

PCGK : Pressure Case Gamma
PCDC: Pressure Case Directional

1 : 600 / 1 : 240

Country		: USA			
Field		: Wattenberg			
Location		: Lat: 40° 31' 24.89" North Long: 104° 23' 15.61" West			
Well		: Crow Creek State AC36-76HN			
Company		: Noble Energy			
Rig		: H&P 315			
LOCATION		Latitude : 40° 31' 24.89" North Longitude : 104° 23' 15.61" West UTM Easting = 3,309,222.734 ft UTM Northing = 1,435,520.504 ft		Other Services Directional Drilling	
Permanent Datum		: Ground Level		Elev. KB N/A	
Log Measured From		: Drill Floor		24.00 ft Above Permanent Datum DF 4813.00 ft	
Drilling Measured From		: Drill Floor		GL 4789.00 ft WD N/A	
Depth Logged		: 648.99 ft To 6,613.56 ft		Unit No. : 11610113	
Date Logged		: 16-Oct-13 To 18-Oct-13		Job No. : CA-XX-090080837	
Total Depth MD		: 6,969.00 ft TVD: 6,613.56 ft		Plot Type : Final	
Spud Date		: 15-Oct-13		Plot Date : 19-Oct-13	
Run No.		Borehole Record (TVD)		Run No.	
		Size From To		Size From To	
2		8.750 in 648.99 ft 5,950.63 ft			
3		8.750 in 5,950.63 ft 6,613.56 ft			
				Casing Record (TVD)	
				Size Weight From To	
				7.000 in 26.00 lbpf SURFACE 6,613.03 ft	

WELL INFORMATION

MWD Run Number	100	200		
Date run completed	17-Oct-13	18-Oct-13		
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)	648.99	5,950.63		
Log End Depth (TVD, ft)	5,950.63	6,613.56		
Drill or Wipe	Drill	Drill		
Drill/Wipe Start Date and Time	16-Oct-13 05:00	17-Oct-13 08:45		
Drill/Wipe End Date and Time	16-Oct-13 22:45	18-Oct-13 00:00		
Min Inc (deg) @ Depth (TVD, ft)	0.10 @ 1,457.98	1.31 @ 5,921.65		
Max Inc (deg) @ Depth (TVD, ft)	12.56 @ 3,062.87	80.41 @ 6,607.21		
Bit TFA(in2) / Bit Type	0.75 / PDC	0.86 / PDC		
Flow Rate (gpm)	594.41	560.81		
Max AV (fpm) / CV (fpm) @ MWD	N/A / N/A	N/A / N/A		
Fluid Type	Fresh Water Gel	Fresh Water Gel		
Density (ppg) / Viscosity (spqt)	8.70 / 28.00	9.93 / 38.00		
Filtrate CL (ppm)	1,300.00	1,200.00		
pH / Fluid Loss (mptm)	9.20 / 0	8.80 / 0		
PV (cP) / YP (Ihf2)	3 / 4.00	13 / 12.00		
% Solids / % Sand	2.3 / .2	11.60 / 0.20		
% 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		

Max Tool Temp (degF) / Source	145.90 / PCM	160.83 / PCM			
Rm @ Max Tool Temp (degF)	N/A @ N/A	N/A @ N/A			
Lead MWD Engineer	Paul Kock	Paul Kock			
Customer Representative	Steve Record	Steve Record			

SENSOR INFORMATION

Downhole Processor Information

Tool Type	PCM	PCM			
Software Version	5.84	5.84			
Sub Serial Number	11404299	11404299			
Insert Serial Number	12001055	12001055			
Date and Time Initialized	15-Oct-13 21:14	15-Oct-13 21:14			
Date and Time Read	18-Oct-13 07:57	18-Oct-13 08:29			
ECMB SW Version	N/A	N/A			

Directional Sensor Information

Tool Type	PCDC	PCDC			
Distance From Bit (ft)	54.12	52.25			
Software Version	6.21	6.21			
Sub Serial Number	11404299	11404299			
Sonde Serial Number	12177609	12177609			
Sensor ID Number	N/A	N/A			
Toolface Offset (deg)	287.34	279.70			

