

Noble Energy

Weld County, CO (NAD 83)

Sec. 28-T4N-R64W (Thompson Sec. 28 PAD)

Thompson C33-69HN - A1

Design: Final MWD Survey

Sperry Drilling Services Standard Report

07 August, 2011

Well Coordinates: 1,345,145.14 N, 3,261,136.92 E (40° 16' 37.34" N, 104° 33' 50.62" W)
Ground Level: 4,765.00 ft

Local Coordinate Origin:	Centered on Well Thompson C33-69HN - Slot A1
Viewing Datum:	KB @ 4789.00ft (H&P 322)
TVDs to System:	N
North Reference:	Grid
Unit System:	API - US Survey Feet - Custom

Geodetic Scale Factor Applied

Version: 2003.16 Build: 43I

HALLIBURTON

Design Report for Thompson C33-69HN - Final 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
968.00	0.48	277.08	967.99	0.50	-4.02	-4.04	0.05
1,062.00	0.66	250.66	1,061.98	0.37	-4.93	-4.94	0.33
1,157.00	1.69	172.35	1,156.97	-1.20	-5.26	-5.20	1.77
1,252.00	1.90	166.43	1,251.92	-4.12	-4.70	-4.52	0.29
1,347.00	1.65	175.68	1,346.88	-7.01	-4.23	-3.93	0.40
1,442.00	1.75	179.67	1,441.83	-9.83	-4.12	-3.70	0.16
1,536.00	1.28	170.49	1,535.80	-12.30	-3.93	-3.41	0.56
1,628.00	1.45	178.54	1,627.77	-14.48	-3.73	-3.12	0.28
1,723.00	1.20	183.89	1,722.75	-16.67	-3.77	-3.07	0.29
1,817.00	0.81	221.14	1,816.74	-18.15	-4.27	-3.51	0.79
1,911.00	0.57	289.48	1,910.73	-18.50	-5.15	-4.37	0.85
2,009.00	1.65	183.64	2,008.72	-19.74	-5.70	-4.87	1.93
2,104.00	2.70	178.52	2,103.65	-23.35	-5.73	-4.75	1.12
2,199.00	3.67	184.27	2,198.50	-28.61	-5.90	-4.69	1.07
2,293.00	4.09	184.48	2,292.28	-34.96	-6.39	-4.91	0.45
2,388.00	5.94	181.88	2,386.92	-43.25	-6.81	-4.99	1.96
2,483.00	7.05	179.60	2,481.30	-53.99	-6.93	-4.66	1.20
2,577.00	8.65	186.38	2,574.42	-66.79	-7.68	-4.87	1.96
2,672.00	8.24	187.53	2,668.39	-80.63	-9.36	-5.97	0.47
2,767.00	9.45	182.51	2,762.26	-95.18	-10.60	-6.60	1.51
2,862.00	9.04	183.06	2,856.03	-110.42	-11.34	-6.70	0.44
2,957.00	9.92	178.66	2,949.73	-126.05	-11.54	-6.25	1.20
3,052.00	8.90	178.22	3,043.45	-141.58	-11.12	-5.18	1.08
3,148.00	8.57	178.93	3,138.34	-156.15	-10.76	-4.20	0.36
3,243.00	6.39	178.56	3,232.52	-168.52	-10.50	-3.42	2.30
3,338.00	4.29	174.77	3,327.11	-177.34	-10.04	-2.59	2.24
3,433.00	2.69	175.28	3,421.93	-183.10	-9.53	-1.85	1.68
3,527.00	3.60	173.41	3,515.78	-188.23	-9.01	-1.11	0.97
3,622.00	3.66	174.01	3,610.59	-194.21	-8.35	-0.20	0.07
3,717.00	2.78	170.99	3,705.44	-199.50	-7.67	0.70	0.94
3,812.00	2.25	157.99	3,800.35	-203.51	-6.62	1.92	0.82
3,907.00	2.44	161.32	3,895.27	-207.15	-5.27	3.42	0.25
4,001.00	2.08	151.35	3,989.20	-210.54	-3.81	5.02	0.57
4,096.00	2.30	136.73	4,084.13	-213.44	-1.68	7.27	0.63
4,191.00	1.17	116.00	4,179.09	-215.26	0.50	9.53	1.34
4,287.00	0.81	85.92	4,275.07	-215.64	2.06	11.10	0.65
4,476.00	1.11	55.14	4,464.05	-214.50	4.89	13.88	0.31
4,571.00	2.31	20.71	4,559.01	-212.18	6.33	15.22	1.61
4,666.00	1.72	46.34	4,653.95	-209.41	8.04	16.81	1.12
4,761.00	0.98	84.35	4,748.92	-208.34	9.88	18.60	1.18
4,856.00	1.06	97.80	4,843.91	-208.38	11.55	20.28	0.26
4,951.00	0.41	48.86	4,938.90	-208.28	12.68	21.40	0.89
5,046.00	0.81	5.10	5,033.89	-207.38	13.00	21.68	0.62
5,140.00	1.24	30.73	5,127.88	-205.85	13.58	22.19	0.66
5,236.00	0.84	39.45	5,223.86	-204.41	14.55	23.11	0.45
5,426.00	1.44	16.25	5,413.83	-201.04	16.11	24.52	0.39
5,521.00	0.87	42.19	5,508.81	-199.36	16.92	25.27	0.80
5,616.00	0.83	224.60	5,603.80	-199.32	16.93	25.27	1.79
5,712.00	0.57	225.16	5,699.80	-200.15	16.10	24.48	0.27

