

Noble Energy

Weld County, CO (NAD 83)

Sec. 28-T9N-R59W (LC28-15-A)

Rainbow LC28-74HNA

Job# 901399475:: API:05-123-38847

Plan B

Design: Actual Surveys

Sperry Drilling Services

Final Survey Report

02 September, 2014

Surface UWI : Job# 901399475:: API:05-123-38847

Well Coordinates: 1,506,936.79 N, 3,421,334.02 E (40° 42' 54.07" N, 103° 58' 48.18" W)

Ground Level: 4,843.00 usft

Local Coordinate Origin:

Centered on Well Rainbow LC28-74HNA

Viewing Datum:

GL=4843 @ 4867.00usft (H&P 273)

TVDs to System:

N

North Reference:

Grid

Unit System:

API - US Survey Feet - Custom

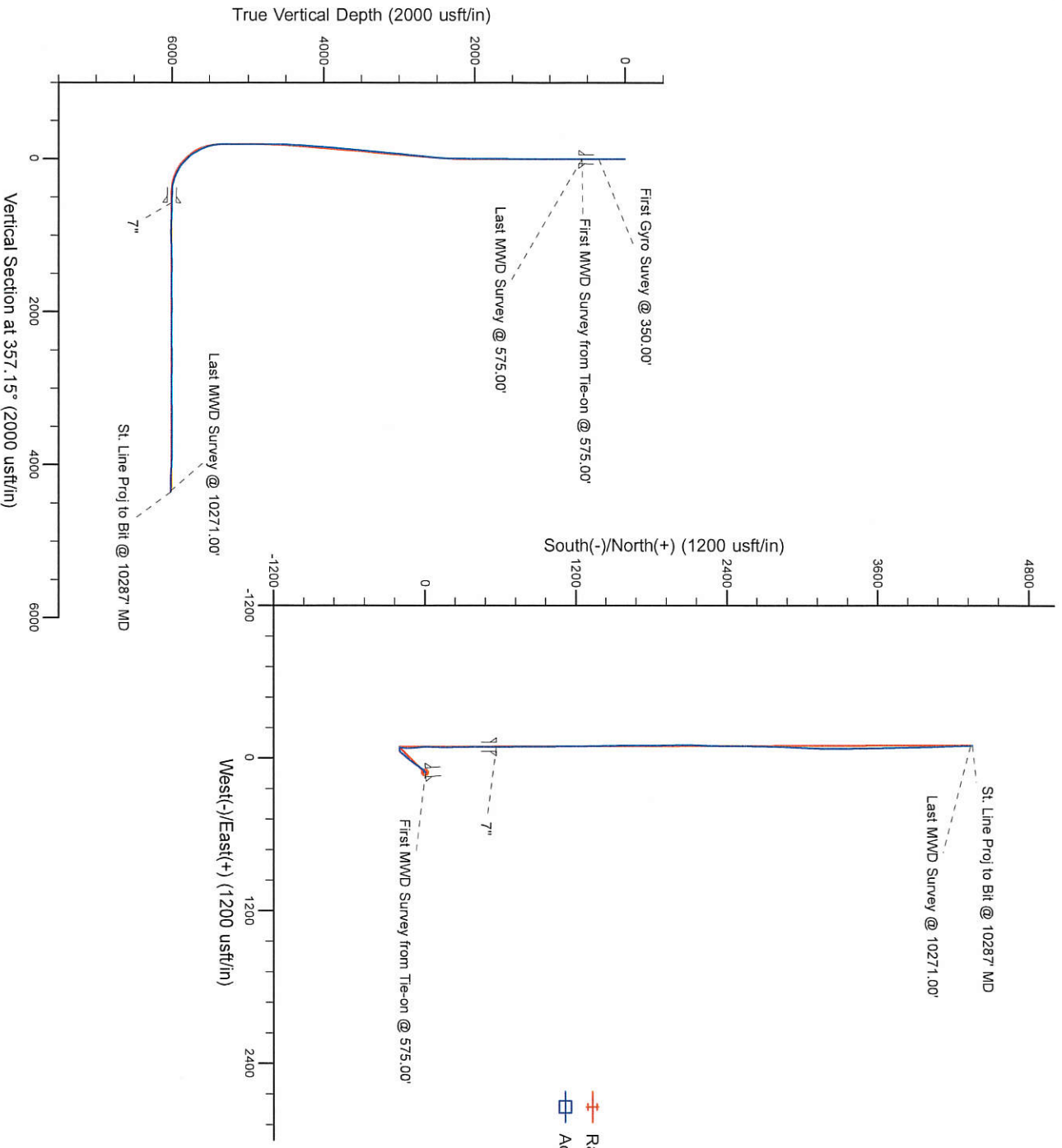
Geodetic Scale Factor Applied

Version: 5000.1 Build: 70

HALLIBURTON

Project: Weld County, CO (NAD 83)
 Site: Sec. 28-19N-R59W (LC28-15-A)
 Well: Rainbow LC28-74HNA
 Wellbore: Plan B
 Design: Actual Surveys

Noble Energy



LEGEND
 —+— Rainbow LC28-74HNA, Plan B, Rev B0 - PROPOSAL V0
 —□— Actual Surveys

WELL DETAILS: Rainbow LC28-74HNA	
Ground Level:	4843.00
GL=4843 @ 4867.00usft (H&P 273)	

Created By: Taliana Gomez
 Created On: 17:40, August 27, 2014

Design Report for Rainbow LC28-74HNA - 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
350.00	0.60	338.64	349.99	1.71	-0.67	1.74	0.17
First Gyro Survey @ 350.00'							
575.00	0.10	169.54	574.99	2.61	-1.06	2.66	0.31
Last MWD Survey @ 575.00' - First MWD Survey from Tie-on @ 575.00'							
619.00	0.19	176.40	618.99	2.50	-1.05	2.55	0.20
9 5/8"							
810.00	0.56	181.71	809.99	1.26	-1.06	1.31	0.20
903.00	0.15	169.96	902.98	0.69	-1.05	0.74	0.45
996.00	0.17	144.60	995.98	0.45	-0.95	0.50	0.08
1,274.00	0.33	184.11	1,273.98	-0.68	-0.77	-0.64	0.08
1,460.00	0.35	184.96	1,459.98	-1.78	-0.86	-1.74	0.01
1,738.00	0.94	244.52	1,737.96	-3.61	-2.99	-3.45	0.30
1,928.00	1.05	244.61	1,927.93	-5.02	-5.97	-4.72	0.06
2,022.00	0.99	246.85	2,021.92	-5.71	-7.49	-5.33	0.08
2,117.00	0.96	271.35	2,116.90	-6.02	-9.04	-5.56	0.44
