

# SPERRY-SUN DRILLING SERVICES

## CERTIFIED SURVEY WORK SHEET

OPERATOR:	Anadarko
WELL:	Sack 37N-6HZ
FIELD:	Wattenburg
RIG:	Xtreme 22
LEGALS:	Sec 31-T1N-R67W
COUNTY:	Weld
STATE:	CO
CAL. METHOD:	Min Curvature
MAG. DECL. APPLIED:	8.45
VERTICAL SEC. DIR. :	179.230

SSDS Job Number :	901557473
Start Date of Job :	9/26/2014
End Date of Job :	11/20/2014
Lead Directional Driller:	J. Suttter
	B. Seghetti
Other SSDS DD's :	
SSDS MWD Engineers :	C. Wass
	C. Jones
	D. Macbeth

	Main Hole =====>		1st Side Track =====>		2nd Side Track =====>		3rd Side Track =====>		4th Side Track =====>	
First Survey Depth	1289.00	Tie On		Tie On		Tie On		Tie On		Tie On
Last Survey Depth	1850.00									
	12637.00									
KOP Depth/Sidetrack MD	7178.00	KOP		KOP-ST1		KOP-ST2		KOP-ST3		KOP-ST4
First Survey Depth	1850.00	MWD		MWD		MWD		MWD		MWD
Last Survey Depth	12637.00	MWD		MWD		MWD		MWD		MWD
Bit Extrapolation to TD	12680.00	T.D.		T.D.		T.D.		T.D.		T.D.

The following Sperry Sun Drilling Services personnel listed below, do certify the above survey information to be accurate :

Print Name : J. Suttter      Print Name : C. Wass      Print Name :

Sign Name :       Sign Name :       Sign Name :

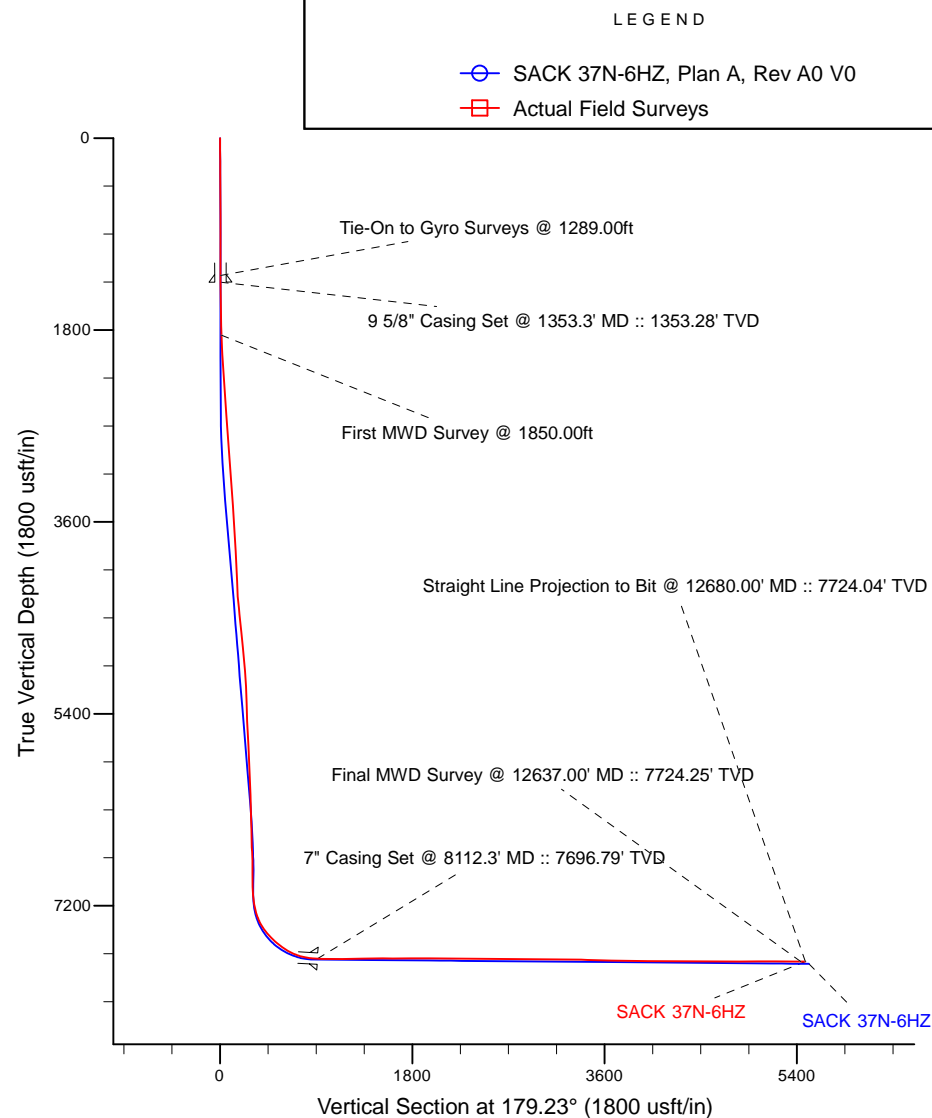
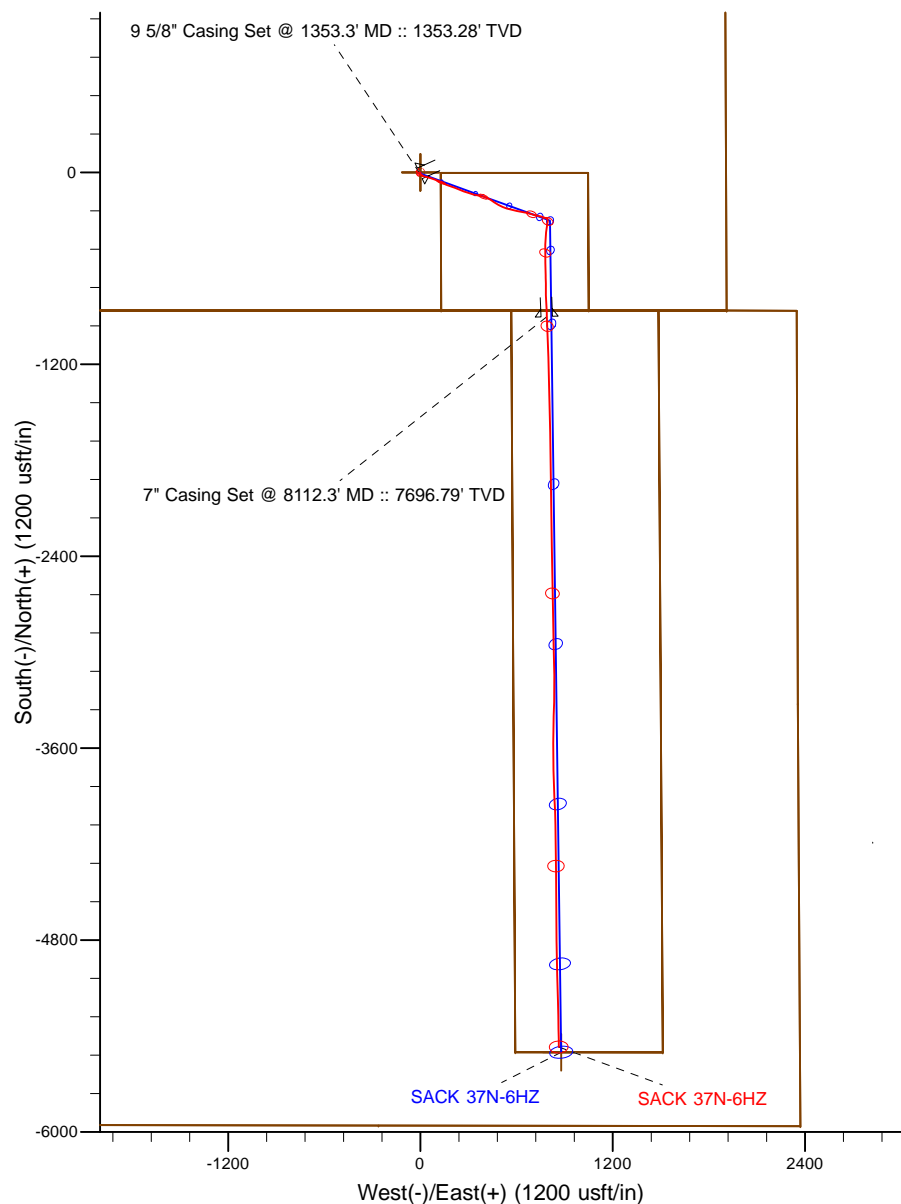
Print Name : B. Seghetti      Print Name : D. Macbeth      Print Name :

