HALLIBURTON | Sperry Drilling

PCDC - Pressure Cased Directional
PCG - Pressure Cased Gamma

Powered by INSITE™

1 : 600 / 1 : 240

Country : **USA**
Field : **Wattenberg**
Location : **Lat: 40° 31' 19.31" North**
Long: 104° 23' 32.93" West
Well : **Crow Creek AA01-789**
Company : **Noble Energy**
Rig : **H&P 315**

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Well : **Crow Creek AA01-789**
Field : **Wattenberg**
Country : **USA**
API Number : **05-123-40166**

LOCATION
Latitude : **40° 31' 19.31" North**
Longitude : **104° 23' 32.93" West**
UTM Easting = 449,980 ft
UTM Northing = 1,252,355 ft

Other Services
Directional Drilling

Permanent Datum : **Ground Level** Elevation : **4796.00 ft**
Log Measured From : **Drill Floor** **24.00 ft** Above Permanent Datum
Drilling Measured From : **Drill Floor**

TVD LOG

Elev. KB **N/A**
DF **4820.00 ft**
GL **4796.00 ft**
WD **N/A**

Depth Logged : **696.97 ft** To **6,694.66 ft**
Date Logged : **18-Dec-14** To **20-Dec-14**
Total Depth MD : **7,046.00 ft** TVD : **6,694.66 ft**
Spud Date : **15-Dec-14**

Unit No. : **11610113** Job No. : **CA-XX-0901850044**
Plot Type : **Final**
Plot Date : **21-Dec-14**

Run No.	Borehole Record (TVD) Size	From	To
100	8.750 in	696.97 ft	6,694.66 ft

Run No.	Borehole Record (TVD) Size	From	To

Casing Record (TVD) Size	Weight	From	To
9.625 in	36.00 lbpf	SURFACE	694.97 ft

WELL INFORMATION

MWD Run Number	Date run completed	Rig Bit Number	Bit Size (in)	Tool Nominal OD (in)	Log Start Depth (MD, ft)	Log End Depth (MD, ft)	Drill or Wipe	Drill/Wipe Start Date and Time	Drill/Wipe End Date and Time	Min Inc (deg) @ Depth (MD, ft)	Max Inc (deg) @ Depth (MD, ft)	Bit TFA(in2) / Bit Type	Flow Rate (gpm)	Max AV (fpm) / CV (fpm) @ MWD	Fluid Type	Density (ppg) / Viscosity (spqt)	Filtrate CL (ppm)	pH / Fluid Loss (mptm)	PV (cP) / YP (lhf2)	% Solids / % Sand	% Oil / Oil:Water Ratio	Rm @ Measured Temp (degF)	Rmf @ Measured Temp (degF)	Rmc @ Measured Temp (degF)
100	20-Dec-14	2	8.750	6.750	697.00	7,046.00	Drill	18-Dec-14 10:11	19-Dec-14 22:58	0.38 @ 819.00	79.25 @ 6,988.00	0.91 / PDC	620.85	N/A / N/A	Native/Spud Mud	9.18 / 42.00	800.00	9.30 / 7	12 / 14.00	8.80 / 0.25	N/A / N/A	N/A @ N/A	N/A @ N/A	N/A @ N/A

Max Tool Temp (degF) / Source	165.58 / PCM				
Rm @ Max Tool Temp (degF)	N/A @ N/A				
Lead MWD Engineer	Paul Sheets				
Customer Representative	Martin Suarez				

SENSOR INFORMATION

Downhole Processor Information

Tool Type	PCM				
Software Version	5.93				
Sub Serial Number	11404272				
Insert Serial Number	11680742				
Date and Time Initialized	16-Dec-14 22:59				
Date and Time Read	20-Dec-14 08:32				
ECMB SW Version	N/A				

