

# Noble Energy

Weld County, CO (NAD 83)

Sec. 1-T6N-R63W (Crow Creek 1/AA01 PAD)

Crow Creek AA01-785

05-123-40160

Plan A

Design: Actual Surveys

## Sperry Drilling Services

### Final Survey Report

19 January, 2015

Surface UWI : 05-123-40160

Well Coordinates: 1,434,939.35 N, 3,307,928.69 E (40° 31' 19.31" N, 104° 23' 32.46" W)

Ground Level: 4,797.00 usft

Local Coordinate Origin:

Centered on Well Crow Creek AA01-785

Viewing Datum:

KB=24 @ 4821.00usft (H&P 315)

TVDs to System:

N

North Reference:

Grid

Unit System:

Dec-Deg - API - US Survey Feet - Custom

Geodetic Scale Factor Applied

Version: 5000.1 Build: 70

**HALLIBURTON**

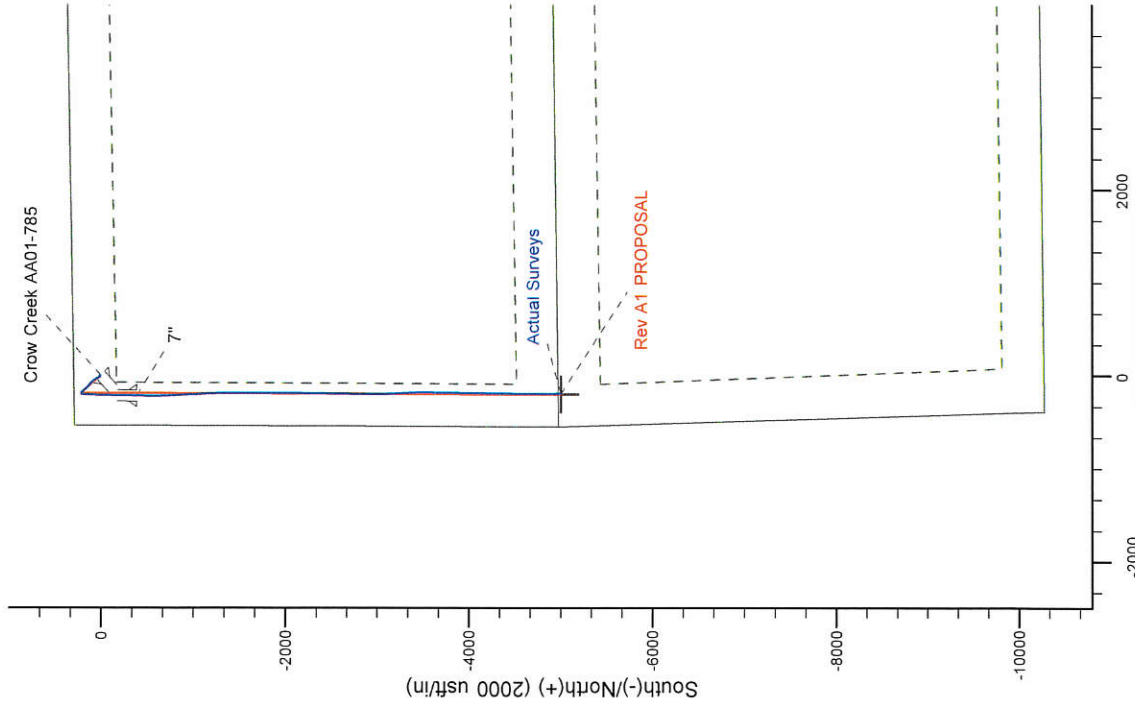
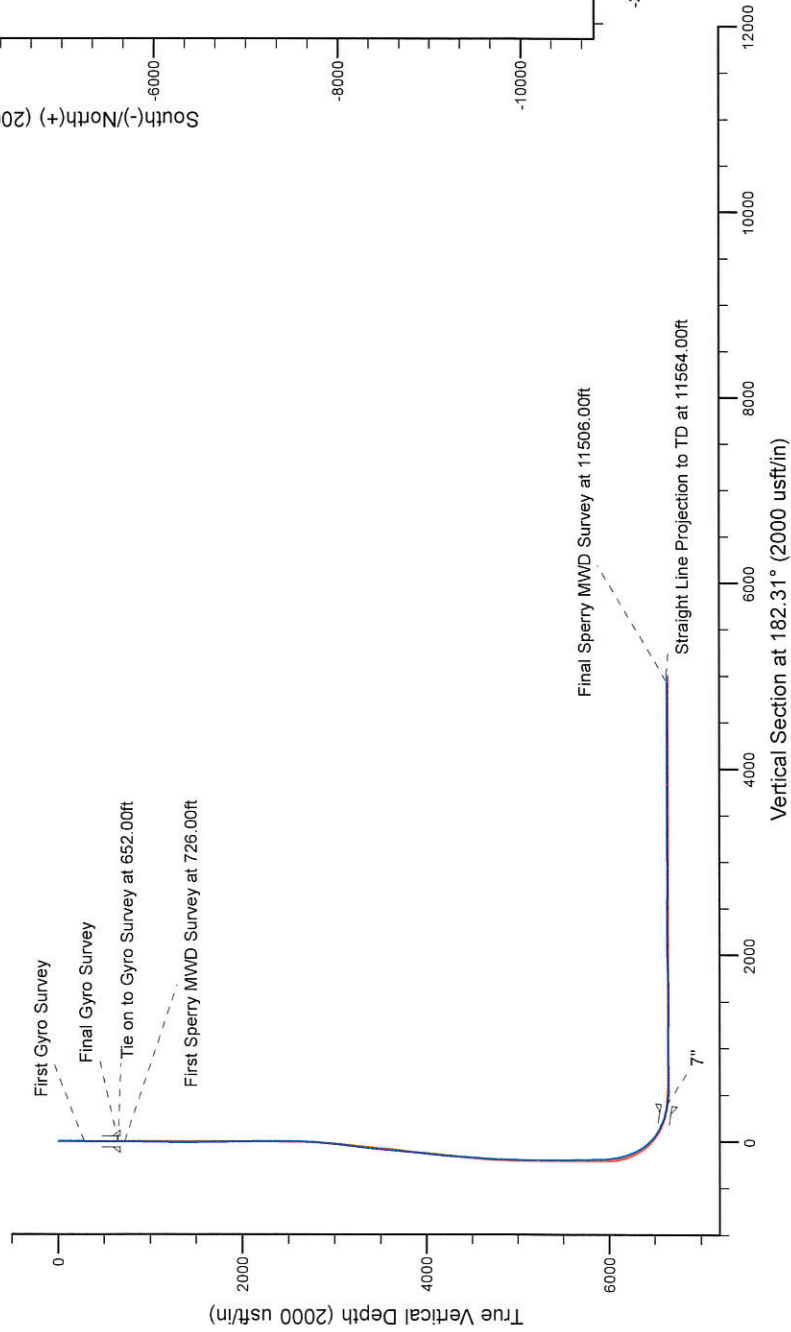
Project: Weld County, CO (NAD 83)  
 Site: Sec. 1-T6N-R63W (Crow Creek 1/AA01 PAD)  
 Well: Crow Creek AA01-785  
 Wellbore: Plan A  
 Design: Actual Surveys



Platted SHL: 290' FNL, 500' FWL Platted Lat/Long: 40.52203 N, 104.39235 W Location: Sec. 1-T6N-R63W	~7" Casing: 660' FNL, 352' FWL Lat/Long: 40.520986 N, 104.393148 W State Planes - CO Northern: 1,434,556.34 N, 3,307,711.67 E Location: Sec. 1-T6N-R63W
Platted BHL: 30' FNL, 350' FWL Lat/Long: 40.50831 N, 104.39330 W State Planes - CO Northern: 1,429,998.21 N, 3,307,732.43 E Location: Sec. 12-T6N-R63W	

