	104.77 N	1.53 E	23.56	1.12
2216.00	14.95	0.59	2202.45	128.03 N	1.62 E	28.55	1.65
2311.00	15.15	359.42	2294.19	152.69 N	1.62 E	33.75	0.38
2406.00	14.99	359.38	2385.93	177.39 N	1.36 E	38.70	0.17
2501.00	15.23	359.31	2477.64	202.15 N	1.08 E	43.64	0.25
2596.00	17.16	3.03	2568.87	228.63 N	1.67 E	49.79	2.31
2691.00	14.84	1.50	2660.18	254.79 N	2.73 E	56.34	2.48
2786.00	15.68	359.75	2751.83	279.79 N	2.99 E	61.86	1.01
2881.00	16.39	357.61	2843.14	306.02 N	2.38 E	66.78	0.97
2976.00	15.79	358.12	2934.42	332.33 N	1.39 E	71.37	0.65
3071.00	14.07	357.66	3026.21	356.79 N	0.50 E	75.64	1.81
3166.00	14.97	359.01	3118.17	380.59 N	0.18 W	79.99	1.01
3261.00	14.67	2.24	3210.01	404.88 N	0.07 E	85.36	0.93
3356.00	14.07	359.26	3302.04	428.45 N	0.39 E	90.64	1.00
3451.00	13.37	3.83	3394.33	450.96 N	0.98 E	95.95	1.36
3545.00	13.61	5.23	3485.74	472.81 N	2.71 E	102.25	0.43
3640.00	15.77	5.66	3577.63	496.79 N	5.01 E	109.54	2.28
3735.00	18.16	4.20	3668.49	524.41 N	7.36 E	117.66	2.56
3830.00	19.61	3.89	3758.37	555.08 N	9.53 E	126.24	1.53
3925.00	21.80	4.39	3847.23	588.58 N	11.96 E	135.67	2.31
4020.00	20.15	0.71	3935.94	622.53 N	13.51 E	144.34	2.22
4115.00	17.37	358.13	4025.88	653.07 N	13.25 E	150.52	3.05
4210.00	14.00	354.38	4117.33	678.69 N	11.67 E	154.36	3.70
4305.00	11.02	354.80	4210.07	699.17 N	9.72 E	156.77	3.14
4399.00	11.45	352.80	4302.27	717.38 N	7.73 E	158.67	0.62
4494.00	12.93	353.11	4395.12	737.28 N	5.28 E	160.46	1.56
4589.00	10.78	347.64	4488.09	756.52 N	2.10 E	161.41	2.55
4684.00	8.94	358.55	4581.69	772.58 N	0.01 E	162.75	2.75
4779.00	7.66	353.09	4675.70	786.24 N	0.94 W	164.70	1.58
4874.00	7.28	351.47	4769.89	798.48 N	2.59 W	165.66	0.46
4969.00	7.04	355.03	4864.15	810.23 N	3.99 W	166.77	0.53
5061.00	7.30	352.59	4955.43	821.65 N	5.23 W	167.96	0.44
5156.00	8.04	356.65	5049.58	834.26 N	6.40 W	169.48	0.96
5251.00	7.36	354.93	5143.73	846.96 N	7.33 W	171.24	0.76
5346.00	6.60	354.58	5238.02	858.45 N	8.38 W	172.64	0.80
5440.00	7.58	356.44	5331.30	870.02 N	9.27 W	174.20	1.07
5535.00	6.08	355.39	5425.62	881.29 N	10.07 W	175.80	1.58
5630.00	5.09	355.83	5520.17	890.51 N	10.78 W	177.04	1.04

