



LWD MEMORY LOG - 8.500" SECTION

Gamma Ray

Scale:	Company: Noble Energy					
	Well:	Benelli Federal LC22-760				
	Field:	Weld County(Noble NAD 83 Grid)				
Depth Reference:	Driller's Depth	County:	Weld	State:	United States	
Status:	Final Print	Surface Location:	Latitude:	040° 44' 32.424" N	Other Services:	
API No:	05-123-42977-00	Longitude:	103° 58' 03.648" W	Drilling Dynamics	Wellbore Survey	
Job ID:	8300297	UTM:	N/A	N/A		
Permanent Datum (P.D.):	Ground Level	Elevation:	4915.00 ft	KB:	N/A	
Log Measured From:	Rig Floor	Above P.D.	30.00 ft	DF:	4945.00 ft	
				GL:	4915.00 ft	
Dates	Interval Logged			Magnetic Field Reference		
Date From:	2017-02-28	Top: (ft)	1919.00	Azi Reference North:	Grid	Dip Angle: (deg)
Date To:	2017-03-01	Bottom: (ft)	6125.00	Total Magnetic Field Strength: (nT)		52668
Spud Date:	2017-02-28			Mag to Reference North Correction: (deg)		6.70 E
	Borehole Record			Casing Record		
Hole Size (in)	From (ft)	To (ft)	Size (in)	Weight (lb/ft)	From (ft)	To (ft)
13.500	30.00	1922.00	9.625	36.00	30.00	1912.00
8.500	1922.00	11100.00				

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Log Run Summary

Run No	Bit Run No.	Bit Size (in)	Bit Type	Bit Gauge Length (in)	Assembly Type	Logged Interval		Bit Depth Interval		Date / Time		Circ. Hours (h)
						Top	Bottom	From	To	Start Logging	End Logging	
						(ft)	(ft)	(ft)	(ft)			
1	1	8.500	PDC	3.00	AutoTrak Curve	1909.00	2047.00	1922.00	2060.00	2017-02-28 21:27	2017-02-28 23:28	2.02
2	2	8.500	PDC	3.00	AutoTrak Curve	2047.00	11009.00	2060.00	11022.00	2017-03-01 02:07	2017-03-02 13:07	31.30

Crew

Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite
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	Weights	Weights	Weights	Weights	Weights	Weights	Weights	Weights
Emi Iyalla	2017-02-28	2017-03-02	Zac Williams	2017-02-28	2017-03-02			

Mud Properties Record

Date / Time	Run No.	Measured Depth (ft)	Mud Type	Density (ppg)	Viscosity (cP)	pH	Fluid Loss (cm3)	Oil / Water	Source	Total Chlorides (ppm)	K+ (%)
2017-02-28 21:10	1	1912.00	Diesel-Oil Based Mud	9.2	55	N/A	26.0	89/11	Active Pit	16500	0.00
2017-03-01 05:00	2	2505.00	Diesel-Oil Based Mud	9.0	44	N/A	18.0	87.4/12.6	Active Pit	16500	0.00
2017-03-02 05:00	2	8273.00	Diesel-Oil Based Mud	9.0	41	N/A	17.0	88.5/11.5	Active Pit	17500	0.00

Equipment and Service Data

Run No.	Tool	Serial Number	Measurement	Sensor Offset (ft)	Bit Offset (ft)	Max O.D. (in)	Min I.D. (in)
1	ATC_SU	12194649	Near Bit VSS	5.93	6.73	7.000	2.250
1	ATC_SU	12194649	Near Bit Inclination	5.93	6.73	7.000	2.250
1	ATC_MWD	12271697	Gamma (single)	2.76	12.90	7.000	2.250
1	ATC_MWD	12271697	Directional (mag)	12.28	22.42	7.000	2.250
2	ATC_SU	12088418	Near Bit VSS	6.15	6.95	7.000	4.330
2	ATC_SU	12088418	Near Bit Inclination	6.15	6.95	7.000	4.330
2	ATC_MWD	12161072	Gamma (single)	2.76	12.90	7.000	3.250
2	ATC_MWD	12161072	Directional (mag)	13.08	23.22	7.000	3.250

Service and Tool Mnemonics

Mnemonic	Name	Description
ATC_SU	ATC_SU	Auto Trak Curve Steering Unit
ATC_MWD	ATC_MWD	Auto Trak Curve MWD
ATC_LCPM	ATC_LCPM	Auto Trak Curve LCPM

Comments

1	Depth measurements were obtained from a depth control system not supplied or operated by Baker Hughes. Due to the lack of control by Baker Hughes, depth calibrations and measurements could not be independently verified.
2	Baker Hughes LWD runs 1 & 2 utilized a 6.75 inch NaviGamma (Directional and Gamma Ray) services behind a 8.5 inch bit and rotary steerable assembly from 1922 to11022 feet MD (1922 to 6110 feet TVD).

Remarks

Number	Measured Depth (ft)	Hole Section (in)	Run No.	Remark
1	1922.00	8.500	1	Gamma Ray logging operations began at 1922 feet MD (1922 feet TVD).

