



## LWD MEMORY LOG

# Gamma Ray

Scale:	Company: Noble Energy																				
	Well: Holliday Federal LC23-780																				
	1:1200 MD																				
	Depth Reference:																				
Driller's Depth										Field: D&E		County: Weld County		Country: United States							
Status:										State: Colorado											
Final Print										Surface Location:		Other Services:									
API No: 05123429500000										Latitude: 40° 41' 00" N		Wellbore Survey									
Job ID: 8300307										Longitude: 105° 00' 00" W											
Permanent Datum (P.D.): Ground Level										SEC: 11		TWN: 9N		RGE: 59W		Elev. KB: N/A					
Log Measured From: Rig Floor										Elevation: Above P.D.		30.00 ft		Elev. DF: 5007.00 ft		Elev. GL: 4977.00 ft					
Dates										Interval Logged				Magnetic Field Reference							
Date From: 2017-01-20										Top: (ft) 1910.00		Azi Reference North: Grid				Dip Angle: (deg) 67.11					
Date To: 2017-01-23										Bottom: (ft) 16710.00		Total Magnetic Field Strength: (nT) 52703									
Spud Date: 2017-01-19										Mag to Reference North Correction: (deg) 6.59 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		1919.00		11.625		36.00		30.00		1910.00	
8.500										1919.00		16710.00									

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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	2.00	Steerable	1906.16	5936.34	1919.00	5949.18	2017-01-20 12:39	2017-01-21 05:37	18.48
2	2	8.500	PDC	2.00	Steerable	5936.25	16697.48	5949.18	16710.41	2017-01-21 12:11	2017-01-23 06:29	38.59

## Crew

Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite
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Matthew Leopold	2017-01-19	2017-01-23	Steven Cano	2017-01-19	2017-01-23			
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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+ (%)
2017-01-20 03:38	1	1919.00	Oil Based Mud	9.3	10	N/A	20.0	84.3/15.7	Active Pit	18000	0.00
2017-01-20 14:30	1	2334.45	Oil Based Mud	9.3	10	N/A	19.0	84.3/15.7	Active Pit	21500	0.00
2017-01-21 11:15	2	5949.18	Oil Based Mud	9.1	9	N/A	17.8	83.9/16.1	Active Pit	21500	0.00
2017-01-21 17:19	2	6319.16	Oil Based Mud	9.0	8	N/A	18.5	84.6/15.4	Active Pit	22000	0.00
2017-01-22 03:00	2	8835.79	Oil Based Mud	9.3	9	N/A	17.5	84.4/15.6	Active Pit	23500	0.00
2017-01-22 17:20	2	13226.10	Oil Based Mud	9.4	10	N/A	20.3	85.5/14.5	Active Pit	22500	0.00
2017-01-23 03:09	2	15962.97	Oil Based Mud	9.3	10	N/A	20.3	85.5/14.5	Active Pit	23500	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	13993179	Near Bit Inclination	5.93	6.67	7.000	4.330
1	ATC_SU	13993179	Near Bit VSS	5.93	6.67	7.000	4.330
1	ATC_MWD	12271805	Gamma (single)	2.75	12.84	7.000	3.250
1	ATC_MWD	12271805	Directional (mag)	12.27	22.36	7.000	3.250
2	ATC_SU	13993179	Near Bit Inclination	5.93	6.76	7.000	4.330
2	ATC_SU	13993179	Near Bit VSS	5.93	6.76	7.000	4.330
2	ATC_MWD	12271805	Gamma (single)	2.75	12.93	7.000	3.250
2	ATC_MWD	12271805	Directional (mag)	12.27	22.45	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

