

# Noble Energy

Weld County, CO (NAD 83)

Sec. 23-T7N-R64W (Letterly 23 PAD)

Letterly USX AB23-68HN

Design: MWD Survey

## Sperry Drilling Services

### Final Survey Report

28 December, 2012

Well Coordinates: 1,450,174.39 N, 3,270,886.61 E (40° 33' 54.14" N, 104° 31' 29.93" W)

Ground Level: 4,827.00 ft

Local Coordinate Origin:

Centered on Well Letterly USX AB23-68HN

Viewing Datum:

KB @ 4851.00ft (H&P 315)

TVDs to System:

N

North Reference:

Grid

Unit System:

API - US Survey Feet - Custom

Geodetic Scale Factor Applied

Version: 2003.16 Build: 431

**HALLIBURTON**

## Design Report for Letterly USX AB23-68HN - MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
889.00	0.40	232.77	888.99	-1.88	-2.47	-2.37	0.04
<b>First MWD Survey</b>							
981.00	0.29	148.07	980.99	-2.27	-2.60	-2.48	0.51
1,255.00	0.19	20.25	1,254.99	-2.43	-2.08	-1.95	0.16
1,538.00	0.25	357.99	1,537.99	-1.37	-1.94	-1.86	0.04
1,822.00	0.22	77.66	1,821.99	-0.64	-1.43	-1.39	0.11
2,011.00	2.20	182.55	2,010.94	-4.19	-1.23	-1.01	1.20
2,105.00	5.11	177.77	2,104.74	-10.17	-1.15	-0.62	3.11
2,200.00	6.55	172.86	2,199.25	-19.78	-0.31	0.72	1.60
2,294.00	7.43	172.68	2,292.55	-31.13	1.13	2.75	0.94
2,392.00	8.69	169.23	2,389.58	-44.68	3.32	5.64	1.38
2,487.00	8.83	160.49	2,483.47	-58.61	7.09	10.14	1.41
2,583.00	8.35	167.45	2,578.40	-72.36	11.07	14.83	1.19
2,677.00	10.36	170.42	2,671.14	-87.35	13.96	18.50	2.20
2,773.00	9.66	167.03	2,765.68	-103.72	17.20	22.59	0.95
2,868.00	9.44	172.29	2,859.37	-119.20	20.04	26.23	0.95
2,964.00	9.18	169.39	2,954.10	-134.53	22.50	29.49	0.56
3,060.00	9.10	167.01	3,048.89	-149.46	25.62	33.38	0.40
3,155.00	9.60	169.24	3,142.62	-164.56	28.79	37.33	0.65
3,251.00	9.30	170.12	3,237.32	-180.06	31.61	40.96	0.35
3,347.00	9.52	169.62	3,332.03	-195.52	34.38	44.52	0.24
3,442.00	8.99	171.27	3,425.79	-210.58	36.92	47.85	0.62
3,538.00	7.95	171.28	3,520.74	-224.56	39.06	50.72	1.08
3,633.00	7.68	184.50	3,614.87	-237.38	39.56	51.89	1.91
3,729.00	6.81	182.95	3,710.10	-249.46	38.76	51.72	0.93
3,824.00	7.47	178.91	3,804.37	-261.26	38.59	52.16	0.87
3,920.00	8.23	174.17	3,899.47	-274.33	39.41	53.66	1.04
4,016.00	8.35	173.79	3,994.46	-288.10	40.86	55.83	0.14
4,111.00	6.98	162.38	4,088.62	-300.46	43.35	58.96	2.15
4,206.00	4.94	153.81	4,183.10	-309.63	46.91	62.99	2.34
4,303.00	2.00	119.06	4,279.92	-314.20	50.23	66.55	3.60
4,399.00	1.10	82.67	4,375.89	-314.90	52.61	68.96	1.35
4,494.00	1.41	63.02	4,470.86	-314.25	54.56	70.87	0.55
4,589.00	1.47	19.55	4,565.84	-312.57	56.00	72.23	1.12
4,684.00	1.00	11.05	4,660.81	-310.61	56.57	72.69	0.53
4,780.00	1.61	346.58	4,756.79	-308.48	56.42	72.43	0.85
4,875.00	0.42	254.11	4,851.78	-307.27	55.77	71.72	1.77
4,970.00	0.93	313.95	4,946.77	-306.84	54.88	70.81	0.85
5,065.00	1.32	288.11	5,041.75	-305.96	53.29	69.17	0.66
5,160.00	1.61	284.03	5,136.72	-305.30	50.95	66.81	0.32
5,257.00	0.89	280.57	5,233.70	-304.83	48.89	64.72	0.75
5,543.00	1.71	312.51	5,519.63	-301.54	43.56	59.23	0.37
5,639.00	1.71	309.48	5,615.58	-299.66	41.40	56.97	0.09
5,734.00	1.06	300.78	5,710.55	-298.31	39.55	55.05	0.72
5,834.00	0.32	353.35	5,810.55	-297.56	38.73	54.19	0.90
5,930.00	0.25	15.31	5,906.55	-297.09	38.75	54.19	0.13
6,025.00	0.39	131.71	6,001.55	-297.10	39.05	54.49	0.58
6,120.00	0.69	116.36	6,096.54	-297.57	39.80	55.26	0.35
6,215.00	0.69	95.32	6,191.53	-297.88	40.88	56.36	0.27

