

# Noble Energy (Rockies)

Garfield County, CO

Sec. 17-T7S-R94W (Rulison 17M PAD) NAD 83

Rulison Federal 20-11B

Plan A Rev 1

Design: Actual Field Surveys

## Sperry Drilling Services Standard Report

06 April, 2011

Well Coordinates: 1,591,771.82 N, 2,317,173.03 E (39° 25' 59.64" N, 107° 55' 04.01" W)

Ground Level: 7,545.00 ft

Local Coordinate Origin:	Centered on Well Rulison Federal 20-11B
Viewing Datum:	RKB 24' @ 7569.00ft (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 Rulison Federal 20-11B - Actual Field Surveys**

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
126.00	2.40	166.57	125.96	-2.57	0.61	2.63	1.90
<b>First AVI Gyro Survey</b>							
157.00	3.57	170.57	156.92	-4.15	0.92	4.25	3.83
188.00	4.13	176.63	187.85	-6.22	1.15	6.32	2.23
249.00	6.16	181.99	248.60	-11.68	1.16	11.70	3.42
341.00	7.20	165.39	339.98	-22.19	2.44	22.28	2.37
432.00	6.80	162.43	430.31	-32.85	5.51	33.31	0.59
524.00	8.64	158.63	521.47	-44.48	9.67	45.48	2.07
615.00	9.77	159.57	611.30	-58.08	14.86	59.78	1.25
<b>Final AVI Gyro Survey</b>							
694.00	10.58	166.96	689.06	-71.43	18.83	73.62	1.94
<b>First Sperry MWD Survey</b>							
785.00	11.13	168.84	778.43	-88.18	22.42	90.75	0.72
880.00	11.62	166.33	871.56	-106.47	26.45	109.46	0.73
974.00	12.19	166.29	963.54	-125.31	31.04	128.81	0.61
1,068.00	12.64	166.20	1,055.34	-144.94	35.85	148.98	0.48
1,162.00	12.44	168.33	1,147.10	-164.85	40.35	169.37	0.54
1,256.00	12.96	169.14	1,238.80	-185.11	44.38	190.03	0.58
1,351.00	13.44	168.32	1,331.29	-206.39	48.63	211.72	0.54
1,445.00	12.35	169.06	1,422.92	-226.96	52.75	232.69	1.17
1,481.00	12.26	169.04	1,458.09	-234.49	54.20	240.36	0.25
1,603.00	12.24	173.21	1,577.32	-260.05	58.20	266.22	0.73
1,634.00	11.73	172.34	1,607.64	-266.43	59.00	272.65	1.75
1,728.00	11.15	171.02	1,699.77	-284.88	61.70	291.28	0.68
1,822.00	12.11	165.24	1,791.84	-303.40	65.63	310.20	1.60
1,917.00	11.56	166.21	1,884.82	-322.28	70.43	329.63	0.62
2,011.00	11.12	165.61	1,976.99	-340.20	74.93	348.07	0.48
2,105.00	11.92	164.65	2,069.09	-358.35	79.76	366.78	0.88
2,199.00	11.55	163.15	2,161.13	-376.71	85.05	385.79	0.51
2,294.00	10.59	161.94	2,254.36	-394.12	90.52	403.88	1.04
2,388.00	11.62	162.52	2,346.60	-411.36	96.04	421.82	1.10
2,482.00	11.69	164.99	2,438.66	-429.59	101.35	440.70	0.54
2,576.00	11.71	165.55	2,530.71	-448.02	106.19	459.69	0.12
2,671.00	11.55	166.50	2,623.76	-466.60	110.82	478.80	0.26
2,765.00	11.27	165.85	2,715.90	-484.66	115.26	497.36	0.33
2,859.00	11.42	171.08	2,808.07	-502.76	118.95	515.82	1.11
2,954.00	11.74	169.44	2,901.13	-521.55	122.18	534.89	0.48
3,048.00	11.30	169.72	2,993.24	-540.02	125.58	553.66	0.47
3,142.00	12.04	166.33	3,085.30	-558.61	129.54	572.66	1.07
3,237.00	11.86	164.85	3,178.24	-577.66	134.43	592.27	0.37
3,331.00	11.13	166.62	3,270.35	-595.81	139.05	610.95	0.86
3,425.00	10.07	166.68	3,362.75	-612.63	143.05	628.21	1.13
3,520.00	11.54	170.13	3,456.06	-630.08	146.59	646.01	1.69
3,614.00	11.22	171.21	3,548.21	-648.38	149.60	664.56	0.41
3,708.00	11.66	166.17	3,640.35	-666.64	153.27	683.18	1.16
3,803.00	12.31	166.95	3,733.28	-685.83	157.85	702.87	0.71
3,897.00	12.19	165.79	3,825.14	-705.21	162.55	722.78	0.29
3,991.00	11.45	166.50	3,917.14	-723.90	167.16	741.99	0.80
4,086.00	10.85	167.88	4,010.35	-741.81	171.24	760.34	0.69