Gamma Ray - Apparent 3 ft Average GRAM		TVD 1:1200 feet	Depth Averaged ROP 3 ft Average ROPA		Weight On Bit, Average 1 ft Average WOBA	
0	300		1000	0	0	50
API			ft/h		klb	
					Downhole Temperature TCDM	
					0	300
					degF	
		1800				

9 5/8" Casing

>R1

R1<R2

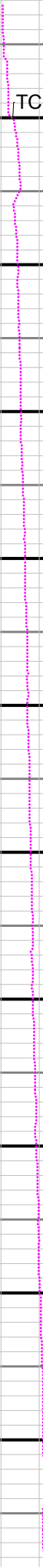
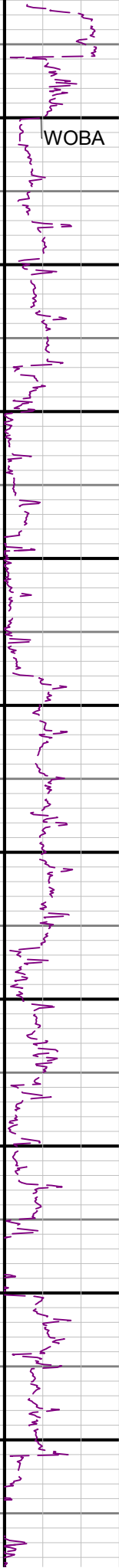
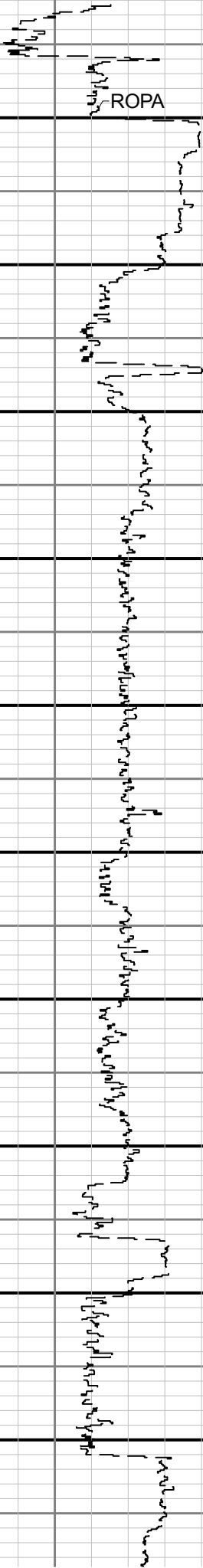
TCDM

