

**Noble Energy**  
Weld County, CO (NAD 83)  
Sec. 9-T9N-R58W  
Rohn PC LD16-96HN

**Design: MWD Survey**

# **Sperry Drilling Services**

## **Final Survey Report**

**02 December, 2011**

Well Coordinates: 1,523,557.18 N, 3,449,341.24 E (40° 45' 33.37" N, 103° 52' 40.58" W)  
Ground Level: 4,787.00 ft

Local Coordinate Origin:	Centered on Well Rohn PC LD16-96HN
Viewing Datum:	KB @ 4811.00ft (Rig KB)
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 Rohn PC LD16-96HN - 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
801.00	0.07	235.37	801.00	-0.28	-0.40	-0.34	0.01
<b>First MWD Survey</b>							
893.00	0.44	88.98	893.00	-0.30	-0.10	-0.03	0.54
985.00	0.33	7.52	985.00	-0.03	0.29	0.29	0.55
1,078.00	2.82	181.97	1,077.96	-2.06	0.25	0.65	3.39
1,173.00	3.61	191.70	1,172.81	-7.32	-0.44	1.00	1.01
1,267.00	5.85	194.65	1,266.49	-14.85	-2.25	0.70	2.40
1,362.00	9.10	183.91	1,360.67	-27.04	-3.99	1.38	3.71
1,457.00	11.60	183.44	1,454.12	-44.07	-5.07	3.65	2.63
1,552.00	13.54	186.27	1,546.84	-64.66	-6.86	5.93	2.14
1,646.00	15.80	192.34	1,637.77	-88.10	-10.80	6.65	2.90
1,741.00	16.07	191.56	1,729.12	-113.62	-16.20	6.35	0.36
1,836.00	16.34	191.64	1,820.35	-139.59	-21.53	6.21	0.29
1,930.00	18.60	197.01	1,910.01	-166.88	-28.58	4.63	2.95
2,025.00	20.08	196.93	1,999.65	-196.97	-37.76	1.52	1.56
2,120.00	22.05	197.05	2,088.30	-229.63	-47.74	-1.88	2.07
2,219.00	20.15	193.93	2,180.66	-263.95	-57.30	-4.53	2.23
2,315.00	18.91	191.06	2,271.14	-295.26	-64.26	-5.23	1.63
2,410.00	20.21	191.34	2,360.65	-326.46	-70.44	-5.19	1.37
2,506.00	22.54	188.49	2,450.04	-360.92	-76.42	-4.30	2.66
2,601.00	21.89	188.28	2,537.99	-396.46	-81.66	-2.49	0.69
2,697.00	21.83	187.97	2,627.09	-431.84	-86.71	-0.52	0.14
2,792.00	20.26	185.77	2,715.75	-465.70	-90.81	2.09	1.85
2,888.00	20.86	195.44	2,805.66	-498.73	-97.04	2.45	3.59
2,983.00	19.14	192.48	2,894.93	-530.24	-104.91	0.90	2.10
3,079.00	17.28	194.01	2,986.12	-559.44	-111.76	-0.11	2.00
3,174.00	17.30	192.55	3,076.83	-586.92	-118.25	-1.09	0.46
3,270.00	18.88	193.89	3,168.08	-615.93	-125.08	-2.11	1.70
3,460.00	20.06	192.94	3,347.21	-677.54	-139.75	-4.45	0.64
3,556.00	20.14	195.71	3,437.37	-709.49	-147.92	-6.20	1.00
3,651.00	20.54	193.88	3,526.45	-741.42	-156.34	-8.21	0.79
3,747.00	19.86	193.64	3,616.54	-773.61	-164.23	-9.64	0.71
3,843.00	18.35	191.48	3,707.25	-804.27	-171.08	-10.36	1.74
3,938.00	16.65	190.67	3,797.85	-832.30	-176.58	-10.27	1.81
4,034.00	15.28	191.94	3,890.15	-858.19	-181.74	-10.26	1.47
4,129.00	13.97	189.36	3,982.07	-881.76	-186.20	-10.02	1.54
4,225.00	12.25	189.50	4,075.56	-903.24	-189.76	-9.31	1.79
4,320.00	9.65	183.80	4,168.83	-921.13	-191.95	-7.96	2.96
4,416.00	6.94	185.29	4,263.81	-934.93	-193.02	-6.31	2.83
4,511.00	3.45	184.15	4,358.41	-943.50	-193.76	-5.35	3.68
4,607.00	2.90	169.37	4,454.26	-948.77	-193.52	-4.09	1.02
4,702.00	0.59	98.52	4,549.22	-951.20	-192.59	-2.70	2.91
4,798.00	0.87	49.47	4,645.21	-950.80	-191.55	-1.76	0.68
4,893.00	0.39	77.18	4,740.20	-950.26	-190.69	-1.02	0.58
4,989.00	0.72	79.09	4,836.20	-950.08	-189.78	-0.16	0.34
5,084.00	0.82	70.50	4,931.19	-949.74	-188.55	0.98	0.16
5,179.00	0.90	103.76	5,026.18	-949.69	-187.18	2.31	0.52
5,227.00	4.78	73.15	5,074.11	-949.20	-184.90	4.45	8.40
5,275.00	8.54	65.82	5,121.78	-947.16	-179.73	9.12	8.02