## Design Report for Letterly USX AB23-68HN - MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
6,279.00	2.60	79.77	6,255.51	-297.66	42.69	58.16	3.04
6,311.00	5.46	84.83	6,287.42	-297.39	44.92	60.37	9.00
6,359.00	10.06	84.95	6,334.97	-296.82	51.38	66.79	9.58
6,406.00	14.58	86.33	6,380.88	-296.08	61.38	76.73	9.64
6,454.00	17.72	88.40	6,426.98	-295.48	74.71	90.02	6.65
6,502.00	20.62	88.48	6,472.31	-295.06	90.47	105.73	6.04
6,550.00	23.94	89.78	6,516.72	-294.80	108.66	123.88	6.99
6,598.00	27.97	90.33	6,559.87	-294.82	129.66	144.86	8.41
6,646.00	32.40	89.16	6,601.35	-294.70	153.79	168.95	9.31
6,693.00	34.53	91.32	6,640.56	-294.82	179.70	194.83	5.19
6,741.00	37.82	89.86	6,679.30	-295.10	208.03	223.13	7.08
6,788.00	42.14	88.66	6,715.31	-294.69	238.21	253.26	9.34
6,836.00	45.32	89.06	6,749.99	-294.04	271.38	286.35	6.65
6,884.00	48.31	88.54	6,782.83	-293.30	306.37	321.25	6.28
6,932.00	52.40	87.92	6,813.45	-292.15	343.30	358.07	8.58
6,980.00	57.04	89.03	6,841.17	-291.12	382.46	397.12	9.85
7,028.00	61.20	90.55	6,865.80	-290.98	423.65	438.25	9.08
7,075.00	64.02	91.28	6,887.42	-291.65	465.37	479.94	6.16
7,123.00	68.42	90.80	6,906.77	-292.45	509.28	523.83	9.21
7,170.00	71.10	90.16	6,923.03	-292.81	553.37	567.88	5.84
7,218.00	75.72	88.53	6,936.73	-292.28	599.35	613.78	10.16
7,283.00	82.43	88.86	6,949.04	-290.83	663.12	677.38	10.34
7,383.00	84.19	93.58	6,960.70	-292.95	762.38	776.62	5.01
7,478.00	87.29	92.99	6,967.76	-298.38	856.95	871.35	3.32
7,574.00	91.36	92.31	6,968.89	-302.82	952.82	967.32	4.30
7,669.00	93.21	91.79	6,965.10	-306.21	1,047.68	1,062.23	2.02
7,765.00	93.21	90.32	6,959.72	-307.98	1,143.51	1,158.02	1.53
7,860.00	91.70	89.39	6,955.65	-307.73	1,238.42	1,252.79	1.87
7,955.00	92.25	89.85	6,952.38	-307.11	1,333.36	1,347.56	0.75
8,051.00	90.96	89.45	6,949.69	-306.52	1,429.32	1,443.36	1.41
8,147.00	89.75	90.04	6,949.10	-306.09	1,525.32	1,539.20	1.40
8,242.00	90.55	90.61	6,948.85	-306.63	1,620.31	1,634.10	1.03
8,338.00	89.29	89.07	6,948.98	-306.36	1,716.31	1,729.95	2.07
8,433.00	88.92	88.82	6,950.47	-304.61	1,811.28	1,824.70	0.47
8,527.00	89.48	89.00	6,951.78	-302.83	1,905.25	1,918.45	0.63
8,622.00	91.05	87.73	6,951.34	-300.12	2,000.21	2,013.14	2.13
8,717.00	93.49	89.71	6,947.58	-297.99	2,095.10	2,107.79	3.31
8,814.00	92.07	87.38	6,942.87	-295.53	2,191.94	2,204.37	2.81
8,909.00	91.05	89.03	6,940.28	-292.56	2,286.86	2,299.00	2.04
9,005.00	89.41	86.98	6,939.90	-289.22	2,382.79	2,394.63	2.73
9,100.00	90.09	87.67	6,940.31	-284.78	2,477.69	2,489.17	1.02
9,196.00	90.28	88.44	6,940.00	-281.52	2,573.63	2,584.81	0.83
9,291.00	91.32	88.57	6,938.68	-279.05	2,668.59	2,679.51	1.10
9,386.00	90.55	88.91	6,937.13	-276.96	2,763.55	2,774.23	0.89
9,482.00	91.48	88.50	6,935.43	-274.79	2,859.51	2,869.95	1.06
9,577.00	92.47	88.84	6,932.15	-272.58	2,954.43	2,964.62	1.10
9,672.00	90.18	88.80	6,929.96	-270.63	3,049.37	3,059.34	2.41
9,768.00	90.92	88.01	6,929.03	-267.96	3,145.33	3,155.02	1.13
9,863.00	92.03	90.91	6,926.59	-267.06	3,240.28	3,249.80	3.27
9,959.00	92.59	91.18	6,922.72	-268.81	3,336.19	3,345.67	0.65
10,054.00	91.02	89.42	6,919.73	-269.31	3,431.13	3,440.51	2.48

