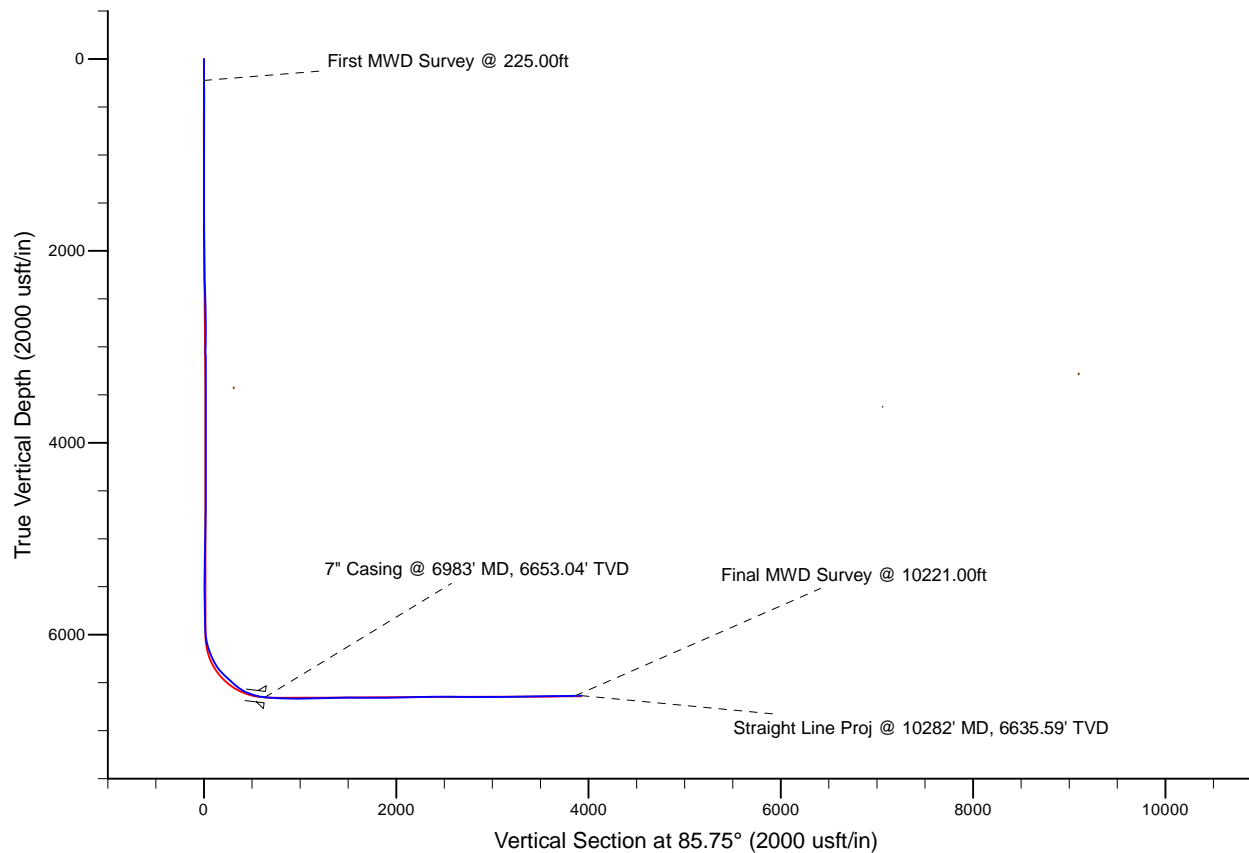
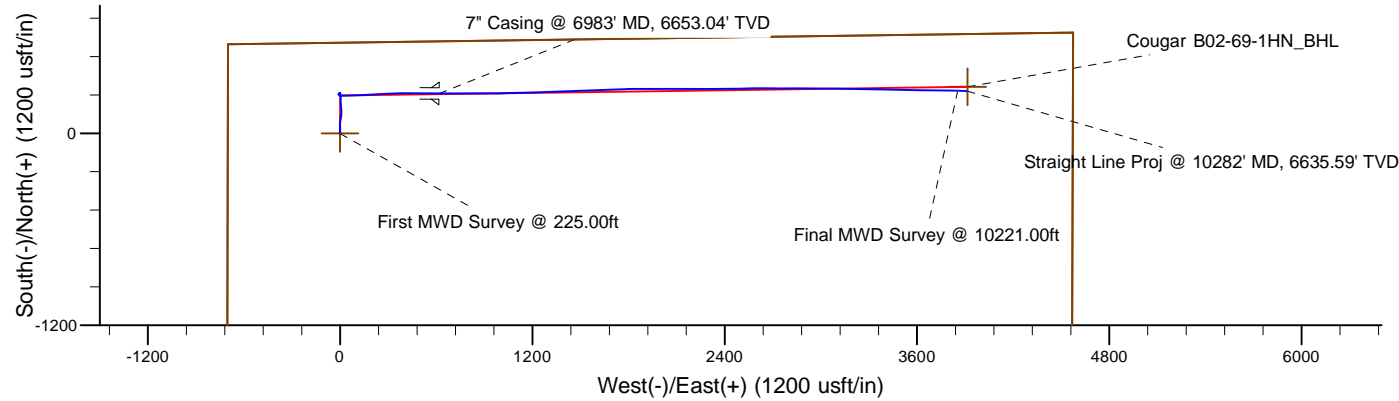


