

# Noble Energy

Weld County, CO (NAD 83)  
Sec. 4-T6N-R63W (Mahalo State PAD)  
Mahalo State AA09-79-1HNB  
05-123-39102  
Plan C

Design: Actual Surveys

## Sperry Drilling Services

### Final Survey Report

21 January, 2015

Surface UWI : 05-123-39102

Well Coordinates: 1,429,912.97 N, 3,292,488.22 E (40° 30' 31.50" N, 104° 26' 53.16" W)  
Ground Level: 4,698.00 usft

Local Coordinate Origin:

Viewing Datum:

TVDs to System:

North Reference:

Unit System:

Geodetic Scale Factor Applied

Version: 5000.1 Build: 70

Centered on Well Mahalo State AA09-79-1HNB

KB=24 @ 4722.00usft (H&P 322)

N

Grid

Dec-Deg - API - US Survey Feet - Custom

**HALLIBURTON**

Project: Weld County, CO (NAD 83)  
 Site: Sec. 4-T6N-R63W (Mahalo State PAD)  
 Well: Mahalo State AA09-79-1HNB  
 Wellbore: Plan C  
 Design: Actual Surveys



**HALLIBURTON**  
 Sperry Drilling

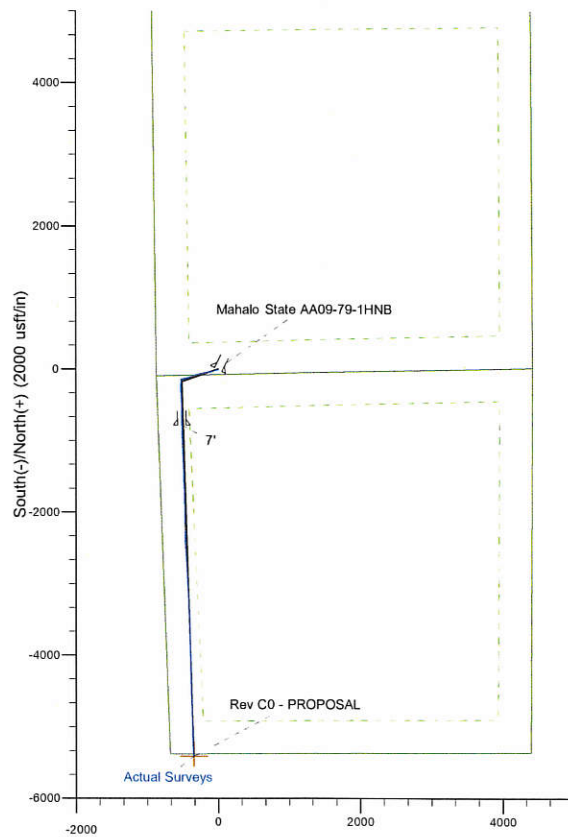
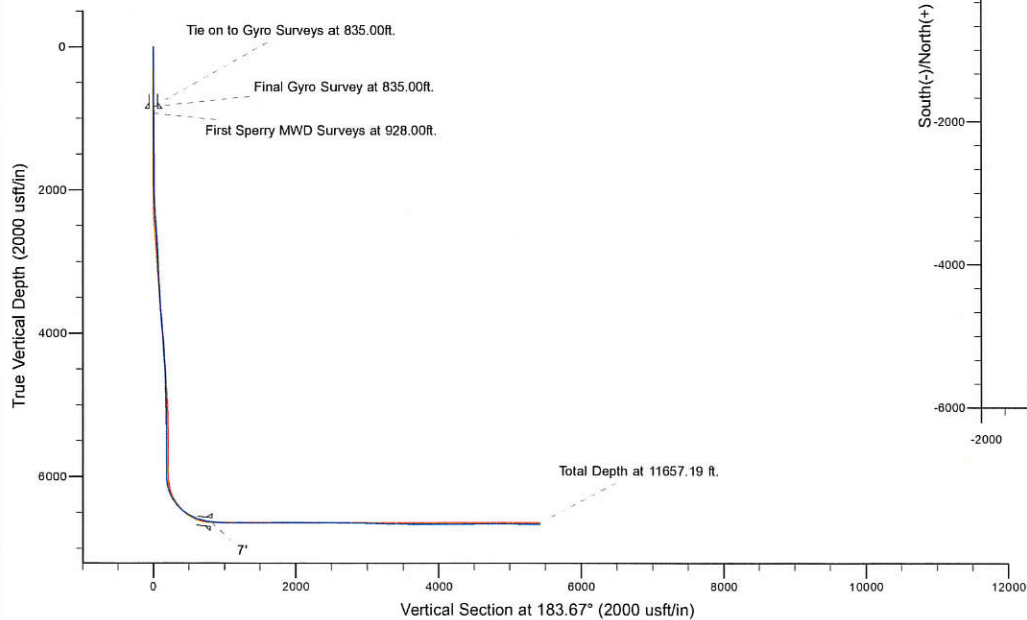
Platted SHL: 75' FSL, 870' FWL  
 Platted Lat/Long: 40.508750 N, 104.4481 W  
 Location: Sec. 4-T6N-R63W