Directional Sensor Information

Tool Type	PCDC				
Distance From Bit (ft)	55.74				
Software Version	6.21				
Sub Serial Number	11404272				
Sonde Serial Number	11638470				
Sensor ID Number	N/A				
Toolface Offset (deg)	99.35				

Gamma Ray Sensor Information

Tool Type	PCG				
Distance From Bit (ft)	50.64				
Recorded Sample Period (sec)	10				
Software Version	8.15				
Sub Serial Number	11404272				
Insert/Sonde Serial Number	11293343				

REMARKS

1. All depths are calibrated to the drillers 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 8.1.10

WARRANTY

HALLIBURTON

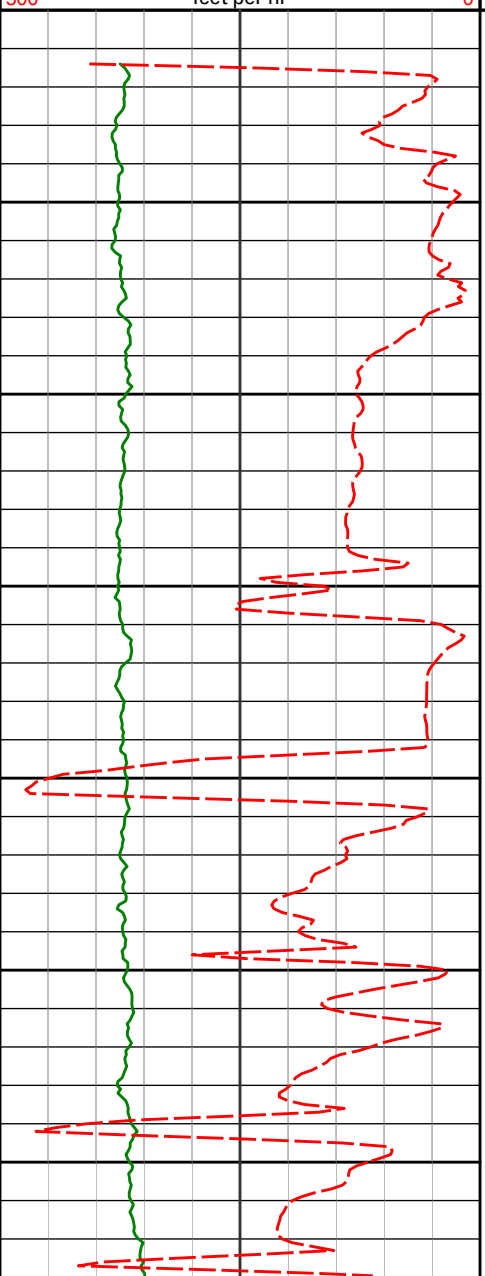
Sperry Drilling Services

TVD Detail Log 1:600

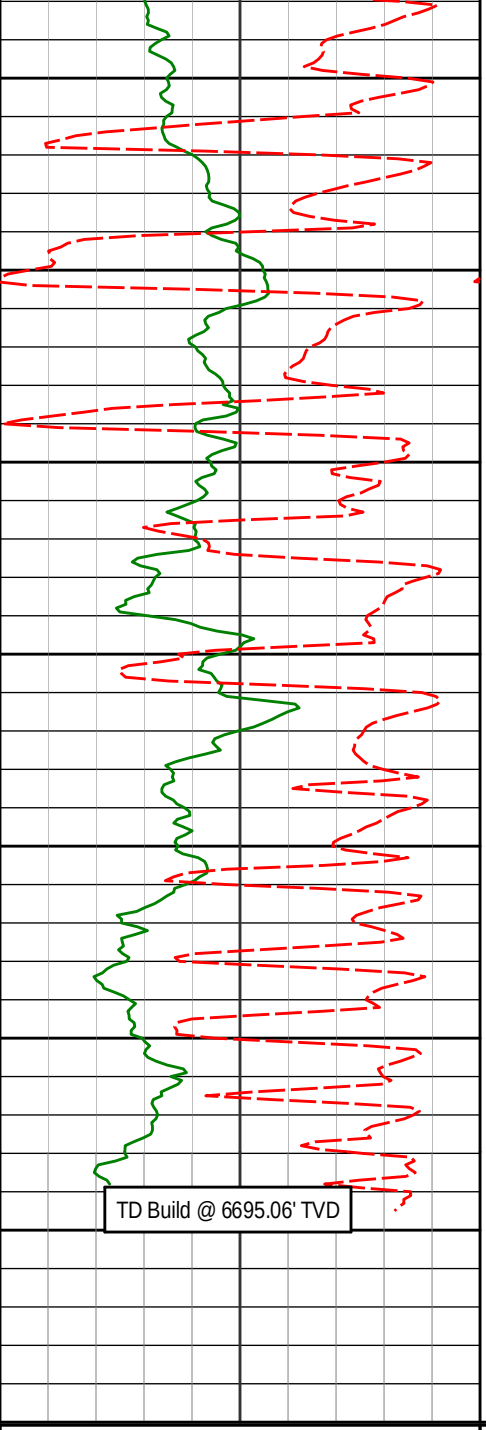
Noble Energy, Inc
Crow Creek AA01-789
H&P 315
T6N R63W

PCG Gamma Ray
PGRC
0 api 300

Avg Rate of Penetration
ROPA
500 feet per hr 0



Depth ft	Depth	Inc.	Azi.	TVD	V.S.
<KOP>					
6100'					
