

Pressure Cased Gamma (PCGK)



1:240

[illegible]

WELL INFORMATION

MWD Run Number	100	200			
Date run completed	07-Jul-14	08-Jul-14			
Rig Bit Number	2	3			
Bit Size (in)	8.750	8.750			
Tool Nominal OD (in)	6.750	6.750			
Log Start Depth (TVD, ft)	806.98	5,961.41			
Log End Depth (TVD, ft)	5,961.41	6,686.74			
Drill or Wipe	Drill	Drill			
Drill/Wipe Start Date and Time	06-Jul-14 06:00	07-Jul-14 14:10			
Drill/Wipe End Date and Time	07-Jul-14 04:00	08-Jul-14 06:15			
Min Inc (deg) @ Depth (TVD, ft)	0.28 @ 901.98	11.18 @ 6,086.83			
Max Inc (deg) @ Depth (TVD, ft)	16.54 @ 3,965.86	83.13 @ 6,681.65			
Bit TFA(in2) / Bit Type	1.37 /	1.03 /			
Flow Rate (gpm)	587.57	568.52			
Max AV (fpm) / CV (fpm) @ MWD	N/A/ N/A	N/A/ N/A			
Fluid Type	Polymer	Polymer			
Density (ppg) / Viscosity (spcP)	8.90 / 32.00	10.60 / 44.00			
Filtrate CL (ppm)	1,600.00	1,900.00			
pH/ Fluid Loss (mptm)	8.90 / 0	9.00 / 9			
PV (cP) / YP (lbf2)	3 / 2.00	10 / 11.00			
% Solids / % Sand	2.5 / 1.00	12.2 / 0.50			
% Oil / Oil:Water Ratio	N/A/ N/A	N/A/ N/A			
Rm @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A			
Rmf @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A			
Rmc @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A			
Min Fracture Width (in)	1.22 @ 4,521.4	1.22 @ 4,521.4			

Max Tool Temp (degF) / Source	160.83 / PCM	175.21 / PCM			
Rm @ Max Tool Temp (degF)	N/A @ 160.83	N/A @ 175.21			
Lead MWD Engineer	Henry Schmeidler	Henry Schmeidler			
Customer Representative	Martin Suarez	Martin Suarez			

SENSOR INFORMATION

Downhole Processor Information

Tool Type	PCM	PCM			
Software Version	5.93	5.93			
Sub Serial Number	11331929	246470			
Insert Serial Number	10997272	11400826			
Date and Time Initialized	06-Jul-14 02:28	07-Jul-14 06:34			
Date and Time Read	07-Jul-14 08:19	08-Jul-14 14:29			
ECMB SW Version	N/A	N/A			

Directional Sensor Information

Tool Type	PCDC	PCDC			
Distance From Bit (ft)	54.17	51.43			
Software Version	6.21	6.21			
Sub Serial Number	11331929	246470			
Sonde Serial Number	10835193	11833258			
Sensor ID Number	N/A	N/A			
Toolface Offset (deg)	296.59	7.95			

Gamma Ray Sensor Information

Tool Type	PCG	PCG			
Distance From Bit (ft)	49.17	46.43			
Recorded Sample Period (sec)	10	10			
Software Version	8.15	8.15			
Sub Serial Number	11331929	246470			
Insert/Sonde Serial Number	12071301	11579809			

Pulser Controller Sensor Information

Tool Type	PCM	PCM			
Software Version	5.93	5.93			
PIC Software Version	1.40	1.40			
Sub/HOC Serial Number	11331929	246470			
Insert/Probe/Module SN	10997272	11400826			
Battery Serial Number	N/A	N/A			
Valve Insert SN	N/A	N/A			
DC Insert Serial Number	N/A	N/A			
Choke Size (32nd)	N/A	N/A			
Driver Current (amps)	N/A	N/A			
Driver SMI Current (amps)	N/A	N/A			
Boot Strap Version	4,130.00	4,130.00			

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. All data presented is recorded data unless otherwise specified.
4. The following smoothing parameters have been applied to the

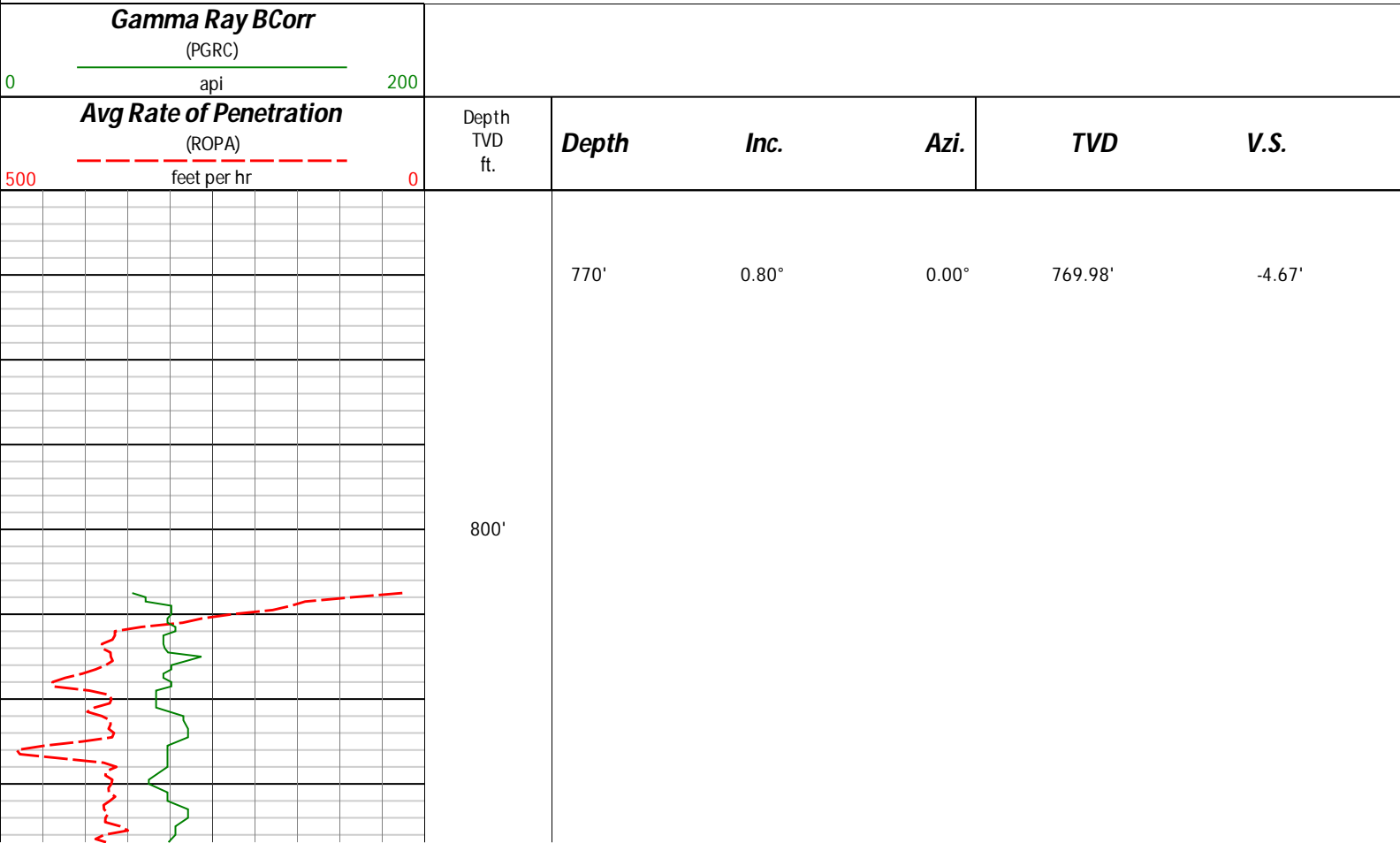
4. The following smoothing parameters have been applied to the data:
PGRC(Gamma Ray Bor Corr)
Interval Resolution: 0.5 ft.
Interval Distance: 0.6 ft.
Gap Fill: 3.0 ft.
ROPA (Average Rate of Penetration)
Interval Resolution: 0.5 ft.
Interval Distance: 1.2 ft.
Gap Fill : 3.0 ft.
5. INSOLE version 3.4.10

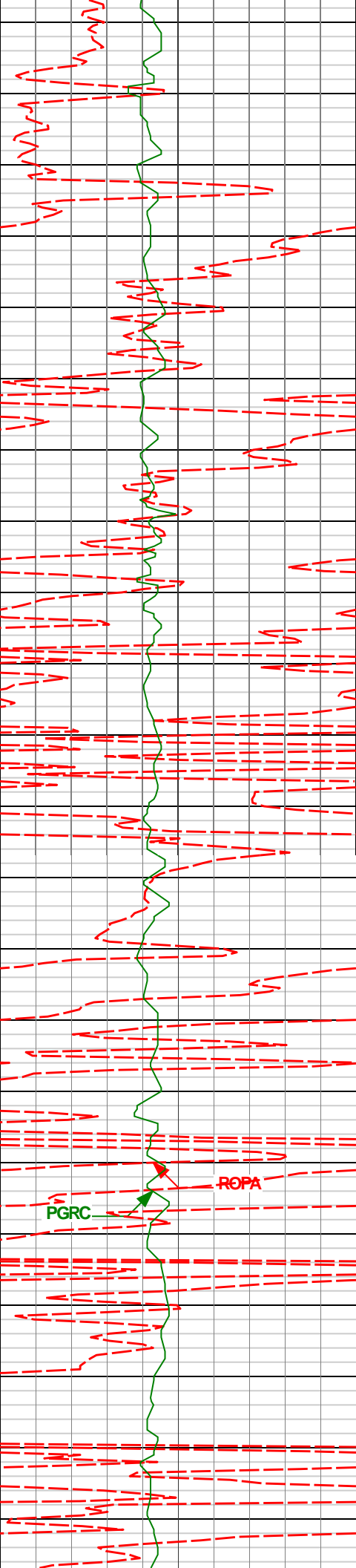
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Sperry Drilling Services