Gamma Ray Sensor Information

Tool Type	PCG	PCG			
Distance From Bit (ft)	49.12	47.25			
Recorded Sample Period (sec)	10	10			
Software Version	8.15	8.15			
Sub Serial Number	11404299	11404299			
Insert/Sonde Serial Number	11293274	11293274			

REMARKS

1. All depths are calibrated to the driller's pipe tally and are measured from the Rig drill floor.
2. No depth corrections have been made for pipe stretch or compression.
3. All data presented is recorded (memory data) unless otherwise stated.
 - ROPA: Average Rate of Penetration is real time data.
 - PGRC: Smooth Pressure Case Gamma Ray Borehole corrected is recorded data.
4. The following smoothing parameters have been applied to the data:
 - All 2" (1:600) logs - 1 ft. interval, 3 ft. coercion distance.
 - All 5" (1:240) logs - .5 ft. interval, .6 ft. coercion distance.
5. INSITE version 8.0.0

WARRANTY

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Sperry Drilling Services

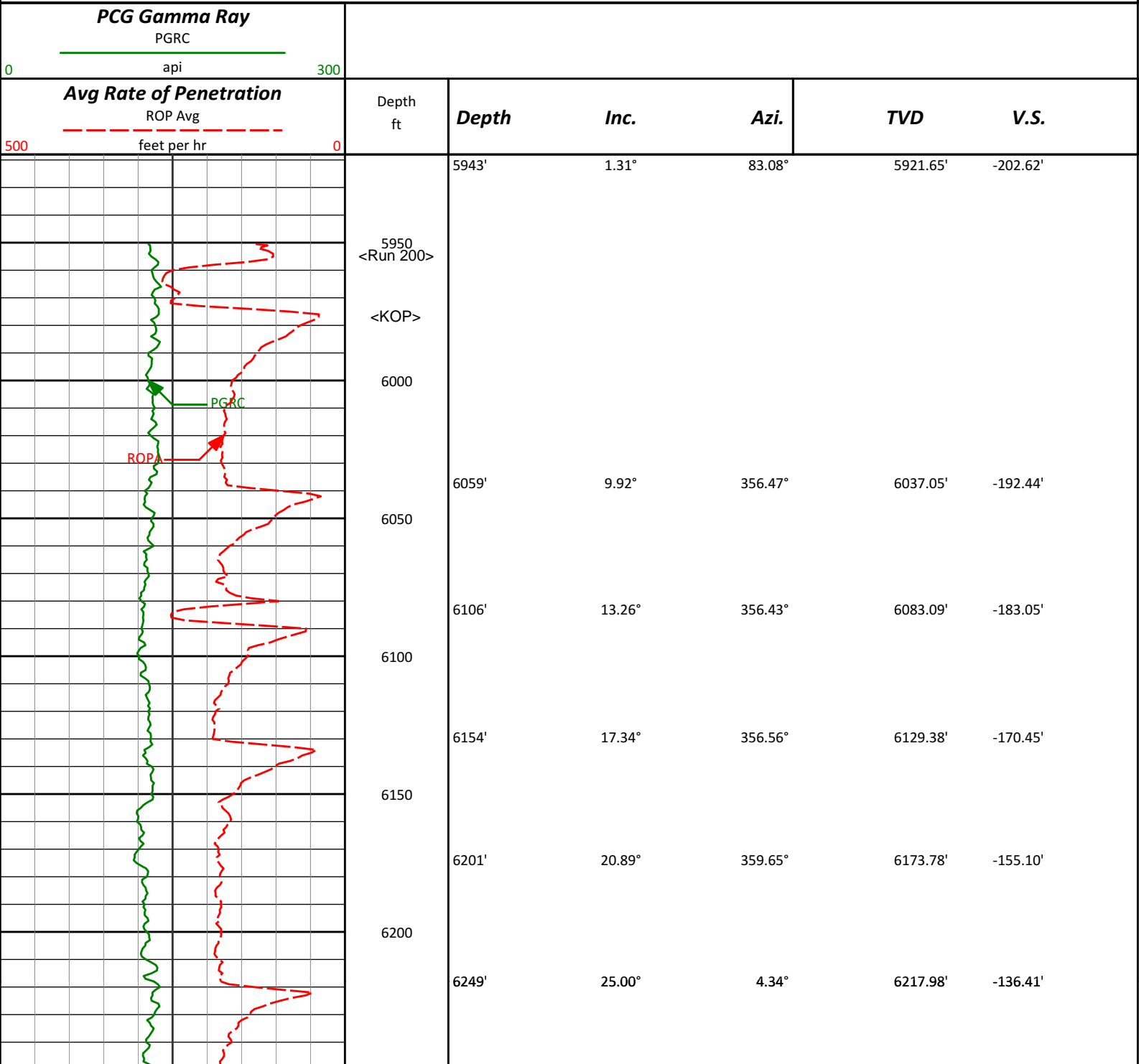
TVD Detail Log 1:600

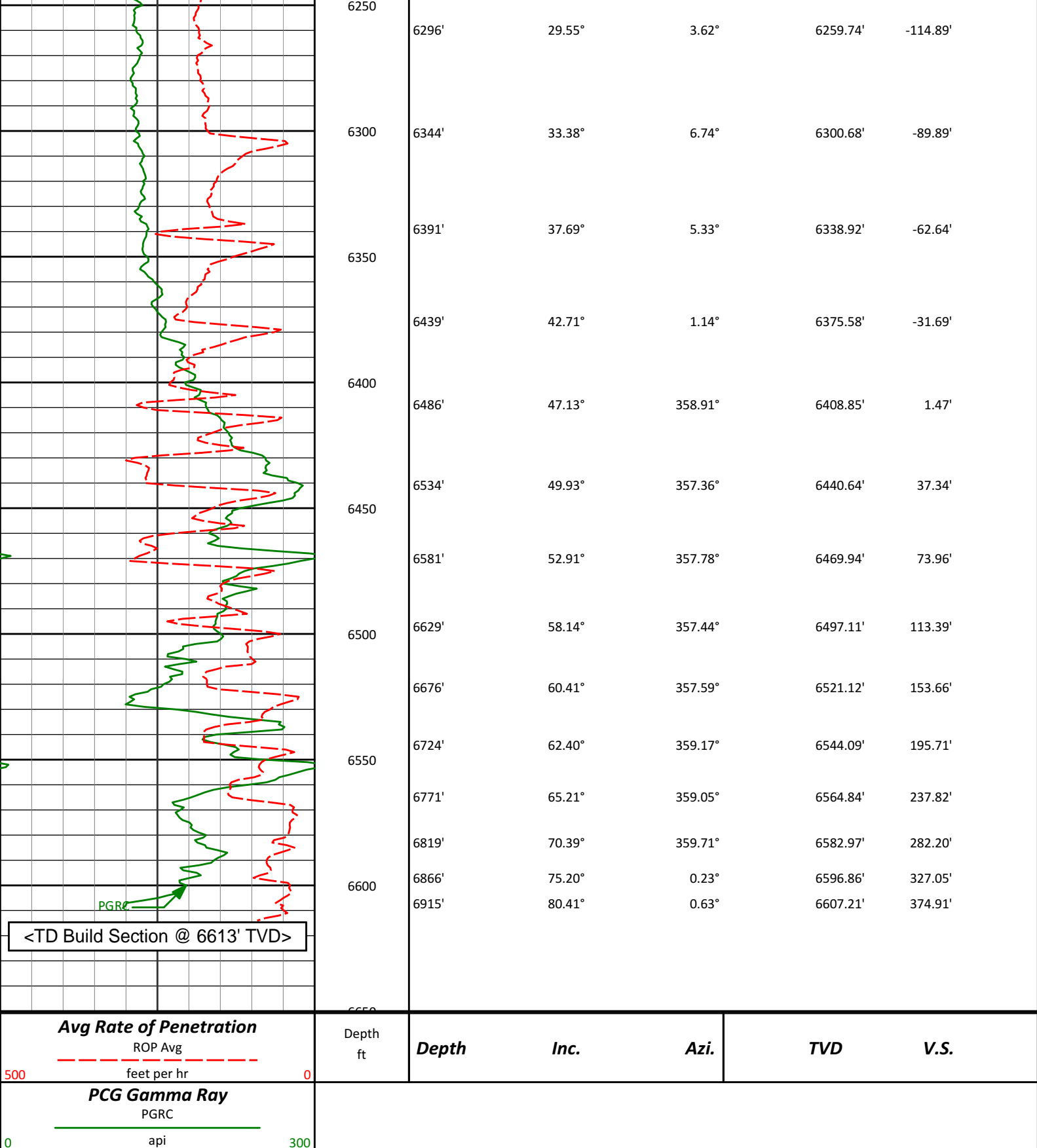
Noble Energy, Inc

Crow Creek State AC36-76HN

H&P 315

T7N R63W

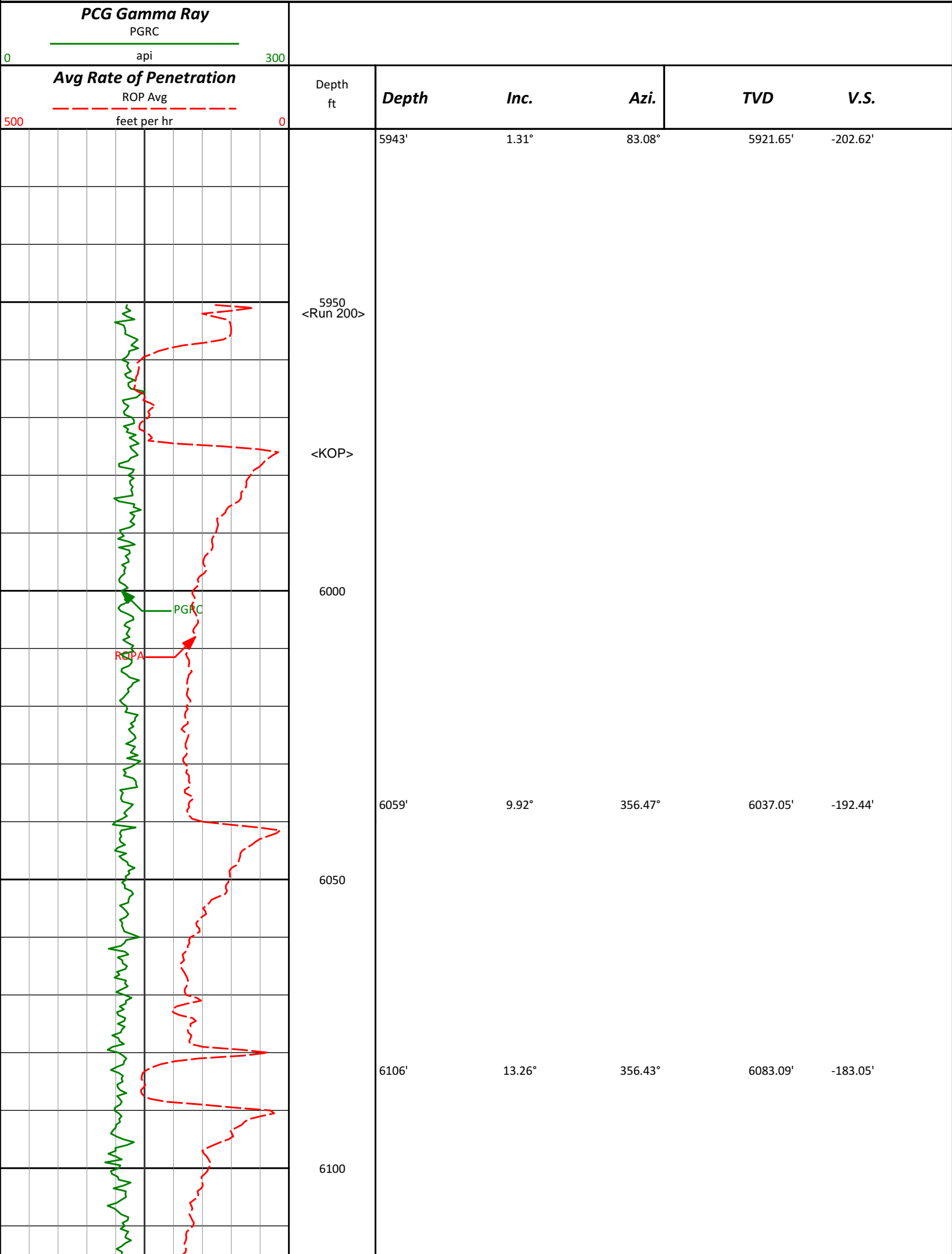


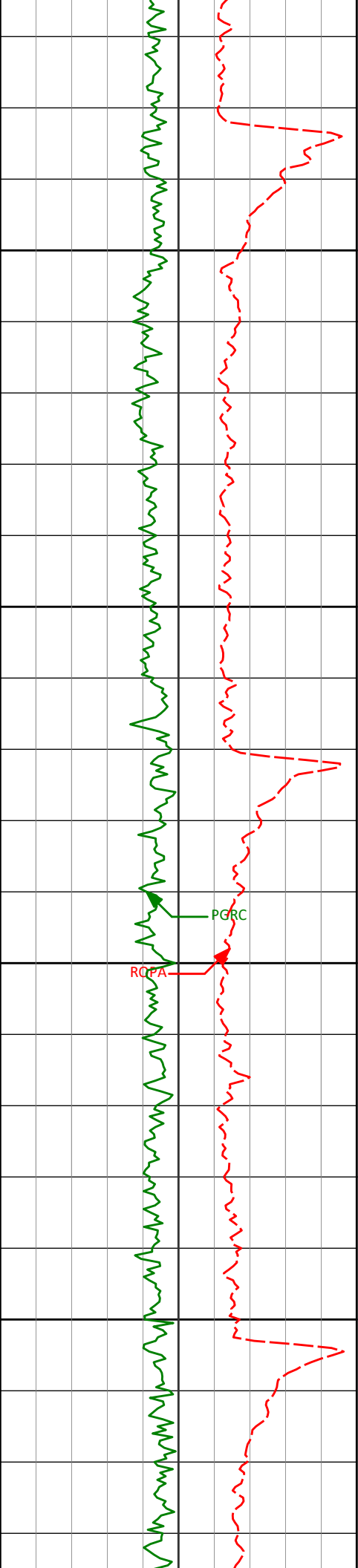


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Sperry Drilling Services

