HALLIBURTON | Sperry Drilling

PCGK: Pressure Case Gamma
PCDC: Pressure Case Directional

Powered by INSITE™

1 : 600 / 1 : 240

Country : **USA**
Field : **Wattenberg**
Location : **Lat: 40° 26' 16.98" North**
Long: 104° 21' 16.13" West
Well : **Wells Ranch AE32-630**
Company : **Noble Energy**
Rig : **H&P 273**

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Well : **Wells Ranch AE32-630**
Field : **Wattenberg**
Country : **USA**
API Number : **05-123-41787**

LOCATION
Latitude : **40° 26' 16.98" North**
Longitude : **104° 21' 16.13" West**
UTM Easting = **3,318,851.250 usft**
UTM Northing = **1,404,481.460 usft**

Other Services
Directional Drilling

Permanent Datum : **Ground Level**
Elevation : **4720.00 ft**
Log Measured From : **Drill Floor**
24.00 ft Above Permanent Datum
Drilling Measured From : **Drill Floor**

MD LOG

Elev. KB **N/A**
DF **4744.00 ft**
GL **4720.00 ft**
WD **N/A**

Depth Logged : **676.00 ft** To **7,005.00 ft**
Date Logged : **05-Oct-15** To **25-Sep-15**
Total Depth MD : **7,005.00 ft** TVD : **6,532.56 ft**
Spud Date : **05-Oct-15**

Unit No. : **11703717**
Job No. : **CA-XX-0902715777**
Plot Type : **Final**
Plot Date : **08-Oct-15**

Run No.	Borehole Record (MD)			Size	Casing Record (MD)		
	Size	From	To		Weight	From	To
2	8.750 in	676.00 ft	7,005.00 ft				

WELL INFORMATION

MWD Run Number	100
Date run completed	07-Oct-15
Rig Bit Number	2
Bit Size (in)	8.750
Tool Nominal OD (in)	6.750
Log Start Depth (MD, ft)	676.00
Log End Depth (MD, ft)	7,005.00
Drill or Wipe	Drill
Drill/Wipe Start Date and Time	06-Oct-15 12:30
Drill/Wipe End Date and Time	07-Oct-15 17:30
Min Inc (deg) @ Depth (MD, ft)	0.18 @ 816.00
Max Inc (deg) @ Depth (MD, ft)	83.27 @ 6,944.00
Bit TFA(in2) / Bit Type	0.98 / PDC
Flow Rate (gpm)	579.77
Max AV (fpm) / CV (fpm) @ MWD	N/A / N/A
Fluid Type	Fresh Water Gel
Density (ppg) / Viscosity (spqt)	10.00 / 36.00
Filtrate CL (ppm)	1,800.00
pH / Fluid Loss (mptm)	8.70 / 0
PV (cP) / YP (lhf2)	12 / 9.00
% Solids / % Sand	7.2 / .1
% Oil / Oil:Water Ratio	N/A / N/A
Rm @ Measured Temp (degF)	N/A @ N/A
Rmf @ Measured Temp (degF)	N/A @ N/A
Rmc @ Measured Temp (degF)	N/A @ N/A

Max Tool Temp (degF) / Source	179.70 / PCM				
Rm @ Max Tool Temp (degF)	N/A @ N/A				
Lead MWD Engineer	Paul Kock				
Customer Representative	Dave Nielsen				

SENSOR INFORMATION

Downhole Processor Information

Tool Type	PCM				
Software Version	5.93				
Sub Serial Number	11619287				
Insert Serial Number	11145605				
Date and Time Initialized	06-Oct-15 06:15				
Date and Time Read	07-Oct-15 22:05				
ECMB SW Version	N/A				

Directional Sensor Information

Tool Type	PCDC				
Distance From Bit (ft)	61.00				
Software Version	6.33				
Sub Serial Number	11619287				
Sonde Serial Number	11297584				
Sensor ID Number	N/A				
Toolface Offset (deg)	150.90				

Gamma Ray Sensor Information

Tool Type	PCG				
Distance From Bit (ft)	48.98				
Recorded Sample Period (sec)	10				
Software Version	8.15				
Sub Serial Number	11619287				
Insert/Sonde Serial Number	11681042				

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 ROP in logs - 0.5 ft interval, 1.2 ft coercion distance.
- Gamma in 2" (1:600) logs - 1 ft interval, 3 ft coercion distance.
- Gamma in 5" (1:240) logs - 0.5 ft interval, 0.6 ft coercion distance.