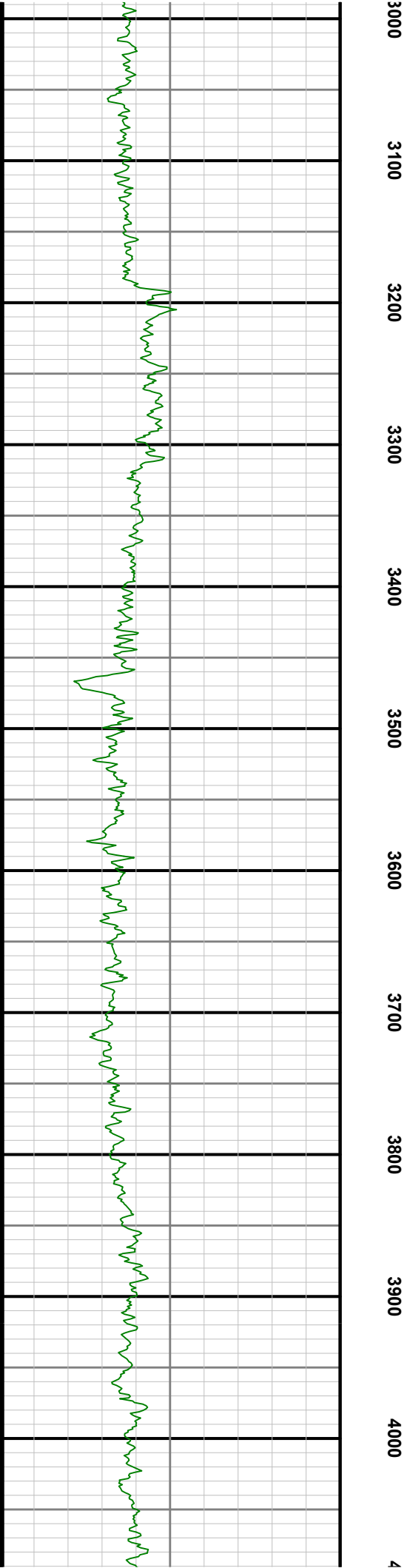
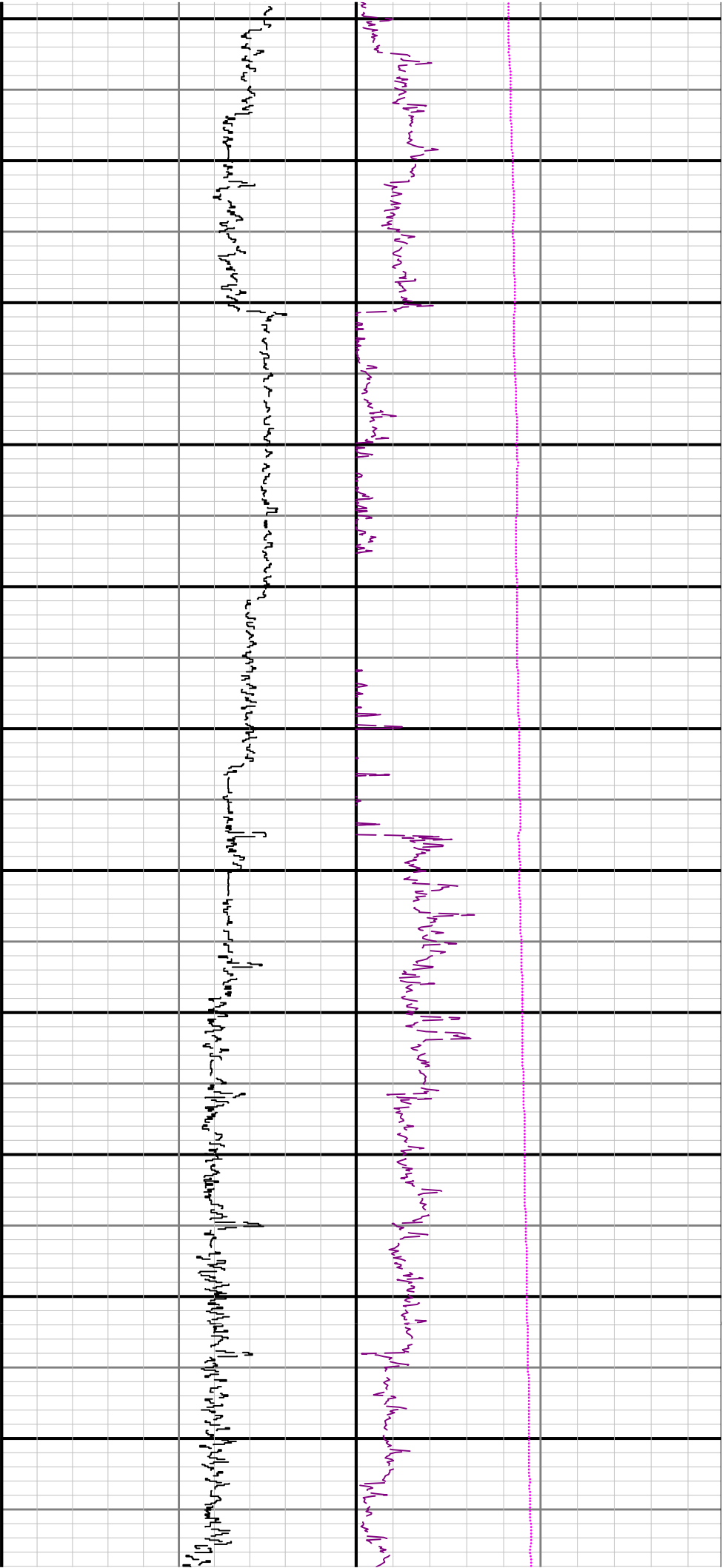
WOBA

