

**Natural Gamma Ray  
Rate Of Penetration**



**1 : 1200**

County	: Barber
Field	: Arrowhead
Location	: Lat: 37° 2' 5.26" North Long: 98° 24' 44.15" West
Well	: Schupbach 3510 #4-1H
Company	: Shell Exploration and Productio
Rig	: Nabors 180
LOCATION	Company : Shell Exploration and Productio Rig : Nabors 180 Well : Schupbach 3510 #4-1H Field : Arrowhead County : Barber API Number : 15007238530100
Latitude	: 37° 2' 5.26" North
Longitude	: 98° 24' 44.15" West
UTM Easting	= 2,025,611.78 ft
UTM Northing	= 134,054.97 ft
Other Services	Directional Services

Permanent Datum	: Ground Level	Elevation	: 1309.00 ft
Log Measured From	: Drill Floor	23.80 ft	Above Permanent Datum
Drilling Measured From	: Drill Floor		

**TVD LOG**

Elev.	KB	N/A
	DF	1332.80 ft
	GL	1309.00 ft
	WD	N/A

Depth Logged	: 83.00 ft	To	4,794.26 ft
Date Logged	: 17-Aug-12	To	20-Sep-12
Total Depth MD	: 9,880.00 ft	TVD	: 4,794.26 ft
Spud Date	: 18-Aug-12	Plot Type	: Final
		Plot Date	: 20-Sep-12
Unit No.	: PP#40	Job No.	: OK-XX-0009504797

Run No.	Borehole Record (TVD)		Run No.	Borehole Record (TVD)	
	Size	From		Size	From
0100	12.250 in	83.00 ft			
0200	8.750 in	797.58 ft			
0300	8.750 in	4,314.44 ft			
0400	6.125 in	4,814.28 ft			
0500	6.125 in	4,804.14 ft			
0600	6.125 in	4,803.27 ft			
0700	6.125 in	4,803.27 ft			

**WELL INFORMATION**

MWD Run Number	200	300	400	500	600
Date run completed	05-Sep-12	08-Sep-12	12-Sep-12	14-Sep-12	16-Sep-12
Rig Bit Number	0200	0300	0400	0500	0600
Bit Size (in)	8.750	8.750	6.125	6.125	6.125
Tool Nominal OD (in)	8.000	6.750	4.750	4.750	4.750
Log Start Depth (TVD, ft)	797.58	4,314.44	4,814.28	4,804.14	4,803.27
Log End Depth (TVD, ft)	4,314.44	4,814.28	4,804.14	4,803.27	4,794.76
Drill or Wipe	Drill	Drill	Drill	Drill	Drill
Drill/Wipe Start Date and Time	02-Sep-12 09:13	05-Sep-12 13:11	10-Sep-12 04:45	12-Sep-12 08:44	14-Sep-12 01:35
Drill/Wipe End Date and Time	05-Sep-12 06:00	08-Sep-12 11:32	12-Sep-12 08:31	14-Sep-12 09:44	16-Sep-12 12:30
Min Inc (deg) @ Depth (TVD, ft)	.03 @ 2,880.22	6.89 @ 4,270.01	89.60 @ 4,804.02	89.38 @ 4,803.03	89.66 @ 4,795.59
Max Inc (deg) @ Depth (TVD, ft)	4.59 @ 801.57	86.28 @ 4,811.81	91.67 @ 4,806.15	90.62 @ 4,803.24	91.48 @ 4,797.72
Bit TFA(in2) / Bit Type	.66 / PDC	.45 / PDC	.55 / PDC	.55 / PDC	.52 / PDC
Flow Rate (gpm)	550.00	400.00	297.00	297.00	299.00
Max AV (fpm) / CV (fpm) @ MWD	286.0 / 322.0	332.0 / 420.0	479.0 / 520.0	484.0 / 520.0	484.0 / 520.0
Fluid Type	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel
Density (ppg) / Viscosity (spqt)	9.10 / 55.00	9.10 / 60.00	8.40 / 27.00	8.40 / 27.00	8.40 / 28.00
Filtrate CL (ppm)	22,000.00	20,500.00	2,600.00	2,500.00	28,000.00
pH / Fluid Loss (mptm)	11.20 / 0	11.20 / 0	11.20 / 5	11.20 / 0	11.20 / 5
PV (cP) / YP (lbf2)	18 / 18.00	25 / 18.00	1 / 1.00	1 / 1.00	1 / 1.00
% Solids / % Sand	4.50 / 1.00	7.90 / 1.00	1.00 / 0.75	1.00 / 1.00	1.00 / 0.75
% Oil / Oil:Water Ratio	N/A / N/A	N/A / N/A	N/A / N/A	N/A / N/A	N/A / N/A
Rm @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A	N/A @ N/A	N/A @ N/A
Rmf @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A	N/A @ N/A	N/A @ N/A
Rmc @ Measured Temp (degF)	N/A @ N/A	N/A @ N/A	N/A @ N/A	N/A @ N/A	N/A @ N/A

<b>Max Tool Temp (degF) / Source</b>	144.54 / PCM	139.96 / PCM	133.20 / PCM	133.20 / PCM	130.96 / PCM
<b>Rm @ Max Tool Temp (degF)</b>	N/A @ N/A	N/A @ N/A	N/A @ N/A	N/A @ N/A	N/A @ N/A
<b>Lead MWD Engineer</b>	Fred Martin	Fred Martin	Fred Martin	Fred Martin	Fred Martin
<b>Customer Representative</b>	Jack Everett	Jack Everett	John Dyer	Jack Everett	Jack Everett