#### LEGEND

✖ Crow Creek AA01-785, Plan A, Rev A1 PROPOSAL V0  
 — Actual Surveys



WELL DETAILS: Crow Creek AA01-785
Ground Level: 4797.00
K8-24 @ 4821.00usft (H&P 315)
Created By: Tatiana Gomez Created On: 1/19/2015

## Design Report for Crow Creek AA01-785 - 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
283.00	0.60	26.18	282.99	1.33	0.65	-1.36	0.21
<b>First Gyro Survey</b>							
652.00	0.20	70.98	651.99	3.27	2.12	-3.36	0.13
<b>Tie on to Gyro Survey at 652.00ft - Final Gyro Survey</b>							
678.00	0.10	46.75	677.99	3.30	2.17	-3.39	0.45
<b>9 5/8"</b>							
726.00	0.16	298.04	725.99	3.36	2.15	-3.45	0.45
<b>First Sperry MWD Survey at 726.00ft</b>							
914.00	0.30	308.54	913.98	3.79	1.53	-3.85	0.08
1,100.00	0.96	303.39	1,099.97	4.96	-0.15	-4.94	0.36
1,192.00	0.89	331.54	1,191.96	6.01	-1.14	-5.96	0.49
1,284.00	0.95	333.32	1,283.95	7.32	-1.82	-7.24	0.07
1,376.00	0.86	346.14	1,375.94	8.67	-2.33	-8.57	0.24
1,469.00	1.08	260.84	1,468.93	9.21	-3.36	-9.06	1.42
1,563.00	1.14	238.07	1,562.91	8.57	-5.03	-8.36	0.47
1,653.00	1.65	185.59	1,652.89	6.81	-5.91	-6.56	1.46
1,746.00	1.57	175.73	1,745.85	4.21	-5.95	-3.96	0.31
1,840.00	1.80	189.14	1,839.81	1.46	-6.09	-1.22	0.48
1,933.00	0.19	228.91	1,932.79	-0.08	-6.44	0.34	1.78
2,027.00	0.28	265.44	2,026.79	-0.20	-6.78	0.47	0.18
2,122.00	0.14	268.62	2,121.79	-0.22	-7.13	0.51	0.15
2,217.00	0.45	293.42	2,216.79	-0.08	-7.59	0.38	0.35
2,312.00	0.50	241.57	2,311.79	-0.13	-8.30	0.46	0.44
2,407.00	0.58	281.44	2,406.78	-0.23	-9.13	0.60	0.40
2,501.00	0.85	261.60	2,500.78	-0.24	-10.29	0.65	0.39
2,596.00	1.29	317.76	2,595.76	0.45	-11.70	0.02	1.14
2,691.00	2.61	328.80	2,690.71	3.10	-13.54	-2.55	1.44
2,786.00	3.61	330.24	2,785.56	7.54	-16.15	-6.89	1.06
2,881.00	5.18	333.25	2,880.28	13.97	-19.56	-13.17	1.67
2,976.00	7.08	334.16	2,974.73	23.07	-24.05	-22.08	2.00
3,070.00	7.85	332.18	3,067.94	33.96	-29.57	-32.74	0.86
3,165.00	7.62	332.00	3,162.07	45.26	-35.55	-43.79	0.24
3,259.00	8.16	323.39	3,255.19	56.12	-42.46	-54.36	1.38
3,354.00	7.66	322.12	3,349.28	66.53	-50.36	-64.44	0.56
3,449.00	6.69	322.20	3,443.54	75.90	-57.64	-73.51	1.02
3,543.00	7.52	314.29	3,536.82	84.52	-65.40	-81.81	1.36
3,638.00	8.64	315.90	3,630.87	93.98	-74.82	-90.89	1.20
3,733.00	9.67	315.83	3,724.66	104.83	-85.34	-101.31	1.08
3,828.00	9.24	313.69	3,818.37	115.82	-96.42	-111.84	0.58
3,923.00	8.48	309.74	3,912.24	125.57	-107.32	-121.14	1.02
4,018.00	8.68	309.59	4,006.17	134.62	-118.23	-129.74	0.21
4,113.00	7.41	315.12	4,100.24	143.53	-128.08	-138.25	1.56
4,207.00	7.00	314.19	4,193.50	151.81	-136.46	-146.19	0.45
4,302.00	6.06	314.59	4,287.88	159.37	-144.18	-153.43	0.99
4,397.00	6.68	318.82	4,382.29	167.05	-151.39	-160.81	0.82
4,492.00	6.05	320.07	4,476.71	175.05	-158.25	-168.53	0.68
4,587.00	6.05	320.43	4,571.18	182.74	-164.65	-175.96	0.04
4,681.00	5.92	321.68	4,664.66	190.37	-170.81	-183.33	0.20
4,776.00	3.88	323.84	4,759.31	196.81	-175.74	-189.56	2.16