TVD Detail Log 1:240





850'

900'

950'

1000'

1050'

902'

0.28°

272.12°

901.98'

-5.65'

994'

1.09°

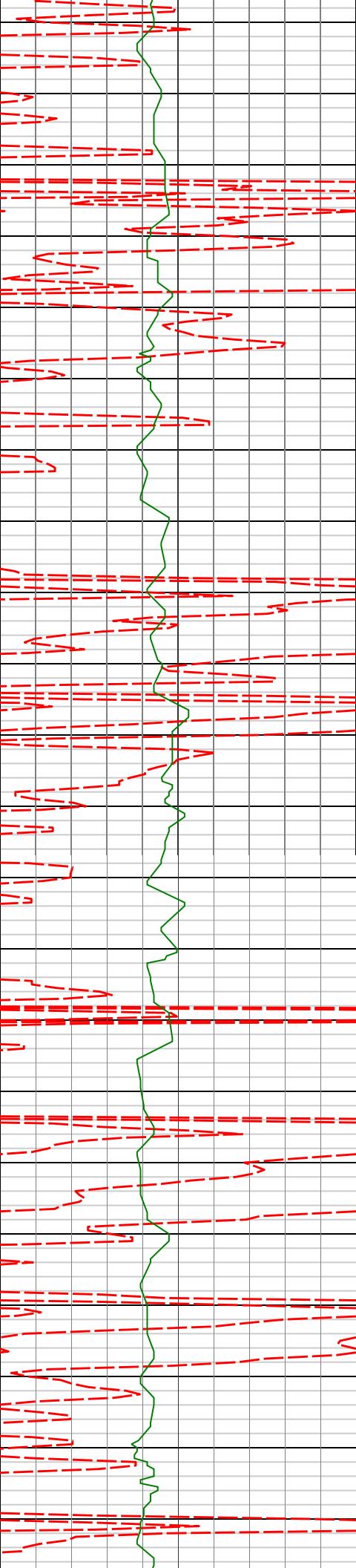
108.12°

993.97'

-5.23'

PGRC

ROPA



1100'

1150'

1200'

1250'

1179'

1.08°

112.20°

1178.94'

-3.12'

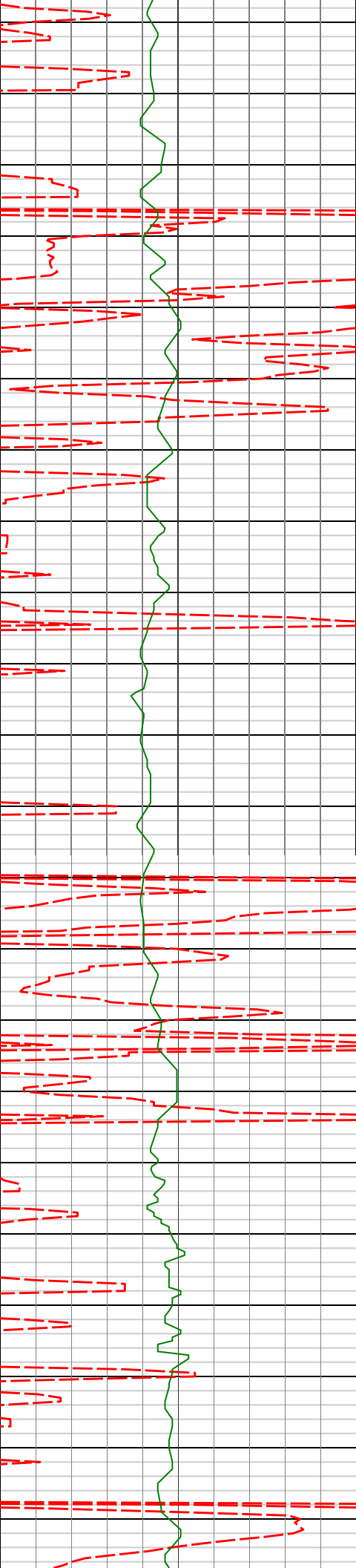
1273'

1.12°

104.85°

1272.92'

-2.07'



1300'

1350'

1400'

1450'

1366'

1.19°

96.10°

1365.90'

-1.21'

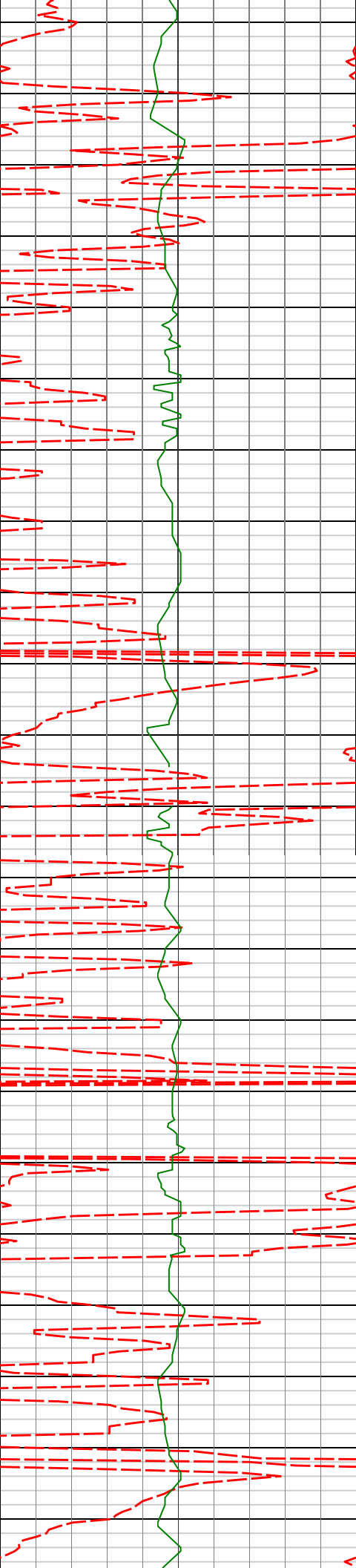
1458'

1.02°

104.43°

1457.89'

-0.41'



1500'

1550'

1600'

1650'

1700'

1553'

2.52°

83.78°

1552.84'

0.41'

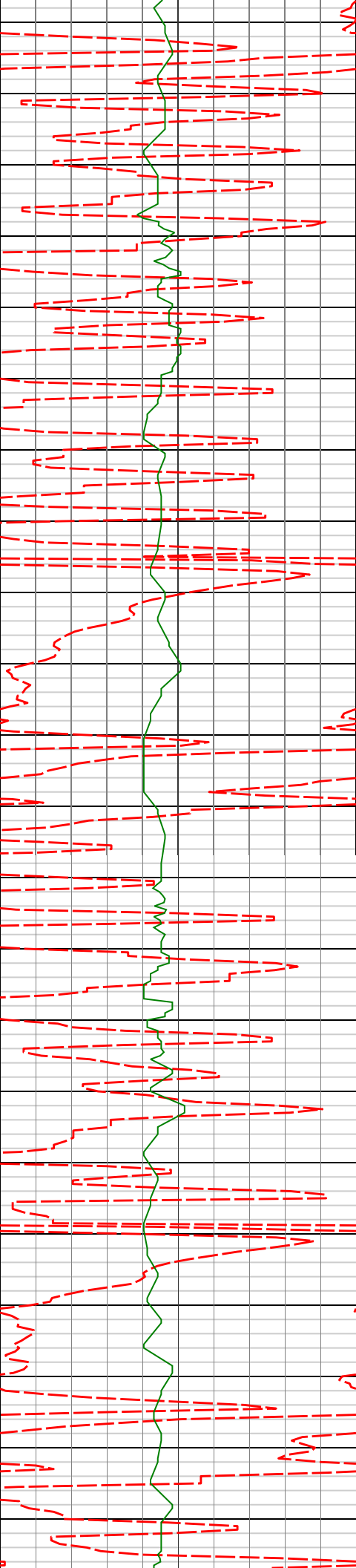
1648'

3.52°

75.22°

1647.71'

0.92'



1743'

4.26°

76.42°

1742.49'

1.24'

1750'

1800'

1838'

5.89°

75.35°

1837.11'

1.64'

1850'

1900'

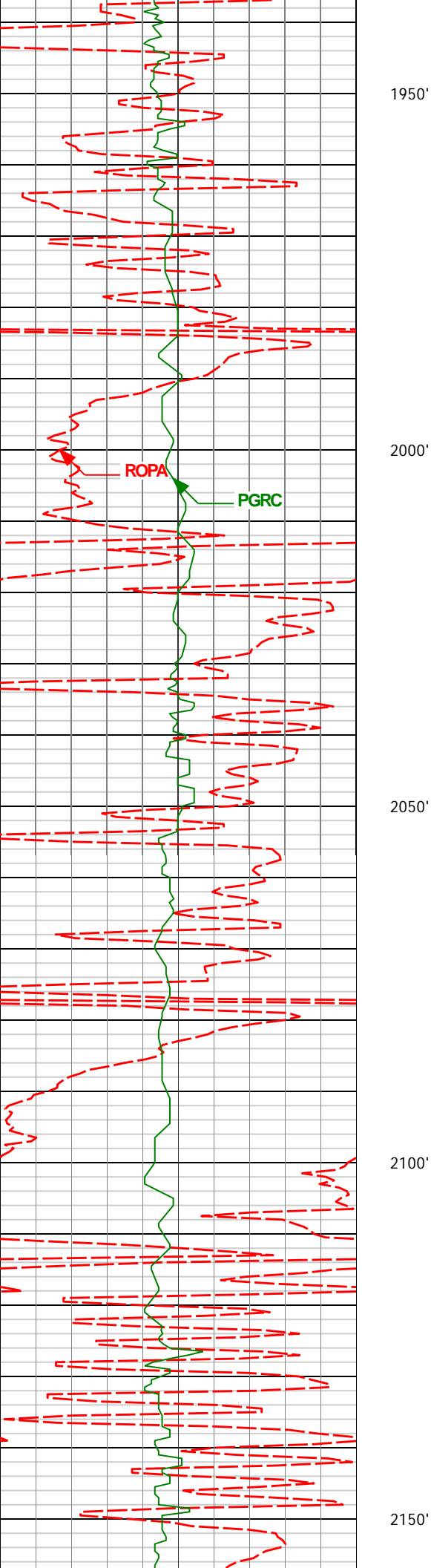
1932'