TVD Detail Log 1:240





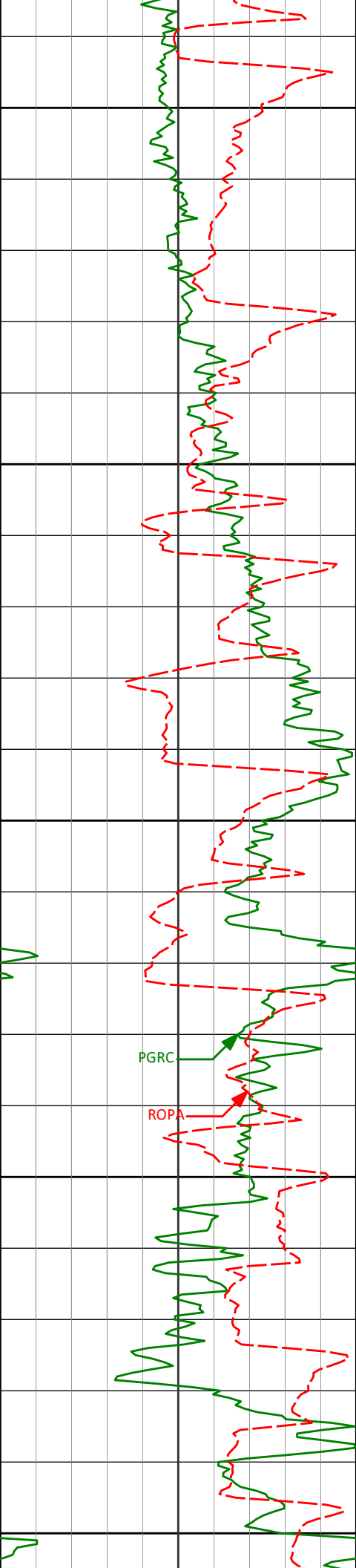
6150

6200

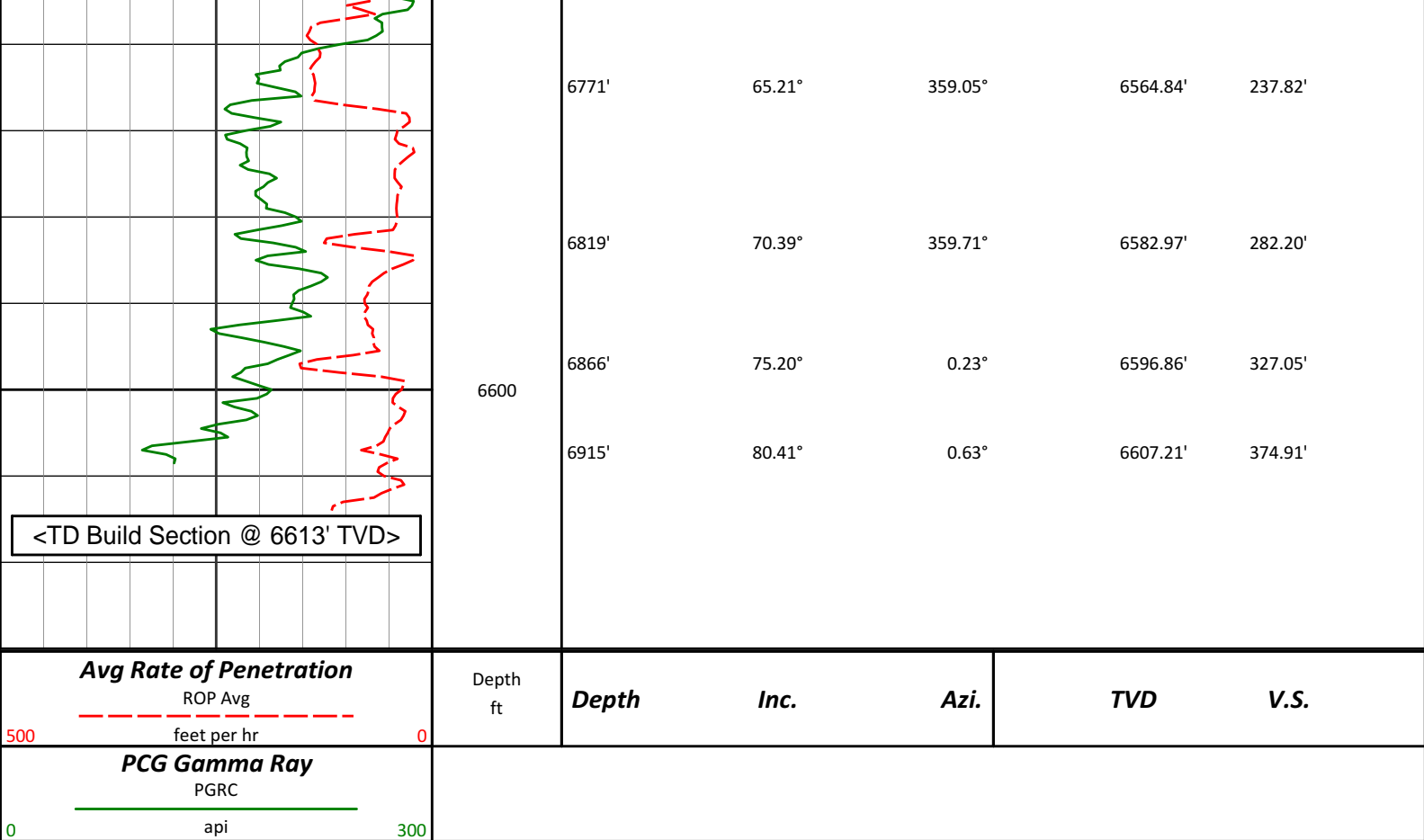
6250

6300

6154'	17.34°	356.56°	6129.38'	-170.45'
6201'	20.89°	359.65°	6173.78'	-155.10'
6249'	25.00°	4.34°	6217.98'	-136.41'
6296'	29.55°	3.62°	6259.74'	-114.89'
6344'	33.38°	6.74°	6300.68'	-89.89'