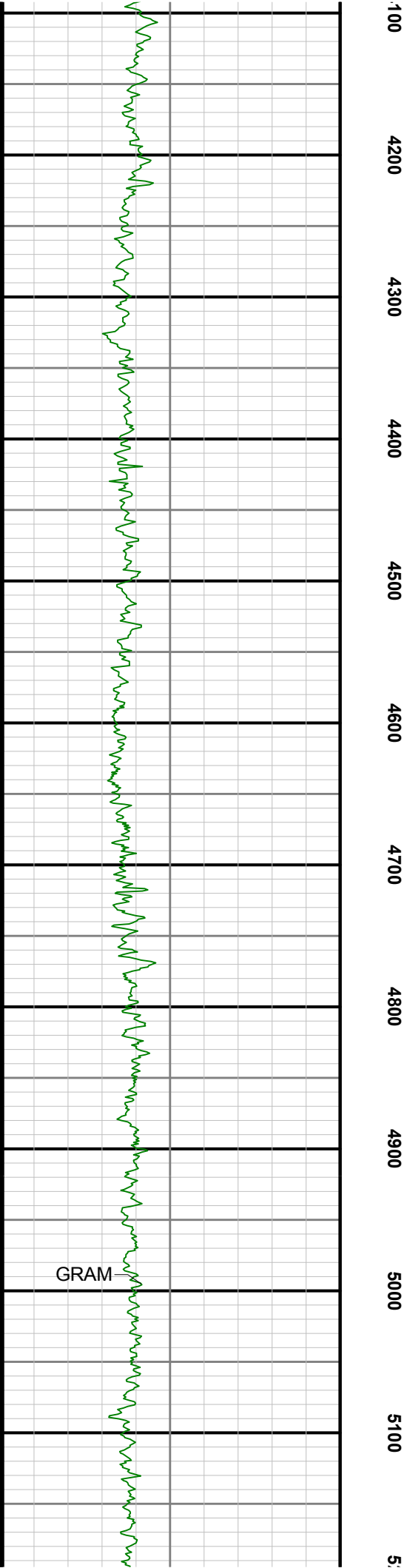
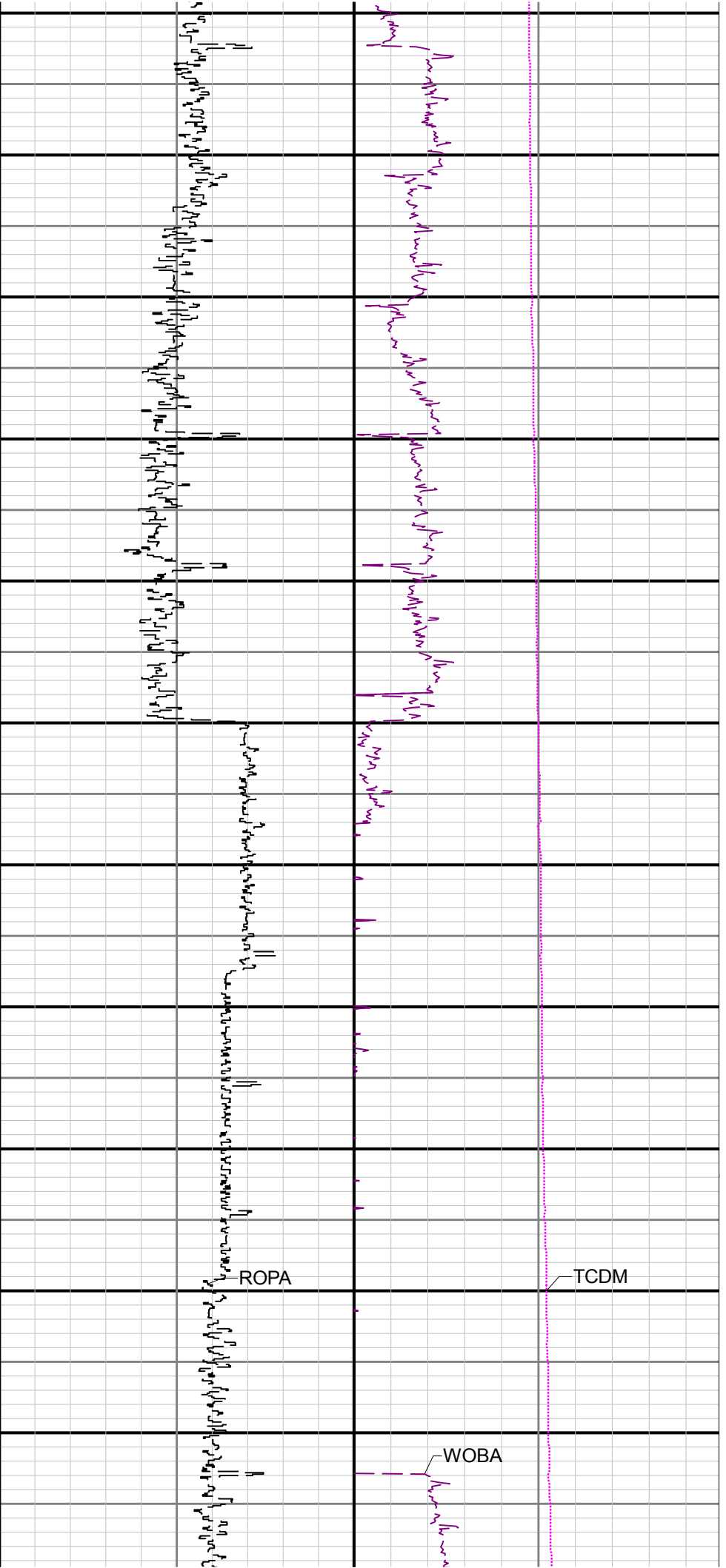
ROPA