6.50°

80.09°

1930.56'

2.49'



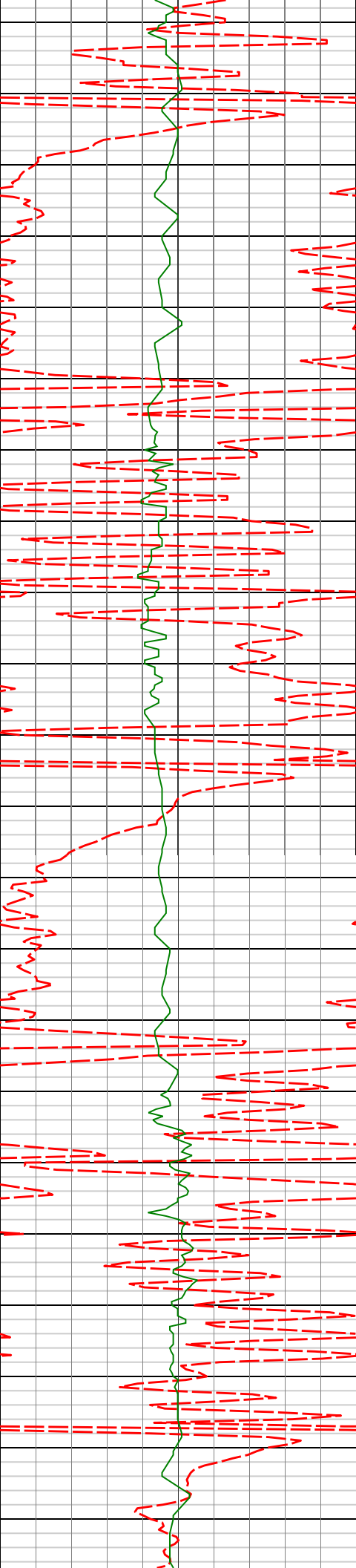
2122'

9.09°

78.24°

2118.79'

5.18'



2200'

2250'

2300'

2350'

2217'

10.58°

81.50°

2212.39'

7.15'

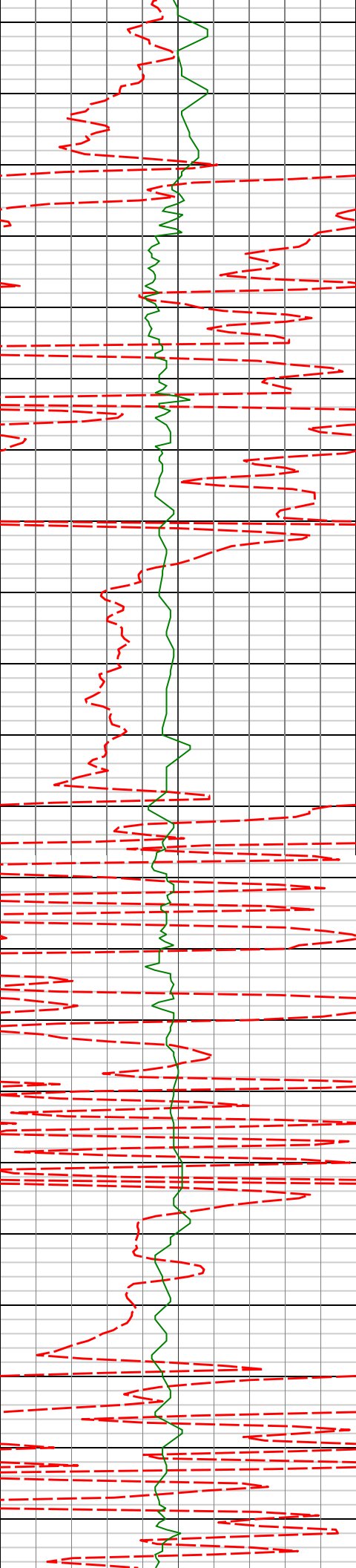
2312'

11.05°

78.72°

2305.71'

9.33'



2400'

2450'

2500'

2550'

2407'

2502'

2597'

11.49°

13.24°

12.79°

88.71°

89.84°

86.62°

2398.88'

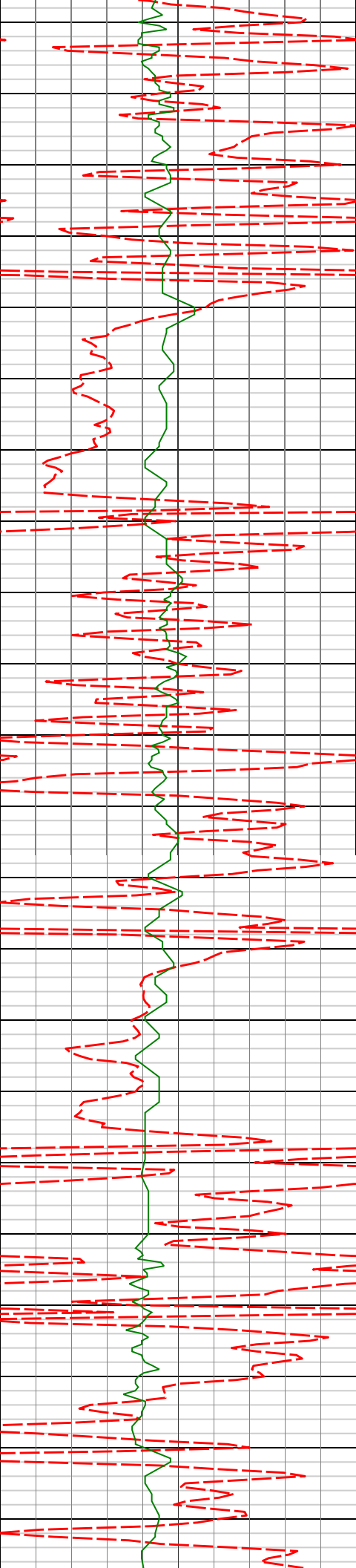
2491.68'

2584.24'

12.79'

18.49'

24.11'



2600'

2650'

2700'

2750'

2800'

2692'

13.38°

86.51°

2676.77'

29.14'

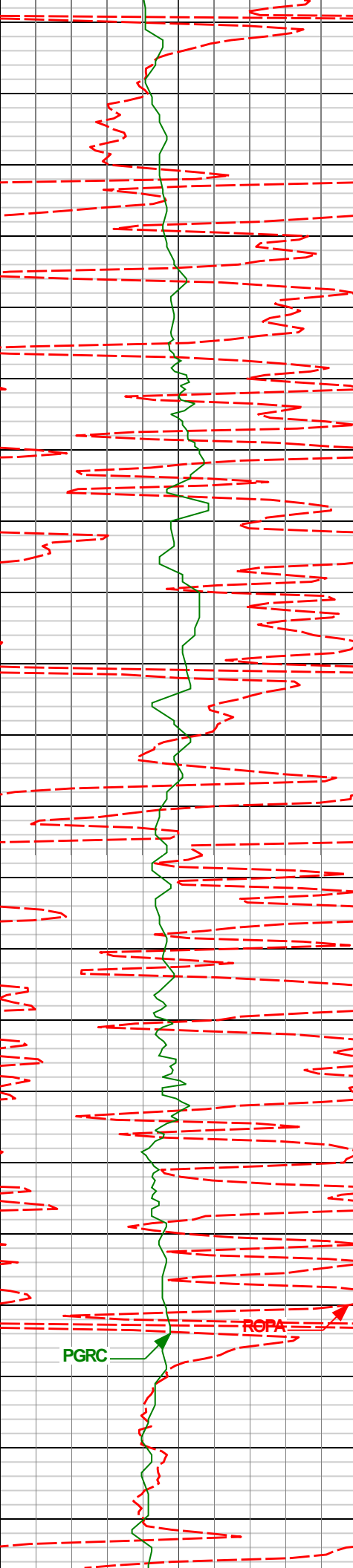
2787'

14.68°

83.13°

2768.94'

33.82'



2850'

2882'

15.30°

87.41°

2860.71'

39.04'

2900'

2950'

2977'