## Design Report for Letterly USX AB23-68HN - MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
10,149.00	91.20	89.05	6,917.89	-268.04	3,526.11	3,535.29	0.43
10,245.00	92.03	88.69	6,915.18	-266.15	3,622.05	3,631.00	0.94
10,339.00	92.53	88.47	6,911.44	-263.82	3,715.95	3,724.65	0.58
10,435.00	90.43	87.47	6,908.96	-260.42	3,811.85	3,820.24	2.42
10,530.00	91.51	88.04	6,907.35	-256.70	3,906.76	3,914.83	1.29
10,626.00	90.18	86.19	6,905.94	-251.87	4,002.62	4,010.31	2.37
10,721.00	90.00	85.68	6,905.79	-245.13	4,097.38	4,104.59	0.57
10,817.00	89.14	84.54	6,906.51	-236.95	4,193.03	4,199.68	1.49
10,913.00	89.48	84.04	6,907.66	-227.40	4,288.54	4,294.57	0.63
10,998.00	91.29	86.05	6,907.09	-220.06	4,373.21	4,378.74	3.18
<b>Final MWD Survey</b>							
11,054.00	91.29	86.05	6,905.83	-216.20	4,429.07	4,434.32	0.00
<b>Survey Projection to TD - Estimated BHL: 644' FNL, 538' FEL</b>							