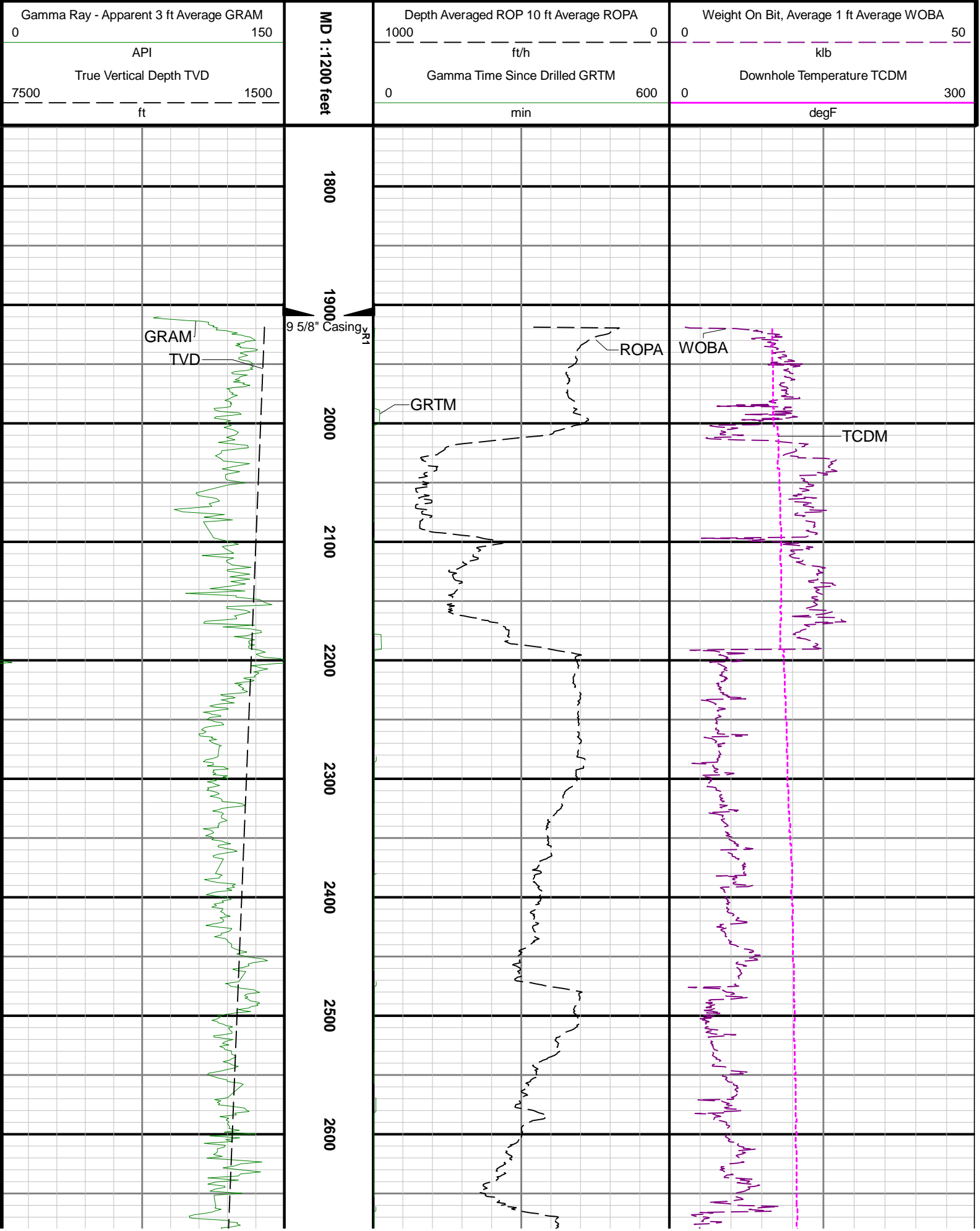
1	Baker Hughes LWD Runs 1 and 2 utilized 6 3/4 inch Navigamma service (Gamma Ray and Directional) behind a 8 1/2 inch bit and rotary steerable assembly from 1919 to 16710 feet MD ( 1918 to 6152 TVD).
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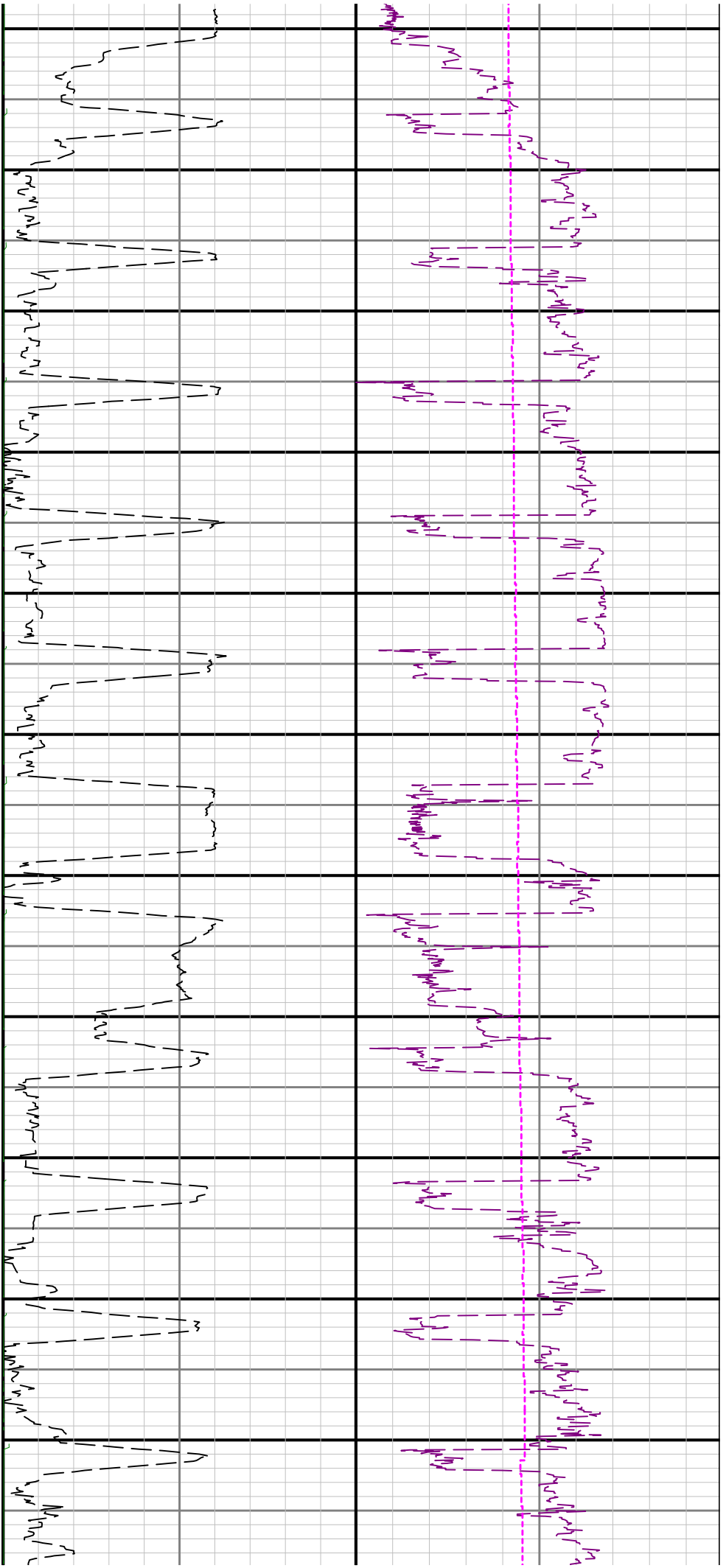
Remarks

Number	Measured Depth (ft)	Hole Section (in)	Run No.	Remark
1	16694.00	8.500	2	The interval from 16694 to 16710 feet MD (6152 feet TVD) was not logged due to sensor to bit offset at well TD.

Curve Mnemonics

Presented Curves	Description	Units
ROPA	Depth Averaged ROP 10 ft Average	ft/h
TVD	True Vertical Depth	ft
WOBA	Weight On Bit, Average 1 ft Average	klb
GRAM	Gamma Ray - Apparent 3 ft Average	API
GRTM	Gamma Time Since Drilled	min
TCDM	Downhole Temperature	degF





2700 2800 2900 3000 3100 3200 3300 3400 3500 3600 3700 :