## SENSOR INFORMATION

### Directional Sensor Information

<b>Tool Type</b>	PCDC	PCDC	PCDC	PCDC	PCDC
<b>Distance From Bit (ft)</b>	60.16	54.22	50.29	51.20	51.24
<b>Software Version</b>	6.21	6.21	6.21	6.21	6.21
<b>Sub Serial Number</b>	11149805	11149805	11130241	11130241	11130421
<b>Sonde Serial Number</b>	400471	400261	400261	400471	400261
<b>Sensor ID Number</b>	N/A	N/A	N/A	N/A	N/A
<b>Toolface Offset (deg)</b>	39.40	358.40	234.52	101.36	38.01

### Gamma Ray Sensor Information

<b>Tool Type</b>	PCG	PCG	PCG	PCG	PCG
<b>Distance From Bit (ft)</b>	55.06	49.12	45.19	46.10	46.14
<b>Recorded Sample Period (sec)</b>	20	15	15	15	15
<b>Software Version</b>	8.15	8.15	8.15	8.15	8.15
<b>Sub Serial Number</b>	11149805	11149805	11130241	11130241	11130241
<b>Insert/Sonde Serial Number</b>	11293316	11293340	11293340	11293316	11293340

### Pulser Controller Sensor Information

<b>Tool Type</b>	PCM	PCM	PCM	PCM	PCM
<b>Software Version</b>	5.28	5.28	5.28	5.28	5.28
<b>PIC Software Version</b>	1.40	1.40	1.40	1.40	1.40
<b>Sub/HOC Serial Number</b>	11149805	11149805	11130241	11130241	11130241
<b>Insert/Probe/Module SN</b>	11400905	10868851	10868851	11400905	10868851
<b>Battery Serial Number</b>	N/A	N/A	N/A	N/A	N/A
<b>Valve Insert SN</b>	N/A	N/A	N/A	N/A	N/A
<b>DC Insert Serial Number</b>	N/A	N/A	N/A	N/A	N/A
<b>Choke Size (32nd)</b>	N/A	N/A	N/A	N/A	N/A
<b>Driver Current (amps)</b>	N/A	N/A	N/A	N/A	N/A
<b>Driver SMI Current (amps)</b>	N/A	N/A	N/A	N/A	N/A
<b>Boot Strap Version</b>	4,130.00	4,130.00	4,130.00	4,130.00	4,130.00

## WELL INFORMATION

<b>MWD Run Number</b>	700			
<b>Date run completed</b>	20-Sep-12			
<b>Rig Bit Number</b>	0700			
<b>Bit Size (in)</b>	6.125			
<b>Tool Nominal OD (in)</b>	4.750			
<b>Log Start Depth (TVD, ft)</b>	4,794.76			
<b>Log End Depth (TVD, ft)</b>	4,794.26			
<b>Drill or Wipe</b>	Drill			
<b>Drill/Wipe Start Date and Time</b>	16-Sep-12 21:13			
<b>Drill/Wipe End Date and Time</b>	19-Sep-12 12:42			
<b>Min Inc (deg) @ Depth (TVD, ft)</b>	88.37 @ 4,798.20			
<b>Max Inc (deg) @ Depth (TVD, ft)</b>	91.97 @ 4,797.19			
<b>Bit TFA(in2) / Bit Type</b>	.64 / PDC			
<b>Flow Rate (gpm)</b>	300.00			
<b>Max AV (fpm) / CV (fpm) @ MWD</b>	490.0 / 498.0			
<b>Fluid Type</b>	Fresh Water Gel			
<b>Density (ppg) / Viscosity (spqt)</b>	8.40 / 30.00			

Filtrate CL (ppm)	2,700.00				
pH / Fluid Loss (mptm)	11.20 / 5				
PV (cP) / YP (lhf2)	1 / 2.00				
% Solids / % Sand	1.00 / 1.00				
% Oil / Oil:Water Ratio	N/A / N/A				
Rm @ Measured Temp (degF)	N/A @ N/A				
Rmf @ Measured Temp (degF)	N/A @ NA				
Rmc @ Measured Temp (degF)	N/A @ N/A				
Max Tool Temp (degF) / Source	142.25 / PCM				
Rm @ Max Tool Temp (degF)	N/A @ N/A				
Lead MWD Engineer	Fred Martin				
Customer Representative	John Dyer				

## SENSOR INFORMATION

### Directional Sensor Information

Tool Type	PCDC				
Distance From Bit (ft)	57.17				
Software Version	6.21				
Sub Serial Number	11130241				
Sonde Serial Number	400471				
Sensor ID Number	N/A				
Toolface Offset (deg)	248.19				

### Gamma Ray Sensor Information

Tool Type	PCG				
Distance From Bit (ft)	52.07				
Recorded Sample Period (sec)	15				
Software Version	8.15				
Sub Serial Number	11130241				
Insert/Sonde Serial Number	11293316				

### Pulser Controller Sensor Information

Tool Type	PCM				
Software Version	5.28				
PIC Software Version	1.40				
Sub/HOC Serial Number	11130241				
Insert/Probe/Module SN	11400905				
Battery Serial Number	N/A				
Valve Insert SN	N/A				
DC Insert Serial Number	N/A				
Choke Size (32nd)	N/A				
Driver Current (amps)	N/A				
Driver SMI Current (amps)	N/A				
Boot Strap Version	4,130.00				

## REMARKS

1. All depths are calibrated to the driller's pipe tally and are measured from the rotary table.
2. No depth corrections have been made for pipe stretch or compression.
3. All data presented is recorded (memory data) unless otherwise stated.