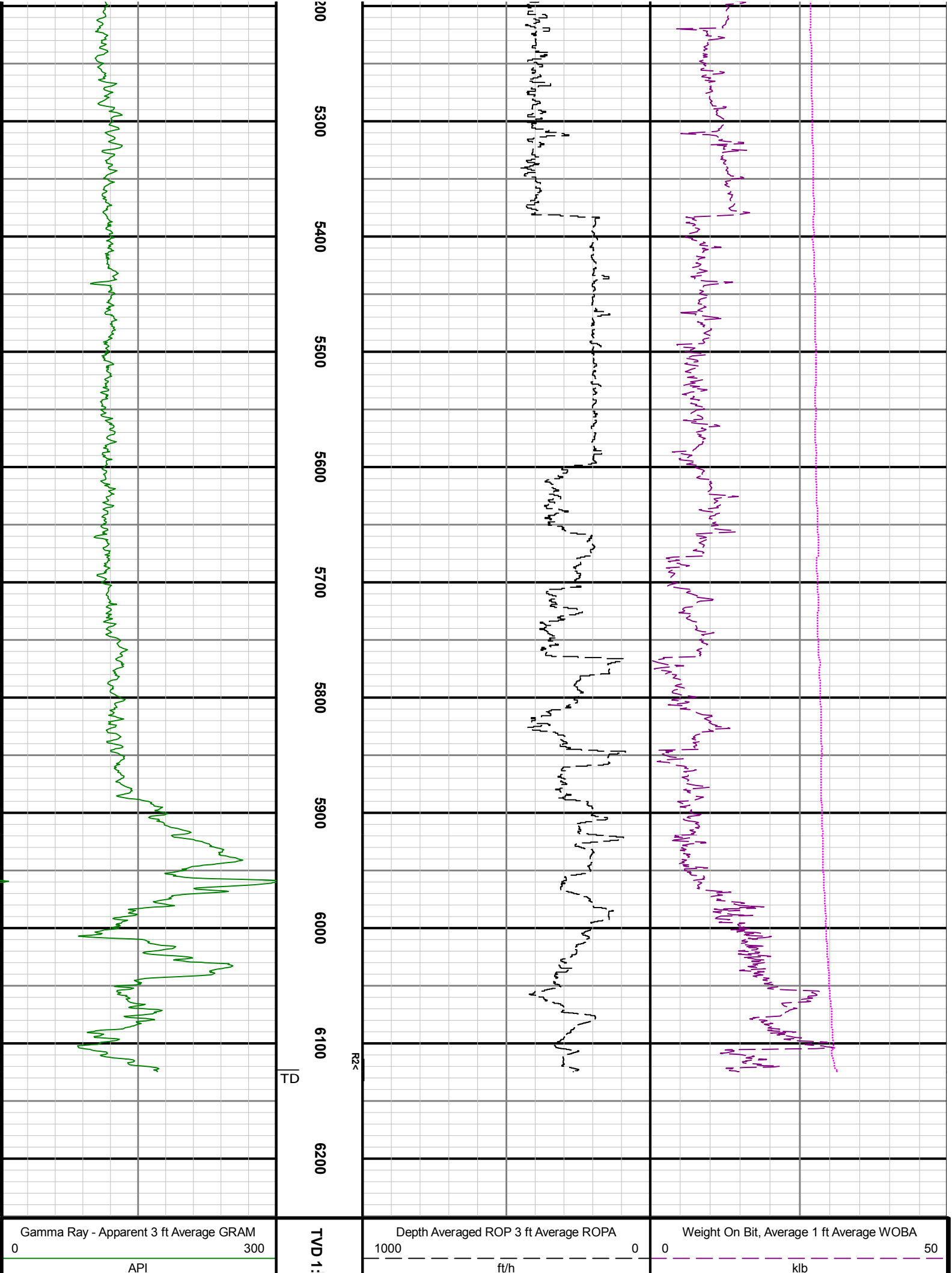
GRAM

1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900









	1200 feet		Downhole Temperature TCDM	
			0	300
degF				

Directional Survey Summary				
Latitude:	040° 44' 32.424" N	Longitude:	103° 58' 03.648" W	
North Reference:	Grid	Drill Depth Zero:	Rig Floor	
Vertical Datum is:	Ground Level	Vertical Datum to DDZ: (ft)	30.00	
Vertical Section North: (m)	0.00	Vertical Section East: (m)	0.00	
Vertical Section Azimuth: (deg)	169.58			
Grid Convergence: (deg)	-0.99	Magnetic Declination: (deg)	7.69	
Total Correction: (deg)	6.70	TVD Calculation Method:	Minimum Curvature	
Magnetic Correction:	On	Local Magnetic Field: (nT)	52668	
Local Magnetic Dip Angle: (deg)	67.09	Local Gravity Field: (m/s2)	9.804	