Design Report for Thompson C33-69HN - Final MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
5,807.00	0.80	237.19	5,794.79	-200.84	15.21	23.61	0.28
5,902.00	0.50	285.85	5,889.78	-201.09	14.25	22.67	0.63
5,997.00	1.09	306.54	5,984.77	-200.44	13.13	21.52	0.68
6,045.00	2.20	50.50	6,032.76	-199.58	13.47	21.83	5.58
6,092.00	6.72	83.83	6,079.61	-198.71	16.90	25.22	10.70
6,140.00	11.41	80.12	6,127.00	-197.59	24.38	32.64	9.84
6,187.00	14.32	79.83	6,172.82	-195.77	34.68	42.86	6.19
6,235.00	16.15	88.26	6,219.13	-194.52	47.20	55.31	5.98
6,282.00	18.35	92.96	6,264.02	-194.70	61.12	69.23	5.54
6,329.00	21.27	95.19	6,308.23	-195.85	77.00	85.15	6.42
6,376.00	23.28	98.39	6,351.72	-197.98	94.68	102.90	4.99
6,424.00	25.76	95.22	6,395.39	-200.31	114.46	122.76	5.85
6,471.00	29.40	93.42	6,437.05	-201.93	136.15	144.50	7.94
6,519.00	33.59	93.53	6,477.97	-203.45	161.18	169.57	8.73
6,566.00	37.88	92.30	6,516.11	-204.83	188.59	197.01	9.25
6,614.00	42.51	92.73	6,552.76	-206.20	219.53	227.98	9.66
6,661.00	47.13	93.05	6,586.09	-207.87	252.60	261.10	9.84
6,709.00	53.18	93.22	6,616.83	-209.89	289.39	297.93	12.61
6,731.70	55.92	93.03	6,630.00	-210.90	307.85	316.42	12.10
Sharon Springs Mrkr							
6,756.00	58.86	92.84	6,643.09	-211.94	328.29	336.89	12.10
6,775.73	60.86	92.49	6,653.00	-212.74	345.33	353.95	10.24
Niobrara							
6,804.00	63.72	92.02	6,666.14	-213.72	370.34	378.97	10.24
6,837.75	67.78	90.81	6,680.00	-214.48	401.09	409.73	12.48
Niobrara A							
6,849.00	69.14	90.42	6,684.13	-214.59	411.56	420.19	12.48
6,869.10	70.89	90.10	6,691.00	-214.67	430.44	439.07	8.84
Nio A Marl							
6,895.00	73.15	89.70	6,698.99	-214.63	455.08	463.68	8.84
6,942.00	75.89	90.24	6,711.54	-214.61	500.37	508.93	5.93
6,988.00	79.30	89.71	6,721.42	-214.59	545.29	553.81	7.50
7,034.00	81.63	89.67	6,729.04	-214.34	590.65	599.12	5.07
7,076.45	82.22	89.40	6,735.00	-214.00	632.67	641.09	1.52
Niobrara B							
7,080.00	82.27	89.38	6,735.48	-213.96	636.19	644.61	1.52
7,115.00	82.83	89.24	6,740.02	-213.55	670.90	679.26	1.65
7,184.00	85.31	88.91	6,747.15	-212.44	739.51	747.77	3.63
7,206.31	85.15	88.73	6,749.00	-211.98	761.74	769.96	1.05
Nio B Top Target							
7,243.00	84.90	88.44	6,752.18	-211.08	798.28	806.43	1.05
7,338.00	84.47	88.69	6,760.98	-208.71	892.84	900.81	0.52
7,433.00	84.57	88.77	6,770.05	-206.61	987.39	995.18	0.13
7,528.00	87.69	88.83	6,776.46	-204.63	1,082.14	1,089.76	3.28
7,622.00	91.14	88.55	6,777.42	-202.48	1,176.09	1,183.55	3.68
7,717.00	91.02	90.14	6,775.63	-201.39	1,271.07	1,278.39	1.68
7,812.00	90.40	91.05	6,774.46	-202.38	1,366.05	1,373.34	1.16
7,908.00	90.74	90.39	6,773.50	-203.59	1,462.04	1,469.29	0.77
8,003.00	91.45	90.66	6,771.68	-204.46	1,557.02	1,564.22	0.80
8,097.00	89.01	91.26	6,771.31	-206.03	1,651.00	1,658.18	2.67
8,192.00	89.66	91.29	6,772.41	-208.15	1,745.97	1,753.16	0.68