5. INSITE version 8.3.0

WARRANTY

MD Detail 1:600 Scale

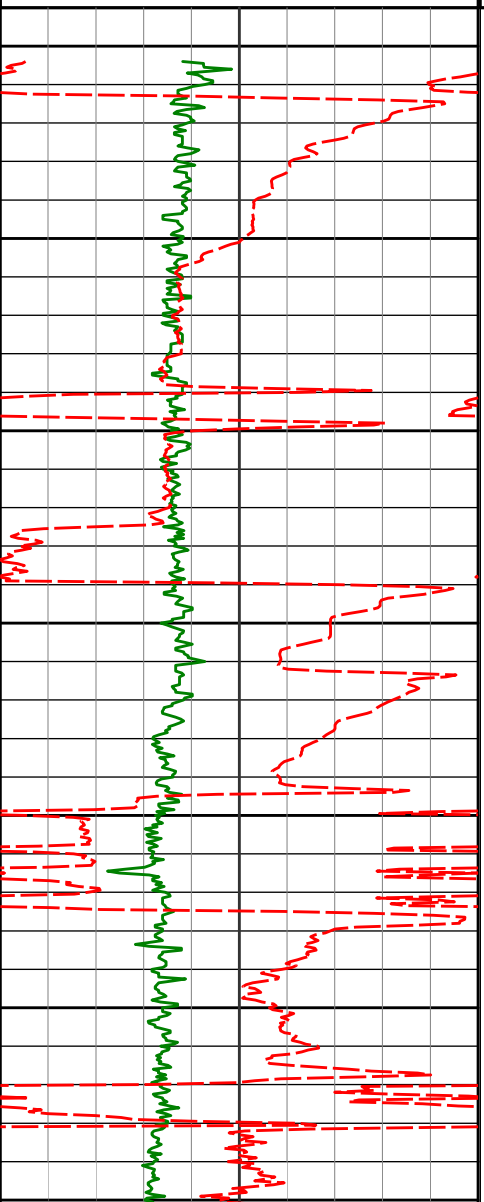
PGXC

0 api 300

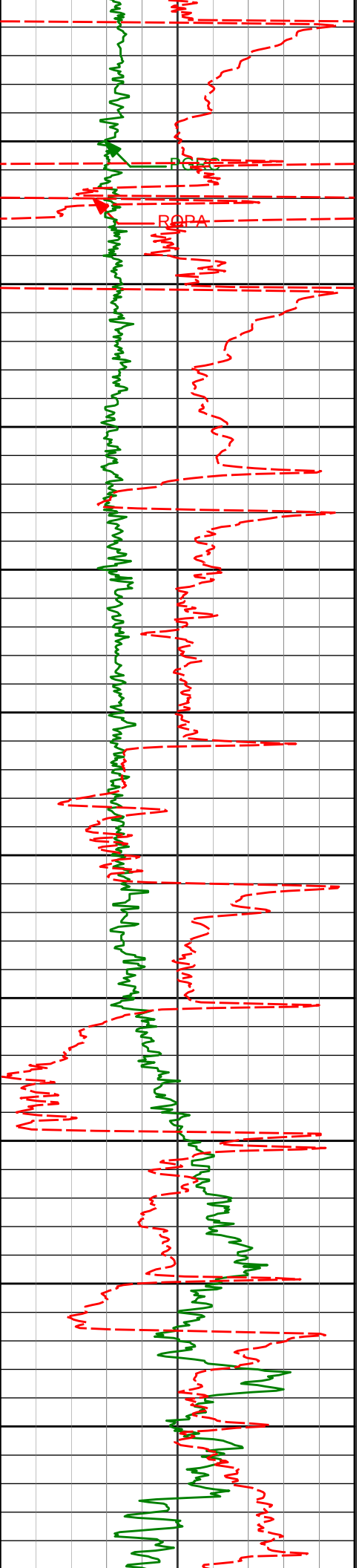
Avg Rate of Penetration

ROP Avg

500 feet per hr 0

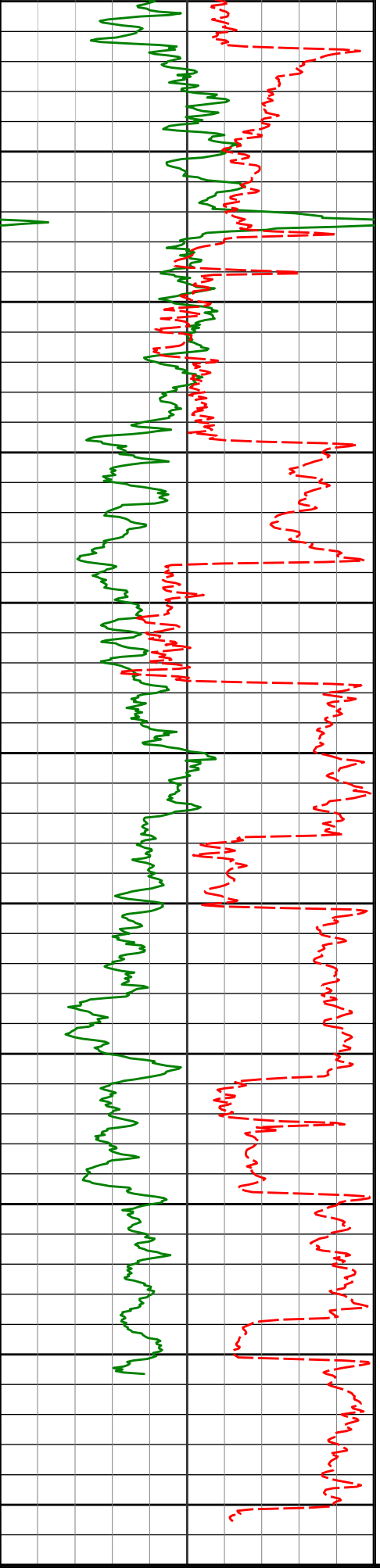


Depth MD ft	Depth	Inc	Azi	TVD	V.S.	Temp
5650 <KOP>						
	5674'	10.06°	320.62°	5646.91'	-286.26'	141.69°F
5700						145.91°F
						145.91°F
5750						145.91°F
	5768'	15.61°	345.77°	5738.60'	-292.81'	
						145.91°F
5800						
						145.91°F
5850						145.91°F
	5863'	18.00°	2.17°	5829.58'	-292.85'	
						150.13°F
5900						
						150.13°F
						150.13°F
5950						



5958'	20.36°	18.32°	5919.37'	-284.28'	154.34°F
					154.34°F
					154.34°F
6053'	24.04°	26.50°	6007.33'	-267.41'	154.34°F
					154.34°F
					154.34°F
6147'	29.43°	45.03°	6091.39'	-239.44'	158.56°F
					158.56°F
					158.56°F
6242'	34.98°	53.98°	6171.79'	-197.97'	162.78°F
					162.78°F
					162.78°F
6337'	38.06°	56.61°	6248.13'	-148.68'	162.78°F
					162.78°F
					162.78°F
6432'	43.68°	62.36°	6319.96'	-92.40'	162.78°F
					167.00°F
					167.00°F

5950
6000
6050
6100
6150
6200
6250
6300
6350
6400
6450
6500



Depth MD ft	Depth	Inc	Azi	TVD	V.S.	Temp
6500						167.00°F
	6526'	55.55°	65.15°	6380.76'	-25.57'	
6550						167.00°F
						167.00°F
6600						167.00°F
	6621'	64.18°	68.78°	6428.42'	52.65'	
						167.00°F
6650						167.00°F
						167.00°F
6700						
	6716'	67.38°	74.02°	6467.41'	136.96'	175.44°F
6750						175.44°F
						175.44°F
6800						
	6811'	72.45°	79.61°	6500.04'	225.29'	175.44°F
6850						175.44°F
						175.44°F
6900						179.66°F
						179.66°F
	6944'	83.27°	83.26°	6527.98'	354.90'	
6950						
7000						
	7005'	88.11°	86.23°	6532.56'	415.70'	