14.25°

84.18°

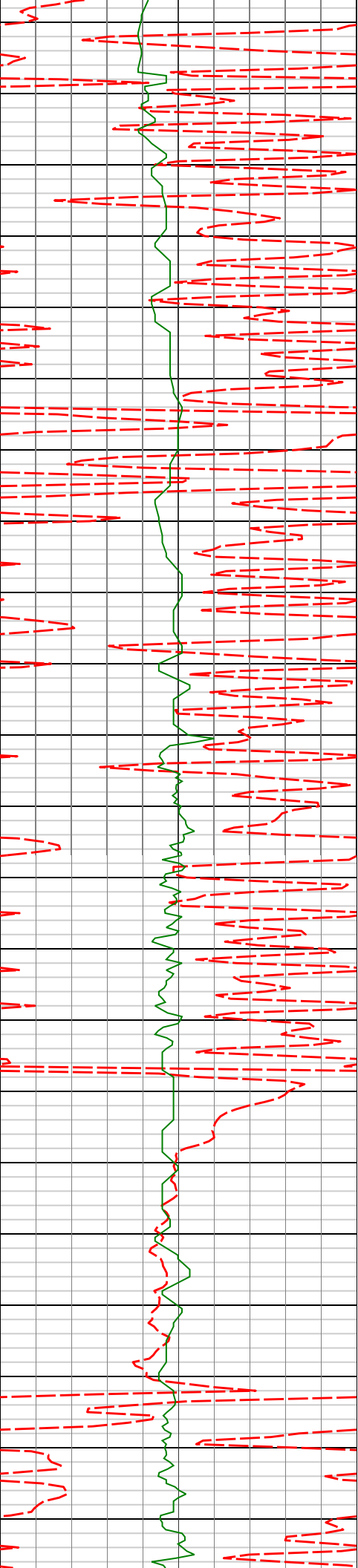
2952.57'

44.41'

3000'

PGRC

ROPA



3072'

15.15°

87.04°

3044.46'

49.68'

3050'

3100'

3167'

12.97°

83.93°

3136.61'

54.70'

3150'

3200'

3262'

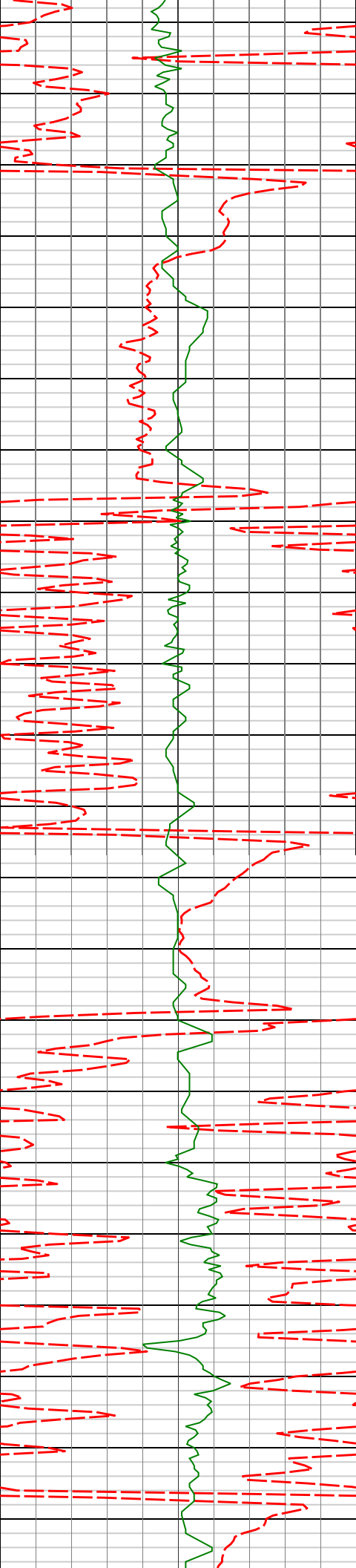
12.76°

83.93°

3229.23'

58.70'

3250'



3300'

3357'

12.50°

89.82°

3321.93'

63.65'

3350'

3400'

3452'

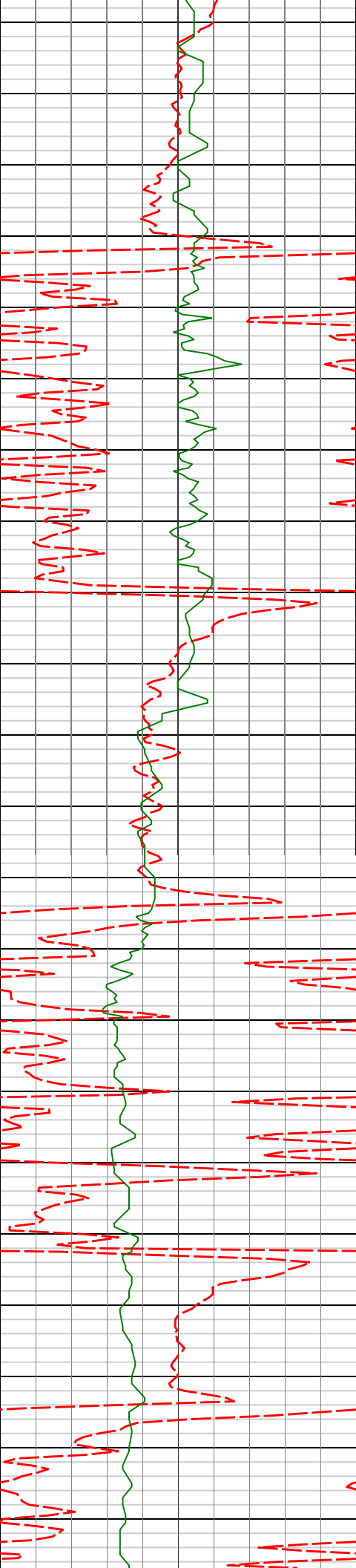
11.72°

87.53°

3414.82'

69.04'

3450'



3500'

3547'

12.28°

87.98°

3507.74'

74.06'

3550'

3600'

3641'

12.83°

85.28°

3599.50'

78.85'

3650'

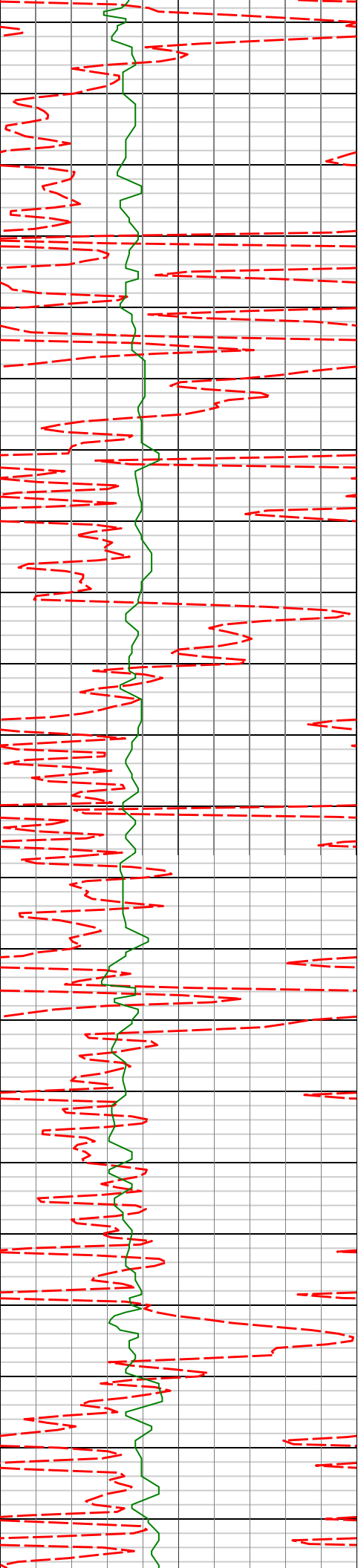
3736'

14.80°

87.55°

3691.74'

84.13'



3700'

3750'

3831'

15.57°

87.95°

3783.43'

90.46'

3800'

3850'

3926'

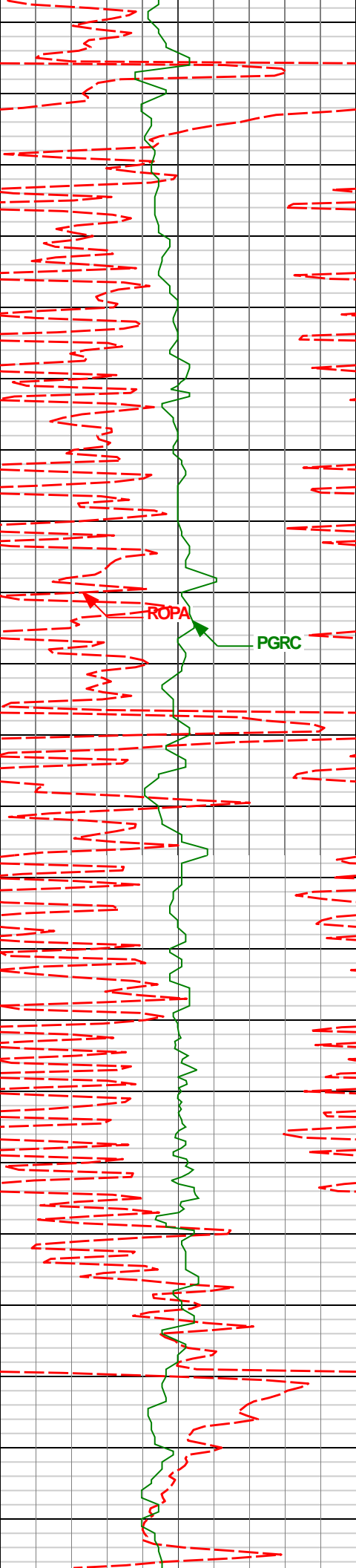
16.38°

87.95°

3874.76'

97.19'

3900'



3950'

4021'

16.54°

88.19°

3965.86'

104.17'

4000'

ROPA

PGRC

4050'

4116'