Design Report for Thompson C33-69HN - Final MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
8,287.00	89.72	89.93	6,772.92	-209.16	1,840.96	1,848.11	1.43
8,382.00	89.48	89.74	6,773.59	-208.88	1,935.95	1,943.01	0.32
8,477.00	90.40	88.61	6,773.69	-207.52	2,030.94	2,037.86	1.53
8,572.00	90.74	88.08	6,772.74	-204.77	2,125.90	2,132.61	0.66
8,667.00	91.64	88.55	6,770.77	-201.98	2,220.83	2,227.35	1.07
8,763.00	93.09	88.56	6,766.81	-199.56	2,316.72	2,323.05	1.51
8,857.00	90.46	88.23	6,763.90	-196.93	2,410.63	2,416.77	2.82
8,953.00	91.70	88.59	6,762.09	-194.27	2,506.57	2,512.51	1.34
9,047.00	91.08	87.74	6,759.81	-191.26	2,600.50	2,606.23	1.12
9,143.00	90.03	89.00	6,758.88	-188.53	2,696.45	2,701.98	1.71
9,238.00	91.05	89.31	6,757.98	-187.13	2,791.43	2,796.82	1.12
9,332.00	89.38	89.90	6,757.63	-186.48	2,885.43	2,890.71	1.88
9,427.00	89.38	90.04	6,758.66	-186.43	2,980.42	2,985.62	0.15
9,522.00	89.01	90.20	6,759.99	-186.63	3,075.41	3,080.53	0.42
9,617.00	89.97	90.06	6,760.84	-186.84	3,170.41	3,175.45	1.02
9,712.00	89.91	90.60	6,760.94	-187.39	3,265.40	3,270.39	0.57
9,808.00	89.81	90.56	6,761.17	-188.36	3,361.40	3,366.34	0.11
9,903.00	92.47	90.23	6,759.28	-189.02	3,456.37	3,461.25	2.82
9,998.00	90.59	89.59	6,756.74	-188.87	3,551.33	3,556.13	2.09
10,093.00	91.23	90.15	6,755.24	-188.65	3,646.32	3,651.02	0.90
10,187.00	92.00	90.40	6,752.59	-189.10	3,740.28	3,744.92	0.86
10,283.00	91.11	91.03	6,749.98	-190.30	3,836.23	3,840.84	1.14
10,377.00	92.35	91.18	6,747.14	-192.11	3,930.17	3,934.77	1.33
10,472.00	90.09	90.96	6,745.12	-193.88	4,025.13	4,029.72	2.39
10,567.00	90.80	91.96	6,744.38	-196.30	4,120.09	4,124.70	1.29
10,661.00	91.61	91.86	6,742.41	-199.44	4,214.02	4,218.67	0.87
10,685.00	91.76	92.05	6,741.70	-200.26	4,237.99	4,242.66	1.01
10,739.89	92.10	92.05	6,739.85	-202.22	4,292.81	4,297.52	0.62
Thompson C33-69HN_Plan A - Rev 0_BHL Tgt							
10,740.00	92.10	92.05	6,739.85	-202.22	4,292.93	4,297.63	0.62

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/-S (ft)	Origin +E/-W (ft)	Start TVD (ft)
Target	Thompson C33-69HN_Plan A - Rev 0_BHL Tgt	92.40	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
968.00	10,740.00	Final Sperry MWD Surveys	MWD

Casing Details

Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")
7,159.00	6,744.91	7" Csg	7	8-3/4