6150'	6189'	9.14°	168.34°	6152.15'	-185.98'
6200'	6237'	14.21°	169.64°	6199.15'	-176.50'
6250'	6284'	18.16°	172.18°	6244.27'	-163.63'
6300'	6332'	22.88°	171.05°	6289.22'	-147.06'
6350'	6379'	27.60°	170.65°	6331.72'	-127.38'
	6427'	32.47°	175.49°	6373.27'	-103.64'



Depth ft	Depth	Inc.	Azi.	TVD	V.S.
6400'	6473'	35.16°	178.05°	6411.48'	-78.13'
6450'	6521'	38.15°	178.28°	6449.99'	-49.53'
	6568'	42.51°	177.76°	6485.81'	-19.18'
6500'	6616'	45.05°	179.17°	6520.46'	13.98'
6550'	6663'	49.17°	180.09°	6552.44'	48.38'
	6711'	54.89°	179.90°	6581.96'	86.19'
6600'	6758'	60.47°	181.24°	6607.08'	125.89'
	6806'	64.49°	182.34°	6629.26'	168.45'
6650'	6853'	67.66°	183.73°	6648.32'	211.39'
	6901'	71.73°	181.98°	6664.97'	256.38'
	6948'	75.84°	180.48°	6678.09'	301.50'
	6988'	79.25°	179.94°	6686.72'	340.54'
6700'					
6750'					

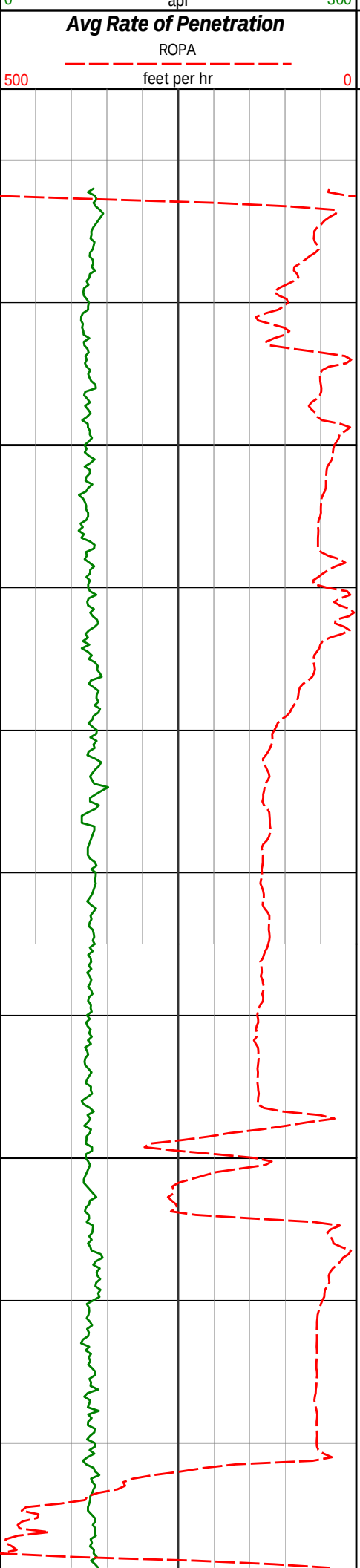
Avg Rate of Penetration
ROPA
500 feet per hr 0