Tie-In / Projection	Measured Depth (ft)	Inclination (deg)	Azimuth (deg)	Temperature (degF)	North (ft)	East (ft)	True Vertical Depth (ft)	Vertical Section (ft)	Course Length (ft)	Dog Leg Severity (deg/100ft)	Build Rate (deg/100ft)	Turn Rate (deg/100ft)
Tie-In	0.00	0.00	0.00	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	81.00	0.12	18.38	N/A	0.08	0.03	81.00	-0.07	81.00	0.15	0.15	22.69
	175.00	0.15	61.55	N/A	0.23	0.17	175.00	-0.20	94.00	0.11	0.03	45.93
	270.00	0.58	41.27	N/A	0.65	0.59	270.00	-0.54	95.00	0.47	0.45	-21.35
	365.00	0.56	28.30	N/A	1.42	1.13	364.99	-1.20	95.00	0.14	-0.02	-13.65
	460.00	0.42	104.72	N/A	1.74	1.69	459.99	-1.41	95.00	0.65	-0.15	80.44
	554.00	0.22	97.37	N/A	1.63	2.20	553.99	-1.21	94.00	0.22	-0.21	-7.82
	649.00	0.34	165.82	N/A	1.34	2.45	648.99	-0.87	95.00	0.35	0.13	72.05
	743.00	0.53	155.10	N/A	0.67	2.70	742.99	-0.17	94.00	0.22	0.20	-11.40
	838.00	0.28	124.46	N/A	0.14	3.08	837.98	0.42	95.00	0.34	-0.26	-32.25
	932.00	0.21	315.39	N/A	0.13	3.14	931.98	0.44	94.00	0.52	-0.07	-179.86
	1027.00	0.22	216.48	N/A	0.11	2.91	1026.98	0.42	95.00	0.34	0.01	-104.12
	1122.00	0.33	118.34	N/A	-0.16	3.05	1121.98	0.71	95.00	0.44	0.12	-103.31
	1216.00	0.06	185.35	N/A	-0.34	3.28	1215.98	0.93	94.00	0.33	-0.29	71.29
	1311.00	0.10	194.48	N/A	-0.47	3.25	1310.98	1.05	95.00	0.04	0.04	9.61
	1406.00	0.07	154.35	N/A	-0.60	3.26	1405.98	1.18	95.00	0.07	-0.03	-42.24
	1500.00	0.13	5.72	N/A	-0.55	3.29	1499.98	1.14	94.00	0.21	0.06	-158.12
	1595.00	0.13	244.97	N/A	-0.49	3.21	1594.98	1.06	95.00	0.24	0.00	-127.11
	1689.00	0.22	214.70	N/A	-0.68	3.01	1688.98	1.22	94.00	0.13	0.10	-32.20
	1784.00	0.08	323.78	N/A	-0.78	2.87	1783.98	1.28	95.00	0.27	-0.15	114.82
	1879.00	0.65	35.38	N/A	-0.29	3.14	1878.98	0.85	95.00	0.66	0.60	75.37
	1906.00	0.78	35.56	N/A	-0.01	3.33	1905.98	0.61	27.00	0.48	0.48	0.67
	1979.00	0.21	7.34	N/A	0.53	3.64	1978.97	0.14	73.00	0.83	-0.78	-38.66
	2074.00	2.08	43.22	N/A	1.95	4.84	2073.95	-1.05	95.00	2.01	1.97	37.77
	2168.00	4.65	66.34	N/A	4.73	9.50	2167.78	-2.93	94.00	3.04	2.73	24.60
	2263.00	6.49	59.63	N/A	8.99	17.66	2262.33	-5.64	95.00	2.05	1.94	-7.06
	2357.00	7.44	44.27	N/A	16.03	26.49	2355.65	-10.98	94.00	2.22	1.01	-16.34
	2452.00	9.12	53.58	N/A	24.91	36.85	2449.66	-17.83	95.00	2.26	1.77	9.80
	2547.00	10.40	63.30	N/A	33.23	50.57	2543.29	-23.54	95.00	2.19	1.35	10.23
	2641.00	12.64	72.60	N/A	40.12	67.97	2635.39	-27.17	94.00	3.09	2.38	9.89
	2736.00	14.30	75.32	N/A	46.20	89.24	2727.78	-29.30	95.00	1.87	1.75	2.86
	2831.00	14.99	56.34	N/A	55.99	110.82	2819.74	-35.02	95.00	5.08	0.73	-19.98
	2925.00	17.29	43.33	N/A	72.90	130.54	2910.06	-48.09	94.00	4.55	2.45	-13.84
	3020.00	15.49	20.65	N/A	95.06	144.71	3001.29	-67.32	95.00	6.95	-1.89	-23.87
	3115.00	13.90	352.18	N/A	118.27	147.64	3093.30	-89.62	95.00	7.70	-1.67	-29.97
	3209.00	13.68	345.39	N/A	140.21	143.30	3184.60	-111.98	94.00	1.74	-0.23	-7.22
	3304.00	13.73	3.99	N/A	162.34	141.25	3276.94	-134.12	95.00	4.62	0.05	19.58
	3398.00	14.68	16.32	N/A	184.91	145.37	3368.08	-155.56	94.00	3.37	1.01	13.12
	3493.00	14.73	28.26	N/A	207.10	154.48	3459.99	-175.75	95.00	3.19	0.05	12.57
	3588.00	14.74	41.03	N/A	226.86	168.13	3551.89	-192.71	95.00	3.41	0.01	13.44
	3683.00	14.65	49.76	N/A	243.74	185.24	3643.80	-206.22	95.00	2.33	-0.09	9.19
	3777.00	15.03	47.57	N/A	259.64	203.31	3734.66	-218.59	94.00	0.72	0.40	-2.33
	3872.00	15.09	36.26	N/A	277.93	219.72	3826.42	-233.61	95.00	3.09	0.06	-11.91
	3967.00	15.13	38.43	N/A	297.61	234.74	3918.14	-250.25	95.00	0.60	0.04	2.28
	4061.00	15.13	43.03	N/A	316.19	250.73	4008.88	-265.63	94.00	1.28	0.00	4.89
	4156.00	15.07	50.61	N/A	333.09	268.74	4100.61	-278.99	95.00	2.08	-0.06	7.98
	4250.00	15.12	55.88	N/A	347.72	288.33	4191.37	-289.84	94.00	1.46	0.05	5.61
	4345.00	15.07	57.93	N/A	361.23	309.06	4283.09	-299.38	95.00	0.56	-0.05	2.16
	4439.00	15.11	56.31	N/A	374.52	329.61	4373.85	-308.73	94.00	0.45	0.04	-1.72
	4534.00	15.04	62.58	N/A	387.06	350.85	4465.59	-317.22	95.00	1.72	-0.07	6.60
	4628.00	15.08	68.35	N/A	397.19	373.04	4556.37	-323.17	94.00	1.59	0.04	6.14
	4723.00	15.04	65.60	N/A	406.84	395.76	4648.11	-328.55	95.00	0.75	-0.04	-2.89
	4818.00	15.08	58.95	N/A	418.31	417.57	4739.85	-335.89	95.00	1.82	0.04	-7.00
	4912.00	15.00	58.88	N/A	430.90	438.46	4830.63	-344.49	94.00	0.09	-0.09	-0.07
	5007.00	15.00	57.07	N/A	442.08	450.26	4922.27	-352.57	95.00	0.50	0.00	1.04