2,212.00	1.85	245.47	2,211.88	-6.63	-11.23	-6.07	1.13
2,307.00	2.83	232.91	2,306.80	-8.69	-14.50	-7.95	1.16
2,402.00	4.14	225.58	2,401.62	-12.50	-18.82	-11.55	1.45
2,497.00	5.85	215.47	2,496.26	-18.84	-24.08	-17.62	2.02
2,591.00	6.60	216.12	2,589.70	-27.11	-30.04	-25.58	0.80
2,686.00	7.93	216.69	2,683.94	-36.77	-37.18	-34.88	1.40
2,781.00	7.56	216.27	2,778.07	-47.07	-44.79	-44.78	0.39
2,876.00	6.84	216.23	2,872.32	-56.67	-51.83	-54.02	0.76
2,971.00	6.02	215.38	2,966.72	-65.29	-58.06	-62.33	0.87
3,066.00	7.04	216.31	3,061.10	-74.05	-64.39	-70.76	1.08
3,161.00	5.31	215.56	3,155.55	-82.32	-70.39	-78.72	1.82
3,256.00	6.88	210.55	3,250.01	-90.79	-75.84	-86.91	1.74
3,350.00	7.46	215.95	3,343.28	-100.58	-82.29	-96.37	0.95
3,445.00	7.80	216.58	3,437.43	-110.75	-89.75	-106.15	0.37
3,541.00	7.26	219.81	3,532.61	-120.64	-97.51	-115.65	0.71
3,636.00	7.67	221.10	3,626.80	-130.03	-105.53	-124.63	0.47
3,730.00	8.14	220.01	3,719.91	-139.85	-113.93	-134.02	0.52
3,825.00	7.34	220.89	3,814.04	-149.59	-122.22	-143.34	0.85
3,920.00	7.19	224.88	3,908.28	-158.39	-130.39	-151.72	0.55
4,015.00	6.17	222.73	4,002.63	-166.36	-138.05	-159.29	1.11
4,110.00	4.81	215.00	4,097.20	-173.37	-143.80	-166.01	1.63
4,205.00	4.74	215.20	4,191.87	-179.84	-148.35	-172.25	0.08
4,299.00	4.41	218.58	4,285.57	-185.84	-152.84	-178.02	0.45
4,394.00	5.19	221.91	4,380.23	-191.89	-157.99	-183.81	0.87
4,489.00	3.77	239.09	4,474.94	-196.69	-163.54	-188.33	2.04
4,584.00	3.85	243.42	4,569.74	-199.73	-169.07	-191.08	0.31
4,679.00	4.25	251.40	4,664.50	-202.28	-175.26	-193.32	0.73
4,773.00	3.88	267.79	4,758.27	-203.51	-181.74	-194.23	1.29
4,868.00	3.49	274.61	4,853.07	-203.40	-187.83	-193.82	0.62
4,963.00	3.14	280.60	4,947.91	-202.69	-193.27	-192.84	0.52
5,058.00	1.56	273.81	5,042.83	-202.13	-197.12	-192.08	1.69
5,153.00	0.22	252.20	5,137.81	-202.09	-198.58	-191.98	1.43
5,248.00	0.19	324.08	5,232.81	-202.02	-198.85	-191.89	0.25
5,337.00	0.37	45.06	5,321.81	-201.70	-198.73	-191.58	0.44