PCG Gamma Ray
PGRC
0 api 300

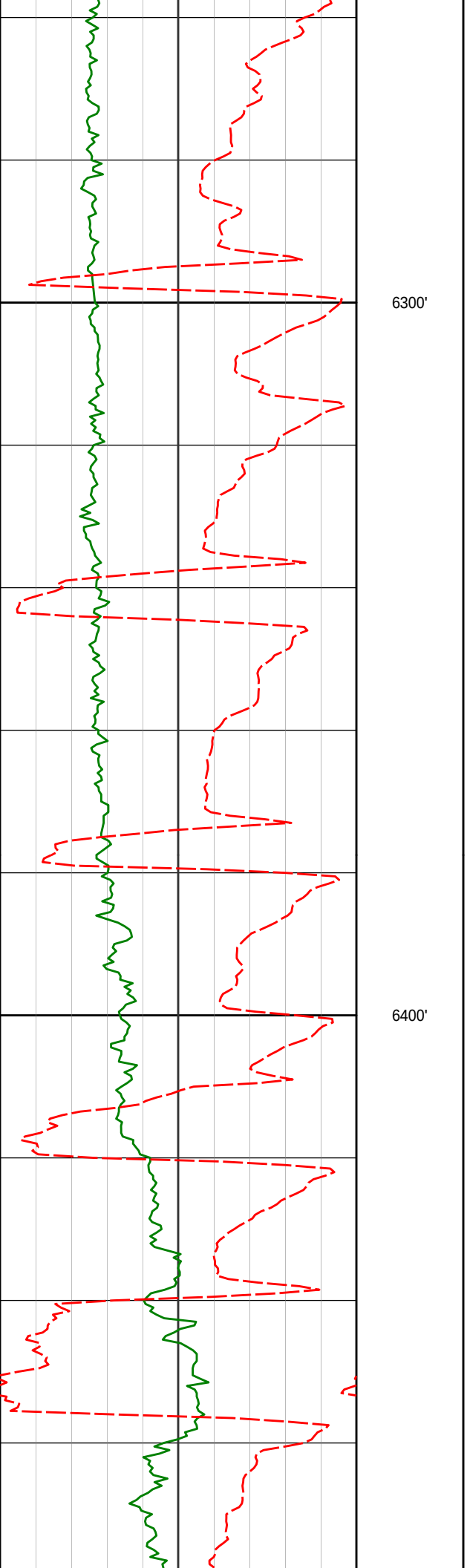
HALLIBURTON
Sperry Drilling Services
TVD Detail Log 1:240