Project: Weld County, CO (NAD 83)
Site: Sec. 2-T5N-R64W (Cougar Pad)
Well: Cougar B02-69-1HN
Wellbore: Plan A
Design: Final Surveys

Noble Energy

HALLIBURTON
Sperry Drilling



LEGEND

- △ Cougar B02-69-1HN, Plan A, Rev A0 - PROPOSAL V0
- Final Surveys

Platted SHL: 566' FNL, 702' FWL
Platted Lat/Long: 40.43407 N, 104.52428 W
Location: Sec. 2-T5N-R64W

7" Casing: ~326.21' FNL, ~1318.14' FWL
Lat/Long: 40.434735 N, 104.522050 W
State Planes - CO Northern: 1,402,715.35' N, 3,272,224.10' E
Location: Sec. 2-T5N-R64W

BHL: ~356.07' FNL, ~658.86' FEL
Lat/Long: 40.434678 N, 104.510206 W
State Planes - CO Northern: 1,402,731.14' N, 3,275,521.32' E
Location: Sec. 2-T5N-R64W

WELL DETAILS: Cougar B02-69-1HN

Ground Level: 4641.00
RKB = 24 @ 4665.00usft (H&P 315)

Created By: Fred Hartmann
Created On: 02/04/2014

Noble Energy

Weld County, CO (NAD 83)

Sec. 2-T5N-R64W (Cougar Pad)

Cougar B02-69-1HN

Design: Final Surveys

Sperry Drilling Services

Final Survey Report

04 February, 2014

Well Coordinates: 1,402,466.32 N, 3,271,606.07 E (40° 26' 02.65" N, 104° 31' 27.41" W)

Ground Level: 4,641.00 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 Cougar B02-69-1HN

RKB = 24 @ 4665.00usft (H&P 315)