Design Report for Thompson C33-69HN - Final MWD Survey

Formation Details

Measured Depth (ft)	Vertical Depth (ft)	TVDSS (ft)	Name	Lithology	Dip (°)	Dip Direction (°)
6,731.70	6,630.00	1,841.00	Sharon Springs Mrkr		0.00	
6,775.73	6,653.00	1,864.00	Niobrara		0.00	
6,837.75	6,680.00	1,891.00	Niobrara A		0.00	
6,869.10	6,691.00	1,902.00	Nio A Marl		0.00	
7,076.45	6,735.00	1,946.00	Niobrara B		0.00	
7,206.31	6,749.00	1,960.00	Nio B Top Target		0.00	

Targets

Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
- hit/miss target									
- Shape									
Thompson C33-69HN_	0.00	0.00	6,740.48	-180.19	4,293.62	1,344,964.96	3,265,430.36	40° 16' 35.112 N	104° 32' 55.248 W
- actual wellpath misses target center by 22.05ft at 10739.89ft MD (6739.85 TVD, -202.22 N, 4292.81 E)									
- Point									
Thompson C33-69HN_	0.00	0.00	0.00	0.00	0.00	1,345,145.14	3,261,136.92	40° 16' 37.344 N	104° 33' 50.616 W
- actual wellpath hits target center									
- Polygon									
Point 1			-368.00	-299.00		1,344,846.16	3,260,768.93		
Point 2			-376.00	2,328.00		1,347,473.04	3,260,760.93		
Point 3			-379.00	4,969.00		1,350,113.93	3,260,757.93		
Point 4			2,243.00	4,993.00		1,350,137.93	3,263,379.82		
Point 5			4,863.00	5,018.00		1,350,162.93	3,265,999.71		
Point 6			4,883.00	2,376.00		1,347,521.04	3,266,019.71		
Point 7			4,905.00	-250.00		1,344,895.15	3,266,041.71		
Point 8			2,269.00	-275.00		1,344,870.16	3,263,405.82		
Point 9			-368.00	-299.00		1,344,846.16	3,260,768.93		
Thompson C33-69HN_	0.00	0.00	0.00	0.00	0.00	1,345,145.14	3,261,136.92	40° 16' 37.344 N	104° 33' 50.616 W
- actual wellpath hits target center									
- Polygon									
Point 1			-368.00	-299.00		1,344,846.16	3,260,768.93		
Point 2			-337.00	-2,940.00		1,342,205.27	3,260,799.93		
Point 3			-304.00	-5,577.00		1,339,568.38	3,260,832.93		
Point 4			-2,939.00	-5,594.00		1,339,551.38	3,258,198.04		
Point 5			-5,576.00	-5,614.00		1,339,531.39	3,255,561.16		
Point 6			-5,614.00	-2,988.00		1,342,157.27	3,255,523.16		
Point 7			-5,652.00	-365.00		1,344,780.16	3,255,485.16		
Point 8			-3,010.00	-334.00		1,344,811.16	3,258,127.05		
Point 9			-368.00	-299.00		1,344,846.16	3,260,768.93		
Thompson C33-69HN_	0.00	0.00	0.00	0.00	0.00	1,345,145.14	3,261,136.92	40° 16' 37.344 N	104° 33' 50.616 W
- actual wellpath hits target center									
- Polygon									
Point 1			-368.00	-299.00		1,344,846.16	3,260,768.93		
Point 2			2,269.00	-275.00		1,344,870.16	3,263,405.82		
Point 3			4,905.00	-250.00		1,344,895.15	3,266,041.71		
Point 4			4,925.00	-2,884.00		1,342,261.27	3,266,061.71		
Point 5			4,945.00	-5,518.00		1,339,627.38	3,266,081.70		
Point 6			2,319.00	-5,550.00		1,339,595.38	3,263,455.82		
Point 7			-304.00	-5,577.00		1,339,568.38	3,260,832.93		
Point 8			-337.00	-2,940.00		1,342,205.27	3,260,799.93		
Point 9			-368.00	-299.00		1,344,846.16	3,260,768.93		

**North Reference Sheet for Sec. 28-T4N-R64W (Thompson Sec. 28 PAD) -
Thompson C33-69HN - 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 @ 4789.00ft (H&P 322). Northing and Easting are relative to Thompson C33-69HN - Slot A1

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: 0.99995695

Grid Coordinates of Well: 1,345,145.14 ft N, 3,261,136.92 ft E

Geographical Coordinates of Well: 40° 16' 37.34" N, 104° 33' 50.62" W

Grid Convergence at Surface is: 0.60°

Based upon Minimum Curvature type calculations, at a Measured Depth of 10,740.00ft
the Bottom Hole Displacement is 4,297.69ft in the Direction of 92.70° (Grid).

Magnetic Convergence at surface is: -8.11° (17 July 2011, , BGGM2011)