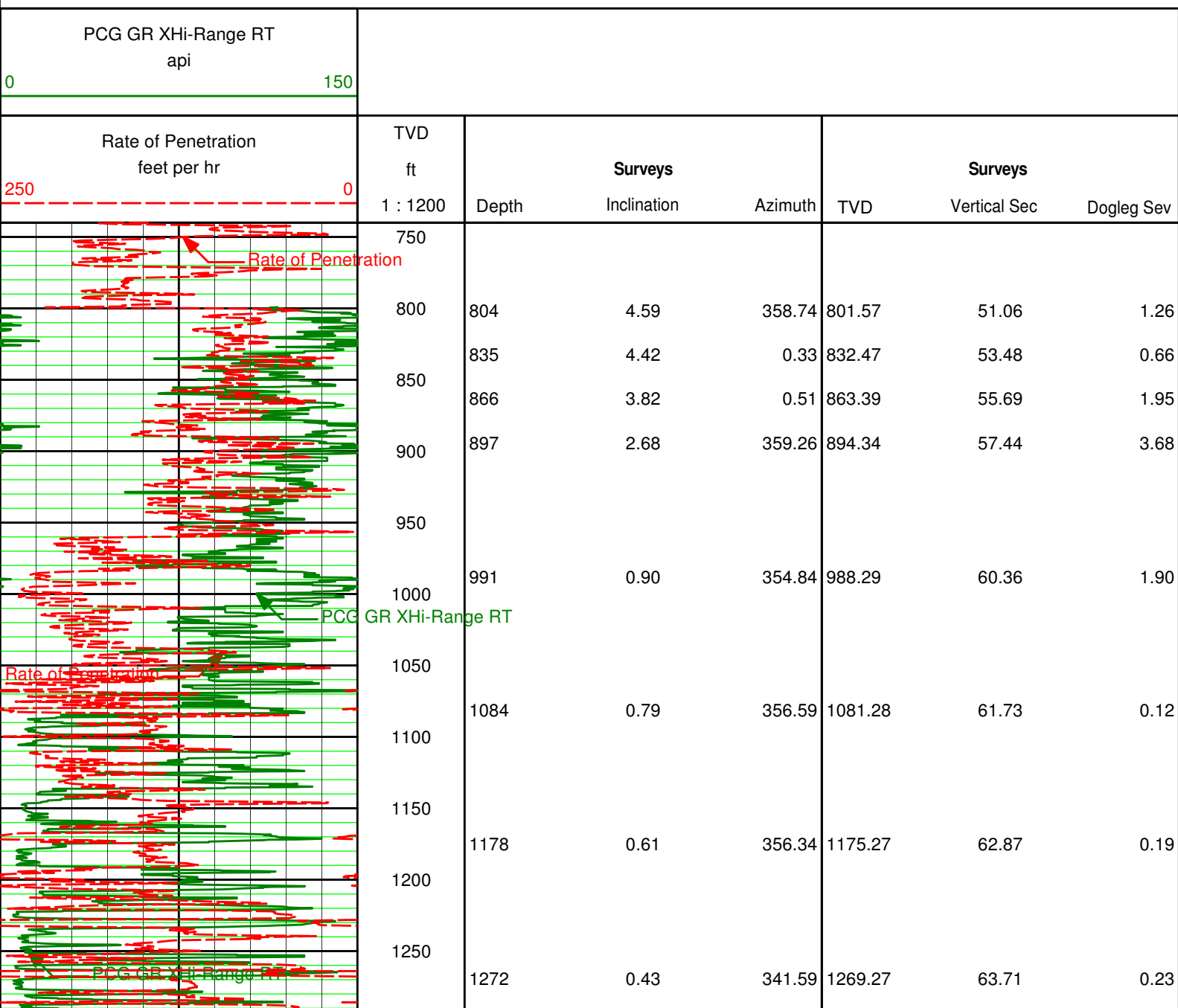
4. The following smoothing parameters have been applied to the data:

