

# Noble Energy

Weld County, CO (NAD 83)

Sec. 2-T9N-R58W (Sharpe State 2 /Davis State (PAD)

Moses State LD11-78HN

05-123-39828

Plan A

Design: Actual Surveys

## Sperry Drilling Services

### Final Survey Report

04 February, 2015

Surface UWI : 05-123-39828

Well Coordinates: 1,529,337.78 N, 3,460,623.69 E (40° 46' 28.42" N, 103° 50' 12.59" W)

Ground Level: 4,748.00 usft

Local Coordinate Origin:

Viewing Datum:

TVDs to System:

North Reference:

Unit System:

Geodetic Scale Factor Applied

Version: 5000.1 Build: 73

Centered on Well Moses State LD11-78HN

KB=24 @ 4772.00usft (H&P 273)

N

Grid

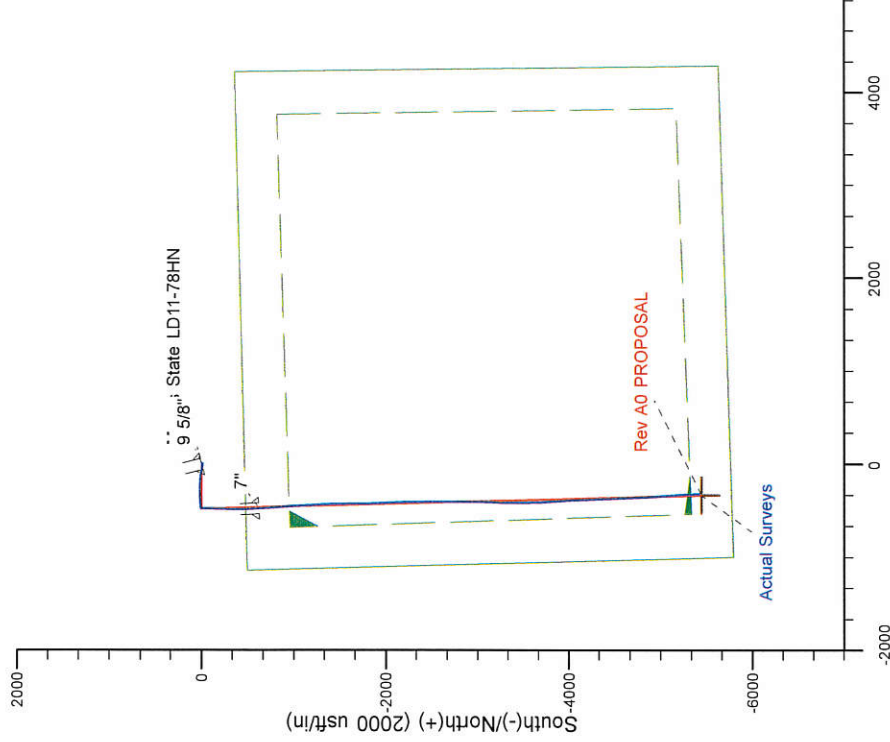
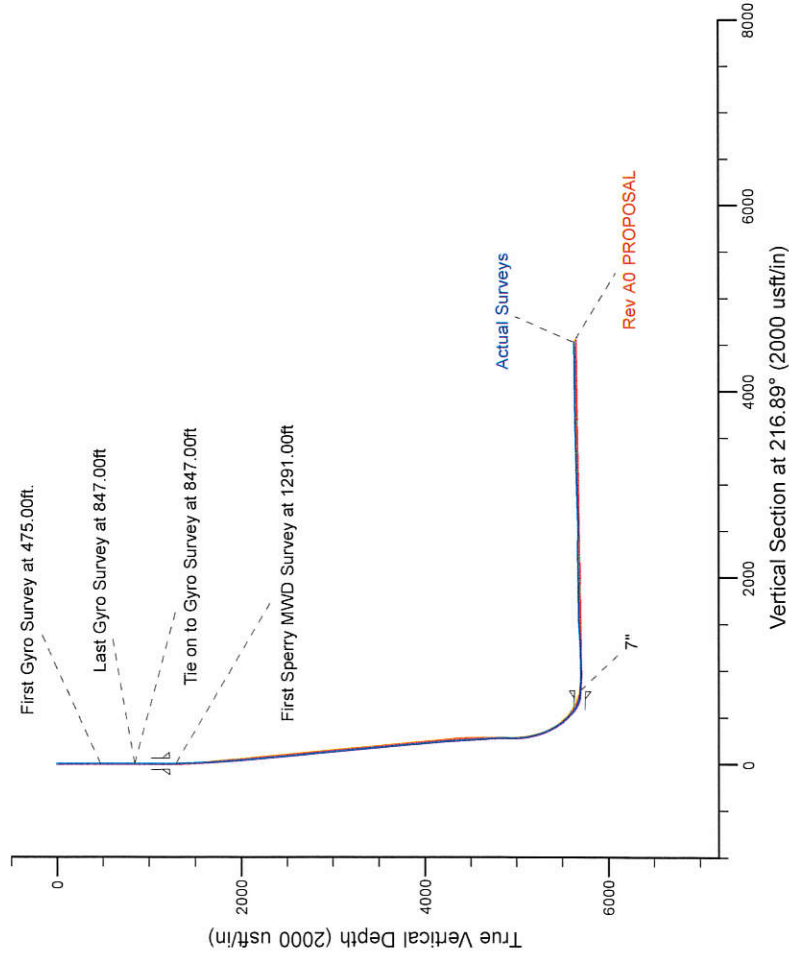
Dec-Deg - API - US Survey Feet - Custom