~7" Casing: 700' FNL, 339' FWL  
 Lat/Long: 40.506610 N, 104.449964 W  
 State Planes - CO Northern: 1,429,127.10 N, 3,291,979.15 E  
 Location: Sec. 9-T6N-R63W

Platted BHL: 30' FNL, 330' FWL  
 Lat/Long: 40.4939 N, 104.449580 W  
 State Planes - CO Northern: 1,424,565.14 N, 3,292,135.58 E  
 Location: Sec. 16-T6N-R63W

#### LEGEND

- Mahalo State AA09-79-1HNB, Plan C, Rev C0 - PROPOSAL V0
- Actual Surveys



WELL DETAILS: Mahalo State AA09-79-1HNB

Ground Level: 4098.00  
 KB=24 @ 4722.00usft (H&P 322)

Created By: Tatiana Gomez  
 Created On: 1/21/2015

## Design Report for Mahalo State AA09-79-1HNB - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
269.00	1.00	158.85	268.99	-2.19	0.85	2.13	0.37
552.00	0.30	78.85	551.97	-4.35	2.46	4.18	0.35
835.00	0.80	205.65	834.96	-5.99	2.34	5.83	0.36
Final Gyro Survey at 835.00ft. - Tie on to Gyro Surveys at 835.00ft.							
861.00	0.60	207.15	860.96	-6.27	2.20	6.12	0.76
9 5/8"							
928.00	0.11	236.57	927.96	-6.62	1.98	6.48	0.76
First Sperry MWD Surveys at 928.00ft.							
1,021.00	0.29	266.95	1,020.96	-6.68	1.67	6.56	0.22
1,114.00	0.58	243.66	1,113.95	-6.90	1.01	6.83	0.36
1,207.00	0.91	254.56	1,206.95	-7.31	-0.12	7.30	0.38
1,299.00	1.00	260.08	1,298.93	-7.64	-1.61	7.73	0.14
1,485.00	1.24	266.48	1,484.90	-8.05	-5.22	8.36	0.15
1,578.00	1.29	263.21	1,577.88	-8.23	-7.27	8.68	0.09
1,671.00	1.20	265.58	1,670.85	-8.43	-9.28	9.01	0.11
1,856.00	1.14	263.59	1,855.82	-8.79	-13.04	9.60	0.04
2,042.00	5.13	251.85	2,041.50	-11.58	-22.78	13.02	2.16
2,228.00	8.56	250.22	2,226.15	-18.86	-43.71	21.62	1.85
2,321.00	10.50	251.04	2,317.86	-23.96	-58.24	27.64	2.09
2,414.00	11.79	251.81	2,409.10	-29.68	-75.28	34.44	1.40
2,599.00	10.38	251.75	2,590.65	-40.80	-109.07	47.70	0.76
2,694.00	11.83	260.21	2,683.87	-45.13	-126.80	53.16	2.29
2,788.00	11.51	261.41	2,775.93	-48.17	-145.56	57.39	0.43
2,883.00	11.24	261.19	2,869.06	-51.00	-164.09	61.41	0.29
2,978.00	11.58	260.66	2,962.19	-53.97	-182.64	65.56	0.37
3,073.00	10.63	259.88	3,055.41	-57.06	-200.68	69.79	1.01
3,168.00	9.78	259.15	3,148.90	-60.12	-217.23	73.90	0.91
3,358.00	8.75	256.36	3,336.42	-66.56	-247.12	82.25	0.59
3,452.00	9.55	248.57	3,429.23	-71.10	-261.33	87.69	1.57
3,547.00	9.17	256.30	3,522.97	-75.77	-276.02	93.29	1.38
3,642.00	11.31	255.75	3,616.45	-79.86	-292.41	98.42	2.25
3,737.00	12.57	254.86	3,709.39	-84.85	-311.41	104.62	1.34
3,832.00	11.82	251.00	3,802.25	-90.72	-330.59	111.70	1.17
3,927.00	12.63	248.93	3,895.09	-97.62	-349.49	119.80	0.97
4,022.00	12.62	248.77	3,987.80	-105.11	-368.85	128.51	0.04
4,117.00	11.71	246.84	4,080.66	-112.66	-387.39	137.24	1.05
4,211.00	10.69	248.07	4,172.87	-119.67	-404.25	145.31	1.11
4,306.00	10.26	256.08	4,266.29	-124.99	-420.63	151.67	1.60
4,401.00	7.69	258.18	4,360.12	-128.33	-435.07	155.93	2.73
4,496.00	8.40	255.47	4,454.19	-131.38	-448.01	159.79	0.85
4,591.00	9.46	256.52	4,548.04	-134.94	-462.32	164.26	1.13
4,686.00	8.38	258.98	4,641.89	-138.08	-476.70	168.32	1.21
4,781.00	7.38	263.21	4,735.99	-140.12	-489.56	171.19	1.22
4,876.00	5.90	255.23	4,830.35	-142.09	-500.34	173.84	1.83
4,970.00	5.39	257.26	4,923.89	-144.30	-509.32	176.61	0.58
5,065.00	4.27	247.23	5,018.56	-146.65	-516.93	179.45	1.47
5,160.00	2.78	216.12	5,113.38	-149.88	-521.55	182.97	2.50
5,255.00	1.07	110.48	5,208.34	-152.05	-522.08	185.17	3.41
5,350.00	1.28	94.18	5,303.32	-152.44	-520.19	185.44	0.41