## Design Report for Rohn PC LD16-96HN - MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
5,323.00	12.10	64.87	5,169.00	-943.56	-171.93	16.07	7.42
5,370.00	15.33	69.08	5,214.65	-939.25	-161.66	25.29	7.19
5,418.00	18.67	70.53	5,260.55	-934.42	-148.49	37.27	7.01
5,466.00	21.90	74.55	5,305.57	-929.47	-132.61	51.87	7.33
5,514.00	25.39	75.47	5,349.53	-924.50	-114.01	69.13	7.31
5,562.00	27.81	74.63	5,392.45	-918.95	-93.25	88.41	5.10
5,610.00	31.70	77.39	5,434.12	-913.23	-70.14	109.95	8.59
5,657.00	35.21	80.51	5,473.32	-908.30	-44.71	133.92	8.31
5,705.00	39.18	82.29	5,511.55	-903.98	-16.03	161.21	8.57
5,753.00	42.75	85.41	5,547.80	-900.64	15.25	191.23	8.57
5,801.00	46.78	88.77	5,581.88	-898.96	48.99	223.99	9.73
5,848.00	50.44	91.32	5,612.95	-899.01	84.24	258.56	8.79
5,896.00	55.57	91.80	5,641.82	-900.06	122.55	296.34	10.72
5,943.00	59.80	92.20	5,666.94	-901.45	162.24	335.53	9.03
5,991.00	64.79	90.34	5,689.25	-902.38	204.71	377.36	10.95
6,039.00	68.64	89.54	5,708.22	-902.32	248.79	420.58	8.17
6,087.00	71.68	89.43	5,724.51	-901.92	293.93	464.77	6.34
6,134.00	76.13	90.04	5,737.54	-901.71	339.08	509.00	9.55
6,182.00	77.66	90.20	5,748.42	-901.81	385.83	554.87	3.20
6,230.00	79.52	90.05	5,757.92	-901.91	432.88	601.03	3.89
6,280.00	81.01	90.07	5,766.37	-901.96	482.16	649.36	2.98
6,345.00	84.49	91.35	5,774.57	-902.77	546.62	712.74	5.70
6,440.00	86.97	92.89	5,781.65	-906.27	641.28	806.25	3.07
6,536.00	88.52	93.50	5,785.43	-911.62	737.05	901.22	1.73
6,631.00	91.36	91.63	5,785.52	-915.87	831.95	995.11	3.58
6,727.00	91.79	89.74	5,782.89	-917.02	927.90	1,089.43	2.02
6,822.00	89.63	88.45	5,781.71	-915.52	1,022.87	1,182.27	2.65
6,918.00	89.20	89.11	5,782.69	-913.47	1,118.84	1,275.99	0.82
7,013.00	90.99	87.94	5,782.53	-911.03	1,213.81	1,368.64	2.25
7,109.00	89.38	87.94	5,782.22	-907.58	1,309.74	1,462.04	1.68
7,204.00	92.47	87.74	5,780.69	-904.00	1,404.65	1,554.41	3.26
7,300.00	92.10	89.51	5,776.86	-901.70	1,500.54	1,648.00	1.88
7,395.00	92.35	89.69	5,773.17	-901.03	1,595.47	1,740.96	0.32
7,491.00	90.87	91.25	5,770.47	-901.82	1,691.42	1,835.21	2.24
7,586.00	89.57	90.12	5,770.11	-902.96	1,786.41	1,928.59	1.81
7,681.00	89.88	91.23	5,770.57	-904.08	1,881.40	2,021.96	1.21
7,777.00	89.94	91.61	5,770.72	-906.45	1,977.37	2,116.54	0.40
7,872.00	89.01	91.97	5,771.59	-909.42	2,072.32	2,210.23	1.05
7,968.00	87.84	91.85	5,774.23	-912.62	2,168.23	2,304.91	1.23
8,063.00	89.32	91.49	5,776.58	-915.39	2,263.16	2,398.54	1.60
8,159.00	91.24	90.43	5,776.11	-917.00	2,359.13	2,492.98	2.28
8,254.00	90.49	88.22	5,774.68	-915.88	2,454.11	2,585.90	2.46
8,350.00	90.68	87.65	5,773.70	-912.42	2,550.04	2,679.30	0.63
8,445.00	89.88	87.72	5,773.23	-908.58	2,644.96	2,771.64	0.85
8,541.00	91.54	88.47	5,772.04	-905.39	2,740.90	2,865.09	1.90
8,636.00	90.19	89.00	5,770.61	-903.29	2,835.86	2,957.81	1.53
8,732.00	91.97	89.33	5,768.80	-901.89	2,931.83	3,051.65	1.89
8,827.00	89.32	88.34	5,767.73	-899.96	3,026.80	3,144.40	2.98
8,922.00	90.12	88.50	5,768.19	-897.34	3,121.76	3,237.01	0.86
9,018.00	92.22	88.63	5,766.23	-894.94	3,217.70	3,330.63	2.19
9,113.00	90.80	89.57	5,763.73	-893.45	3,312.65	3,423.45	1.79