Design Report for Rainbow LC28-74HNA - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
5,385.00	1.02	7.69	5,369.81	-201.17	-198.57	-191.05	1.58
5,432.00	6.65	9.20	5,416.68	-198.06	-198.07	-187.98	11.98
5,480.00	12.36	9.18	5,464.01	-190.24	-196.81	-180.23	11.90
5,527.00	17.46	7.68	5,509.41	-178.28	-195.06	-168.37	10.88
5,575.00	20.27	2.27	5,554.83	-162.83	-193.77	-153.00	6.89
5,622.00	23.93	1.27	5,598.37	-145.16	-193.24	-135.38	7.83
5,670.00	27.52	1.47	5,641.60	-124.34	-192.74	-114.61	7.48
5,717.00	30.63	356.51	5,682.68	-101.52	-193.19	-91.80	8.37
5,765.00	33.94	352.74	5,723.26	-76.01	-195.63	-66.20	8.07
5,811.00	39.74	352.74	5,760.06	-48.67	-199.11	-38.71	12.61
5,859.00	43.19	357.58	5,796.03	-17.02	-201.74	-6.97	9.81
5,906.00	45.96	0.67	5,829.51	15.95	-202.23	25.98	7.48
5,954.00	50.60	1.78	5,861.45	51.76	-201.45	61.71	9.82
6,001.00	56.21	3.12	5,889.46	89.45	-199.82	99.26	12.15
6,049.00	60.21	1.87	5,914.74	130.20	-198.05	139.88	8.62
6,096.00	64.99	358.91	5,936.37	171.91	-197.79	181.52	11.60
6,144.00	68.01	358.18	5,955.50	215.90	-198.91	225.52	6.44
6,191.00	72.24	358.51	5,971.48	260.08	-200.19	269.70	9.02
6,239.00	77.74	359.27	5,983.91	306.41	-201.08	316.02	11.56
6,286.00	82.46	359.44	5,991.98	352.70	-201.60	362.28	10.05
6,313.00	85.59	0.03	5,994.79	379.55	-201.73	389.10	11.79
7"							
6,461.00	88.70	359.69	6,002.17	527.34	-202.09	536.73	2.11
6,556.00	89.17	359.14	6,003.93	622.32	-203.06	631.64	0.76
6,651.00	88.92	359.00	6,005.51	717.30	-204.60	726.57	0.30
6,745.00	88.24	359.40	6,007.84	811.26	-205.91	820.49	0.84
6,840.00	88.74	359.80	6,010.35	906.22	-206.57	915.37	0.67
6,935.00	90.34	0.84	6,011.11	1,001.21	-206.04	1,010.21	2.01
7,030.00	91.76	0.19	6,009.37	1,096.19	-205.19	1,105.03	1.64
7,125.00	90.89	359.50	6,007.17	1,191.16	-205.45	1,199.90	1.17
7,219.00	91.54	359.14	6,005.18	1,285.13	-206.56	1,293.81	0.79
7,314.00	89.78	358.78	6,004.09	1,380.11	-208.29	1,388.75	1.89
7,409.00	88.55	358.03	6,005.47	1,475.06	-210.93	1,483.72	1.52
7,504.00	89.51	359.76	6,007.08	1,570.02	-212.76	1,578.65	2.08
7,599.00	90.43	359.76	6,007.13	1,665.02	-213.16	1,673.55	0.97
7,694.00	92.10	0.26	6,005.03	1,759.99	-213.14	1,768.41	1.83
7,789.00	91.60	359.80	6,001.96	1,854.94	-213.09	1,863.24	0.71
7,884.00	88.61	358.06	6,001.79	1,949.91	-214.87	1,958.18	3.64
7,979.00	87.69	359.73	6,004.86	2,044.84	-216.70	2,053.08	2.01
8,074.00	89.38	1.62	6,007.29	2,139.80	-215.58	2,147.86	2.67
8,168.00	91.33	2.17	6,006.70	2,233.74	-212.47	2,241.53	2.16
8,263.00	91.29	0.51	6,004.53	2,328.68	-210.25	2,336.25	1.75
8,358.00	90.12	0.81	6,003.36	2,423.67	-209.16	2,431.07	1.27
8,452.00	89.57	359.93	6,003.62	2,517.66	-208.55	2,524.92	1.10
8,547.00	90.00	0.58	6,003.97	2,612.66	-208.13	2,619.78	0.82
8,642.00	89.75	1.56	6,004.18	2,707.64	-206.35	2,714.55	1.06
8,737.00	88.58	1.86	6,005.56	2,802.59	-203.52	2,809.24	1.27
8,831.00	88.71	1.95	6,007.79	2,896.51	-200.39	2,902.89	0.17
8,926.00	90.09	4.05	6,008.78	2,991.37	-195.42	2,997.38	2.64
9,021.00	90.80	1.77	6,008.04	3,086.24	-190.60	3,091.89	2.51
9,116.00	92.19	2.03	6,005.57	3,181.15	-187.45	3,186.53	1.49