5725.00	3.21	346.81	5614.92	897.30 N	11.69 W	177.58	2.09
5820.00	1.87	357.77	5709.82	901.44 N	12.36 W	177.80	1.49
5915.00	2.22	23.36	5804.77	904.68 N	11.69 W	179.14	1.02
6010.00	7.54	82.73	5899.43	907.16 N	4.77 W	186.42	7.04
6057.00	13.79	87.85	5945.59	907.76 N	3.90 E	195.02	13.44
6105.00	16.26	90.01	5991.95	907.97 N	16.33 E	207.23	5.28
6152.00	18.74	90.13	6036.77	907.95 N	30.47 E	221.04	5.28
6200.00	20.65	91.37	6081.96	907.73 N	46.64 E	236.80	4.07
6247.00	23.25	91.69	6125.55	907.26 N	64.20 E	253.87	5.54
6295.00	26.35	91.44	6169.12	906.71 N	84.32 E	273.43	6.46
6342.00	29.84	90.88	6210.57	906.27 N	106.45 E	294.96	7.45
6390.00	33.77	89.57	6251.36	906.19 N	131.74 E	319.67	8.31
6437.00	37.71	89.51	6289.50	906.41 N	159.19 E	346.55	8.38
6485.00	42.85	88.98	6326.11	906.83 N	190.21 E	376.96	10.73
6532.00	48.11	89.35	6359.05	907.31 N	223.70 E	409.80	11.21
6579.00	51.93	90.04	6389.24	907.50 N	259.71 E	445.04	8.21
6626.00	55.23	89.98	6417.14	907.49 N	297.53 E	482.01	7.02
6674.00	58.77	90.07	6443.28	907.47 N	337.78 E	521.35	7.38
6721.00	63.28	88.87	6466.04	907.86 N	378.88 E	561.61	9.85
6769.00	66.94	88.91	6486.24	908.70 N	422.40 E	604.34	7.63
6816.00	72.01	90.64	6502.72	908.87 N	466.40 E	647.39	11.32
6864.00	76.41	90.70	6515.77	908.33 N	512.58 E	692.41	9.17
6912.00	81.75	89.58	6524.87	908.22 N	559.69 E	738.44	11.36
7039.00	85.59	87.32	6538.87	911.64 N	685.84 E	862.48	3.50
7134.00	89.26	88.10	6543.13	915.43 N	780.65 E	955.96	3.95
7229.00	91.42	88.57	6542.57	918.19 N	875.60 E	1049.37	2.33
7324.00	93.67	87.23	6538.35	921.67 N	970.44 E	1142.81	2.76
7419.00	92.72	86.65	6533.06	926.73 N	1065.15 E	1236.46	1.17
7514.00	87.84	82.50	6532.59	935.71 N	1159.68 E	1330.76	6.74
7609.00	88.92	81.43	6535.28	948.98 N	1253.70 E	1425.47	1.60
7704.00	86.89	86.77	6538.75	958.74 N	1348.10 E	1519.80	6.01
7799.00	89.51	86.43	6541.74	964.37 N	1442.88 E	1613.64	2.78
7894.00	90.80	87.86	6541.48	969.10 N	1537.75 E	1707.38	2.03
7989.00	91.20	89.16	6539.82	971.57 N	1632.70 E	1800.73	1.43
8084.00	89.97	88.80	6538.85	973.26 N	1727.68 E	1893.93	1.35
8179.00	88.49	88.12	6540.13	975.81 N	1822.64 E	1987.29	1.71
8274.00	88.95	89.64	6542.25	977.67 N	1917.59 E	2080.51	1.67
8369.00	88.55	90.86	6544.32	977.26 N	2012.57 E	2173.26	1.35
8464.00	89.11	89.99	6546.26	976.55 N	2107.54 E	2265.96	1.09
8559.00	89.57	90.49	6547.36	976.15 N	2202.53 E	2358.74	0.72
8654.00	90.77	89.59	6547.08	976.09 N	2297.53 E	2451.59	1.58
8749.00	90.56	89.66	6545.97	976.71 N	2392.52 E	2544.58	0.23
8843.00	90.86	90.54	6544.81	976.54 N	2486.51 E	2636.43	0.99
8938.00	89.41	89.69	6544.59	976.35 N	2581.51 E	2729.25	1.77
9033.00	88.00	90.83	6546.73	975.92 N	2676.48 E	2822.00	1.91
9128.00	88.06	90.05	6550.00	975.19 N	2771.42 E	2914.66	0.82
9223.00	88.77	89.07	6552.63	975.92 N	2866.38 E	3007.64	1.27
9318.00	89.23	87.51	6554.28	978.76 N	2961.32 E	3101.05	1.71
9413.00	88.71	89.77	6555.99	981.01 N	3056.27 E	3194.34	2.44
9508.00	89.54	88.76	6557.44	982.23 N	3151.25 E	3287.45	1.38
9603.00	89.54	90.58	6558.21	982.78 N	3246.24 E	3380.42	1.92
9698.00	89.88	90.03	6558.69	982.27 N	3341.24 E	3473.18	0.68
9793.00	91.45	91.63	6557.58	980.90 N	3436.22 E	3565.74	2.36
9888.00	89.04	90.68	6557.18	978.98 N	3531.19 E	3658.17	2.73
9983.00	89.23	92.89	6558.61	976.02 N	3626.13 E	3750.36	2.33
10078.00	91.29	105.90	6558.18	960.55 N	3719.64 E	3838.52	13.86
10172.00	89.48	97.92	6557.55	941.17 N	3811.54 E	3924.27	8.70
10267.00	89.01	92.88	6558.80	932.23 N	3906.08 E	4014.81	5.33
10362.00	89.32	90.18	6560.18	929.70 N	4001.03 E	4107.09	2.86
10457.00	89.54	88.86	6561.13	930.49 N	4096.02 E	4200.12	1.41
10552.00	90.71	86.73	6560.92	934.15 N	4190.94 E	4293.68	2.56
10647.00	90.49	86.00	6559.93	940.17 N	4285.74 E	4387.62	0.80
10762.00	88.98	84.06	6560.46	950.13 N	4400.30 E	4501.71	2.14
10826.00	88.98	84.06	6561.60	956.75 N	4463.95 E	4565.32	0.00

CALCULATION BASED ON MINIMUM CURVATURE METHOD

SURVEY COORDINATES RELATIVE TO WELL SYSTEM REFERENCE POINT
TVD VALUES GIVEN RELATIVE TO DRILLING MEASUREMENT POINT

VERTICAL SECTION RELATIVE TO WELL HEAD
VERTICAL SECTION IS COMPUTED ALONG A DIRECTION OF 77.84 DEGREES (GRID)
A TOTAL CORRECTION OF 7.62 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.
HORIZONTAL DISPLACEMENT(CLOSURE) AT 10826.00 FEET
IS 4565.33 FEET ALONG 77.90 DEGREES (GRID)

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