N

Grid

Dec-Deg - API - US Survey Feet - Custom

HALLIBURTON

Design Report for Cougar B02-69-1HN - Final 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
225.00	0.91	134.97	224.99	-1.26	1.26	1.17	0.40
First MWD Survey @ 225.00ft							
317.00	0.98	137.00	316.98	-2.35	2.32	2.14	0.08
410.00	0.93	163.42	409.97	-3.66	3.08	2.80	0.47
502.00	0.37	143.85	501.96	-4.61	3.46	3.11	0.65
594.00	0.37	332.01	593.96	-4.59	3.50	3.15	0.80
687.00	0.84	2.02	686.95	-3.65	3.38	3.10	0.59
779.00	1.09	8.04	778.94	-2.11	3.53	3.36	0.29
872.00	1.64	333.80	871.92	-0.04	3.06	3.05	1.03
965.00	1.87	345.78	964.87	2.63	2.10	2.29	0.46
1,057.00	1.90	340.38	1,056.82	5.52	1.22	1.63	0.20
1,150.00	2.13	345.59	1,149.76	8.65	0.28	0.92	0.32
1,244.00	2.61	352.73	1,243.68	12.46	-0.43	0.50	0.60
1,337.00	2.86	358.91	1,336.58	16.88	-0.74	0.51	0.42
1,429.00	3.28	356.53	1,428.45	21.80	-0.94	0.67	0.48
1,522.00	3.36	359.91	1,521.29	27.19	-1.11	0.91	0.23
1,616.00	3.73	0.27	1,615.11	33.00	-1.10	1.35	0.39
1,711.00	4.12	357.86	1,709.89	39.50	-1.21	1.72	0.45
1,806.00	4.06	5.75	1,804.65	46.25	-1.00	2.43	0.60
1,948.00	3.94	359.95	1,946.30	56.13	-0.50	3.66	0.30
2,025.00	4.02	3.44	2,023.11	61.47	-0.34	4.21	0.33
2,120.00	3.06	349.42	2,117.93	67.29	-0.61	4.38	1.35
2,215.00	4.22	12.61	2,212.75	73.19	-0.31	5.11	1.95
2,310.00	5.91	10.15	2,307.37	81.42	1.31	7.35	1.79
2,405.00	7.58	16.94	2,401.71	92.23	4.00	10.83	1.95
2,500.00	8.99	8.51	2,495.72	105.57	6.92	14.73	1.96
2,595.00	9.99	2.81	2,589.42	121.14	8.43	17.38	1.44
2,690.00	9.92	356.75	2,683.00	137.54	8.37	18.54	1.10
2,784.00	10.52	356.25	2,775.50	154.18	7.35	18.76	0.65
2,879.00	9.66	354.18	2,869.03	170.77	5.97	18.62	0.98
2,974.00	9.80	354.12	2,962.67	186.74	4.33	18.17	0.15
3,069.00	7.97	355.49	3,056.52	201.35	2.99	17.91	1.94
3,164.00	6.20	1.52	3,150.80	213.04	2.61	18.39	2.02
3,259.00	5.20	357.83	3,245.32	222.48	2.58	19.07	1.12
3,354.00	2.59	1.90	3,340.10	228.92	2.49	19.45	2.76
3,449.00	1.59	340.81	3,435.03	232.31	2.13	19.34	1.31
3,544.00	1.13	7.65	3,530.01	234.49	1.82	19.20	0.81
3,828.00	1.33	354.88	3,813.94	240.55	1.90	19.72	0.12
4,112.00	1.79	356.85	4,097.84	248.26	1.36	19.76	0.16
4,397.00	0.53	299.34	4,382.78	253.35	-0.04	18.75	0.55
4,682.00	0.47	151.89	4,667.77	252.96	-0.63	18.12	0.34
4,967.00	1.34	260.68	4,952.75	251.39	-3.37	15.28	0.55
5,251.00	1.26	239.27	5,236.68	249.26	-9.33	9.17	0.17
5,536.00	1.41	148.60	5,521.63	244.66	-10.20	7.97	0.67
5,820.00	1.71	144.07	5,805.52	238.25	-5.89	11.79	0.11
5,913.00	1.72	111.51	5,898.48	236.61	-3.78	13.77	1.03
5,948.00	1.27	116.69	5,933.47	236.25	-2.94	14.58	1.34
6,101.00	12.24	90.09	6,085.19	235.46	14.84	32.26	7.27
6,196.00	20.61	87.53	6,176.23	236.16	41.67	59.06	8.84