Design Report for Rainbow LC28-74HNA - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
9,210.00	91.51	359.62	6,002.53	3,275.08	-186.10	3,280.28	2.66
9,305.00	91.57	358.49	5,999.98	3,370.03	-187.67	3,375.20	1.19
9,400.00	89.69	359.00	5,998.93	3,465.00	-189.75	3,470.15	2.05
9,494.00	90.46	359.55	5,998.81	3,558.99	-190.94	3,564.08	1.01
9,589.00	88.30	358.19	5,999.84	3,653.96	-192.81	3,659.03	2.69
9,684.00	88.09	358.14	6,002.83	3,748.86	-195.85	3,753.97	0.23
9,779.00	90.43	0.11	6,004.06	3,843.83	-197.30	3,848.89	3.22
9,874.00	88.09	358.08	6,005.28	3,938.80	-198.80	3,943.82	3.26
9,968.00	87.72	357.69	6,008.72	4,032.68	-202.27	4,037.74	0.57
10,063.00	88.03	357.99	6,012.24	4,127.54	-205.84	4,132.67	0.45
10,271.00	88.03	357.99	6,019.39	4,335.29	-213.13	4,340.53	0.00
Last MWD Survey @ 10271.00' - Rainbow LC28-74HNA_BHL							
10,287.00	88.03	357.99	6,019.94	4,351.27	-213.70	4,356.52	0.00
St. Line Proj to Bit @ 10287' MD							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
350.00	349.99	1.71	-0.67	First Gyro Survey @ 350.00'
575.00	574.99	2.61	-1.06	Last MWD Survey @ 575.00'
575.00	574.99	2.61	-1.06	First MWD Survey from Tie-on @ 575.00'
10,271.00	6,019.39	4,335.29	-213.13	Last MWD Survey @ 10271.00'
10,287.00	6,019.94	4,351.27	-213.70	St. Line Proj to Bit @ 10287' MD