## Design Report for Mahalo State AA09-79-1HNB - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
5,444.00	0.99	51.05	5,397.31	-152.00	-518.51	184.90	0.93
5,539.00	0.96	52.82	5,492.29	-151.01	-517.24	183.82	0.04
5,634.00	0.65	56.45	5,587.28	-150.23	-516.15	182.97	0.33
5,728.00	0.80	89.19	5,681.28	-149.92	-515.05	182.60	0.46
5,823.00	0.69	98.10	5,776.27	-150.00	-513.82	182.59	0.17
5,918.00	0.63	119.48	5,871.26	-150.33	-512.80	182.86	0.27
6,013.00	0.56	90.36	5,966.26	-150.59	-511.88	183.06	0.32
6,060.00	1.78	190.78	6,013.25	-151.31	-511.79	183.77	4.17
6,108.00	6.52	193.53	6,061.11	-154.70	-512.57	187.20	9.88
6,155.00	11.24	190.33	6,107.53	-161.80	-514.01	194.38	10.09
6,202.00	14.74	190.08	6,153.32	-172.20	-515.88	204.88	7.45
6,249.00	19.15	187.77	6,198.27	-185.73	-517.97	218.52	9.49
6,297.00	24.05	184.73	6,242.89	-203.29	-519.85	236.16	10.47
6,344.00	29.17	181.86	6,284.90	-224.30	-521.01	257.20	11.23
6,392.00	33.05	179.94	6,325.99	-249.09	-521.37	281.96	8.34
6,439.00	36.04	179.87	6,364.70	-275.73	-521.33	308.55	6.36
6,487.00	40.21	179.32	6,402.45	-305.36	-521.11	338.10	8.72
6,534.00	45.92	177.18	6,436.77	-337.42	-520.10	370.03	12.54
6,582.00	50.54	176.71	6,468.74	-373.16	-518.19	405.58	9.65
6,629.00	54.92	175.99	6,497.20	-410.48	-515.80	442.66	9.40
6,677.00	59.06	177.24	6,523.34	-450.65	-513.44	482.60	8.90
6,724.00	62.36	178.36	6,546.33	-491.60	-511.87	523.37	7.32
6,772.00	66.31	178.43	6,567.12	-534.84	-510.66	566.44	8.23
6,819.00	69.53	178.60	6,584.78	-578.37	-509.53	609.82	6.86
6,867.00	71.93	179.13	6,600.62	-623.67	-508.63	654.96	5.11
6,914.00	75.68	179.87	6,613.73	-668.80	-508.24	699.97	8.12
6,961.00	79.40	180.72	6,623.87	-714.68	-508.48	745.78	8.11
6,977.00	80.75	181.04	6,626.62	-730.44	-508.72	761.52	8.66
7,033.00	83.29	179.72	6,634.40	-785.89	-509.09	816.88	5.10
7'							
7,134.00	87.88	177.38	6,642.17	-886.52	-506.54	917.14	5.10
7,227.00	88.80	177.52	6,644.87	-979.39	-502.40	1,009.55	1.00
7,320.00	90.71	177.80	6,645.26	-1,072.31	-498.61	1,102.04	2.08
7,413.00	89.78	178.12	6,644.87	-1,165.25	-495.30	1,194.57	1.06
7,506.00	90.46	177.90	6,644.67	-1,258.19	-492.07	1,287.12	0.77
7,598.00	89.23	178.08	6,644.92	-1,350.13	-488.84	1,378.66	1.35
7,693.00	90.99	178.03	6,644.74	-1,445.07	-485.62	1,473.21	1.85
7,788.00	90.43	178.16	6,643.56	-1,540.01	-482.46	1,567.75	0.61
7,883.00	90.80	177.74	6,642.54	-1,634.95	-479.06	1,662.27	0.59
7,978.00	89.35	178.10	6,642.42	-1,729.88	-475.61	1,756.79	1.57
8,073.00	90.77	178.11	6,642.32	-1,824.83	-472.47	1,851.34	1.49
8,168.00	89.91	179.48	6,641.75	-1,919.80	-470.47	1,945.99	1.70
8,262.00	89.26	179.77	6,642.43	-2,013.80	-469.86	2,039.75	0.76
8,357.00	90.52	180.16	6,642.62	-2,108.79	-469.80	2,134.55	1.39
8,452.00	90.22	178.85	6,642.00	-2,203.79	-468.98	2,229.30	1.41
8,547.00	89.72	177.61	6,642.05	-2,298.74	-466.05	2,323.86	1.41
8,641.00	90.55	177.76	6,641.83	-2,392.66	-462.25	2,417.35	0.90
8,736.00	89.91	177.12	6,641.45	-2,487.56	-458.01	2,511.79	0.95
8,831.00	89.08	176.27	6,642.29	-2,582.40	-452.53	2,606.08	1.25
8,926.00	88.98	175.56	6,643.90	-2,677.15	-445.76	2,700.20	0.75
9,021.00	89.35	177.27	6,645.28	-2,771.95	-439.82	2,794.42	1.84