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
889.00	888.99	-1.88	-2.47	First MWD Survey
10,998.00	6,907.09	-220.06	4,373.21	Final MWD Survey
11,054.00	6,905.83	-216.20	4,429.07	Survey Projection to TD
11,054.00	6,905.83	-216.20	4,429.07	Estimated BHL: 644' FNL, 538' FEL

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (ft)
				+N/-S (ft)	+E/-W (ft)	
Target	Letterly USX AB23-68HN_PlanA - Rev2_BH L Tgt	92.99	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
889.00	11,054.00	Sperry MWD Surveys	MWD

## Design Report for Letterly USX AB23-68HN - MWD Survey

**Targets**

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
Letterly USX	0.00	0.00	6,904.24	-231.42	4,431.63	1,449,942.98	3,275,318.12	40° 33' 51.372 N	104° 30' 32.544 W
- actual wellpath misses target center by 15.51ft at 11054.00ft MD (6905.83 TVD, -216.20 N, 4429.07 E)									
- Point									
Letterly USX	0.00	0.00	0.00	0.00	0.00	1,450,174.39	3,270,886.61	40° 33' 54.144 N	104° 31' 29.928 W
- actual wellpath hits target center									
- Polygon									
Point 1			164.00	-113.00		1,450,061.40	3,271,050.61		
Point 2			2,332.00	-66.00		1,450,108.40	3,273,218.55		
Point 3			4,506.00	-22.00		1,450,152.39	3,275,392.48		
Point 4			4,513.00	-2,204.00		1,447,970.46	3,275,399.48		
Point 5			4,512.00	-4,396.00		1,445,778.52	3,275,398.48		
Point 6			2,349.00	-4,433.00		1,445,741.52	3,273,235.54		
Point 7			164.00	-4,469.00		1,445,705.52	3,271,050.61		
Point 8			166.00	-2,291.00		1,447,883.46	3,271,052.61		
Point 9			164.00	-113.00		1,450,061.40	3,271,050.61		
Letterly USX	0.00	0.00	0.00	0.00	0.00	1,450,174.39	3,270,886.61	40° 33' 54.144 N	104° 31' 29.928 W
- actual wellpath hits target center									
- Polygon									
Point 1			-296.00	347.00		1,450,521.38	3,270,590.62		
Point 2			2,332.00	394.00		1,450,568.38	3,273,218.55		
Point 3			4,966.00	438.00		1,450,612.38	3,275,852.47		
Point 4			4,973.00	-2,204.00		1,447,970.46	3,275,859.47		
Point 5			4,972.00	-4,856.00		1,445,318.53	3,275,858.47		
Point 6			2,349.00	-4,893.00		1,445,281.53	3,273,235.54		
Point 7			-296.00	-4,929.00		1,445,245.53	3,270,590.62		
Point 8			-294.00	-2,291.00		1,447,883.46	3,270,592.62		
Point 9			-296.00	347.00		1,450,521.38	3,270,590.62		

## North Reference Sheet for Sec. 23-T7N-R64W (Letterly 23 PAD) - Letterly USX AB23-68HN

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

Vertical Depths are relative to KB @ 4851.00ft (H&P 315). Northing and Easting are relative to Letterly USX AB23-68HN

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° 30' 0.000 W°, Longitude Origin:0° 0' 0.000 E°, Latitude Origin:40° 47' 0.000 N°