Noble Energy, Inc
Crow Creek AA01-789
H&P 315
T6N R63W

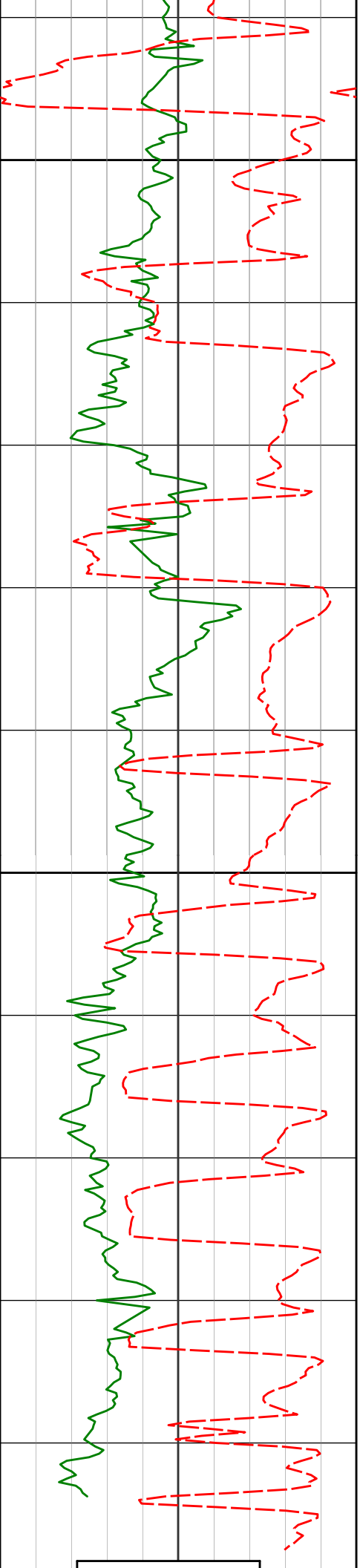
PCG Gamma Ray
PGRC
0 api 300



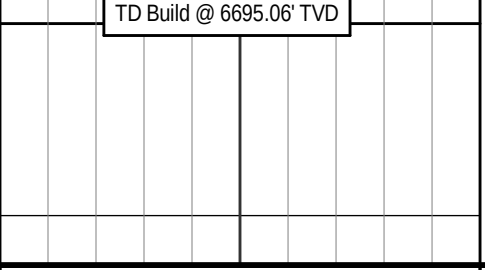
Depth ft	Depth	Inc.	Azi.	TVD	V.S.
<KOP>					
6100'					
	6189'	9.14°	168.34°	6152.15'	-185.98'
6200'	6237'	14.21°	169.64°	6199.15'	-176.50'
	6284'	18.16°	172.18°	6244.27'	-163.63'



6332'	22.88°	171.05°	6289.22'	-147.06'
6379'	27.60°	170.65°	6331.72'	-127.38'
6427'	32.47°	175.49°	6373.27'	-103.64'
6473'	35.16°	178.05°	6411.48'	-78.13'
6521'	38.15°	178.28°	6449.99'	-49.53'



6568'	42.51°	177.76°	6485.81'	-19.18'
6616'	45.05°	179.17°	6520.46'	13.98'
6663'	49.17°	180.09°	6552.44'	48.38'
6711'	54.89°	179.90°	6581.96'	86.19'
6758'	60.47°	181.24°	6607.08'	125.89'
6806'	64.49°	182.34°	6629.26'	168.45'
6853'	67.66°	183.73°	6648.32'	211.39'
6901'	71.73°	181.98°	6664.97'	256.38'
6948'	75.84°	180.48°	6678.09'	301.50'
6988'	79.25°	179.94°	6686.72'	340.54'



HALLIBURTON

DIRECTIONAL SURVEY REPORT

Noble Energy
Crow Creek AA01-789
Wattenberg
Weld Colorado
USA
CA-XX-0901850044
Surveys are MSA and IFR1 corrected.