Avg Rate of Penetration
ROP Avg
feet per hr
500 0

PGXC

0 api 300

MD Detail 1:240 Scale

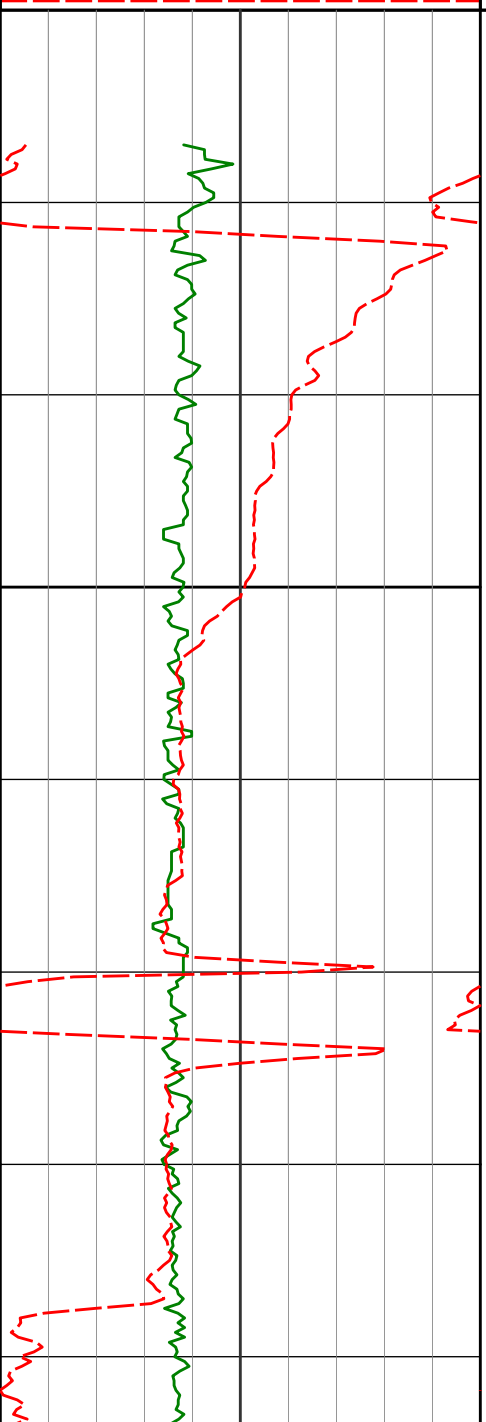
PGXC

0 api 300

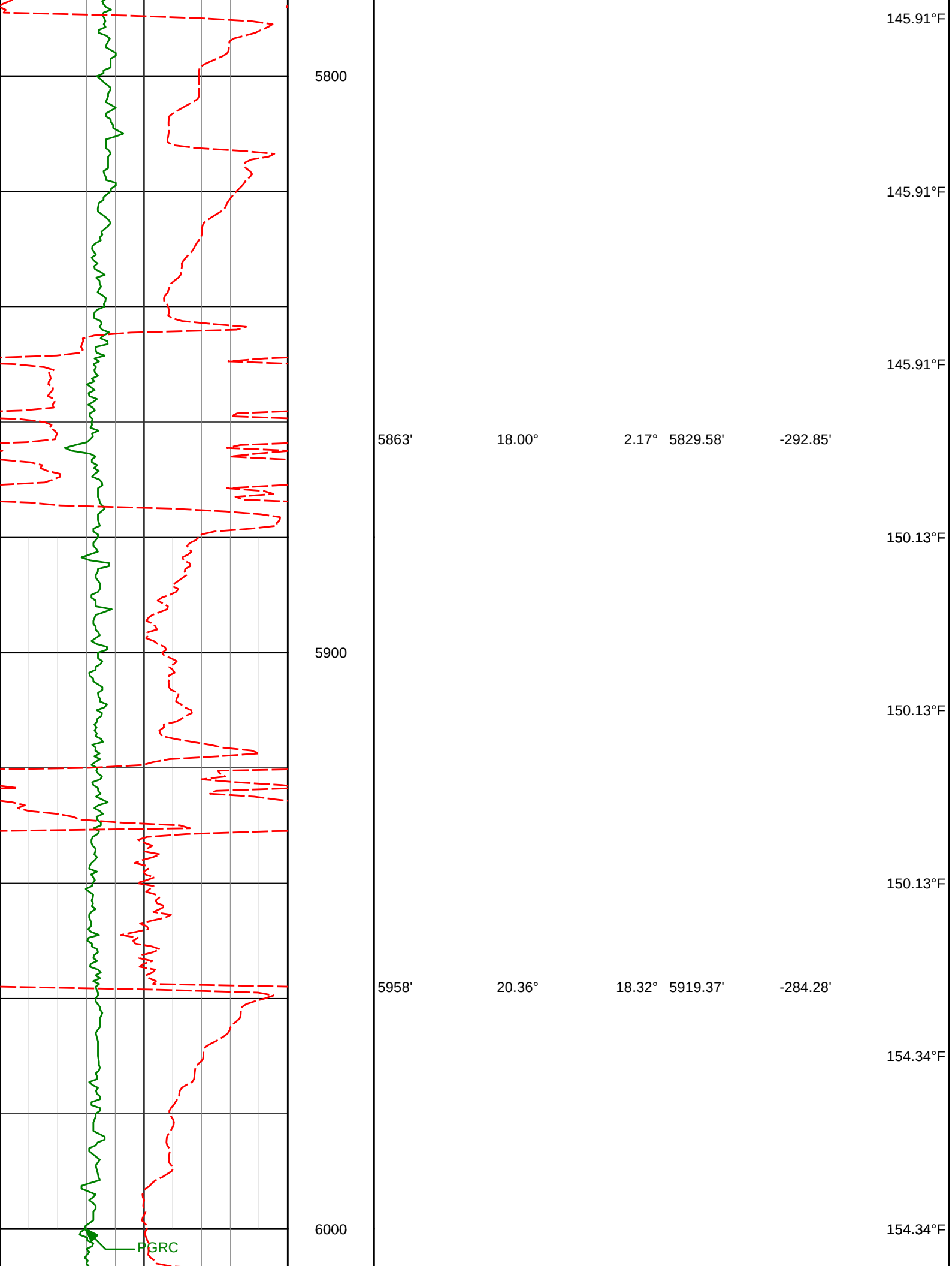
Avg Rate of Penetration

ROP Avg

500 feet per hr 0



Depth MD ft	Depth	Inc	Azi	TVD	V.S.	Temp
						141.69°F
<KOP>						
	5674'	10.06°	320.62°	5646.91'	-286.26'	
						141.69°F
5700						145.91°F
						145.91°F
						145.91°F
	5768'	15.61°	345.77°	5738.60'	-292.81'	