False Easting: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99997186

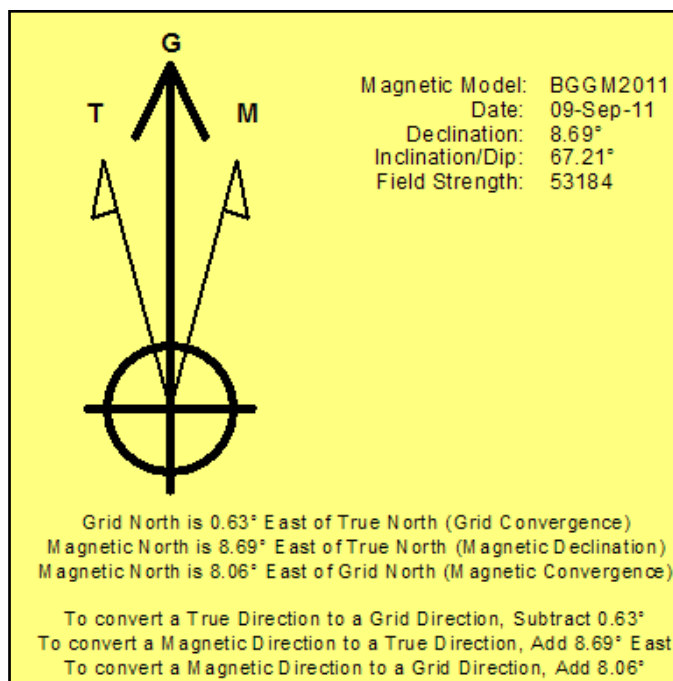
Grid Coordinates of Well: 1,450,174.39 ft N, 3,270,886.61 ft E

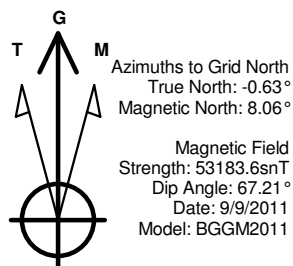
Geographical Coordinates of Well: 40° 33' 54.14" N, 104° 31' 29.93" W

Grid Convergence at Surface is: 0.63°

Based upon Minimum Curvature type calculations, at a Measured Depth of 11,054.00ft the Bottom Hole Displacement is 4,434.34ft in the Direction of 92.79° (Grid).

Magnetic Convergence at surface is: -8.06° ( 9 September 2011, , BGGM2011)