## Design Report for Mahalo State AA09-79-1HNB - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
9,116.00	89.82	177.61	6,645.97	-2,866.85	-435.58	2,888.86	0.61
9,211.00	88.46	177.11	6,647.39	-2,961.73	-431.21	2,983.27	1.53
9,305.00	87.57	176.35	6,650.65	-3,055.52	-425.85	3,076.52	1.24
9,400.00	88.00	176.90	6,654.32	-3,150.29	-420.26	3,170.73	0.73
9,495.00	88.83	178.01	6,656.95	-3,245.16	-416.04	3,265.14	1.46
9,590.00	89.45	177.58	6,658.38	-3,340.07	-412.39	3,359.63	0.79
9,685.00	89.69	176.81	6,659.09	-3,434.96	-407.74	3,454.02	0.85
9,780.00	89.72	178.50	6,659.58	-3,529.87	-403.85	3,548.49	1.78
9,875.00	89.78	178.32	6,659.99	-3,624.83	-401.22	3,643.09	0.20
9,970.00	90.06	177.82	6,660.12	-3,719.78	-398.02	3,737.63	0.60
10,064.00	89.94	179.25	6,660.12	-3,813.75	-395.61	3,831.25	1.53
10,159.00	89.54	178.84	6,660.56	-3,908.73	-394.03	3,925.94	0.60
10,254.00	89.48	178.18	6,661.37	-4,003.70	-391.56	4,020.55	0.70
10,349.00	90.18	179.57	6,661.65	-4,098.67	-389.69	4,115.22	1.64
10,443.00	90.37	179.13	6,661.20	-4,192.67	-388.63	4,208.95	0.51
10,538.00	90.22	178.65	6,660.71	-4,287.65	-386.79	4,303.62	0.53
10,633.00	89.91	178.12	6,660.60	-4,382.61	-384.11	4,398.21	0.65
10,728.00	90.34	178.16	6,660.39	-4,477.56	-381.03	4,492.77	0.45
10,822.00	91.11	177.99	6,659.21	-4,571.50	-377.87	4,586.31	0.84
10,917.00	90.34	178.67	6,658.00	-4,666.45	-375.10	4,680.89	1.08
11,012.00	90.40	178.77	6,657.39	-4,761.42	-372.98	4,775.53	0.12
11,107.00	89.97	178.37	6,657.08	-4,856.39	-370.61	4,870.16	0.62
11,202.00	89.48	177.62	6,657.54	-4,951.33	-367.29	4,964.69	0.94
11,297.00	88.92	176.96	6,658.87	-5,046.22	-362.79	5,059.09	0.91
11,392.00	88.98	177.73	6,660.61	-5,141.10	-358.39	5,153.50	0.81
11,486.00	89.75	178.31	6,661.65	-5,235.03	-355.15	5,247.03	1.03
11,581.00	90.80	179.10	6,661.19	-5,330.01	-353.00	5,341.67	1.38
11,599.00	90.62	178.72	6,660.97	-5,348.00	-352.66	5,359.61	2.34
Final Sperry MWD Survey at 11599.00ft							
11,663.00	90.62	178.72	6,660.28	-5,411.98	-351.23	5,423.37	0.00
Straight Line Projection to TD at 11663.00ft - Mahalo St. AA09-79-1HNB_BHL							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
835.00	834.96	-5.99	2.34	Final Gyro Survey at 835.00ft.
835.00	834.96	-5.99	2.34	Tie on to Gyro Surveys at 835.00ft.
928.00	927.96	-6.62	1.98	First Sperry MWD Surveys at 928.00ft.
11,599.00	6,660.97	-5,348.00	-352.66	Final Sperry MWD Survey at 11599.00ft
11,663.00	6,660.28	-5,411.98	-351.23	Straight Line Projection to TD at 11663.00ft