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
253.00	1.00	175.75	252.99	2.20 S	0.16 E	2.20	0.40
506.00	0.30	142.35	505.97	4.93 S	0.73 E	4.91	0.30
726.00	0.42	181.39	725.97	6.19 S	1.06 E	6.16	0.12
819.00	0.38	166.84	818.96	6.83 S	1.13 E	6.80	0.12
912.00	0.46	167.24	911.96	7.50 S	1.28 E	7.46	0.09
1006.00	0.67	317.71	1005.96	7.46 S	0.99 E	7.43	1.16
1098.00	0.63	333.24	1097.95	6.61 S	0.40 E	6.59	0.20
1191.00	0.68	341.69	1190.95	5.63 S	0.00 W	5.62	0.12
1283.00	0.83	333.33	1282.94	4.51 S	0.47 W	4.52	0.20
1376.00	0.77	342.57	1375.93	3.32 S	0.96 W	3.34	0.15
1468.00	0.97	352.50	1467.92	1.95 S	1.25 W	1.99	0.27
1560.00	0.83	349.12	1559.91	0.53 S	1.48 W	0.57	0.16
1653.00	0.90	334.82	1652.90	0.80 N	1.91 W	-0.74	0.24
1747.00	0.81	322.52	1746.89	1.99 N	2.63 W	-1.92	0.22
1841.00	0.75	332.91	1840.88	3.07 N	3.32 W	-2.97	0.16
1935.00	0.79	325.87	1934.87	4.15 N	3.96 W	-4.04	0.11
2028.00	3.66	295.68	2027.79	5.97 N	7.00 W	-5.77	3.23
2119.00	5.68	294.73	2118.49	9.11 N	13.70 W	-8.72	2.22
2212.00	5.58	290.78	2211.04	12.64 N	22.11 W	-12.02	0.43
2304.00	7.24	295.36	2302.46	16.71 N	31.53 W	-15.82	1.89
2397.00	6.86	296.90	2394.76	21.73 N	41.78 W	-20.56	0.46
2492.00	8.77	289.11	2488.87	26.67 N	53.69 W	-25.16	2.29
2587.00	8.51	289.48	2582.79	31.39 N	67.16 W	-29.50	0.28
2681.00	8.91	292.38	2675.71	36.48 N	80.44 W	-34.22	0.63
2776.00	8.60	290.66	2769.60	41.78 N	93.89 W	-39.15	0.43
2871.00	8.51	289.35	2863.55	46.62 N	107.17 W	-43.61	0.23
2966.00	8.95	295.94	2957.45	52.18 N	120.45 W	-48.80	1.15
3061.00	9.08	294.67	3051.27	58.54 N	133.91 W	-54.78	0.25
3156.00	9.19	299.36	3145.07	65.39 N	147.33 W	-61.25	0.79
3251.00	8.81	297.97	3238.90	72.52 N	160.37 W	-68.02	0.46
3346.00	8.10	296.49	3332.87	78.92 N	172.78 W	-74.07	0.78
3441.00	7.23	296.07	3427.02	84.53 N	184.14 W	-79.36	0.92
3536.00	8.45	299.12	3521.13	90.56 N	195.61 W	-85.06	1.36
3631.00	8.01	298.93	3615.15	97.16 N	207.50 W	-91.32	0.46
3726.00	9.55	296.42	3709.03	103.86 N	220.35 W	-97.67	1.67
3820.00	10.20	296.16	3801.64	111.00 N	234.81 W	-104.40	0.69
3915.00	10.45	296.76	3895.10	118.59 N	250.05 W	-111.56	0.29