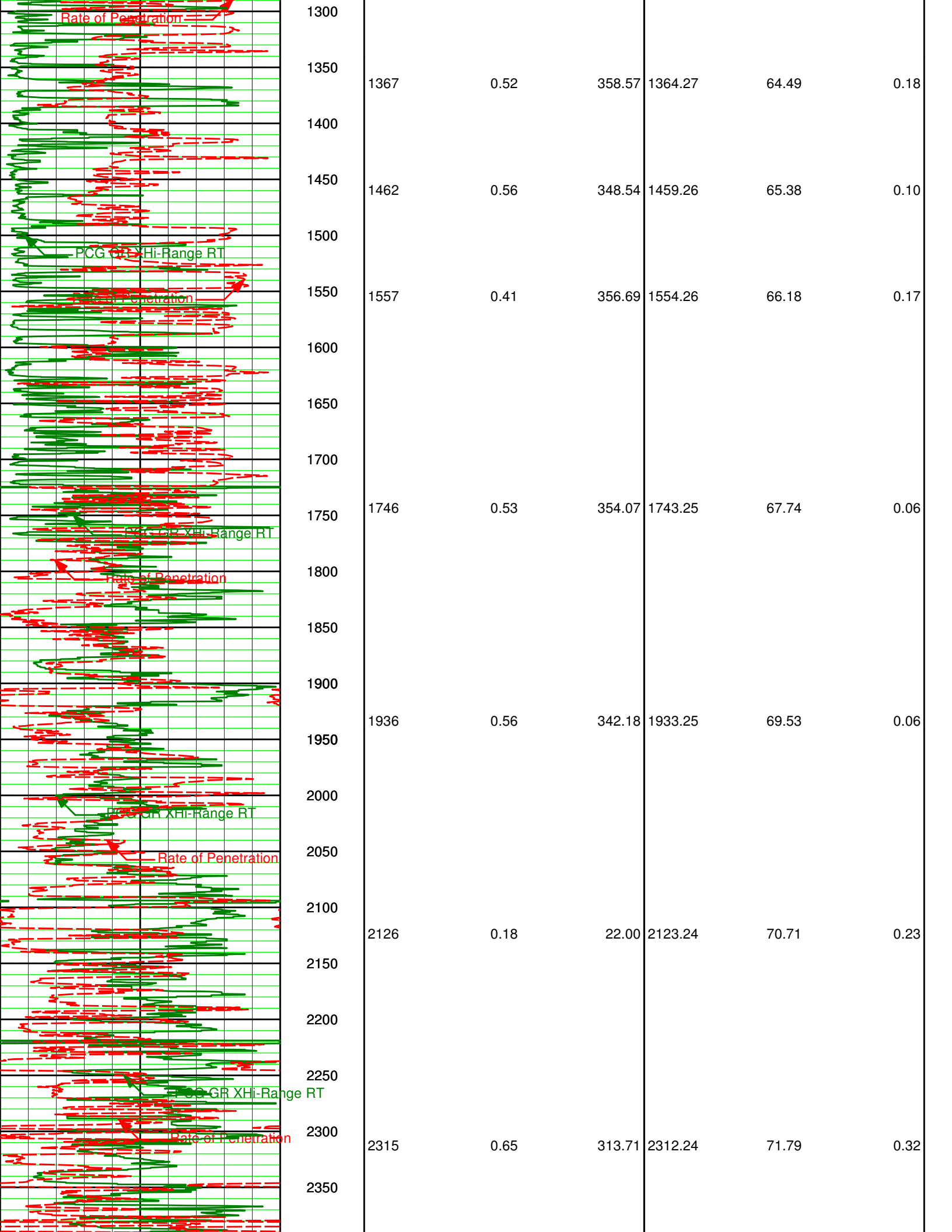
- ROP: 1.0 ft interval, 3.0 ft coercion distance.
- GAMMA: 0.5 ft interval, 0.6 ft coercion distance.

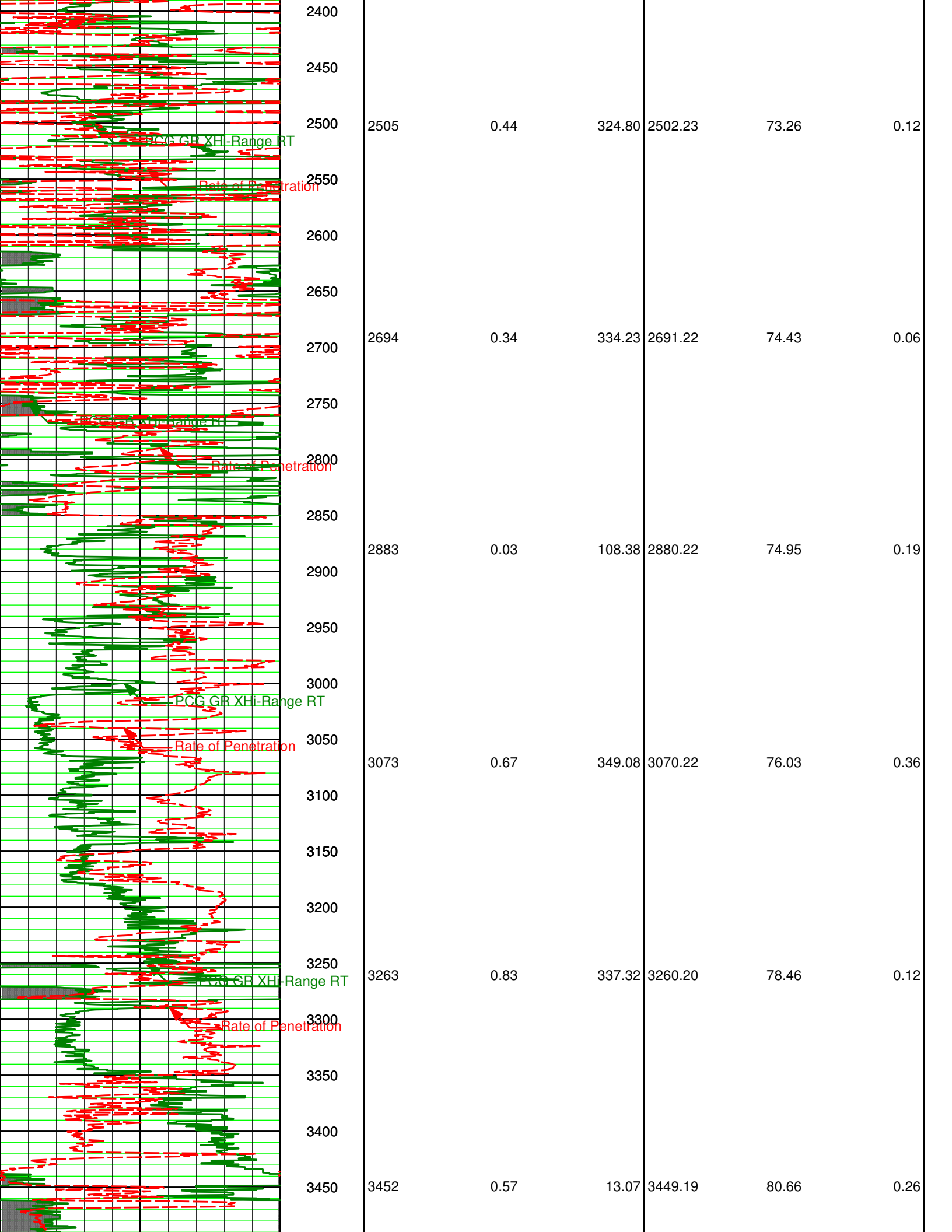
5. Run 100 was directional only.