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/-S (usft)	+E/-W (usft)	
Target	Mahalo St. AA09-79-1HNB_BHL	183.67	Slot	0.00	0.00	0.00

## Design Report for Mahalo State AA09-79-1HNB - Actual Surveys

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
269.00	835.00	Surface Surveys	Flexi-Shot
928.00	6,977.00	Intermediate Surveys	MWD
7,134.00	11,663.00	Production Surveys	MWD

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
861.00	860.96	9 5/8"	9-5/8	13-3/4
7,033.00	6,634.40	7"	7	8-3/4

Wellbore Targets

Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
- hit/miss target									
- Shape									
Mahalo St. AA09-79-11	0.00	0.00	6,642.00	-5,414.57	-347.43	1,424,498.57	3,292,140.80	40.493900	-104.449580
- actual wellpath misses target center by 18.85usft at 11663.00usft MD (6660.28 TVD, -5411.98 N, -351.23 E)									
- Point									

Directional Difficulty Index

Average Dogleg over Survey:	1.64 °/100usft	Maximum Dogleg over Survey:	12.54 °/100usft at 6,534.00 usft
Net Tortousity applicable to Plans:	0.68 °/100usft	Directional Difficulty Index:	6.290

Audit Info



**North Reference Sheet for Sec. 4-T6N-R63W (Mahalo State PAD) - Mahalo State  
AA09-79-1HNB - Plan C**

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to Grid North Reference.

Vertical Depths are relative to KB=24 @ 4722.00usft (H&P 322). Northing and Easting are relative to Mahalo State AA09-79-1HNB

Coordinate System is US State Plane 1983, Colorado Northern Zone using datum North American Datum 1983, ellipsoid GRS 1980

Projection method is Lambert Conformal Conic (2 parallel)

Central Meridian is -105.500000°, Longitude Origin:0.000000°, Latitude Origin:40.783333°

False Easting: 3,000,000.00usft, False Northing: 1,000,000.00usft, Scale Reduction: 0.99996696

Grid Coordinates of Well: 1,429,912.97 usft N, 3,292,488.22 usft E

Geographical Coordinates of Well: 40° 30' 31.50" N, 104° 26' 53.16" W

Grid Convergence at Surface is: 0.68°

Based upon Minimum Curvature type calculations, at a Measured Depth of 11,663.00usft  
the Bottom Hole Displacement is 5,423.37usft in the Direction of 183.71° (Grid).

Magnetic Convergence at surface is: -7.65° (18 November 2014, , BGGM2014)