**HALLIBURTON**

Project: Weld County, CO (NAD 83)  
 Site: Sec. 2-T9N-R58W (Sharpe State 2 /Davis State (PAD)  
 Well: Moses State LD11-78HN  
 Wellbore: Plan A  
 Design: Actual Surveys



Platted SHL: 465' FSL, 1154' FWL Platted Lat/Long: 40.774560 N, 103.836830 W Location: Sec. 2-T9N-R58W	Platted BHL: 330' FSL, 675' FWL Lat/Long: 40.759899 N, 103.838357 W State Planes - CO Northern: 1,523,989.17 N, 3,460,300.85 E Location: Sec. 11-T9N-R58W
~7" Casing: 141' FNL, 661' FWL Lat/Long: 40.772871 N, 103.838588 W State Planes - CO Northern: 1,528,713.43 N, 3,460,148.37 E Location: Sec. 11-T9N-R58W	
<p style="text-align: center;"><b>LEGEND</b></p> <p>  Moses State LD11-78HN, Plan A, Rev A0 PROPOSAL V0   Actual Surveys         </p>	



WELL DETAILS: Moses State LD11-78HN
Ground Level: 4748.00
KB=24 @ 4772.00usft (H&P 273)
Created By: Tatiana Gomez Created On: 2/4/2015