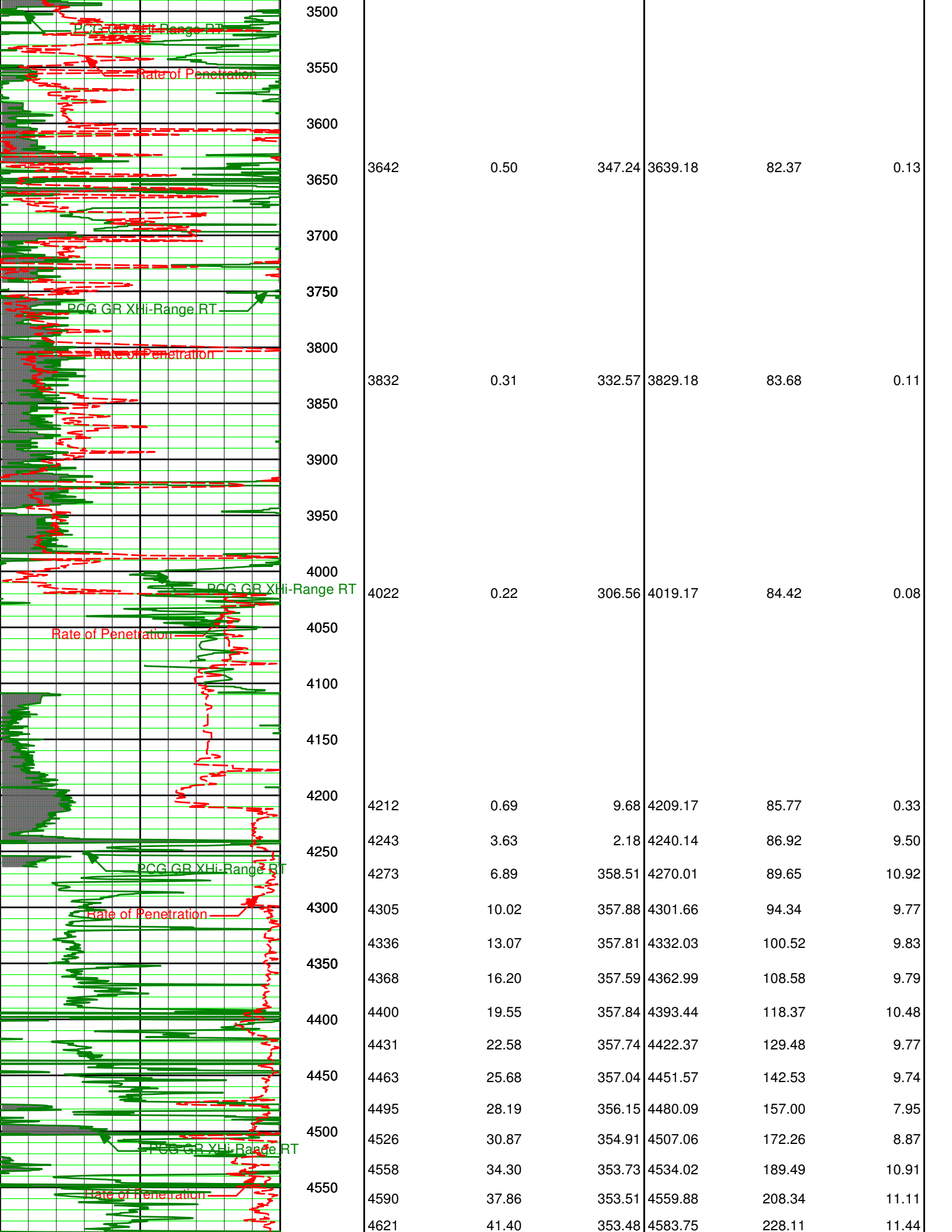
## WARRANTY

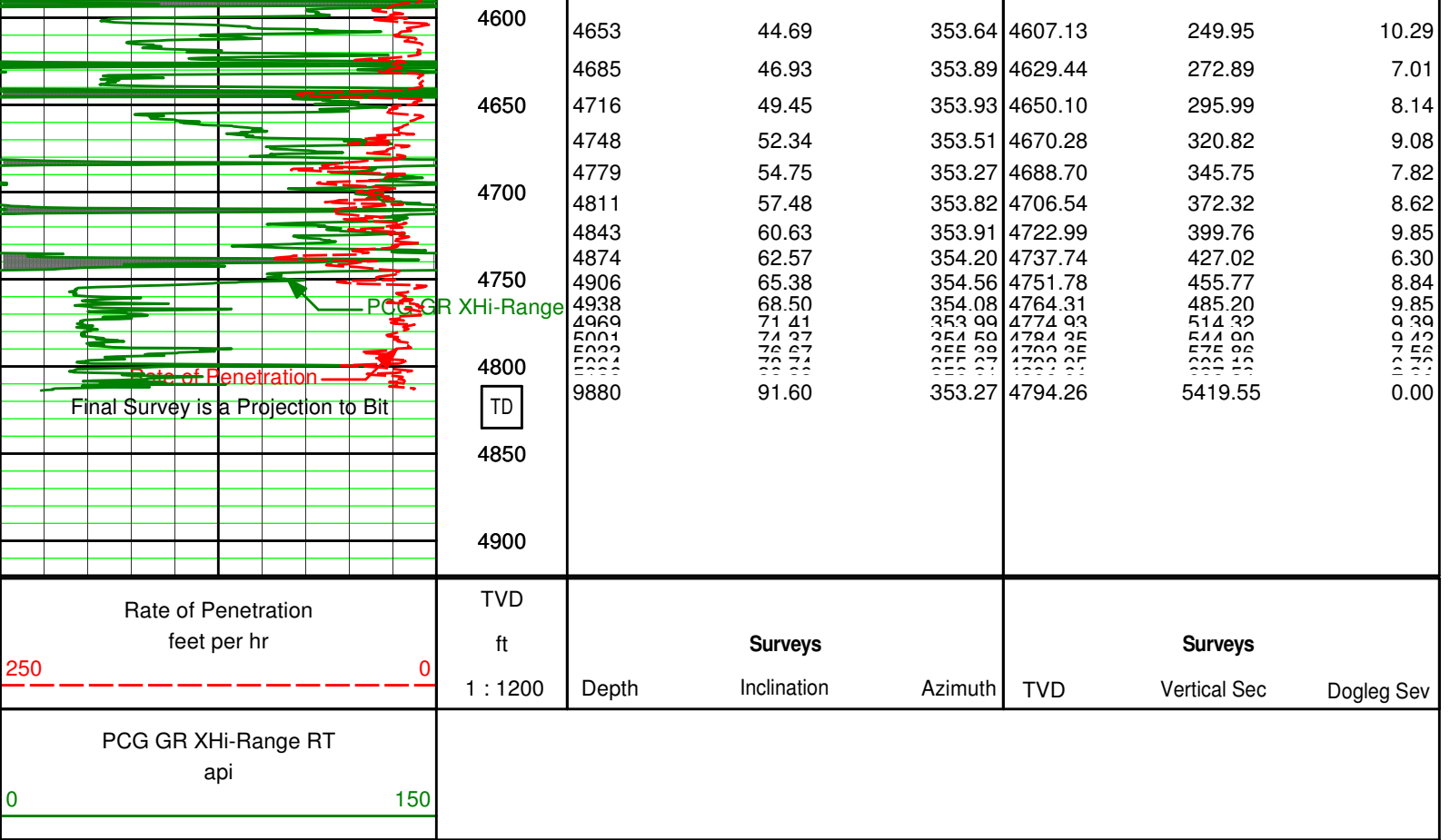
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# HALLIBURTON

## DIRECTIONAL SURVEY REPORT

Shell Exploration and Productio  
 Schupbach 3510 #4-1H  
 Arrowhead  
 Barber KS  
 USA

OK-XX-0009504797

Surveys from 0' MD to 9,880' are provided by Halliburton Sperry Drilling Services.  
 Final Survey is a projection to the bit.

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
80.00	0.31	239.54	80.00	0.11 S	0.19 W	-0.09	0.39
142.00	0.51	111.31	142.00	0.29 S	0.07 W	-0.28	1.20
172.00	0.64	87.19	172.00	0.33 S	0.22 E	-0.36	0.92
202.00	0.86	43.88	201.99	0.16 S	0.54 E	-0.23	1.97
234.00	1.41	21.30	233.99	0.38 N	0.85 E	0.28	2.19
269.00	2.25	2.08	268.97	1.47 N	1.03 E	1.34	2.93
300.00	3.38	358.41	299.93	2.99 N	1.03 E	2.85	3.69
331.00	4.33	353.54	330.86	5.06 N	0.87 E	4.93	3.25
362.00	4.92	352.41	361.76	7.55 N	0.57 E	7.43	1.93
394.00	5.30	351.83	393.63	10.37 N	0.17 E	10.28	1.19
425.00	5.84	348.62	424.49	13.33 N	0.34 W	13.28	1.99
456.00	6.31	345.58	455.31	16.53 N	1.08 W	16.54	1.86
488.00	6.39	345.19	487.12	19.96 N	1.97 W	20.05	0.27
519.00	6.43	344.50	517.92	23.30 N	2.87 W	23.47	0.29
613.00	5.78	351.18	611.39	33.05 N	5.01 W	33.41	1.02
706.00	5.42	351.34	703.95	42.02 N	6.39 W	42.48	0.40
733.00	5.25	351.70	730.83	44.50 N	6.76 W	44.99	0.64
804.00	4.59	358.74	801.57	50.55 N	7.29 W	51.06	1.26
835.00	4.42	0.33	832.47	52.99 N	7.31 W	53.48	0.66