	5007.00	15.09	57.07	N/A	443.36	439.36	4922.37	-333.37	95.00	0.90	0.09	-1.91
	5101.00	15.02	50.91	N/A	458.31	479.09	5013.15	-364.10	94.00	1.70	-0.07	-6.55
	5196.00	14.85	48.47	N/A	474.14	497.76	5104.94	-376.30	95.00	0.69	-0.18	-2.57
	5290.00	15.03	55.79	N/A	488.98	516.85	5195.78	-387.44	94.00	2.02	0.19	7.79
	5385.00	15.07	56.34	N/A	502.75	537.32	5287.52	-397.28	95.00	0.16	0.04	0.58
	5480.00	14.78	52.89	N/A	516.91	557.26	5379.31	-407.60	95.00	0.98	-0.31	-3.63
	5575.00	10.24	79.64	N/A	525.75	575.26	5472.11	-413.04	95.00	7.63	-4.78	28.16
	5669.00	12.05	117.18	N/A	522.77	592.23	5564.45	-407.04	94.00	7.80	1.93	39.94
	5764.00	17.96	150.25	N/A	505.48	608.36	5656.33	-387.11	95.00	10.72	6.22	34.81
	5858.00	25.10	159.23	N/A	474.20	622.64	5743.74	-353.77	94.00	8.35	7.60	9.55
	5953.00	33.12	159.87	N/A	430.93	638.75	5826.67	-308.29	95.00	8.45	8.44	0.67
	6047.00	40.91	165.09	N/A	376.97	655.54	5901.69	-252.20	94.00	8.93	8.29	5.55
	6142.00	49.19	171.41	N/A	311.22	668.94	5968.78	-185.10	95.00	9.90	8.72	6.65
	6236.00	58.59	173.49	N/A	236.02	678.82	6024.12	-109.35	94.00	10.16	10.00	2.21
	6331.00	66.17	175.46	N/A	152.30	686.87	6068.14	-25.56	95.00	8.19	7.98	2.07
	6425.00	75.12	175.96	N/A	63.95	693.49	6099.26	62.53	94.00	9.53	9.52	0.53
	6519.00	81.81	176.01	N/A	-27.88	699.93	6118.04	154.01	94.00	7.12	7.12	0.05
	6614.00	89.72	176.36	N/A	-122.33	706.23	6125.05	248.05	95.00	8.33	8.33	0.37
	6709.00	90.31	175.52	N/A	-217.09	712.96	6125.03	342.46	95.00	1.08	0.62	-0.88
	6803.00	90.34	175.54	N/A	-310.80	720.28	6124.50	435.95	94.00	0.04	0.03	0.02
	6898.00	90.34	175.51	N/A	-405.51	727.69	6123.93	530.44	95.00	0.03	0.00	-0.03
	6992.00	90.37	176.38	N/A	-499.28	734.34	6123.35	623.86	94.00	0.93	0.03	0.93
	7087.00	90.34	178.05	N/A	-594.16	738.96	6122.76	718.01	95.00	1.76	-0.03	1.76
	7181.00	90.40	180.07	N/A	-688.14	740.50	6122.15	810.72	94.00	2.15	0.06	2.15
	7276.00	90.34	180.91	N/A	-783.13	739.69	6121.54	904.00	95.00	0.89	-0.06	0.88
	7370.00	90.40	181.43	N/A	-877.11	737.77	6120.93	996.08	94.00	0.56	0.06	0.55
	7465.00	90.31	179.85	N/A	-972.10	736.71	6120.34	1089.31	95.00	1.67	-0.09	-1.66
	7560.00	90.37	178.04	N/A	-1067.08	738.45	6119.78	1183.04	95.00	1.91	0.06	-1.91
	7654.00	90.34	178.12	N/A	-1161.02	741.60	6119.20	1276.00	94.00	0.09	-0.03	0.09
	7748.00	90.34	178.65	N/A	-1254.98	744.25	6118.64	1368.89	94.00	0.56	0.00	0.56
	7843.00	90.34	178.00	N/A	-1349.94	747.03	6118.08	1462.79	95.00	0.68	0.00	-0.68
	7938.00	90.25	177.35	N/A	-1444.86	750.88	6117.59	1556.84	95.00	0.69	-0.09	-0.68
	8032.00	90.43	178.53	N/A	-1538.80	754.26	6117.03	1649.84	94.00	1.27	0.19	1.26