5800
5900
6000
PGRC
145.91°F
145.91°F
145.91°F
5863' 18.00° 2.17° 5829.58' -292.85'
150.13°F
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5958' 20.36° 18.32° 5919.37' -284.28'
154.34°F
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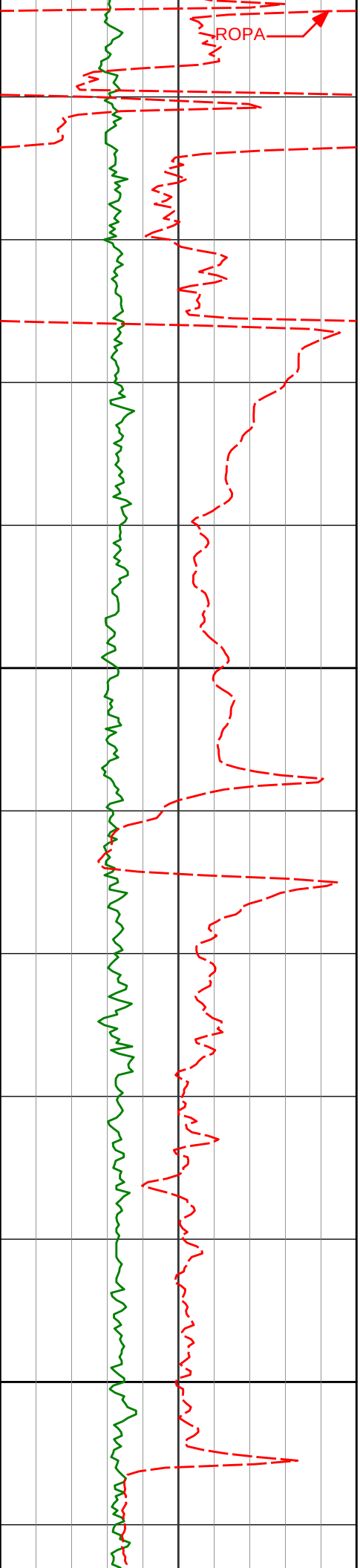


6053'	24.04°	26.50°	6007.33'	-267.41'	

154.34°F

154.34°F

154.34°F

6100

154.34°F

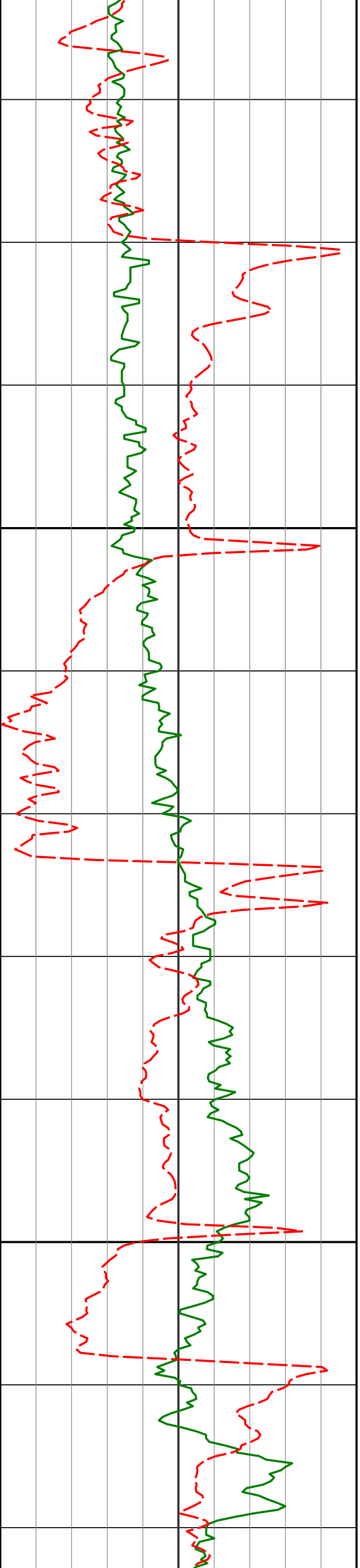
6147'	29.43°	45.03°	6091.39'	-239.44'	