## Design Report for Crow Creek AA01-785 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
4,871.00	3.35	320.65	4,854.12	201.55	-179.40	-194.15	0.60
4,966.00	1.24	302.47	4,949.04	204.25	-182.03	-196.74	2.32
5,061.00	1.23	293.16	5,044.02	205.20	-183.83	-197.62	0.21
5,250.00	1.68	278.01	5,232.96	206.38	-188.44	-198.62	0.31
5,345.00	1.63	285.85	5,327.92	206.95	-191.12	-199.08	0.24
5,440.00	1.70	280.72	5,422.88	207.58	-193.80	-199.60	0.17
5,535.00	1.39	203.04	5,517.85	206.78	-195.64	-198.73	2.06
5,630.00	1.48	205.83	5,612.82	204.61	-196.63	-196.52	0.12
5,724.00	1.43	211.14	5,706.79	202.52	-197.76	-194.38	0.15
5,819.00	1.28	228.02	5,801.77	200.79	-199.16	-192.60	0.45
5,914.00	1.29	227.49	5,896.74	199.36	-200.74	-191.11	0.02
5,948.00	1.33	228.98	5,930.74	198.84	-201.32	-190.57	0.15
6,104.00	11.70	179.85	6,085.56	181.79	-202.65	-173.47	6.97
6,152.00	14.63	185.49	6,132.29	170.88	-203.22	-162.55	6.66
6,199.00	17.34	184.99	6,177.47	157.99	-204.39	-149.63	5.77
6,294.00	23.97	183.50	6,266.32	124.59	-206.80	-116.16	7.00
6,389.00	32.99	183.79	6,349.73	79.43	-209.70	-70.92	9.50
6,484.00	42.98	180.39	6,424.52	21.09	-211.63	-12.54	10.74
6,532.00	47.01	180.60	6,458.46	-12.84	-211.93	21.37	8.40
6,579.00	51.83	179.35	6,489.03	-48.53	-211.90	57.03	10.45
6,627.00	56.19	178.76	6,517.23	-87.35	-211.25	95.79	9.14
6,673.00	60.70	180.33	6,541.29	-126.54	-210.96	134.93	10.23
6,721.00	64.25	181.41	6,563.47	-169.09	-211.61	177.48	7.66
6,768.00	68.79	181.40	6,582.20	-212.17	-212.66	220.57	9.66
6,816.00	72.05	182.24	6,598.28	-257.37	-214.10	265.79	6.99
6,863.00	76.09	181.35	6,611.18	-302.53	-215.52	310.97	8.79
6,892.00	79.00	181.03	6,617.43	-330.84	-216.10	339.28	10.09
6,945.00	81.02	180.98	6,626.62	-383.03	-217.02	391.46	3.82
7"							
7,037.00	84.54	180.90	6,638.18	-474.27	-218.52	482.69	3.82
7,131.00	90.62	181.06	6,642.15	-568.13	-220.12	576.54	6.47
7,226.00	91.05	177.70	6,640.76	-663.10	-219.10	671.39	3.57
7,321.00	91.08	176.74	6,639.00	-757.97	-214.49	766.00	1.01
7,416.00	90.31	176.54	6,637.84	-852.80	-208.92	860.53	0.84
7,511.00	90.06	178.06	6,637.54	-947.69	-204.45	955.16	1.62
7,606.00	90.68	177.83	6,636.92	-1,042.63	-201.04	1,049.88	0.70
7,701.00	89.38	176.89	6,636.87	-1,137.52	-196.67	1,144.52	1.69
7,796.00	89.82	177.18	6,637.54	-1,232.39	-191.75	1,239.12	0.55
7,891.00	89.51	180.64	6,638.09	-1,327.36	-189.94	1,333.94	3.66
7,986.00	89.11	180.32	6,639.24	-1,422.35	-190.74	1,428.88	0.54
8,081.00	90.43	180.34	6,639.62	-1,517.34	-191.29	1,523.82	1.39
8,176.00	89.78	179.68	6,639.44	-1,612.34	-191.30	1,618.74	0.98
8,271.00	92.22	179.91	6,637.79	-1,707.32	-190.96	1,713.63	2.58
8,366.00	93.14	179.45	6,633.34	-1,802.21	-190.43	1,808.42	1.08
8,461.00	91.45	180.09	6,629.54	-1,897.13	-190.05	1,903.25	1.90
8,555.00	89.72	180.36	6,628.58	-1,991.12	-190.42	1,997.18	1.86
8,650.00	90.12	179.96	6,628.71	-2,086.12	-190.69	2,092.11	0.60
8,745.00	90.92	179.51	6,627.85	-2,181.12	-190.25	2,187.01	0.97
8,840.00	90.00	181.31	6,627.09	-2,276.11	-190.93	2,281.95	2.13
8,935.00	88.80	181.27	6,628.08	-2,371.08	-193.07	2,376.93	1.26
9,030.00	88.89	181.01	6,630.00	-2,466.04	-194.96	2,471.89	0.29