Design Report for Cougar B02-69-1HN - Final Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
6,244.00	23.58	87.12	6,220.70	237.01	59.70	77.11	6.20
6,291.00	25.47	88.65	6,263.46	237.72	79.19	96.60	4.24
6,339.00	29.55	89.08	6,306.02	238.15	101.36	118.73	8.51
6,386.00	34.64	86.20	6,345.83	239.23	126.29	143.68	11.31
6,434.00	42.71	87.61	6,383.27	240.81	156.22	173.64	16.91
6,481.00	45.78	87.57	6,416.94	242.19	188.98	206.41	6.53
6,529.00	47.65	85.88	6,449.85	244.20	223.86	241.35	4.66
6,576.00	47.88	86.51	6,481.44	246.50	258.58	276.14	1.11
6,624.00	47.88	88.06	6,513.63	248.19	294.14	311.73	2.40
6,671.00	52.05	88.64	6,543.86	249.22	330.10	347.67	8.92
6,719.00	57.25	87.38	6,571.62	250.59	369.22	386.78	11.04
6,765.00	63.58	88.84	6,594.32	251.90	409.18	426.72	14.03
6,813.00	69.66	89.72	6,613.36	252.44	453.21	470.68	12.78
6,860.00	73.13	91.25	6,628.36	252.06	497.74	515.06	8.00
6,937.00	80.06	91.89	6,646.20	250.00	572.57	589.53	9.04
6,983.00	82.84	90.56	6,653.04	249.03	618.04	634.81	6.68
7" Casing @ 6983' MD, 6653.04' TVD							
7,030.00	85.68	89.22	6,657.74	249.12	664.80	681.44	6.68
7,125.00	88.00	89.95	6,662.97	249.81	759.65	776.08	2.56
7,220.00	88.89	89.32	6,665.55	250.41	854.61	870.82	1.15
7,315.00	91.42	90.56	6,665.29	250.51	949.60	965.56	2.97
7,410.00	89.20	87.64	6,664.78	252.00	1,044.57	1,060.38	3.86
7,505.00	91.63	89.14	6,664.09	254.67	1,139.52	1,155.27	3.01
7,600.00	91.60	88.63	6,661.41	256.52	1,234.47	1,250.09	0.54
7,694.00	92.47	87.90	6,658.08	259.37	1,328.36	1,343.93	1.21
7,789.00	89.54	87.27	6,656.41	263.37	1,423.25	1,438.86	3.15
7,884.00	90.00	87.57	6,656.79	267.64	1,518.15	1,533.82	0.58
7,979.00	89.78	88.25	6,656.97	271.11	1,613.09	1,628.75	0.75
8,074.00	89.91	87.41	6,657.23	274.71	1,708.02	1,723.69	0.89
8,169.00	89.75	89.45	6,657.51	277.31	1,802.98	1,818.58	2.15
8,263.00	89.88	89.79	6,657.82	277.93	1,896.98	1,912.36	0.39
8,358.00	91.88	90.68	6,656.36	277.54	1,991.96	2,007.05	2.30
8,453.00	92.28	89.68	6,652.91	277.24	2,086.89	2,101.71	1.13
8,548.00	90.99	89.77	6,650.20	277.70	2,181.85	2,196.44	1.36
8,643.00	90.43	89.92	6,649.02	277.96	2,276.84	2,291.19	0.61
8,738.00	91.42	89.76	6,647.49	278.22	2,371.83	2,385.93	1.06
8,832.00	89.57	89.06	6,646.68	279.19	2,465.82	2,479.73	2.10
8,927.00	89.07	87.72	6,647.80	281.86	2,560.77	2,574.62	1.51
9,022.00	89.72	90.88	6,648.81	283.02	2,655.75	2,669.42	3.40
9,117.00	88.71	90.66	6,650.11	281.74	2,750.73	2,764.05	1.09
9,212.00	90.34	90.03	6,650.90	281.17	2,845.72	2,858.73	1.84
9,307.00	90.19	89.33	6,650.46	281.70	2,940.72	2,953.51	0.75
9,401.00	90.89	91.21	6,649.57	281.26	3,034.71	3,047.21	2.13
9,496.00	90.74	91.21	6,648.22	279.25	3,129.67	3,141.76	0.16
9,591.00	91.05	90.96	6,646.74	277.45	3,224.65	3,236.34	0.42
9,686.00	90.86	91.20	6,645.15	275.66	3,319.62	3,330.92	0.32
9,781.00	90.62	91.09	6,643.93	273.77	3,414.59	3,425.49	0.28
9,876.00	90.52	91.53	6,642.98	271.59	3,509.56	3,520.04	0.47
9,971.00	91.08	90.03	6,641.65	270.30	3,604.54	3,614.66	1.69
10,065.00	90.43	90.43	6,640.41	269.92	3,698.53	3,708.36	0.81
10,160.00	91.11	91.28	6,639.14	268.51	3,793.51	3,802.97	1.15

Design Report for Cougar B02-69-1HN - Final Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
10,221.00	91.85	91.88	6,637.56	266.82	3,854.46	3,863.64	1.56
Final MWD Survey @ 10221.00ft							
10,282.00	91.85	91.88	6,635.59	264.82	3,915.40	3,924.26	0.00
Straight Line Proj @ 10282' MD, 6635.59' TVD							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
225.00	224.99	-1.26	1.26	First MWD Survey @ 225.00ft
10,221.00	6,637.56	266.82	3,854.46	Final MWD Survey @ 10221.00ft
10,282.00	6,635.59	264.82	3,915.40	Straight Line Proj @ 10282' MD, 6635.59' TVD

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/_S (usft)	+E/-W (usft)	
Target	Cougar B02-69-1HN_BHL	85.75	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
225.00	1,948.00	MWD Surveys - Surface	MWD
2,025.00	6,937.00	MWD Surveys - Intermediate	MWD
7,030.00	10,221.00	MWD Surveys - Production	MWD