	8127.00	90.37	179.61	N/A	-1633.78	755.80	6116.37	1743.53	95.00	1.14	-0.06	1.14
	8221.00	90.34	180.08	N/A	-1727.78	756.06	6115.78	1836.03	94.00	0.50	-0.03	0.50
	8316.00	90.31	179.37	N/A	-1822.78	756.51	6115.25	1929.54	95.00	0.75	-0.03	-0.75
	8410.00	90.34	180.35	N/A	-1916.77	756.74	6114.71	2022.03	94.00	1.04	0.03	1.04
	8505.00	90.25	180.16	N/A	-2011.77	756.32	6114.22	2115.38	95.00	0.22	-0.09	-0.20
	8599.00	90.25	178.10	N/A	-2105.75	757.75	6113.81	2208.07	94.00	2.19	0.00	-2.19
	8694.00	90.65	179.42	N/A	-2200.73	759.80	6113.07	2301.85	95.00	1.45	0.42	1.39
	8789.00	90.31	179.85	N/A	-2295.72	760.41	6112.27	2395.39	95.00	0.58	-0.36	0.45
	8883.00	90.34	180.30	N/A	-2389.72	760.29	6111.74	2487.82	94.00	0.48	0.03	0.48
	8978.00	90.37	180.72	N/A	-2484.71	759.44	6111.15	2581.09	95.00	0.44	0.03	0.44
	9073.00	90.00	180.13	N/A	-2579.71	758.74	6110.84	2674.39	95.00	0.73	-0.39	-0.62
	9167.00	89.94	178.15	N/A	-2673.69	760.15	6110.89	2767.08	94.00	2.11	-0.06	-2.11
	9262.00	90.00	177.84	N/A	-2768.64	763.47	6110.94	2861.06	95.00	0.33	0.06	-0.33
	9356.00	90.12	177.95	N/A	-2862.57	766.92	6110.84	2954.07	94.00	0.17	0.13	0.12
	9451.00	89.97	176.58	N/A	-2957.46	771.46	6110.77	3048.22	95.00	1.45	-0.16	-1.44
	9545.00	90.00	176.37	N/A	-3051.28	777.24	6110.79	3141.54	94.00	0.23	0.03	-0.22
	9640.00	90.09	177.01	N/A	-3146.12	782.72	6110.72	3235.80	95.00	0.68	0.09	0.67
	9737.00	90.00	176.34	N/A	-3242.96	788.35	6110.64	3332.06	97.00	0.70	-0.09	-0.69
	9829.00	90.03	177.26	N/A	-3334.82	793.48	6110.62	3423.33	92.00	1.00	0.03	1.00
	9924.00	90.00	177.20	N/A	-3429.71	798.07	6110.59	3517.49	95.00	0.07	-0.03	-0.06
	10018.00	89.97	176.92	N/A	-3523.58	802.90	6110.62	3610.69	94.00	0.30	-0.03	-0.30
	10113.00	90.03	176.18	N/A	-3618.41	808.61	6110.62	3704.98	95.00	0.78	0.06	-0.78
	10208.00	89.97	175.81	N/A	-3713.18	815.25	6110.62	3799.39	95.00	0.39	-0.06	-0.39
	10302.00	90.03	175.21	N/A	-3806.89	822.61	6110.62	3892.88	94.00	0.64	0.06	-0.64
	10397.00	90.03	174.65	N/A	-3901.52	831.00	6110.57	3987.47	95.00	0.59	0.00	-0.59
	10491.00	90.00	175.48	N/A	-3995.17	839.09	6110.54	4081.04	94.00	0.88	-0.03	0.88
	10586.00	90.00	175.92	N/A	-4089.90	846.21	6110.54	4175.50	95.00	0.46	0.00	0.46
	10680.00	90.09	177.82	N/A	-4183.75	851.34	6110.47	4268.73	94.00	2.02	0.10	2.02
	10775.00	90.06	179.89	N/A	-4278.73	853.24	6110.35	4362.49	95.00	2.18	-0.03	2.18
	10869.00	90.09	182.19	N/A	-4372.71	851.53	6110.22	4454.61	94.00	2.45	0.03	2.45
	10964.00	90.06	182.86	N/A	-4467.61	847.35	6110.10	4547.19	95.00	0.71	-0.03	0.71
Projection	11022.00	90.06	182.86	N/A	-4525.54	844.46	6110.04	4603.64	58.00	0.00	0.00	0.00