## Design Report for Crow Creek AA01-785 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
9,125.00	88.89	180.62	6,631.84	-2,561.01	-196.31	2,566.84	0.41
9,220.00	90.18	180.71	6,632.61	-2,656.00	-197.41	2,661.80	1.36
9,315.00	89.69	180.53	6,632.72	-2,750.99	-198.44	2,756.75	0.55
9,409.00	89.82	180.27	6,633.12	-2,844.99	-199.09	2,850.70	0.31
9,504.00	89.57	179.67	6,633.62	-2,939.99	-199.04	2,945.62	0.68
9,599.00	91.66	180.36	6,632.60	-3,034.98	-199.07	3,040.53	2.32
9,694.00	90.95	179.87	6,630.44	-3,129.95	-199.26	3,135.44	0.91
9,789.00	90.46	178.14	6,629.27	-3,224.92	-197.61	3,230.27	1.89
9,884.00	89.32	175.27	6,629.45	-3,319.76	-192.15	3,324.80	3.25
9,978.00	88.83	177.78	6,630.97	-3,413.56	-186.45	3,418.30	2.72
10,073.00	90.18	180.10	6,631.79	-3,508.53	-184.70	3,513.13	2.83
10,168.00	91.66	180.90	6,630.27	-3,603.52	-185.53	3,608.06	1.77
10,263.00	89.97	180.04	6,628.92	-3,698.50	-186.31	3,703.00	2.00
10,358.00	90.18	179.70	6,628.79	-3,793.50	-186.09	3,797.92	0.42
10,453.00	89.88	180.67	6,628.74	-3,888.50	-186.40	3,892.85	1.07
10,548.00	89.88	182.02	6,628.94	-3,983.47	-188.63	3,987.83	1.42
10,643.00	90.49	182.24	6,628.63	-4,078.40	-192.16	4,082.83	0.68
10,738.00	89.82	180.56	6,628.38	-4,173.37	-194.48	4,177.82	1.90
10,833.00	90.40	180.58	6,628.19	-4,268.36	-195.42	4,272.77	0.61
10,927.00	88.86	180.13	6,628.80	-4,362.36	-196.01	4,366.71	1.71
11,022.00	90.09	179.66	6,629.67	-4,457.35	-195.83	4,461.62	1.39
11,117.00	90.06	181.15	6,629.55	-4,552.34	-196.50	4,556.57	1.57
11,212.00	89.60	180.47	6,629.83	-4,647.33	-197.85	4,651.53	0.86
11,307.00	90.28	180.16	6,629.93	-4,742.33	-198.37	4,746.47	0.79
11,402.00	90.96	179.57	6,628.90	-4,837.32	-198.14	4,841.38	0.95
11,506.00	89.66	178.36	6,628.34	-4,941.30	-196.27	4,945.20	1.71
Final Sperry MWD Survey at 11506.00ft							
11,564.00	89.66	178.36	6,628.68	-4,999.28	-194.61	5,003.06	0.00
Straight Line Projection to TD at 11564.00ft - Crow Creek AA01-785_BHL							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
283.00	282.99	1.33	0.65	First Gyro Survey
652.00	651.99	3.27	2.12	Tie on to Gyro Survey at 652.00ft
652.00	651.99	3.27	2.12	Final Gyro Survey
726.00	725.99	3.36	2.15	First Sperry MWD Survey at 726.00ft
11,506.00	6,628.34	-4,941.30	-196.27	Final Sperry MWD Survey at 11506.00ft
11,564.00	6,628.68	-4,999.28	-194.61	Straight Line Projection to TD at 11564.00ft