158.56°F

158.56°F

6200

158.56°F



6242'	34.98°	53.98°	6171.79'	-197.97'	162.78°F
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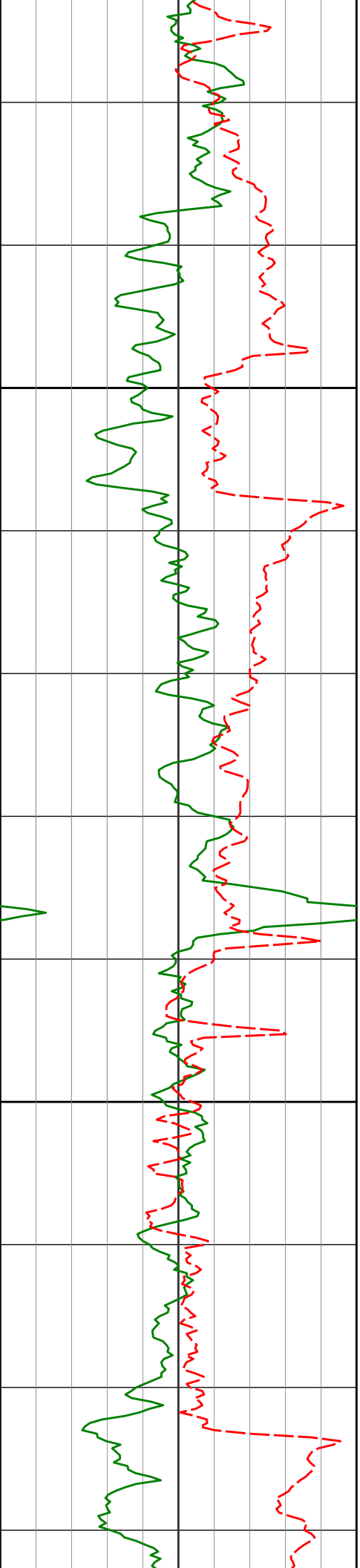
6300					162.78°F
6337'	38.06°	56.61°	6248.13'	-148.68'	162.78°F
					162.78°F
6400					162.78°F
6432'	43.68°	62.36°	6319.96'	-92.40'	162.78°F



6500					167.00°F
					167.00°F
	6526'	55.55°	65.15°	6380.76'	-25.57'
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					167.00°F
6600					167.00°F
	6621'	64.18°	68.78°	6428.42'	52.65'
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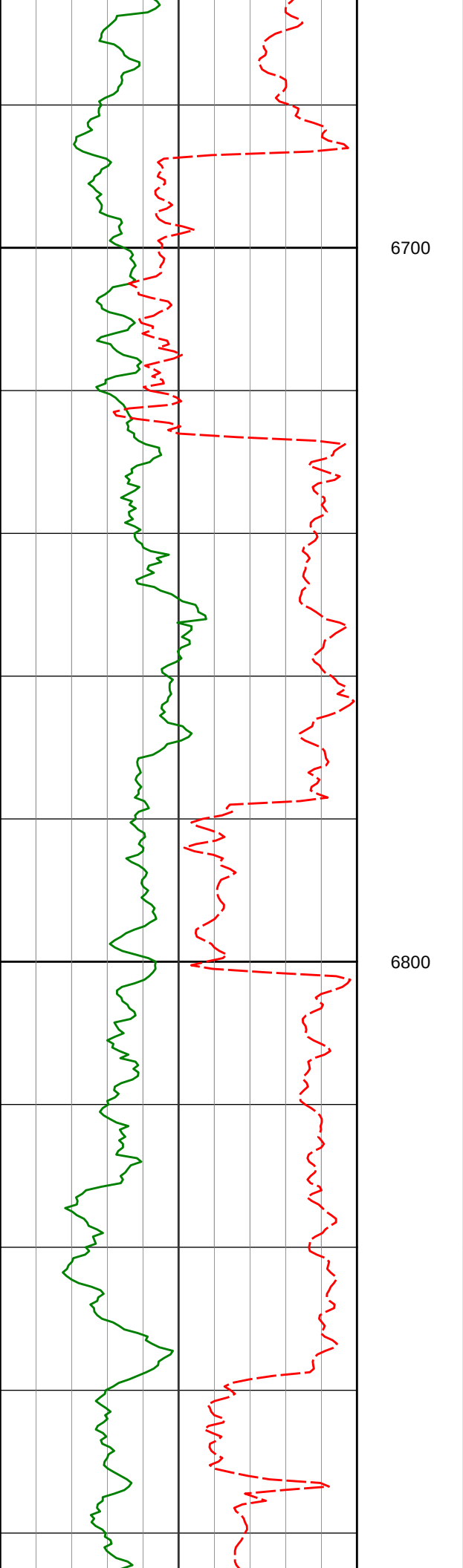