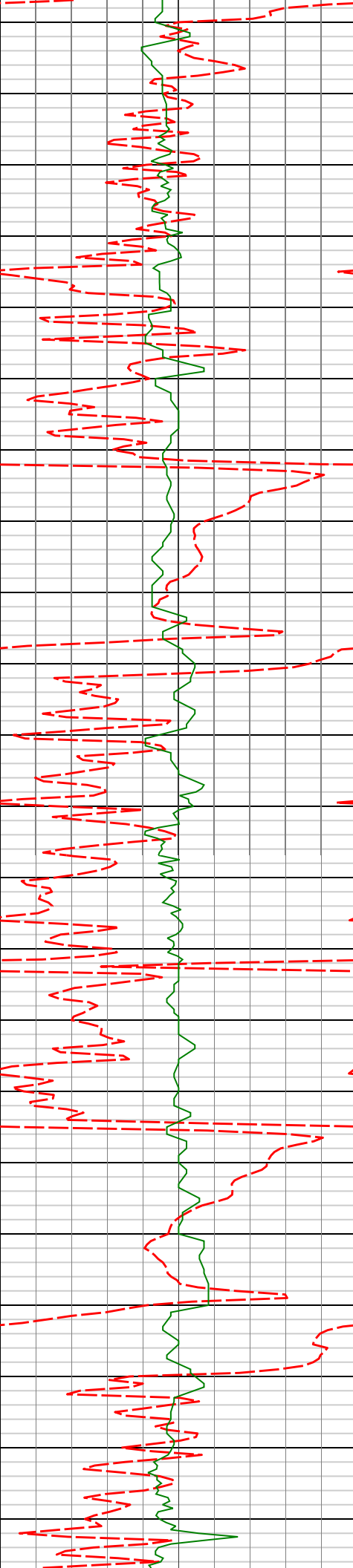
13.99°

87.14°

4057.50'

110.51'

4100'



4150'

4211'

13.92°

84.67°

4149.70'

115.62'

4200'

4250'

4306'

13.56°

83.72°

4241.98'

119.98'

4300'

4401'

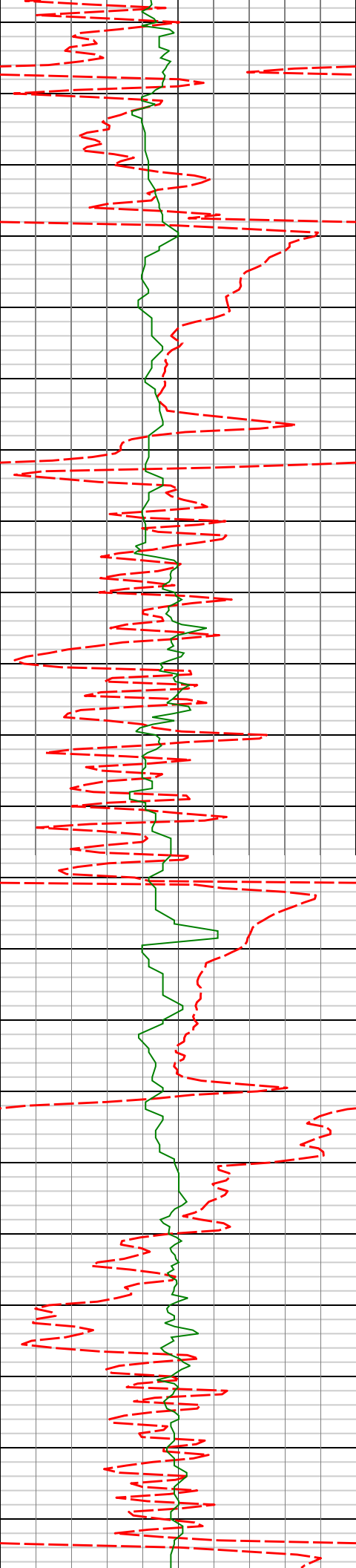
12.50°

86.30°

4334.53'

124.41'

4350'



4400'

4450'

4500'

4550'

4496'

12.44°

84.41°

4427.29'

128.79'

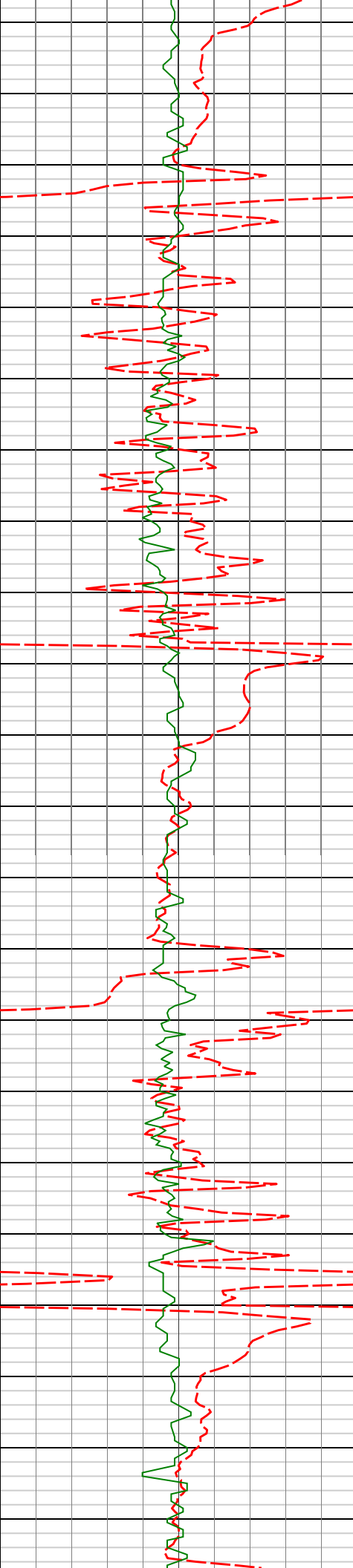
4591'

12.78°

86.42°

4520.00'

133.25'



4600'

4650'

4700'

4750'

4685'

11.35°

85.23°

4611.92'

137.61'

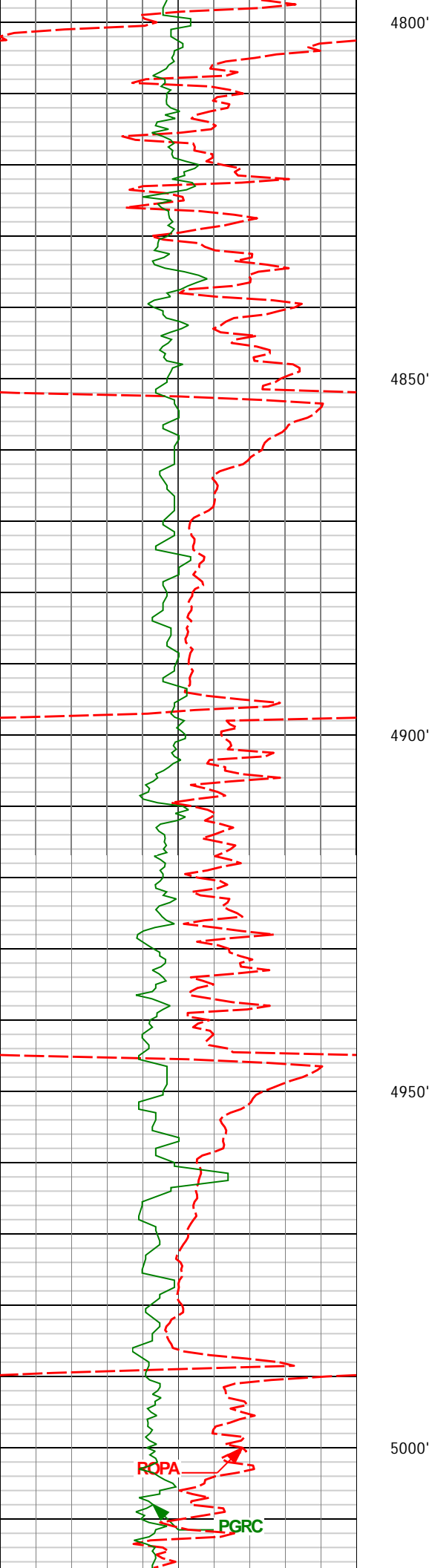
4780'

11.19°

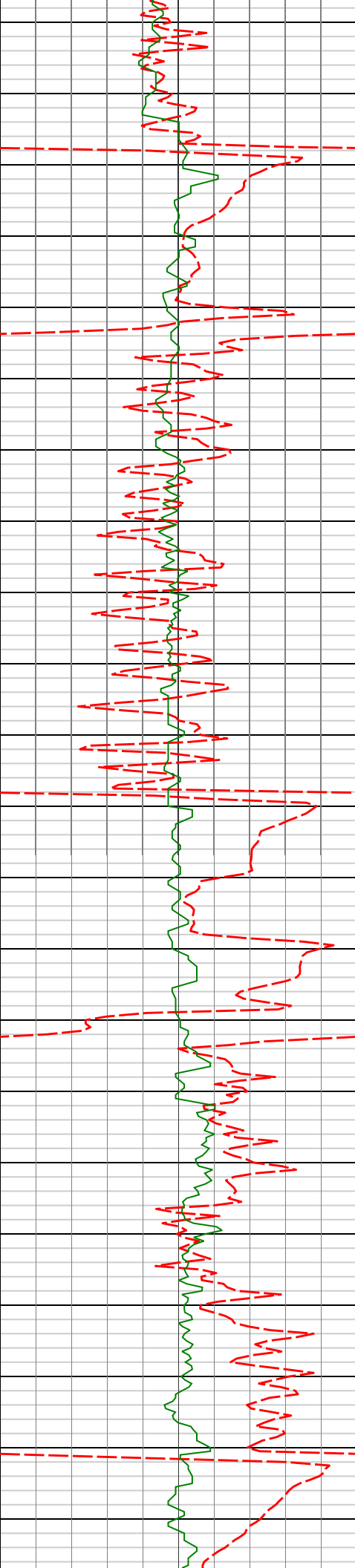
88.41°

4705.09'