## Design Report for Rohn PC LD16-96HN - MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
9,208.00	90.31	90.34	5,762.81	-893.37	3,407.65	3,516.60	0.96
9,304.00	88.52	89.80	5,763.79	-893.49	3,503.64	3,610.75	1.95
9,399.00	88.39	90.51	5,766.35	-893.75	3,598.60	3,703.93	0.76
9,495.00	89.44	91.00	5,768.17	-895.01	3,694.58	3,798.29	1.21
9,590.00	90.43	91.55	5,768.28	-897.13	3,789.55	3,891.85	1.19
9,685.00	89.38	89.41	5,768.43	-897.92	3,884.54	3,985.15	2.51
9,781.00	90.25	89.26	5,768.74	-896.81	3,980.53	4,079.07	0.92
9,876.00	92.35	90.21	5,766.59	-896.37	4,075.50	4,172.12	2.43
9,971.00	91.54	87.73	5,763.36	-894.66	4,170.42	4,264.87	2.74
10,067.00	91.61	86.69	5,760.73	-889.99	4,266.27	4,357.95	1.09
10,078.00	91.61	86.80	5,760.42	-889.37	4,277.25	4,368.59	1.00
Final MWD Survey							
10,140.00	91.61	86.80	5,758.67	-885.91	4,339.13	4,428.60	0.00
Survey Projection to TD - Estimated BHL: 715' FNL, 699' FEL							

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
801.00	801.00	-0.28	-0.40	First MWD Survey
10,078.00	5,760.42	-889.37	4,277.25	Final MWD Survey
10,140.00	5,758.67	-885.91	4,339.13	Survey Projection to TD
10,140.00	5,758.67	-885.91	4,339.13	Estimated BHL: 715' FNL, 699' FEL

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (ft)
				+N/-S (ft)	+E/-W (ft)	
Target	Rohn PC LD16-96HN_PlanB - Rev1_BHL Tgt	101.29	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
801.00	10,140.00	Sperry MWD Surveys	MWD