6700

6800

					167.00°F
6716'	67.38°	74.02°	6467.41'	136.96'	175.44°F
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6811'	72.45°	79.61°	6500.04'	225.29'	175.44°F
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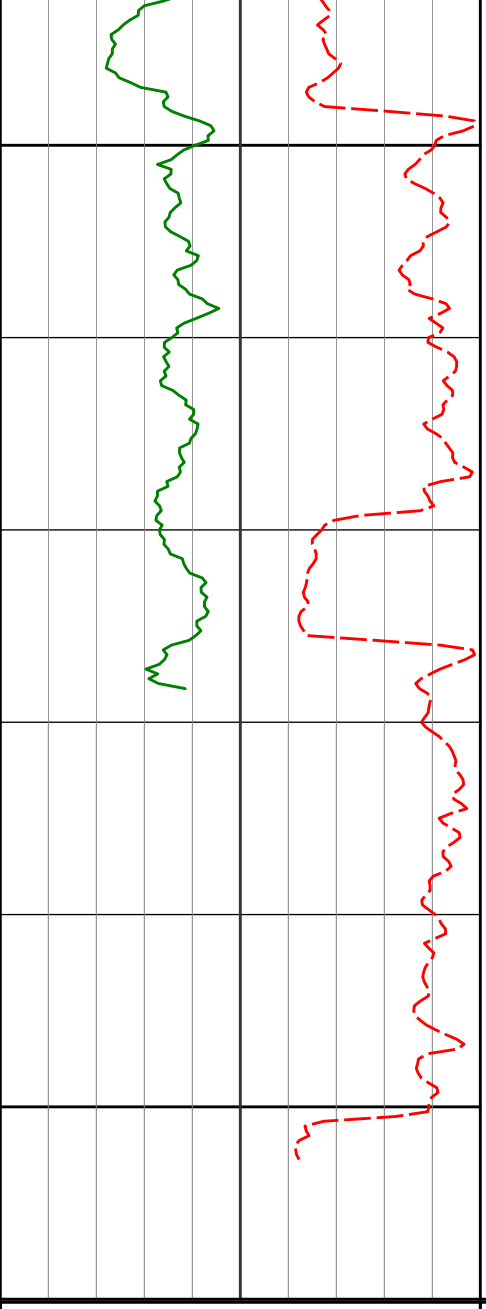

Depth MD ft	Depth	Inc	Azi	TVD	V.S.	Temp
6900						179.66°F
						179.66°F
	6944'	83.27°	83.26°	6527.98'	354.90'	
7000						
	7005'	88.11°	86.23°	6532.56'	415.70'	

DIRECTIONAL SURVEY REPORT

Noble Energy
Wells Ranch AE32-630
Wattenberg
Weld Colorado
USA
CA-XX-0902715777

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**
300.00	**0.07**	**199.87**	**300.00**	**0.17 S**	**0.06 W**	**-0.08**	**0.02**
676.00	**0.15**	**199.87**	**676.00**	**0.85 S**	**0.31 W**	**-0.39**	**0.02**
816.00	**0.18**	**199.87**	**816.00**	**1.24 S**	**0.45 W**	**-0.56**	**0.02**
910.00	**1.20**	**22.42**	**909.99**	**0.47 S**	**0.12 W**	**-0.17**	**1.47**