## Design Report for Moses State LD11-78HN - 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
475.00	0.20	282.52	475.00	0.18	-0.81	0.34	0.04
First Gyro Survey at 475.00ft.							
847.00	0.20	88.92	847.00	0.33	-0.79	0.21	0.11
Last Gyro Survey at 847.00ft - Tie on to Gyro Survey at 847.00ft							
1,225.00	1.68	165.59	1,224.94	-5.01	1.24	3.26	0.43
9 5/8"							
1,291.00	1.96	166.58	1,290.91	-7.04	1.74	4.58	0.43
First Sperry MWD Survey at 1291.00ft							
1,384.00	2.04	248.42	1,383.87	-9.20	0.57	7.01	2.82
1,477.00	4.25	281.44	1,476.73	-9.12	-4.34	9.90	2.98
1,569.00	7.28	283.11	1,568.25	-7.12	-13.37	13.72	3.30
1,662.00	9.28	285.31	1,660.28	-3.80	-26.34	18.85	2.18
1,754.00	9.02	281.90	1,751.11	-0.36	-40.55	24.63	0.65
1,847.00	9.95	281.30	1,842.84	2.72	-55.56	31.18	1.01
1,939.00	9.79	279.58	1,933.48	5.58	-71.07	38.20	0.36
2,031.00	9.46	279.15	2,024.18	8.08	-86.25	45.31	0.37
2,124.00	9.52	276.53	2,115.91	10.17	-101.43	52.76	0.47
2,216.00	8.68	275.97	2,206.75	11.76	-115.90	60.17	0.92
2,308.00	10.14	275.56	2,297.51	13.27	-130.86	67.95	1.59
2,493.00	9.67	274.03	2,479.75	15.94	-162.57	84.85	0.29
2,683.00	10.08	272.90	2,666.94	17.90	-195.09	102.81	0.24
2,778.00	9.90	271.44	2,760.50	18.52	-211.56	112.19	0.33
2,968.00	8.98	273.16	2,947.92	19.75	-242.70	129.90	0.51
3,062.00	7.45	276.08	3,040.95	20.80	-256.08	137.10	1.69
3,157.00	8.52	268.74	3,135.03	21.30	-269.24	144.60	1.55
3,252.00	8.62	266.94	3,228.97	20.76	-283.39	153.52	0.30
3,346.00	8.58	267.22	3,321.92	20.05	-297.42	162.52	0.06
3,441.00	9.09	267.90	3,415.79	19.43	-312.00	171.76	0.55
3,536.00	9.51	268.28	3,509.54	18.92	-327.35	181.38	0.45
3,631.00	9.66	268.60	3,603.21	18.49	-343.16	191.22	0.17
3,725.00	9.42	268.53	3,695.91	18.10	-358.73	200.88	0.26
3,820.00	8.77	268.25	3,789.72	17.68	-373.74	210.23	0.69
3,915.00	7.86	269.54	3,883.72	17.41	-387.48	218.69	0.98
4,009.00	7.29	269.60	3,976.90	17.31	-399.87	226.21	0.61
4,104.00	7.01	267.34	4,071.16	17.00	-411.69	233.55	0.42
4,199.00	6.61	267.49	4,165.49	16.49	-422.94	240.71	0.42
4,293.00	5.92	266.64	4,258.93	15.97	-433.19	247.28	0.74
4,387.00	5.47	265.32	4,352.46	15.32	-442.49	253.38	0.50
4,482.00	5.10	264.55	4,447.06	14.55	-451.21	259.23	0.40
4,575.00	5.10	262.77	4,539.69	13.64	-459.42	264.90	0.17
4,670.00	5.03	260.82	4,634.32	12.44	-467.72	270.83	0.20
4,765.00	2.31	259.28	4,729.12	11.42	-473.72	275.25	2.86
4,860.00	0.68	240.36	4,824.08	10.79	-476.09	277.18	1.77
4,955.00	0.68	260.09	4,919.08	10.41	-477.13	278.11	0.25
5,049.00	3.68	184.39	5,013.01	7.31	-477.91	281.06	3.80
5,144.00	10.96	179.77	5,107.17	-4.78	-478.11	290.85	7.68
5,238.00	17.87	179.41	5,198.15	-28.17	-477.93	309.44	7.35
5,333.00	24.31	179.66	5,286.74	-62.33	-477.66	336.60	6.78
5,428.00	31.18	182.11	5,370.77	-106.52	-478.45	372.41	7.33