## Design Report for Rohn PC LD16-96HN - 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
Rohn PC	0.00	0.00	5,738.55	-870.86	4,363.51	1,522,686.32	3,453,704.73	40.756660	-103.862250
- actual wellpath misses target center by 35.01ft at 10140.00ft MD (5758.67 TVD, -885.91 N, 4339.13 E)									
- Point									
Rohn PC	0.00	0.00	0.00	0.00	0.00	1,523,557.18	3,449,341.24	40.759270	-103.877940
- actual wellpath hits target center									
- Polygon									
Point 1				-242.00	-252.00	1,523,305.18	3,449,099.24		
Point 2				5,013.00	-159.00	1,523,398.18	3,454,354.22		
Point 3				5,199.00	-5,454.00	1,518,103.20	3,454,540.22		
Point 4				-86.00	-5,580.00	1,517,977.20	3,449,255.24		
Point 5				-242.00	-252.00	1,523,305.18	3,449,099.24		
Rohn PC	0.00	0.00	0.00	0.00	0.00	1,523,557.18	3,449,341.24	40.759270	-103.877940
- actual wellpath hits target center									
- Polygon									
Point 1				358.00	348.00	1,523,905.18	3,449,699.23		
Point 2				231.00	4,451.00	1,528,008.16	3,449,572.23		
Point 3				4,278.00	4,551.00	1,528,108.16	3,453,619.22		
Point 4				4,413.00	441.00	1,523,998.18	3,453,754.22		
Point 5				358.00	348.00	1,523,905.18	3,449,699.23		
Rohn PC	0.00	0.00	0.00	0.00	0.00	1,523,557.18	3,449,341.24	40.759270	-103.877940
- actual wellpath hits target center									
- Polygon									
Point 1				358.00	-852.00	1,522,705.18	3,449,699.23		
Point 2				4,413.00	-759.00	1,522,798.18	3,453,754.22		
Point 3				4,599.00	-4,854.00	1,518,703.20	3,453,940.22		
Point 4				514.00	-4,980.00	1,518,577.20	3,449,855.23		
Point 5				358.00	-852.00	1,522,705.18	3,449,699.23		
Rohn PC	0.00	0.00	0.00	0.00	0.00	1,523,557.18	3,449,341.24	40.759270	-103.877940
- actual wellpath hits target center									
- Polygon									
Point 1				-242.00	-252.00	1,523,305.18	3,449,099.24		
Point 2				-369.00	5,051.00	1,528,608.16	3,448,972.24		
Point 3				4,878.00	5,151.00	1,528,708.16	3,454,219.22		
Point 4				5,013.00	-159.00	1,523,398.18	3,454,354.22		
Point 5				-242.00	-252.00	1,523,305.18	3,449,099.24		

**North Reference Sheet for Sec. 9-T9N-R58W - Rohn PC LD16-96HN**

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

Vertical Depths are relative to KB @ 4811.00ft (Rig KB). Northing and Easting are relative to Rohn PC LD16-96HN

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: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99999618

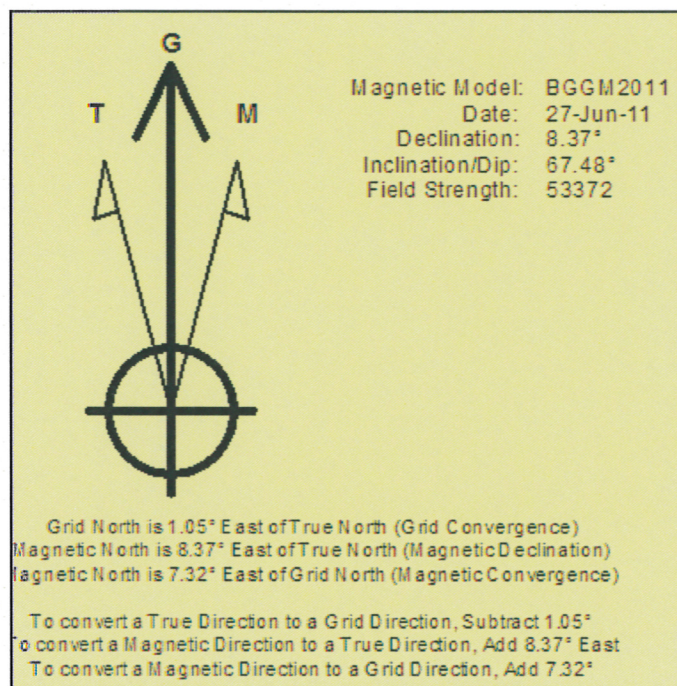
Grid Coordinates of Well: 1,523,557.18 ft N, 3,449,341.24 ft E

Geographical Coordinates of Well: 40° 45' 33.37" N, 103° 52' 40.58" W

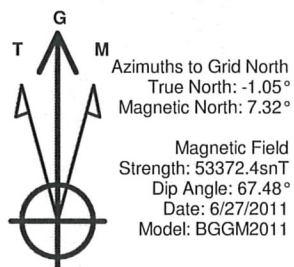
Grid Convergence at Surface is: 1.05°

Based upon Minimum Curvature type calculations, at a Measured Depth of 10,140.00ft  
the Bottom Hole Displacement is 4,428.64ft in the Direction of 101.54° (Grid).