142.03'



4800'	4875'	11.61°	81.03°	4798.22'	145.80'
4850'					
4900'	4970'	12.21°	79.09°	4891.17'	148.19'
4950'					
5000'	5065'	13.66°	77.31°	4983.76'	150.09'



5050'

5100'

5150'

5200'

5160'

13.61°

80.64°

5076.08'

152.41'

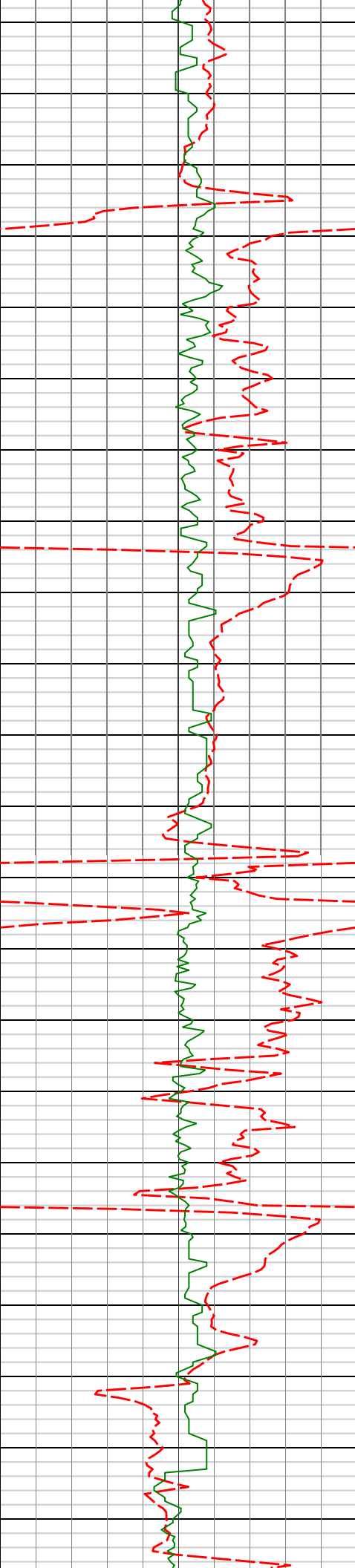
5255'

12.37°

79.98°

5168.65'

155.12'



5250'

5350'

12.89°

82.54°

5261.35'

158.10'

5300'

5350'

5445'

13.03°

82.98°

5353.93'

161.70'

5400'

5450'

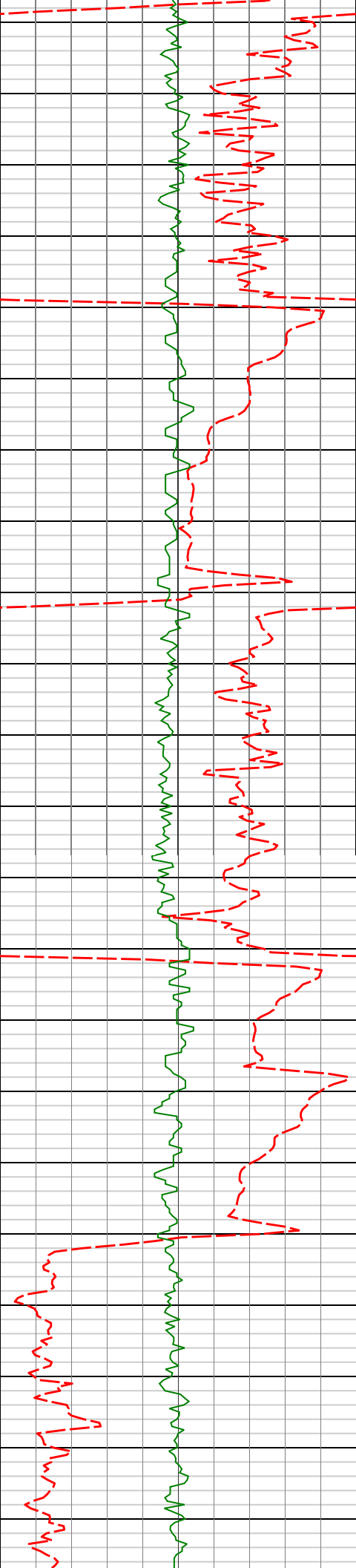
5540'

13.84°

78.07°

5446.34'

164.55'



5500'

5550'

5600'

5650'

5635'

13.83°

80.78°

5538.58'

167.08'

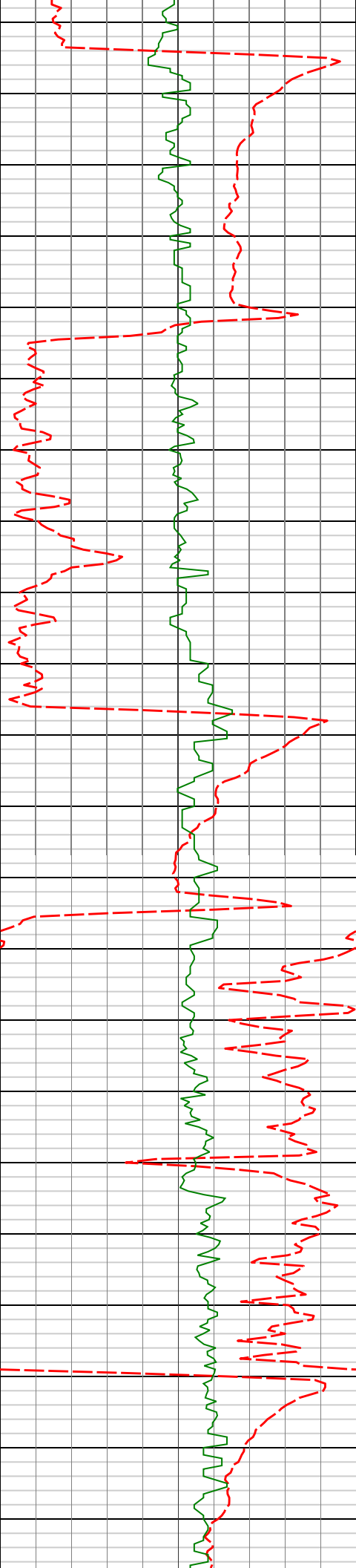
5730'

13.44°

84.00°

5630.91'

170.71'



5700'

5750'

5800'

5850'

5825'

13.84°

81.80°

5723.23'

174.54'

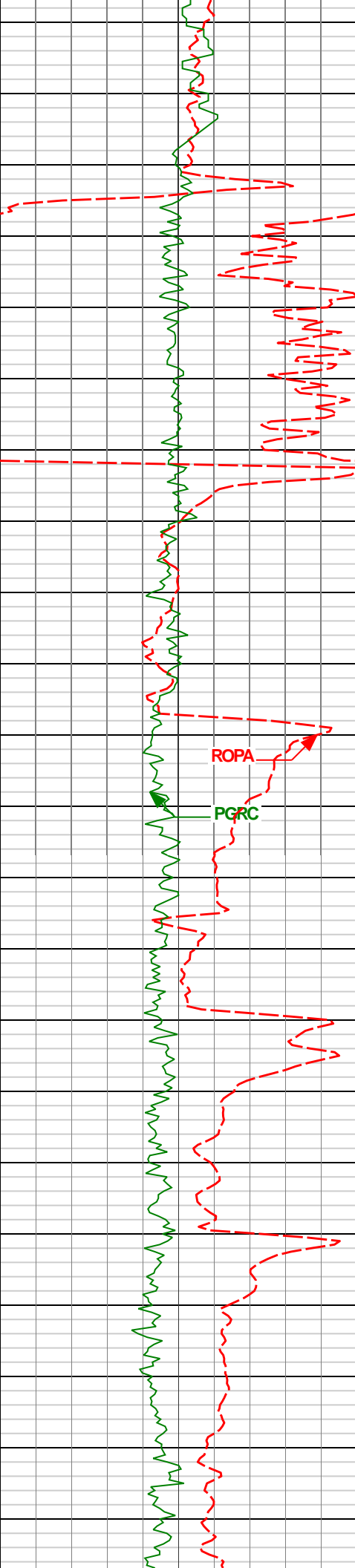
5920'

12.55°

79.54°

5815.72'

177.44'



5900'

6013'

12.22°

87.63°

5906.56'

181.07'

5950'

6055'

11.18°

87.25°

5947.69'

183.19'

6000'

ROPA

PGRC

6050'

6199'

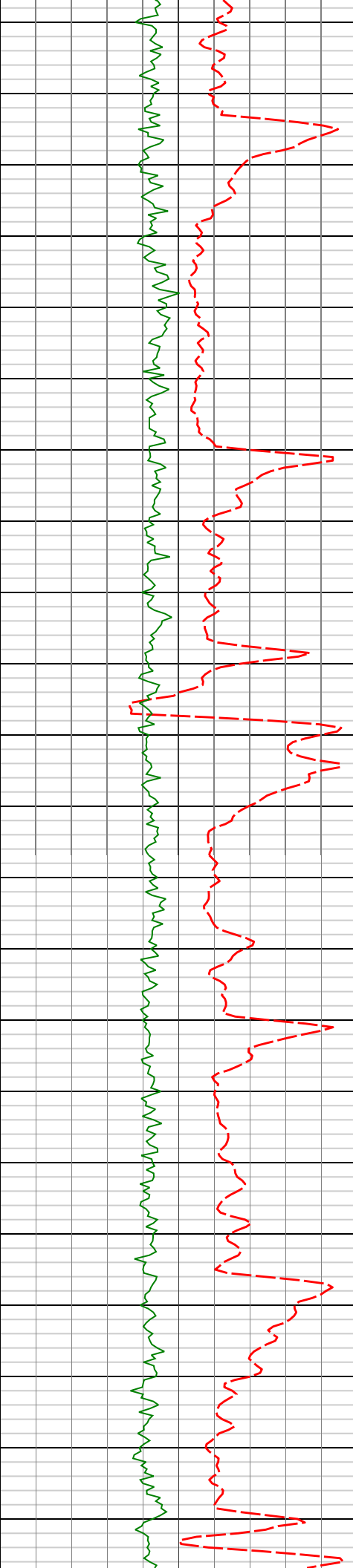
18.44°

96.16°

6086.83'