## Design Report for Moses State LD11-78HN - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
5,523.00	38.01	181.69	5,448.93	-160.39	-480.22	416.56	7.19
5,618.00	46.28	180.04	5,519.31	-224.07	-481.11	468.02	8.78
5,713.00	51.85	183.00	5,581.54	-295.77	-483.09	526.55	6.32
5,808.00	59.32	181.63	5,635.19	-374.02	-486.21	591.01	7.95
5,903.00	72.57	176.93	5,673.85	-460.54	-484.94	659.44	14.66
5,997.00	86.30	176.73	5,691.04	-552.58	-479.84	729.99	14.61
6,024.00	87.47	176.18	5,692.51	-579.49	-478.17	750.51	4.79
6,069.00	87.88	176.54	5,694.33	-624.36	-475.32	784.68	1.22
7"							
6,092.00	88.09	176.73	5,695.14	-647.31	-473.97	802.22	1.22
6,184.00	87.75	175.54	5,698.48	-739.03	-467.77	871.86	1.34
6,277.00	89.82	177.03	5,700.45	-831.81	-461.75	942.44	2.74
6,369.00	90.59	176.97	5,700.13	-923.68	-456.93	1,013.03	0.84
6,461.00	89.72	175.84	5,699.88	-1,015.50	-451.16	1,083.00	1.55
6,554.00	92.53	177.24	5,698.05	-1,108.30	-445.55	1,153.85	3.38
6,646.00	91.85	177.21	5,694.53	-1,200.13	-441.10	1,224.61	0.74
6,738.00	90.62	175.81	5,692.55	-1,291.93	-435.50	1,294.67	2.03
6,831.00	92.50	178.34	5,690.02	-1,384.76	-430.76	1,366.07	3.39
6,923.00	92.10	178.95	5,686.33	-1,476.66	-428.59	1,438.26	0.79
7,016.00	92.10	179.41	5,682.92	-1,569.59	-427.26	1,511.78	0.49
7,108.00	91.60	179.75	5,679.95	-1,661.54	-426.58	1,584.91	0.66
7,200.00	91.94	179.30	5,677.11	-1,753.49	-425.83	1,658.00	0.62
7,295.00	89.32	178.34	5,676.06	-1,848.46	-423.87	1,732.77	2.94
7,389.00	89.66	176.02	5,676.90	-1,942.33	-419.25	1,805.07	2.49
7,484.00	90.59	178.20	5,676.69	-2,037.20	-414.46	1,878.07	2.49
7,579.00	91.45	177.80	5,675.00	-2,132.13	-411.14	1,952.00	1.00
7,674.00	90.80	179.25	5,673.14	-2,227.08	-408.70	2,026.47	1.67
7,768.00	91.85	179.23	5,670.96	-2,321.04	-407.45	2,100.87	1.12
7,863.00	89.51	180.41	5,669.84	-2,416.03	-407.15	2,176.65	2.76
7,958.00	89.51	179.83	5,670.65	-2,511.02	-407.35	2,252.75	0.61
8,052.00	89.57	179.15	5,671.40	-2,605.02	-406.51	2,327.41	0.73
8,146.00	89.75	179.23	5,671.96	-2,699.00	-405.19	2,401.79	0.21
8,240.00	91.14	180.12	5,671.23	-2,793.00	-404.65	2,476.64	1.76
8,335.00	90.59	179.38	5,669.80	-2,887.98	-404.24	2,552.35	0.97
8,429.00	89.94	179.34	5,669.36	-2,981.98	-403.19	2,626.89	0.69
8,524.00	91.67	181.90	5,668.03	-3,076.95	-404.21	2,703.47	3.25
8,619.00	91.69	182.80	5,665.24	-3,171.83	-408.11	2,781.68	0.95
8,713.00	91.39	183.04	5,662.72	-3,265.67	-412.90	2,859.61	0.41
8,808.00	92.10	180.34	5,659.82	-3,360.58	-415.70	2,937.19	2.94
8,902.00	92.22	179.56	5,656.28	-3,454.51	-415.61	3,012.27	0.84
8,997.00	90.55	178.81	5,653.98	-3,549.47	-414.26	3,087.40	1.93
9,092.00	91.42	178.87	5,652.35	-3,644.43	-412.34	3,162.19	0.92
9,186.00	90.52	177.03	5,650.76	-3,738.36	-408.98	3,235.29	2.18
9,282.00	91.17	176.56	5,649.34	-3,834.19	-403.61	3,308.71	0.84
9,376.00	91.11	175.69	5,647.47	-3,927.96	-397.26	3,379.89	0.93
9,471.00	89.60	177.28	5,646.88	-4,022.77	-391.44	3,452.22	2.31
9,566.00	90.65	177.43	5,646.68	-4,117.67	-387.05	3,525.48	1.12
9,662.00	91.69	177.42	5,644.72	-4,213.55	-382.74	3,599.58	1.08
9,756.00	90.89	178.00	5,642.60	-4,307.45	-378.99	3,672.42	1.05
9,852.00	91.82	178.20	5,640.33	-4,403.37	-375.80	3,747.22	0.99
9,947.00	89.45	176.84	5,639.28	-4,498.27	-371.69	3,820.65	2.88