Magnetic Convergence at surface is: -7.32° (27 June 2011, , BGGM2011)



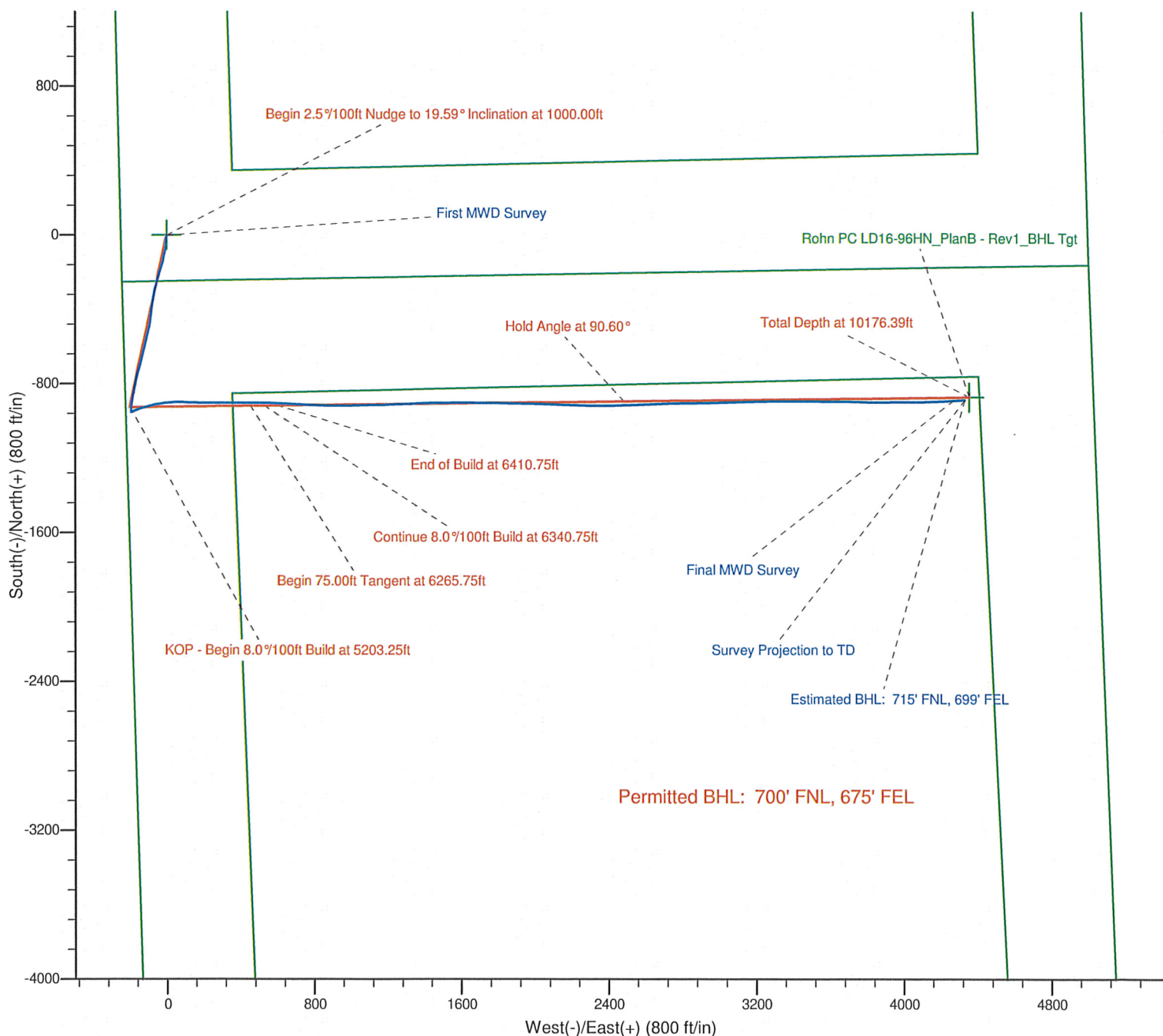




### LEGEND

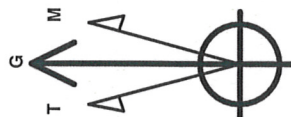
- Rohn PC LD16-96HN, Plan B, Plan B - Rev 1 Proposal V0
- MWD Survey

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Rohn PC LD16-96HN 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. 9-T9N-R58W  
Well: Rohn PC LD16-96HN

# Noble Energy



Azimuths to Grid North  
True North: -1.05°  
Magnetic North: 7.32°  
  
Magnetic Field  
Strength: 53372.4snT  
Dip Angle: 67.48°  
Date: 6/27/2011  
Model: BGGM2011

## LEGEND

- Rohn PC LD16-96HN, Plan B, Plan B - Rev 1 Proposal V0
- MWD Survey

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