	6391'	37.69°	5.33°	6338.92'	-62.64'
6350					
	6439'	42.71°	1.14°	6375.58'	-31.69'
6400					
	6486'	47.13°	358.91°	6408.85'	1.47'
6450					
	6534'	49.93°	357.36°	6440.64'	37.34'
6500					
	6581'	52.91°	357.78°	6469.94'	73.96'
	6629'	58.14°	357.44°	6497.11'	113.39'
6550					
	6676'	60.41°	357.59°	6521.12'	153.66'
	6724'	62.40°	359.17°	6544.09'	195.71'



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DIRECTIONAL SURVEY REPORT

Noble Energy
Crow Creek State AC36-76HN
Wattenberg
Weld Colorado
USA
CA-XX-0900808837

Measured Depth (feet)	Inclination (degrees)	Direction (degrees)	Vertical Depth (feet)	Latitude (feet)	Departure (feet)	Vertical Section (feet)	Dogleg (deg/100ft)
0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
322.00	0.50	335.57	322.00	1.28 N	0.58 W	1.26	0.16
609.00	0.30	313.67	608.99	2.94 N	1.64 W	2.88	0.09
717.00	0.25	243.31	716.99	3.03 N	2.06 W	2.95	0.30
808.00	0.34	149.19	807.99	2.71 N	2.09 W	2.63	0.48
901.00	0.28	263.89	900.99	2.45 N	2.18 W	2.36	0.56
994.00	0.25	259.62	993.99	2.39 N	2.59 W	2.29	0.04
1086.00	0.46	235.84	1085.98	2.14 N	3.09 W	2.03	0.27
1180.00	0.20	287.66	1179.98	1.98 N	3.56 W	1.85	0.39
1273.00	0.47	171.29	1272.98	1.65 N	3.65 W	1.52	0.63
1366.00	0.28	162.59	1365.98	1.06 N	3.53 W	0.93	0.22
1458.00	0.10	155.89	1457.98	0.78 N	3.43 W	0.65	0.19
1553.00	0.33	160.11	1552.98	0.45 N	3.30 W	0.33	0.24
1648.00	0.31	129.61	1647.98	0.03 N	3.01 W	-0.08	0.18
1743.00	0.33	182.40	1742.98	0.41 S	2.82 W	-0.52	0.30
1838.00	0.37	132.43	1837.97	0.89 S	2.61 W	-0.99	0.31
1933.00	0.66	127.39	1932.97	1.43 S	1.95 W	-1.50	0.31
2028.00	0.55	105.85	2027.96	1.89 S	1.07 W	-1.93	0.26
2123.00	0.51	119.82	2122.96	2.23 S	0.26 W	-2.23	0.14
2218.00	1.03	66.54	2217.95	2.10 S	0.89 E	-2.06	0.87
2313.00	2.74	108.95	2312.90	2.50 S	3.82 E	-2.35	2.21
2408.00	3.82	134.72	2407.75	5.46 S	8.22 E	-5.16	1.90