195.58'

6100'



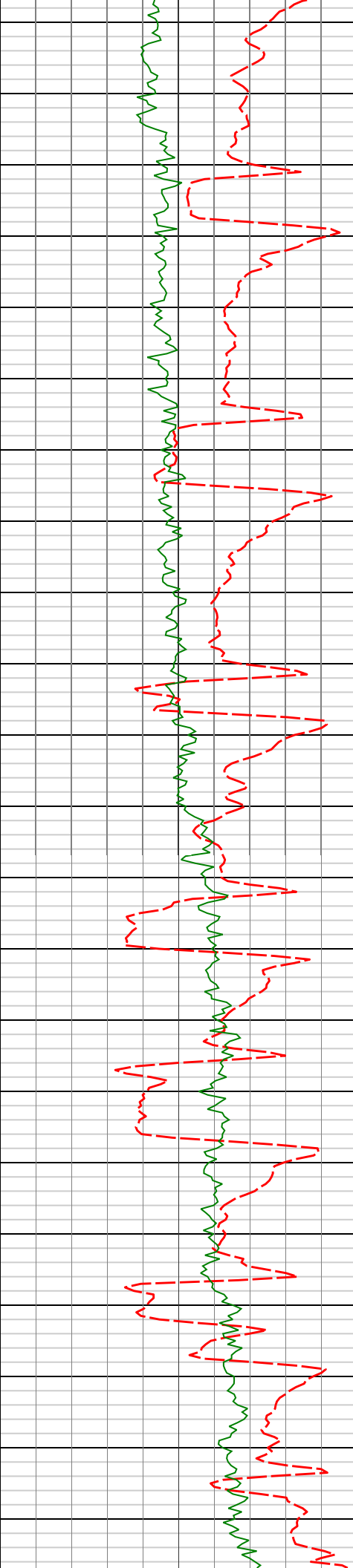
6150'

6200'

6250'

6300'

6247'	23.90°	97.89°	6131.57'	202.66'
6294'	27.90°	101.76°	6173.85'	211.95'
6342'	30.85°	106.73°	6215.68'	224.18'
6389'	33.87°	112.11°	6255.38'	239.13'
6437'	38.47°	118.97°	6294.14'	258.31'
6484'	41.25°	126.32°	6330.23'	281.26'



6350'

6532'

41.79°

132.69°

6366.18'

307.76'

6400'

6579'

42.58°

138.91°

6401.03'

335.80'

6450'

6627'

46.37°

144.74°

6435.29'

367.14'

6500'

6674'

50.52°

147.70°

6466.46'

400.80'

6722'

52.66°

151.40°

6496.29'

437.36'

6769'

52.83°

156.32°

6524.75'

474.28'

6550'

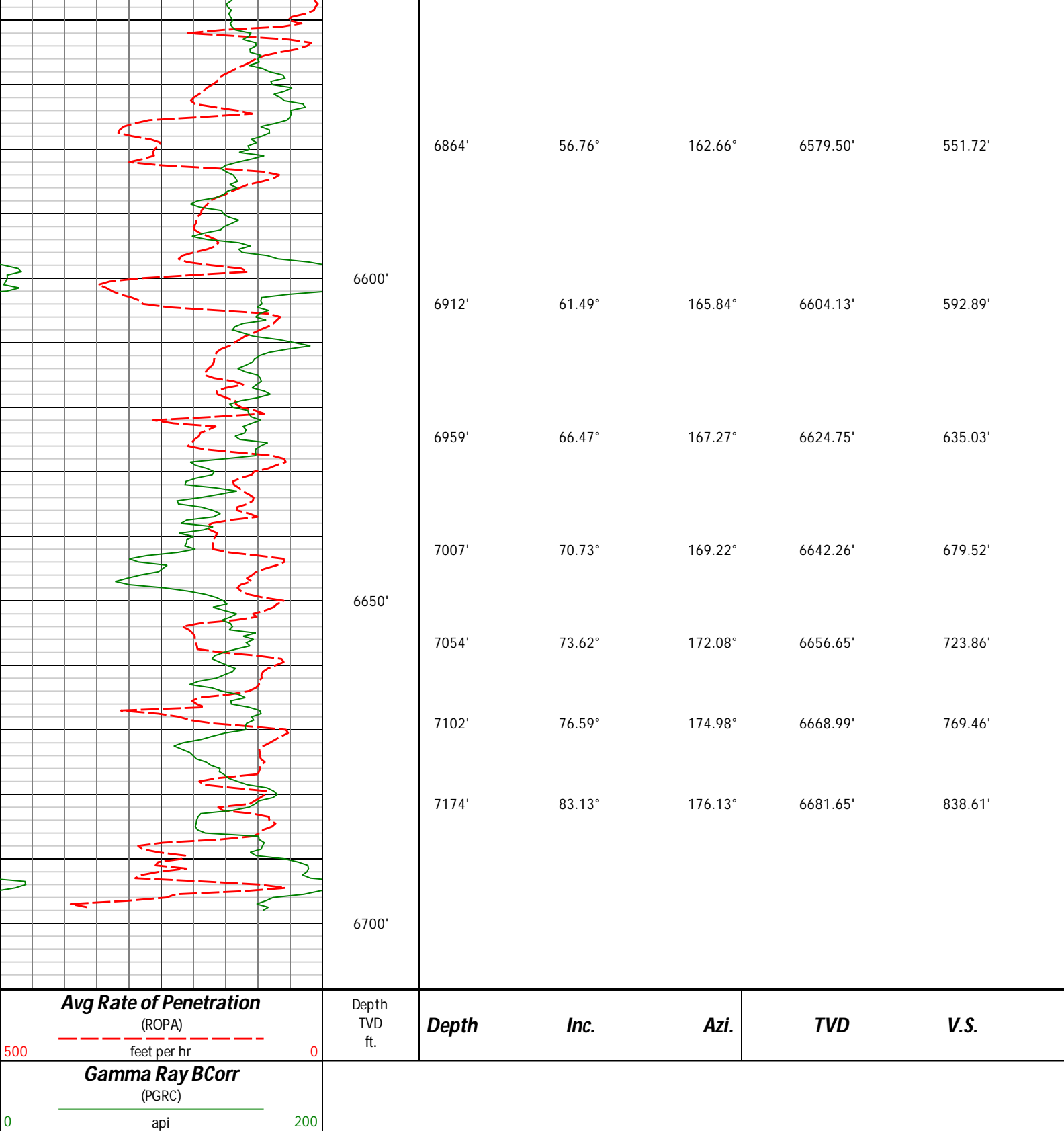
6817'

54.84°

160.01°

6553.08'

512.88'