4010.00	10.90	296.28	3988.46	126.45 N	265.80 W	-118.98	0.48
4105.00	10.34	294.98	4081.83	134.02 N	281.58 W	-126.11	0.64
4200.00	10.13	294.08	4175.32	141.03 N	296.93 W	-132.69	0.28
4295.00	9.22	292.63	4268.97	147.37 N	311.59 W	-138.61	0.99
4389.00	8.00	291.80	4361.91	152.70 N	324.61 W	-143.57	1.30
4483.00	7.48	288.54	4455.05	157.07 N	336.48 W	-147.62	0.72
4578.00	7.35	292.44	4549.26	161.36 N	347.96 W	-151.58	0.55
4672.00	7.01	294.46	4642.52	166.03 N	358.74 W	-155.95	0.45
4767.00	8.24	295.41	4736.68	171.35 N	370.17 W	-160.95	1.30
4861.00	8.69	301.18	4829.66	177.92 N	382.33 W	-167.17	1.02
4956.00	7.66	298.32	4923.69	184.64 N	394.04 W	-173.56	1.17
5051.00	8.78	296.40	5017.71	190.86 N	406.11 W	-179.45	1.21
5146.00	7.92	296.00	5111.70	196.96 N	418.49 W	-185.20	0.91
5240.00	6.49	293.67	5204.96	201.93 N	429.18 W	-189.87	1.55
5335.00	5.28	293.62	5299.46	205.84 N	438.10 W	-193.52	1.27
5430.00	4.29	295.67	5394.12	209.13 N	445.31 W	-196.61	1.06
5525.00	3.08	297.40	5488.93	211.84 N	450.77 W	-199.17	1.28
5620.00	1.42	280.90	5583.85	213.24 N	454.20 W	-200.47	1.86
5714.00	1.11	247.75	5677.83	213.11 N	456.18 W	-200.29	0.83
5809.00	1.04	240.63	5772.81	212.34 N	457.79 W	-199.48	0.16
5904.00	0.85	238.46	5867.80	211.55 N	459.14 W	-198.65	0.20
5999.00	0.73	240.23	5962.79	210.88 N	460.26 W	-197.95	0.13
6043.00	0.69	245.15	6006.79	210.63 N	460.75 W	-197.68	0.17
6189.00	9.14	168.34	6152.15	198.88 N	459.20 W	-185.98	6.17
6237.00	14.21	169.64	6199.15	189.35 N	457.37 W	-176.50	10.58
6284.00	18.16	172.18	6244.27	176.41 N	455.33 W	-163.63	8.54
6332.00	22.88	171.05	6289.22	159.77 N	452.86 W	-147.06	9.87
6379.00	27.60	170.65	6331.72	139.99 N	449.67 W	-127.38	10.05
6427.00	32.47	175.49	6373.27	116.16 N	446.85 W	-103.64	11.32
6473.00	35.16	178.05	6411.48	90.61 N	445.43 W	-78.13	6.62
6521.00	38.15	178.28	6449.99	61.97 N	444.51 W	-49.53	6.24
6568.00	42.51	177.76	6485.81	31.58 N	443.45 W	-19.18	9.30
6616.00	45.05	179.17	6520.46	1.62 S	442.57 W	13.98	5.67
6663.00	49.17	180.09	6552.44	36.05 S	442.36 W	48.38	8.88
6711.00	54.89	179.90	6581.96	73.87 S	442.35 W	86.19	11.92
6758.00	60.47	181.24	6607.08	113.57 S	442.76 W	125.89	12.11
6806.00	64.49	182.34	6629.26	156.11 S	444.10 W	168.45	8.62
6853.00	67.66	183.73	6648.32	199.00 S	446.38 W	211.39	7.27
6901.00	71.73	181.98	6664.97	243.95 S	448.61 W	256.38	9.14
6948.00	75.84	180.48	6678.09	289.06 S	449.58 W	301.50	9.27
6988.00	79.25	179.94	6686.72	328.11 S	449.72 W	340.54	8.63
7046.00	85.00	179.20	6694.66	385.54 S	449.28 W	397.93	9.99

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 181.60 DEGREES (GRID)
A TOTAL CORRECTION OF 7.45 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.
HORIZONTAL DISPLACEMENT(CLOSURE) AT 7046.00 FEET
IS 592.03 FEET ALONG 229.37 DEGREES (GRID)

Surface surveys at 253' and 506' have had azimuths corrected to grid north, but were not taken by Halliburton.

Last survey is a projection to the bit from to 6988' to 7046'.

Date Printed:21 December 2014