2503.00	5.65	139.65	2502.42	11.26 S	13.50 E	-10.75	1.97
2597.00	7.94	147.50	2595.76	20.26 S	19.99 E	-19.51	2.63
2692.00	9.46	148.27	2689.66	32.43 S	27.62 E	-31.39	1.60
2787.00	11.32	150.24	2783.10	47.17 S	36.35 E	-45.80	2.00
2882.00	10.77	148.10	2876.34	62.80 S	45.67 E	-61.08	0.72
2977.00	10.24	147.96	2969.75	77.50 S	54.84 E	-75.42	0.57
3072.00	12.56	147.11	3062.87	93.33 S	64.93 E	-90.87	2.45
3167.00	11.86	145.70	3155.72	110.07 S	76.04 E	-107.19	0.80
3262.00	11.29	142.95	3248.79	125.55 S	87.15 E	-122.26	0.83
3357.00	10.15	141.20	3342.12	139.50 S	98.00 E	-135.80	1.25
3452.00	8.33	139.54	3435.89	151.27 S	107.71 E	-147.20	1.94
3546.00	6.91	142.76	3529.06	160.95 S	115.55 E	-156.58	1.58
3641.00	7.13	144.84	3623.34	170.31 S	122.40 E	-165.69	0.35
3736.00	7.93	145.03	3717.52	180.50 S	129.55 E	-175.61	0.85
3831.00	6.94	140.07	3811.73	190.27 S	136.99 E	-185.10	1.24
3926.00	6.28	134.80	3906.09	198.34 S	144.36 E	-192.89	0.94
4021.00	3.24	124.05	4000.76	203.50 S	150.28 E	-197.83	3.32
4116.00	1.53	77.08	4095.68	204.72 S	153.74 E	-198.92	2.59
4211.00	1.52	293.67	4190.67	203.93 S	153.82 E	-198.13	3.05
4496.00	3.30	309.78	4475.41	197.16 S	144.05 E	-191.73	0.66
4591.00	1.90	295.05	4570.31	194.75 S	140.52 E	-189.44	1.62
4686.00	3.21	316.47	4665.21	192.15 S	137.26 E	-186.97	1.68
4780.00	2.24	320.32	4759.10	188.83 S	134.27 E	-183.75	1.04
4875.00	1.64	269.06	4854.06	187.42 S	131.73 E	-182.44	1.86
4971.00	1.76	159.30	4950.03	188.82 S	130.88 E	-183.87	2.90
5065.00	1.25	152.22	5044.00	191.08 S	131.87 E	-186.10	0.58
5350.00	2.66	163.60	5328.83	200.19 S	135.19 E	-195.07	0.51
5445.00	1.96	164.59	5423.75	203.87 S	136.24 E	-198.71	0.74
5540.00	1.08	80.08	5518.72	205.28 S	137.56 E	-200.08	2.26
5635.00	0.87	95.76	5613.71	205.20 S	139.16 E	-199.94	0.36
5825.00	1.33	128.17	5803.68	206.71 S	142.34 E	-201.33	0.40
5916.00	1.24	125.88	5894.65	207.94 S	143.97 E	-202.50	0.12
5943.00	1.31	83.08	5921.65	208.08 S	144.51 E	-202.62	3.45
6059.00	9.92	356.47	6037.05	197.92 S	145.21 E	-192.44	8.56
6106.00	13.26	356.43	6083.09	188.50 S	144.62 E	-183.05	7.11
6154.00	17.34	356.56	6129.38	175.87 S	143.85 E	-170.45	8.50
6201.00	20.89	359.65	6173.78	160.49 S	143.38 E	-155.10	7.85
6249.00	25.00	4.34	6217.98	141.81 S	144.09 E	-136.41	9.37
6296.00	29.55	3.62	6259.74	120.33 S	145.58 E	-114.89	9.71
6344.00	33.38	6.74	6300.68	95.40 S	147.87 E	-89.89	8.67
6391.00	37.69	5.33	6338.92	68.24 S	150.73 E	-62.64	9.35
6439.00	42.71	1.14	6375.58	37.32 S	152.41 E	-31.69	11.87
6486.00	47.13	358.91	6408.85	4.15 S	152.40 E	1.47	9.97
6534.00	49.93	357.36	6440.64	31.79 N	151.22 E	37.34	6.31
6581.00	52.91	357.78	6469.94	68.49 N	149.67 E	73.96	6.38
6629.00	58.14	357.44	6497.11	108.01 N	148.01 E	113.39	10.93
6676.00	60.41	357.59	6521.12	148.38 N	146.26 E	153.66	4.84
6724.00	62.40	359.17	6544.09	190.50 N	145.08 E	195.71	5.05
6771.00	65.21	359.05	6564.84	232.67 N	144.42 E	237.82	5.98
6819.00	70.39	359.71	6582.97	277.09 N	143.94 E	282.20	10.88
6866.00	75.20	0.23	6596.86	321.97 N	143.92 E	327.05	10.29
6915.00	80.41	0.63	6607.21	369.85 N	144.28 E	374.91	10.66
6969.00	86.06	0.63	6613.56	423.45 N	144.87 E	428.50	10.46

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 2.11 DEGREES (GRID)
A TOTAL CORRECTION OF 7.67 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.
HORIZONTAL DISPLACEMENT(CLOSURE) AT 6969.00 FEET
IS 447.54 FEET ALONG 18.89 DEGREES (GRID)**

Surface surveys at 322 ft and 609 ft have had azimuths corrected to grid north, but were not taken by Halliburton.

Last survey is a projection from 6915 ft MD to TD at 6969 ft MD.