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/-S (usft)	Origin +E/-W (usft)	Start TVD (usft)
Target	Crow Creek AA01-785_BHL	182.31	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
283.00	652.00	Gyro Surveys	Flexi-Shot

## Design Report for Crow Creek AA01-785 - Actual Surveys

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
726.00	6,892.00	Intermediate Surveys	MWD
7,037.00	11,564.00	Production Surveys	MWD

Casing Details

Measured Depth (usft)	Vertical Depth (usft)		Name	Casing Diameter (")	Hole Diameter (")
678.00	677.99	9 5/8"		9-5/8	13-3/4
6,945.00	6,626.62	7"		7	8-3/4

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
Crow Creek AA01-785	0.00	0.00	6,634.00	-5,001.33	-201.72	1,429,938.19	3,307,726.98	40.508310	-104.393300
- actual wellpath misses target center by 9.11usft at 11564.00usft MD (6628.68 TVD, -4999.28 N, -194.61 E)									
- Point									

Directional Difficulty Index

Average Dogleg over Survey:	1.66 °/100usft	Maximum Dogleg over Survey:	10.74 °/100usft at 6,484.00 usft
Net Tortousity applicable to Plans:	0.74 °/100usft	Directional Difficulty Index:	6.267

Audit Info



**North Reference Sheet for Sec. 1-T6N-R63W (Crow Creek 1/AA01 PAD) - Crow Creek AA01-785 - 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=24 @ 4821.00usft (H&P 315). Northing and Easting are relative to Crow Creek AA01-785

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: 0.99996803

Grid Coordinates of Well: 1,434,939.35 usft N, 3,307,928.69 usft E

Geographical Coordinates of Well: 40° 31' 19.31" N, 104° 23' 32.46" W

Grid Convergence at Surface is: 0.72°

Based upon Minimum Curvature type calculations, at a Measured Depth of 11,564.00usft

the Bottom Hole Displacement is 5,003.06usft in the Direction of 182.23° (Grid).

Magnetic Convergence at surface is: -7.58° (29 December 2014, , BGGM2014)