HALLIBURTON

DIRECTIONAL SURVEY REPORT

Noble Energy
Mackinaw A19-79HNA
Wattenberg
Weld Colorado
USA
CA-XX-0901175137

0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
520.00	0.20	0.00	519.99	2.70 N	0.00 E	-2.58	0.12
770.00	0.80	0.00	769.98	4.88 N	0.00 E	-4.67	0.24
902.00	0.28	272.12	901.98	5.81 N	0.33 W	-5.65	0.64
994.00	1.09	108.12	993.97	5.55 N	0.28 E	-5.23	1.48
1179.00	1.08	112.20	1178.94	4.34 N	3.56 E	-3.12	0.04
1273.00	1.12	104.85	1272.92	3.77 N	5.27 E	-2.07	0.16
1366.00	1.19	96.10	1365.90	3.44 N	7.11 E	-1.21	0.20
1458.00	1.02	104.43	1457.89	3.13 N	8.85 E	-0.41	0.26
1553.00	2.52	83.78	1552.84	3.15 N	11.74 E	0.41	1.69
1648.00	3.52	75.22	1647.71	4.12 N	16.63 E	0.92	1.15
1743.00	4.26	76.42	1742.49	5.69 N	22.88 E	1.24	0.79
1838.00	5.89	75.35	1837.11	7.75 N	31.02 E	1.64	1.72
1932.00	6.50	80.09	1930.56	9.89 N	40.93 E	2.49	0.85
2122.00	9.09	78.24	2118.79	14.80 N	66.23 E	5.18	1.37
2217.00	10.58	81.50	2212.39	17.62 N	82.21 E	7.15	1.67
2312.00	11.05	78.72	2305.71	20.68 N	99.76 E	9.33	0.74
2407.00	11.49	88.71	2398.88	22.68 N	118.14 E	12.79	2.10
2502.00	13.24	89.84	2491.68	22.92 N	138.47 E	18.49	1.86
2597.00	12.79	86.62	2584.24	23.57 N	159.84 E	24.11	0.90
2692.00	13.38	86.51	2676.77	24.86 N	181.31 E	29.14	0.63
2787.00	14.68	83.13	2768.94	26.97 N	204.24 E	33.82	1.61
2882.00	15.30	87.41	2860.71	28.97 N	228.71 E	39.04	1.33
2977.00	14.25	84.18	2952.57	30.73 N	252.86 E	44.41	1.40
3072.00	15.15	87.04	3044.46	32.55 N	276.88 E	49.68	1.21
3167.00	12.97	83.93	3136.61	34.32 N	299.88 E	54.70	2.43
3262.00	12.76	83.93	3229.23	36.56 N	320.91 E	58.70	0.22
3357.00	12.50	89.82	3321.93	37.70 N	341.62 E	63.65	1.38
3452.00	11.72	87.53	3414.82	38.15 N	361.54 E	69.04	0.97
3547.00	12.28	87.98	3507.74	38.92 N	381.27 E	74.06	0.60
3641.00	12.83	85.28	3599.50	40.13 N	401.67 E	78.85	0.86
3736.00	14.80	87.55	3691.74	41.52 N	424.31 E	84.13	2.15
3831.00	15.57	87.95	3783.43	42.50 N	449.17 E	90.46	0.81
3926.00	16.38	87.95	3874.76	43.43 N	475.30 E	97.19	0.86
4021.00	16.54	88.19	3965.86	44.34 N	502.21 E	104.17	0.18
4116.00	13.99	87.14	4057.50	45.34 N	527.20 E	110.51	2.70
4211.00	13.92	84.67	4149.70	46.97 N	550.05 E	115.62	0.63
4306.00	13.56	83.72	4241.98	49.25 N	572.49 E	119.98	0.45
4401.00	12.50	86.30	4334.53	51.14 N	593.82 E	124.41	1.27
4496.00	12.44	84.41	4427.29	52.80 N	614.27 E	128.79	0.43
4591.00	12.78	86.42	4520.00	54.45 N	634.95 E	133.25	0.58
4685.00	11.35	85.23	4611.92	55.87 N	654.55 E	137.61	1.55
4780.00	11.19	88.41	4705.09	56.90 N	673.08 E	142.03	0.68
4875.00	11.61	81.03	4798.22	58.65 N	691.74 E	145.80	1.60
4970.00	12.21	79.09	4891.17	62.05 N	711.05 E	148.19	0.76
5065.00	13.66	77.31	4983.76	66.41 N	731.86 E	150.09	1.58
5160.00	13.61	80.64	5076.08	70.69 N	753.83 E	152.41	0.83
5255.00	12.37	79.98	5168.65	74.28 N	774.88 E	155.12	1.32
5350.00	12.89	82.54	5261.35	77.43 N	795.41 E	158.10	0.81
5445.00	13.03	82.98	5353.93	80.11 N	816.54 E	161.70	0.17
5540.00	13.84	78.07	5446.34	83.77 N	838.29 E	164.55	1.47
5635.00	13.83	80.78	5538.58	87.94 N	860.60 E	167.08	0.68
5730.00	13.44	84.00	5630.91	90.91 N	882.79 E	170.71	0.90
5825.00	13.84	81.80	5723.23	93.69 N	905.01 E	174.54	0.69
5920.00	12.55	79.54	5815.72	97.18 N	926.41 E	177.44	1.46
6013.00	12.22	87.63	5906.56	99.43 N	946.19 E	181.07	1.90
6055.00	11.18	87.25	5947.69	99.81 N	954.70 E	183.19	2.50
6199.00	18.44	96.16	6086.83	98.03 N	991.33 E	195.58	5.27
6247.00	23.90	97.89	6131.57	95.88 N	1008.52 E	202.66	11.44
6294.00	27.90	101.76	6173.85	92.33 N	1028.73 E	211.95	9.25
6342.00	30.85	106.73	6215.68	86.49 N	1051.52 E	224.18	7.96
6389.00	33.87	112.11	6255.38	78.09 N	1075.20 E	239.13	8.88
6437.00	38.47	118.97	6294.14	65.81 N	1100.68 E	258.31	12.75
6484.00	41.25	126.32	6330.23	49.54 N	1125.98 E	281.26	11.63
6532.00	41.79	132.69	6366.18	29.32 N	1150.50 E	307.76	8.86
6579.00	42.58	138.91	6401.03	6.71 N	1172.47 E	335.80	9.04
6627.00	46.37	144.74	6435.29	19.74 S	1193.19 E	367.14	11.62
6674.00	50.52	147.70	6466.46	48.98 S	1212.71 E	400.80	9.99
6722.00	52.66	151.40	6496.29	81.40 S	1231.75 E	437.36	7.52
6769.00	55.23	153.23	6524.55	114.32 S	1242.04 E	474.88	1.84

6769.00	52.83	156.32	6524.75	114.96 S	1248.21 E	474.28	8.34
6817.00	54.84	160.01	6553.08	150.93 S	1262.61 E	512.88	7.48
6864.00	56.76	162.66	6579.50	187.75 S	1275.03 E	551.72	6.19
6912.00	61.49	165.84	6604.13	227.39 S	1286.19 E	592.89	11.39
6959.00	66.47	167.27	6624.75	268.46 S	1295.99 E	635.03	10.94
7007.00	70.73	169.22	6642.26	312.20 S	1305.08 E	679.52	9.65
7054.00	73.62	172.08	6656.65	356.34 S	1312.34 E	723.86	8.43
7102.00	76.59	174.98	6668.99	402.42 S	1317.56 E	769.46	8.51
7174.00	83.13	176.13	6681.65	473.05 S	1323.04 E	838.61	9.23
7260.00	87.53	180.02	6688.65	558.68 S	1325.91 E	921.35	6.81
7320.00	86.88	179.39	6691.57	618.60 S	1326.22 E	978.75	1.50
7415.00	88.71	179.51	6695.23	713.53 S	1327.12 E	1069.81	1.92
7510.00	90.12	179.92	6696.20	808.52 S	1327.59 E	1160.80	1.55
7604.00	88.46	180.14	6697.36	902.51 S	1327.55 E	1250.68	1.79
7699.00	90.80	179.39	6697.98	997.50 S	1327.94 E	1341.65	2.59
7794.00	90.40	179.12	6696.98	1092.48 S	1329.17 E	1432.86	0.51
7889.00	89.72	179.57	6696.88	1187.48 S	1330.26 E	1524.03	0.85
7984.00	90.71	179.66	6696.52	1282.47 S	1330.90 E	1615.08	1.04
8079.00	91.05	179.35	6695.07	1377.46 S	1331.72 E	1706.17	0.48
8173.00	91.17	179.12	6693.25	1471.43 S	1332.98 E	1796.42	0.29
8268.00	89.57	178.62	6692.63	1566.41 S	1334.85 E	1887.81	1.77
8363.00	90.03	177.84	6692.96	1661.36 S	1337.79 E	1979.48	0.95
8458.00	90.00	176.92	6692.94	1756.26 S	1342.13 E	2071.52	0.98
8553.00	90.25	177.94	6692.73	1851.16 S	1346.40 E	2163.53	1.10
8647.00	90.37	179.27	6692.23	1945.13 S	1348.68 E	2254.08	1.43
8742.00	89.78	180.44	6692.10	2040.13 S	1348.92 E	2345.01	1.37
8837.00	90.52	179.39	6691.85	2135.13 S	1349.07 E	2435.91	1.35
8932.00	89.54	180.75	6691.80	2230.12 S	1348.95 E	2526.74	1.77
9027.00	88.77	180.98	6693.20	2325.10 S	1347.52 E	2617.16	0.85
9122.00	89.44	180.89	6694.69	2420.08 S	1345.97 E	2707.55	0.72
9217.00	88.12	180.62	6696.70	2515.04 S	1344.72 E	2798.02	1.42
9312.00	89.38	179.43	6698.77	2610.02 S	1344.68 E	2888.85	1.82
9407.00	90.59	178.93	6698.80	2705.01 S	1346.04 E	2980.09	1.37
9501.00	90.83	178.18	6697.64	2798.97 S	1348.41 E	3070.65	0.84
9596.00	91.39	180.58	6695.80	2893.94 S	1349.43 E	3161.79	2.58
9691.00	91.73	181.09	6693.22	2988.89 S	1348.05 E	3252.21	0.65
9786.00	91.85	181.21	6690.25	3083.83 S	1346.15 E	3342.45	0.19
9881.00	90.40	180.92	6688.39	3178.79 S	1344.38 E	3432.76	1.55
9975.00	89.63	181.25	6688.36	3272.77 S	1342.59 E	3522.13	0.89
10070.00	89.66	180.76	6688.95	3367.75 S	1340.92 E	3612.49	0.52
10165.00	89.20	180.67	6689.90	3462.74 S	1339.73 E	3703.00	0.49
10260.00	88.74	179.51	6691.61	3557.72 S	1339.58 E	3793.80	1.31
10355.00	90.22	179.02	6692.48	3652.71 S	1340.80 E	3885.00	1.64
10450.00	90.46	178.38	6691.92	3747.68 S	1342.95 E	3976.47	0.72
10545.00	90.40	177.14	6691.20	3842.61 S	1346.67 E	4068.34	1.31
10640.00	90.09	176.62	6690.79	3937.46 S	1351.84 E	4160.58	0.63
10735.00	89.94	175.37	6690.76	4032.23 S	1358.47 E	4253.16	1.33
10829.00	89.75	174.39	6691.02	4125.85 S	1366.86 E	4345.15	1.06
10924.00	89.69	173.89	6691.48	4220.36 S	1376.56 E	4438.37	0.53
11019.00	89.57	173.42	6692.09	4314.77 S	1387.05 E	4531.74	0.51
11084.00	89.41	173.07	6692.67	4379.32 S	1394.69 E	4595.70	0.59
11144.00	89.41	173.07	6693.28	4438.88 S	1401.93 E	4654.78	0.01

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 163.03 DEGREES (GRID)
A TOTAL CORRECTION OF 7.88 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.
HORIZONTAL DISPLACEMENT(CLOSURE) AT 11144.00 FEET
IS 4655.00 FEET ALONG 162.47 DEGREES (GRID)**