**Design Report for Rulison Federal 20-11B - Actual Field Surveys**

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
4,180.00	11.93	164.54	4,102.50	-759.83	175.69	778.85	1.35
4,274.00	12.16	166.52	4,194.43	-778.82	180.59	798.41	0.50
4,369.00	11.91	169.41	4,287.34	-798.18	184.72	818.20	0.69
4,463.00	12.51	166.16	4,379.22	-817.60	188.94	838.06	0.97
4,557.00	12.28	163.13	4,471.03	-837.06	194.27	858.14	0.73
4,651.00	12.12	162.57	4,562.90	-856.04	200.13	877.86	0.21
4,746.00	11.99	163.93	4,655.81	-875.03	205.85	897.56	0.33
4,840.00	12.15	164.66	4,747.73	-893.96	211.17	917.12	0.24
4,934.00	9.66	165.98	4,840.03	-911.15	215.70	934.85	2.66
5,028.00	7.92	169.44	4,932.92	-925.17	218.80	949.19	1.93
5,123.00	7.77	169.17	5,027.03	-937.91	221.20	962.16	0.16
5,217.00	7.22	164.82	5,120.23	-949.85	223.94	974.39	0.84
5,311.00	4.88	167.86	5,213.70	-959.46	226.33	984.28	2.51
5,406.00	4.50	172.21	5,308.38	-967.11	227.68	992.04	0.55
5,500.00	2.78	157.44	5,402.19	-972.87	229.06	997.95	2.07
5,595.00	2.61	156.24	5,497.08	-976.97	230.81	1,002.30	0.19
5,689.00	2.22	154.44	5,591.00	-980.58	232.46	1,006.13	0.42
5,784.00	0.21	288.38	5,685.98	-982.18	233.09	1,007.82	2.50
5,878.00	0.59	236.53	5,779.97	-982.39	232.52	1,007.93	0.52
5,972.00	0.82	199.48	5,873.97	-983.29	231.90	1,008.71	0.53
6,067.00	1.26	199.85	5,968.95	-984.92	231.31	1,010.21	0.46
6,161.00	1.35	202.31	6,062.93	-986.91	230.54	1,012.04	0.11
6,255.00	1.25	214.81	6,156.90	-988.78	229.54	1,013.70	0.32
6,350.00	1.36	212.65	6,251.88	-990.58	228.34	1,015.26	0.13
6,444.00	1.67	215.23	6,345.85	-992.64	226.95	1,017.04	0.34
6,538.00	1.74	210.68	6,439.80	-994.98	225.43	1,019.09	0.16
6,632.00	1.95	216.60	6,533.76	-997.50	223.75	1,021.27	0.30
6,727.00	2.24	299.85	6,628.71	-997.87	221.17	1,021.18	2.94
6,821.00	2.26	297.61	6,722.64	-996.10	217.94	1,018.87	0.10
6,915.00	2.35	291.62	6,816.56	-994.53	214.50	1,016.72	0.27
7,010.00	0.44	277.03	6,911.53	-993.76	212.33	1,015.59	2.03
7,104.00	0.56	249.65	7,005.53	-993.88	211.54	1,015.57	0.28
7,198.00	0.87	248.47	7,099.52	-994.30	210.45	1,015.79	0.33
7,293.00	1.30	247.32	7,194.50	-994.98	208.78	1,016.17	0.45
7,387.00	1.31	246.38	7,288.48	-995.82	206.81	1,016.65	0.03
7,481.00	1.18	251.75	7,382.45	-996.56	204.91	1,017.04	0.19
7,576.00	1.95	255.11	7,477.42	-997.28	202.42	1,017.32	0.82
7,670.00	2.28	250.43	7,571.35	-998.32	199.11	1,017.76	0.40
7,765.00	2.51	248.39	7,666.27	-999.72	195.40	1,018.49	0.26
7,859.00	2.39	245.04	7,760.19	-1,001.30	191.70	1,019.40	0.20
7,953.00	2.90	235.54	7,854.09	-1,003.47	187.97	1,020.88	0.71
8,048.00	3.20	234.75	7,948.95	-1,006.36	183.82	1,023.00	0.32
8,142.00	2.34	233.75	8,042.84	-1,009.01	180.13	1,024.96	0.92
8,236.00	2.28	238.51	8,136.76	-1,011.12	176.99	1,026.49	0.21
8,331.00	2.52	227.04	8,231.68	-1,013.53	173.85	1,028.32	0.56
8,425.00	2.87	230.25	8,325.58	-1,016.45	170.53	1,030.60	0.41
8,519.00	2.59	228.57	8,419.47	-1,019.36	167.13	1,032.87	0.31
8,614.00	2.49	231.98	8,514.38	-1,022.05	163.89	1,034.96	0.19
8,708.00	2.62	233.18	8,608.28	-1,024.59	160.56	1,036.88	0.15
8,802.00	3.00	234.80	8,702.17	-1,027.30	156.83	1,038.89	0.41
8,897.00	3.04	237.97	8,797.04	-1,030.07	152.66	1,040.88	0.18