1004.00	0.95	25.75	1003.98	1.14 N	0.59 E	0.70	0.27
1097.00	0.83	43.47	1096.96	2.33 N	1.39 E	1.61	0.32
1192.00	0.85	39.84	1191.95	3.38 N	2.32 E	2.63	0.06
1285.00	0.90	42.06	1284.94	4.45 N	3.25 E	3.66	0.06
1560.00	0.83	49.00	1559.91	7.35 N	6.19 E	6.85	0.05
1651.00	0.78	41.22	1650.90	8.25 N	7.10 E	7.84	0.13
1743.00	0.62	14.97	1742.90	9.20 N	7.64 E	8.47	0.39
1835.00	0.85	350.43	1834.89	10.35 N	7.66 E	8.59	0.42
1925.00	0.76	344.52	1924.88	11.58 N	7.39 E	8.44	0.13
2017.00	1.03	337.04	2016.87	12.93 N	6.90 E	8.08	0.31
2109.00	1.01	335.57	2108.85	14.42 N	6.25 E	7.57	0.03
2200.00	1.17	332.24	2199.84	15.98 N	5.48 E	6.95	0.19
2292.00	0.99	319.17	2291.82	17.41 N	4.52 E	6.13	0.33
2383.00	0.55	288.20	2382.81	18.15 N	3.59 E	5.28	0.66
2474.00	0.79	285.88	2473.81	18.45 N	2.57 E	4.29	0.28
2566.00	0.57	297.04	2565.80	18.84 N	1.55 E	3.31	0.28
2657.00	0.33	355.23	2656.80	19.30 N	1.13 E	2.93	0.53
2749.00	2.34	308.75	2748.77	20.75 N	0.36 W	1.58	2.32
2840.00	4.00	309.85	2839.63	23.95 N	4.25 W	-1.99	1.83
2932.00	5.43	310.54	2931.31	28.83 N	10.02 W	-7.28	1.55
3024.00	5.84	291.70	3022.88	33.39 N	17.68 W	-14.47	2.05
3116.00	6.37	298.41	3114.36	37.55 N	26.51 W	-22.88	0.96
3211.00	7.80	300.08	3208.63	43.29 N	36.72 W	-32.51	1.53
3306.00	7.58	295.29	3302.78	49.20 N	47.97 W	-43.16	0.71
3400.00	7.39	291.58	3395.97	54.07 N	59.20 W	-53.88	0.55
3495.00	7.91	300.18	3490.13	59.61 N	70.54 W	-64.65	1.32
3589.00	8.64	301.39	3583.15	66.54 N	82.16 W	-75.57	0.80
3684.00	9.15	301.27	3677.01	74.17 N	94.71 W	-87.35	0.53
3779.00	9.69	301.50	3770.73	82.27 N	107.98 W	-99.81	0.57
3874.00	9.31	300.91	3864.42	90.39 N	121.39 W	-112.40	0.41
3969.00	8.66	300.34	3958.26	97.95 N	134.16 W	-124.40	0.70
4063.00	8.06	297.40	4051.26	104.56 N	146.11 W	-135.69	0.78
4158.00	6.89	298.61	4145.45	110.35 N	157.03 W	-146.01	1.25
4252.00	6.89	301.30	4238.77	115.98 N	166.79 W	-155.20	0.34
4347.00	6.77	296.03	4333.10	121.39 N	176.68 W	-164.55	0.67
4442.00	8.55	306.63	4427.25	128.06 N	187.38 W	-174.58	2.39
4537.00	9.23	316.05	4521.12	137.77 N	198.34 W	-184.58	1.69
4631.00	8.77	313.47	4613.96	148.12 N	208.77 W	-194.00	0.66
4726.00	7.88	313.58	4707.96	157.60 N	218.75 W	-203.04	0.93
4821.00	8.92	319.06	4801.94	167.65 N	228.29 W	-211.60	1.37
4916.00	8.85	319.24	4895.80	178.75 N	237.89 W	-220.12	0.08
5010.00	7.97	318.77	4988.79	189.13 N	246.90 W	-228.12	0.93
5105.00	7.09	316.47	5082.97	198.33 N	255.29 W	-235.60	0.98
5200.00	7.63	310.50	5177.18	206.68 N	264.12 W	-243.62	0.98
5295.00	7.96	304.01	5271.31	214.46 N	274.37 W	-253.10	0.99
5389.00	6.18	308.49	5364.59	221.25 N	283.73 W	-261.77	1.98
5484.00	7.60	320.90	5458.91	229.30 N	291.69 W	-268.95	2.15
5579.00	7.78	309.05	5553.06	238.23 N	300.64 W	-277.03	1.68
5674.00	10.06	320.62	5646.91	248.69 N	310.90 W	-286.26	3.04
5768.00	15.61	345.77	5738.60	267.32 N	319.23 W	-292.81	8.25
5863.00	18.00	2.17	5829.58	294.40 N	321.82 W	-292.85	5.57
5958.00	20.36	18.32	5919.37	324.79 N	316.06 W	-284.28	6.09
6053.00	24.04	26.50	6007.33	357.81 N	302.22 W	-267.41	5.05
6147.00	29.43	45.03	6091.39	391.36 N	277.28 W	-239.44	10.50
6242.00	34.98	53.98	6171.79	423.91 N	238.69 W	-197.97	7.69
6337.00	38.06	56.61	6248.13	456.06 N	192.20 W	-148.68	3.64
6432.00	43.68	62.36	6319.96	487.43 N	138.63 W	-92.40	7.11
6526.00	55.55	65.15	6380.76	518.90 N	74.46 W	-25.57	12.82
6621.00	64.18	68.78	6428.42	550.91 N	1.10 E	52.65	9.67
6716.00	67.38	74.02	6467.41	578.48 N	83.18 E	136.96	6.05
6811.00	72.45	79.61	6500.04	598.74 N	170.00 E	225.29	7.68
6944.00	83.27	83.26	6527.98	617.99 N	298.37 E	354.90	8.57
7005.00	88.11	86.23	6532.56	623.55 N	358.92 E	415.70	9.30

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 84.63 DEGREES (GRID)
A TOTAL CORRECTION OF 7.56 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED

A TOTAL CORRECTION OF 7.50 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.
HORIZONTAL DISPLACEMENT(CLOSURE) AT 7005.00 FEET
IS 719.47 FEET ALONG 29.92 DEGREES (GRID)

Surveys at 300 ft and 676 ft are interpolated between surface and first survey at 816 ft.

Last survey is a projection from 6944 ft MD to TD at 7005 ft MD.

Date Printed:07 October 2015