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
6,983.00	6,653.04	7" Casing @ 6983' MD, 6653.04' TVD	7	8-3/4

Design Report for Cougar B02-69-1HN - Final 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
Cougar B02-69-1HN_4 - actual wellpath hits target center - Polygon	0.00	0.00	0.00	0.00	0.00	1,402,466.33	3,271,606.07	40.434070	-104.524280
Point 1				0.00	97.03	-239.30	1,402,563.35	3,271,366.78	
Point 2				0.00	-4,280.53	-253.55	1,398,185.96	3,271,352.53	
Point 3				0.00	-4,192.96	4,099.30	1,398,273.53	3,275,705.22	
Point 4				0.00	170.06	4,115.37	1,402,636.38	3,275,721.29	
Point 5				0.00	97.03	-239.30	1,402,563.35	3,271,366.78	
Cougar B02-69-1HN_5 - actual wellpath hits target center - Point	0.00	0.00	0.00	0.00	0.00	1,402,466.33	3,271,606.07	40.434070	-104.524280
Cougar B02-69-1HN_5 - actual wellpath hits target center - Polygon	0.00	0.00	0.00	0.00	0.00	1,402,466.33	3,271,606.07	40.434070	-104.524280
Point 1				0.00	557.04	-699.32	1,403,023.35	3,270,906.78	
Point 2				0.00	-4,740.55	-713.57	1,397,725.96	3,270,892.53	
Point 3				0.00	-4,652.98	4,559.32	1,397,813.53	3,276,165.22	
Point 4				0.00	630.08	4,575.39	1,403,096.38	3,276,181.29	
Point 5				0.00	557.04	-699.32	1,403,023.35	3,270,906.78	
Cougar B02-69-1HN_6 - actual wellpath misses target center by 3.33usft at 6031.38usft MD (6016.59 TVD, 235.63 N, 3.10 E) - Circle (radius 35.00)	0.00	0.00	6,016.96	236.46	-0.10	1,402,702.78	3,271,605.98	40.434719	-104.524271
Cougar B02-69-1HN_7 - actual wellpath misses target center by 27.24usft at 10282.00usft MD (6635.59 TVD, 264.82 N, 3915.40 E) - Point	0.00	0.00	6,642.40	291.17	3,916.60	1,402,757.48	3,275,522.52	40.434750	-104.510200
Cougar B02-69-1HN_8 - actual wellpath misses target center by 392.79usft at 6502.27usft MD (6431.66 TVD, 242.95 N, 204.31 E) - Polygon	-0.30	89.20	6,663.00	0.00	0.00	1,402,466.33	3,271,606.07	40.434070	-104.524280
Point 1				6,659.06	281.97	749.44	1,402,748.29	3,272,355.48	
Point 2				6,659.06	211.97	749.44	1,402,678.29	3,272,355.48	
Point 3				6,642.48	256.16	3,916.65	1,402,722.48	3,275,522.52	
Point 4				6,642.47	326.16	3,916.65	1,402,792.48	3,275,522.52	
Point 5				6,659.06	281.97	749.44	1,402,748.29	3,272,355.48	

Directional Difficulty Index

Average Dogleg over Survey:	1.70 °/100usft	Maximum Dogleg over Survey:	16.91 °/100usft at 6,434.00 usft
Net Tortousity applicable to Plans:	0.62 °/100usft	Directional Difficulty Index:	6.055

Audit Info

North Reference Sheet for Sec. 2-T5N-R64W (Cougar Pad) - Cougar B02-69-1HN -

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to Grid North Reference.
 Vertical Depths are relative to RKB = 24 @ 4665.00usft (H&P 315). Northing and Easting are relative to Cougar B02-69-1HN
 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: 0.99996195

Grid Coordinates of Well: 1,402,466.32 usft N, 3,271,606.07 usft E
 Geographical Coordinates of Well: 40° 26' 02.65" N, 104° 31' 27.41" W
 Grid Convergence at Surface is: 0.63°

Based upon Minimum Curvature type calculations, at a Measured Depth of 10,282.00usft
 the Bottom Hole Displacement is 3,924.34usft in the Direction of 86.13° (Grid).
 Magnetic Convergence at surface is: -7.79° (23 January 2014, , BGGM2013)