866.00	3.82	0.51	863.39	55.22 N	7.29 W	55.69	1.95
897.00	2.68	359.26	894.34	56.98 N	7.29 W	57.44	3.68
991.00	0.90	354.84	988.29	59.91 N	7.39 W	60.36	1.90
1084.00	0.79	356.59	1081.28	61.27 N	7.49 W	61.73	0.12
1178.00	0.61	356.34	1175.27	62.41 N	7.56 W	62.87	0.19
1272.00	0.43	341.59	1269.27	63.24 N	7.70 W	63.71	0.23
1367.00	0.52	358.57	1364.27	64.01 N	7.83 W	64.49	0.18
1462.00	0.56	348.54	1459.26	64.90 N	7.93 W	65.38	0.10
1557.00	0.41	356.69	1554.26	65.69 N	8.04 W	66.18	0.17
1746.00	0.53	354.07	1743.25	67.25 N	8.17 W	67.74	0.06
1936.00	0.56	342.18	1933.25	69.01 N	8.55 W	69.53	0.06
2126.00	0.18	22.00	2123.24	70.17 N	8.72 W	70.71	0.23
2315.00	0.65	313.71	2312.24	71.19 N	9.38 W	71.79	0.32
2505.00	0.44	324.80	2502.23	72.53 N	10.58 W	73.26	0.12
2694.00	0.34	334.23	2691.22	73.63 N	11.25 W	74.43	0.06
2883.00	0.03	108.38	2880.22	74.12 N	11.45 W	74.95	0.19
3073.00	0.67	349.08	3070.22	75.19 N	11.61 W	76.03	0.36
3263.00	0.83	337.32	3260.20	77.55 N	12.35 W	78.46	0.12
3452.00	0.57	13.07	3449.19	79.73 N	12.66 W	80.66	0.26
3642.00	0.50	347.24	3639.18	81.46 N	12.63 W	82.37	0.13
3832.00	0.31	332.57	3829.18	82.73 N	13.05 W	83.68	0.11
4022.00	0.22	306.56	4019.17	83.40 N	13.59 W	84.42	0.08
4212.00	0.69	9.68	4209.17	84.76 N	13.69 W	85.77	0.33
4243.00	3.63	2.18	4240.14	85.92 N	13.62 W	86.92	9.50
4273.00	6.89	358.51	4270.01	88.67 N	13.64 W	89.65	10.92
4305.00	10.02	357.88	4301.66	93.37 N	13.79 W	94.34	9.77
4336.00	13.07	357.81	4332.03	99.57 N	14.02 W	100.52	9.83
4368.00	16.20	357.59	4362.99	107.65 N	14.35 W	108.58	9.79
4400.00	19.55	357.84	4393.44	117.46 N	14.74 W	118.37	10.48
4431.00	22.58	357.74	4422.37	128.59 N	15.17 W	129.48	9.77
4463.00	25.68	357.04	4451.57	141.65 N	15.77 W	142.53	9.74
4495.00	28.19	356.15	4480.09	156.12 N	16.63 W	157.00	7.95
4526.00	30.87	354.91	4507.06	171.35 N	17.83 W	172.26	8.87
4558.00	34.30	353.73	4534.02	188.50 N	19.54 W	189.49	10.91
4590.00	37.86	353.51	4559.88	207.22 N	21.64 W	208.34	11.11
4621.00	41.40	353.48	4583.75	226.87 N	23.88 W	228.11	11.44
4653.00	44.69	353.64	4607.13	248.57 N	26.33 W	249.95	10.29
4685.00	46.93	353.89	4629.44	271.38 N	28.82 W	272.89	7.01
4716.00	49.45	353.93	4650.10	294.35 N	31.27 W	295.99	8.14
4748.00	52.34	353.51	4670.28	319.03 N	33.99 W	320.82	9.08
4779.00	54.75	353.27	4688.70	343.80 N	36.86 W	345.75	7.82
4811.00	57.48	353.82	4706.54	370.19 N	39.85 W	372.32	8.62
4843.00	60.63	353.91	4722.99	397.48 N	42.78 W	399.76	9.85
4874.00	62.57	354.20	4737.74	424.60 N	45.60 W	427.02	6.30
4906.00	65.38	354.56	4751.78	453.21 N	48.42 W	455.77	8.84
4938.00	68.50	354.08	4764.31	482.51 N	51.33 W	485.20	9.85
4969.00	71.41	353.99	4774.93	511.47 N	54.36 W	514.32	9.39
5001.00	74.37	354.59	4784.35	541.90 N	57.40 W	544.90	9.42
5033.00	76.67	355.38	4792.35	572.76 N	60.11 W	575.86	7.56
5064.00	78.74	355.67	4798.95	602.95 N	62.47 W	606.13	6.76
5096.00	80.90	356.21	4804.61	634.37 N	64.70 W	637.59	6.94
5128.00	83.33	356.61	4809.00	666.00 N	66.68 W	669.24	7.69
5159.00	86.28	355.82	4811.81	696.80 N	68.72 W	700.07	9.85
5254.00	90.40	355.94	4814.56	791.50 N	75.54 W	794.92	4.34
5347.00	91.11	355.95	4813.33	884.26 N	82.11 W	887.81	0.76
5440.00	89.97	355.54	4812.45	976.99 N	89.01 W	980.72	1.31
5535.00	91.11	354.32	4811.56	1071.61 N	97.40 W	1075.68	1.75
5630.00	91.87	354.62	4809.08	1166.14 N	106.55 W	1170.63	0.86
5725.00	91.67	352.83	4806.15	1260.52 N	116.92 W	1265.58	1.90
5820.00	90.22	352.98	4804.59	1354.78 N	128.65 W	1360.56	1.53
5915.00	90.43	352.89	4804.05	1449.06 N	140.34 W	1455.55	0.25
6010.00	89.60	352.40	4804.02	1543.27 N	152.50 W	1550.55	1.01
6105.00	89.97	353.24	4804.38	1637.53 N	164.37 W	1645.54	0.97
6201.00	90.40	353.93	4804.07	1732.93 N	175.09 W	1741.54	0.84
6295.00	90.62	353.60	4803.24	1826.37 N	185.30 W	1835.53	0.42
6390.00	90.12	352.08	4802.63	1920.62 N	197.15 W	1930.52	1.68
6485.00	89.38	351.51	4803.03	2014.65 N	210.70 W	2025.49	0.98
6579.00	90.06	352.26	4803.49	2107.70 N	223.97 W	2119.45	1.07
6674.00	90.06	351.84	4803.39	2201.79 N	237.12 W	2214.43	0.44
6769.00	90.55	351.68	4802.88	2295.81 N	250.73 W	2309.39	0.54
6864.00	91.08	351.75	4801.52	2389.80 N	264.42 W	2404.34	0.56