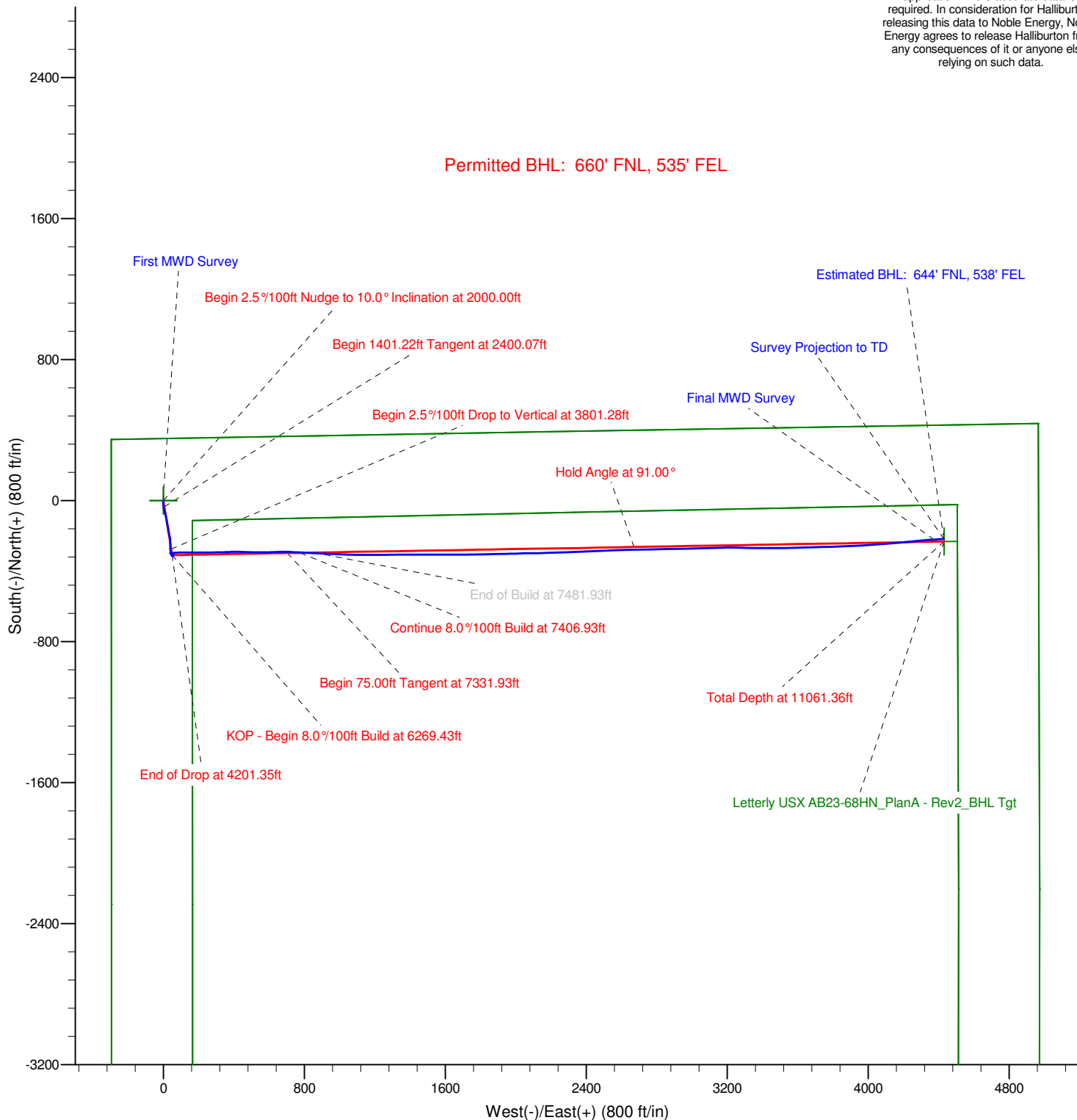




### LEGEND

- Letterly USX AB23-68HN, Plan A, Plan A - Rev 2 Proposal V0
- MWD Survey

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Letterly USX AB23-68HN well located at Weld County, CO. At the conclusion of the job Halliburton performed a final survey on the well. Noble Energy has requested that Halliburton provide them the distances from BHL to section lines from that final survey to allow Noble Energy to meet its requirements under Colorado law. These distances are generated by a mathematical algorithm based on rough data collected after the well is drilled. Halliburton considers it to be a rough estimate only and it is not to be relied upon in any application where accurate data is required. In consideration for Halliburton releasing this data to Noble Energy, Noble Energy agrees to release Halliburton from any consequences of it or anyone else relying on such data.

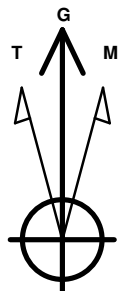


Project: Weld County, CO (NAD 83)  
Site: Sec. 23-T7N-R64W (Letterly 23 PAD)  
Well: Letterly USX AB23-68HN

# Noble Energy

**HALLIBURTON**

Sperry Drilling



Azimuths to Grid North  
True North:  $-0.63^\circ$   
Magnetic North:  $8.06^\circ$

Magnetic Field  
Strength: 53183.6snT  
Dip Angle:  $67.21^\circ$   
Date: 9/9/2011  
Model: BGGM2011

## LEGEND

- Letterly USX AB23-68HN, Plan A, Plan A - Rev 2 Proposal V0
- MWD Survey

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Letterly USX AB23-68HN well located at Weld County, CO. At the conclusion of the job Halliburton performed a final survey on the well. Noble Energy has requested that Halliburton provide them the distances from BHL to section lines from that final survey to allow Noble Energy to meet its requirements under Colorado law. These distances are generated by a mathematical algorithm based on rough data collected after the well is drilled. Halliburton considers it to be a rough estimate only and it is not to be relied upon in any application where accurate data is required. In consideration for Halliburton releasing this data to Noble Energy, Noble Energy agrees to release Halliburton from any consequences of it or anyone else relying on such data.