## Design Report for Moses State LD11-78HN - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
10,041.00	89.01	175.95	5,640.54	-4,592.07	-365.78	3,892.12	1.06
10,136.00	90.92	178.36	5,640.60	-4,686.94	-361.07	3,965.16	3.24
10,230.00	91.63	177.88	5,638.51	-4,780.87	-357.99	4,038.43	0.91
10,325.00	91.94	177.46	5,635.55	-4,875.74	-354.13	4,111.99	0.55
10,421.00	90.59	176.39	5,633.43	-4,971.58	-348.98	4,185.54	1.79
10,515.00	90.03	175.03	5,632.92	-5,065.31	-341.95	4,256.29	1.56
10,610.00	90.28	175.22	5,632.66	-5,159.97	-333.87	4,327.14	0.33
10,705.00	89.69	176.68	5,632.69	-5,254.73	-327.16	4,398.90	1.66
10,799.00	91.33	178.04	5,631.85	-5,348.62	-322.83	4,471.39	2.27
Final Sperry MWD Survey at 10799.00ft							
10,870.00	91.33	178.04	5,630.20	-5,419.56	-320.41	4,526.67	0.00
Straight Line Projection to TD at 10870.00ft - Moses State LD11-78HN_BHL							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
475.00	475.00	0.18	-0.81	First Gyro Survey at 475.00ft.
847.00	847.00	0.33	-0.79	Last Gyro Survey at 847.00ft
847.00	847.00	0.33	-0.79	Tie on to Gyro Survey at 847.00ft
1,291.00	1,290.91	-7.04	1.74	First Sperry MWD Survey at 1291.00ft
10,799.00	5,631.85	-5,348.62	-322.83	Final Sperry MWD Survey at 10799.00ft
10,870.00	5,630.20	-5,419.56	-320.41	Straight Line Projection to TD at 10870.00ft

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/-S (usft)	Origin +E/-W (usft)	Start TVD (usft)
User	No Target (Freehand)	216.89	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
475.00	847.00	Gyro Surveys	Flexi-Shot
1,291.00	6,024.00	Intermediate Surveys	MWD
6,092.00	10,870.00	Production Surveys	MWD

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,225.00	1,224.94	9 5/8"	9-5/8	13-3/4
6,069.00	5,694.33	7"	7	8-3/4

## Design Report for Moses State LD11-78HN - Actual Surveys

Wellbore Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
Moses State LD11-78H	0.00	0.00	5,645.11	-5,446.67	-332.85	1,523,891.12	3,460,290.84	40.759630	-103.838400
- actual wellpath misses target center by 33.35usft at 10870.00usft MD (5630.20 TVD, -5419.56 N, -320.41 E)									
- Point									

Directional Difficulty Index

Average Dogleg over Survey:	1.80 °/100usft	Maximum Dogleg over Survey:	14.66 °/100usft at 5,903.00 usft
Net Tortousity applicable to Plans:	0.80 °/100usft	Directional Difficulty Index:	6.345

Audit Info



**North Reference Sheet for Sec. 2-T9N-R58W (Sharpe State 2 /Davis State (PAD) -  
Moses State LD11-78HN - Plan A**

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 @ 4772.00usft (H&P 273). Northing and Easting are relative to Moses State LD 11-78HN

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: 0.99999859

Grid Coordinates of Well: 1,529,337.78 usft N, 3,460,623.69 usft E

Geographical Coordinates of Well: 40° 46' 28.42" N, 103° 50' 12.59" W

Grid Convergence at Surface is: 1.07°

Based upon Minimum Curvature type calculations, at a Measured Depth of 10,870.00usft  
the Bottom Hole Displacement is 5,429.02usft in the Direction of 183.38° (Grid).

Magnetic Convergence at surface is: -6.92° (12 January 2015, , BGGM2014)