## Design Report for Rulison Federal 20-11B - Actual Field Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
8,991.00	3.58	231.63	8,890.88	-1,033.21	148.25	1,043.21	0.69
9,086.00	4.18	228.59	8,985.66	-1,037.34	143.33	1,046.41	0.67
9,180.00	3.87	231.44	9,079.43	-1,041.59	138.28	1,049.71	0.39
9,274.00	3.78	232.89	9,173.22	-1,045.43	133.33	1,052.63	0.14
9,315.00	3.57	233.03	9,214.14	-1,047.02	131.23	1,053.82	0.51
<b>Final Sperry MWD Survey</b>							
9,373.00	3.57	233.03	9,272.03	-1,049.19	128.34	1,055.45	0.00
<b>Straight Line Projection</b>							

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
126.00	125.96	-2.57	0.61	First AVI Gyro Survey
615.00	611.30	-58.08	14.86	Final AVI Gyro Survey
694.00	689.06	-71.43	18.83	First Sperry MWD Survey
9,315.00	9,214.14	-1,047.02	131.23	Final Sperry MWD Survey
9,373.00	9,272.03	-1,049.19	128.34	Straight Line Projection

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (ft)
				+N/-S (ft)	+E/-W (ft)	
Target	Rulison Federal 20-11B Plan A Rev 1 BH Tgt	169.91	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
126.00	615.00	Gyro	NS-GYRO-MS
694.00	9,373.00	Sperry MWD Surveys	MWD

Formation Details

Measured Depth (ft)	Vertical Depth (ft)	TVDSS (ft)	Name	Lithology	Dip (°)	Dip Direction (°)
0.00	0.00	-7,569.00	Green River			
755.02	749.00	-6,820.00	Wasatch			
6,038.04	5,940.00	-1,629.00	Williams Fork			
7,163.48	7,065.00	-504.00	Top of Gas			
8,644.65	8,545.00	976.00	Cameo			
9,234.69	9,134.00	1,565.00	Rollins			

## Design Report for Rulison Federal 20-11B - Actual Field Surveys

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
Rulison Federal 20-1 - actual wellpath misses target center by 14.30ft at 6023.28ft MD (5925.24 TVD, -984.09 N, 231.61 E) - Rectangle (sides W25.00 H25.00 D0.00)	0.00	360.00	5,925.00	-998.38	232.07	1,590,773.49	2,317,405.09	39° 25' 49.837 N	107° 55' 0.719 W
Rulison Federal 20-1 - actual wellpath misses target center by 41.25ft at 7148.95ft MD (7050.47 TVD, -994.06 N, 211.08 E) - Rectangle (sides W100.00 H200.00 D2,219.00)	0.00	360.00	7,050.00	-1,023.38	182.07	1,590,748.49	2,317,355.09	39° 25' 49.577 N	107° 55' 1.348 W
Rulison Federal 20-1 - actual wellpath misses target center by 59.30ft at 9366.34ft MD (9265.38 TVD, -1048.94 N, 128.68 E) - Point	0.00	360.00	9,269.00	-1,023.38	182.07	1,590,748.49	2,317,355.09	39° 25' 49.577 N	107° 55' 1.348 W

## North Reference Sheet for Sec. 17-T7S-R94W (Rulison 17M PAD) NAD 83 - Rulison Federal 20-11B - Plan A Rev 1

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' @ 7569.00ft (H&P 322). Northing and Easting are relative to Rulison Federal 20-11B

Coordinate System is US State Plane 1983, Colorado Central 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: 39° 45' 0.000 N°

False Easting: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99995268

Grid Coordinates of Well: 1,591,771.82 ft N, 2,317,173.03 ft E

Geographical Coordinates of Well: 39° 25' 59.64" N, 107° 55' 04.01" W

Grid Convergence at Surface is: -1.52°

Based upon Minimum Curvature type calculations, at a Measured Depth of 9,373.00ft  
the Bottom Hole Displacement is 1,057.01ft in the Direction of 173.03° (Grid).

Magnetic Convergence at surface is: -11.87° (20 March 2011, , BGGM2010)