6959.00	90.83	352.13	4799.94	2483.85 N	277.74 W	2499.30	0.48
7054.00	90.18	353.88	4799.10	2578.14 N	289.32 W	2594.29	1.97
7149.00	90.00	354.35	4798.95	2672.64 N	299.06 W	2689.28	0.53
7244.00	91.48	354.82	4797.72	2767.20 N	308.02 W	2784.25	1.64
7339.00	90.71	355.07	4795.90	2861.81 N	316.39 W	2879.20	0.86
7434.00	89.66	354.37	4795.59	2956.41 N	325.13 W	2974.17	1.33
7529.00	90.03	354.66	4795.85	3050.97 N	334.21 W	3069.14	0.49
7624.00	90.77	354.35	4795.18	3145.53 N	343.31 W	3164.12	0.84
7719.00	90.06	353.63	4794.50	3240.01 N	353.26 W	3259.11	1.06
7814.00	89.29	353.29	4795.03	3334.39 N	364.08 W	3354.11	0.89
7909.00	89.91	353.65	4795.69	3428.77 N	374.88 W	3449.11	0.75
8004.00	89.35	353.01	4796.31	3523.12 N	385.91 W	3544.10	0.89
8099.00	88.37	354.33	4798.20	3617.52 N	396.38 W	3639.08	1.73
8193.00	90.43	353.91	4799.19	3711.02 N	406.01 W	3733.06	2.24
8288.00	91.97	354.78	4797.19	3805.53 N	415.37 W	3828.02	1.86
8383.00	91.39	354.13	4794.41	3900.04 N	424.55 W	3922.96	0.92
8478.00	89.91	352.30	4793.34	3994.36 N	435.77 W	4017.95	2.47
8573.00	90.09	352.10	4793.34	4088.49 N	448.66 W	4112.93	0.29
8667.00	90.37	351.88	4792.96	4181.57 N	461.75 W	4206.90	0.38
8762.00	90.40	351.60	4792.32	4275.58 N	475.40 W	4301.86	0.29
8857.00	90.12	351.74	4791.89	4369.58 N	489.17 W	4396.82	0.33
8952.00	89.10	351.17	4792.53	4463.52 N	503.29 W	4491.77	1.23
9047.00	89.97	352.05	4793.30	4557.50 N	517.15 W	4586.72	1.30
9142.00	90.74	352.25	4792.71	4651.60 N	530.12 W	4681.70	0.84
9237.00	91.29	354.06	4791.02	4745.91 N	541.45 W	4776.68	1.99
9332.00	87.96	352.72	4791.64	4840.26 N	552.39 W	4871.66	3.78
9427.00	88.70	353.01	4794.40	4934.48 N	564.19 W	4966.61	0.84
9522.00	89.51	353.51	4795.88	5028.81 N	575.34 W	5061.60	1.00
9617.00	89.63	353.37	4796.60	5123.19 N	586.19 W	5156.60	0.20
9712.00	89.57	352.48	4797.26	5217.46 N	597.88 W	5251.59	0.94
9807.00	91.60	353.27	4796.30	5311.72 N	609.66 W	5346.58	2.29
9880.00	91.60	353.27	4794.26	5384.18 N	618.21 W	5419.55	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 353.34 DEGREES (TRUE)  
A TOTAL CORRECTION OF 4.88 DEG FROM MAGNETIC NORTH TO TRUE NORTH HAS BEEN APPLIED

HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 9880.00 FEET  
IS 5419.56 FEET ALONG 353.45 DEGREES (TRUE)

Final Survey is a projection to the bit.