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	+N/-S (usft)	+E/-W (usft)	Start TVD (usft)
Target	Rainbow LC28-74HNA_BHL	357.15	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
350.00	575.00	Surface Surveys	Flexi-Shot
810.00	6,461.00	MWD Surveys - Intermediate	MWD+SC
6,556.00	10,271.00	MWD Surveys- Production	MWD+SC

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
619.00	618.99	9 5/8"	9-5/8	13-3/4
6,313.00	5,994.79	7"	7	8-3/4

Design Report for Rainbow LC28-74HNA - 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
Rainbow LC28-74HNA - actual wellpath misses target center by 0.01usft at 0.00usft MD (0.00 TVD, 0.00 N, 0.00 E) - Point	0.00	0.00	0.00	0.01	0.00	1,506,936.80	3,421,334.02	40° 42' 54.072 N	103° 58' 48.180 W
Rainbow LC28-74HNA - actual wellpath misses target center by 0.01usft at 0.00usft MD (0.00 TVD, 0.00 N, 0.00 E) - Polygon	0.00	0.00	0.00	0.01	0.00	1,506,936.80	3,421,334.02	40° 42' 54.072 N	103° 58' 48.180 W
Point 1				0.00	4,298.98	-2,932.38	1,511,235.73	3,418,401.67	
Point 2				0.00	184.63	-2,814.30	1,507,121.42	3,418,519.75	
Point 3				0.00	300.95	1,293.29	1,507,237.74	3,422,627.30	
Point 4				0.00	4,469.40	1,142.63	1,511,406.15	3,422,476.64	
Point 5				0.00	4,298.98	-2,932.38	1,511,235.73	3,418,401.67	
Rainbow LC28-74HNA - actual wellpath misses target center by 0.01usft at 0.00usft MD (0.00 TVD, 0.00 N, 0.00 E) - Polygon	0.00	0.00	0.00	0.01	0.00	1,506,936.80	3,421,334.02	40° 42' 54.072 N	103° 58' 48.180 W
Point 1				0.00	4,898.99	-3,532.39	1,511,835.73	3,417,801.67	
Point 2				0.00	-415.38	-3,414.31	1,506,521.42	3,417,919.75	
Point 3				0.00	-299.06	1,893.30	1,506,637.74	3,423,227.30	
Point 4				0.00	5,069.41	1,742.63	1,512,006.15	3,423,076.64	
Point 5				0.00	4,898.99	-3,532.39	1,511,835.73	3,417,801.67	
Rainbow LC28-74HNA - actual wellpath misses target center by 11.71usft at 10271.00usft MD (6019.39 TVD, 4335.29 N, -213.13 E) - Point	0.00	0.00	6,008.00	4,336.15	-215.71	1,511,272.89	3,421,118.32	40° 43' 36.948 N	103° 58' 50.016 W

Directional Difficulty Index

Average Dogleg over Survey:	1.79 °/100usft	Maximum Dogleg over Survey:	12.61 °/100usft at 5,811.00 usft
Net Tortousity applicable to Plans:	0.77 °/100usft	Directional Difficulty Index:	6.185

Audit Info

North Reference Sheet for Sec. 28-T9N-R59W (LC28-15-A) - Rainbow LC28-74HNA - Plan B

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

Vertical Depths are relative to GL=4843 @ 4867.00usft (H&P 273). Northing and Easting are relative to Rainbow LC28-74HNA

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: 3,000,000.00usft, False Northing: 1,000,000.00usft, Scale Reduction: 0.99998963

Grid Coordinates of Well: 1,506,936.79 usft N, 3,421,334.02 usft E

Geographical Coordinates of Well: 40° 42' 54.07" N, 103° 58' 48.18" W

Grid Convergence at Surface is: 0.98°

Based upon Minimum Curvature type calculations, at a Measured Depth of 10,287.00usft
the Bottom Hole Displacement is 4,356.52usft in the Direction of 357.19° (Grid).

Magnetic Convergence at surface is: -7.10° (9 July 2014, , BGGM2013)