Sign Name :       Sign Name :       Sign Name :

### Examples of Survey Types:

TieOn	Tie On to Surface Casing (Assumed Vertical), Tie On to existing MWD Survey (prior drilled hole)
MWD	Sperry Sun Drilling Services (SSDS) Measurement While Drilling (MWD) Survey's
ESS	Sperry Sun Drilling Services (SSDS) Electronic Survey System (ESS) Survey's
Gyro	Gyro Survey's ; Provided by third party vendor, or by Sperry Sun Drilling Services (SSDS)
SS	Single Shot (SS) Survey's ; Provided by Sperry Sun Drilling Services (SSDS) or third party vendor.

Project: Weld County, CO (NAD 83)  
 Site: Sec. 31-T1N-R67W  
 Well: SACK 37N-6HZ  
 Wellbore: Plan A  
 Design: Actual Field Surveys



7" Casing: ~38.35' FNL, ~1559.60' FEL  
 Lat/Long: 40.000234 N, -104.927694 E  
 State Planes - CO Northern: 1,243,449.49' N, 3,160,331.93' E  
 Location: Sec. 6-T1N-R67W

BHL: ~493.09' FSL, ~1505.22' FEL  
 Lat/Long: 39.987699 N, -104.927431 E  
 State Planes - CO Northern: 1,238,883.89' N, 3,160,435.29' E  
 Location: Sec. 6-T1N-R67W

WELL DETAILS: SACK 37N-6HZ	
Ground Level:	5040.00
RKB = 16' @ 5056.00usft (Xtreme 22)	
Design: Actual Field Surveys (SACK 37N-6HZ/Plan A)	
Created By: Katie Benner	Date: 11/24/2014
Reviewed: _____	Date: _____

# Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 31-T1N-R67W

SACK 37N-6HZ

API # 05-123-39426 JOB # 901557475

Plan A

Design: Actual Field Surveys

## Sperry Drilling Services

### Standard Report

27 January, 2015

Surface UWI : API # 05-123-39426 JOB # 901557475

Well Coordinates: 1,244,346.30 N, 3,159,537.51 E (40° 00' 09.76" N, 104° 55' 49.83" W)

Ground Level: 5,040.00 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 SACK 37N-6HZ

RKB = 16' @ 5056.00usft (Xtreme 22)

N

True

Dec-Deg - API - US Survey Feet - Custom

**HALLIBURTON**

**Design Report for SACK 37N-6HZ - Actual Field 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
<b>Sack 37N-6HZ_SHL - Sack 37N-6HZ_SEC - Sack 37N-6HZ_LD</b>							
16.00	0.00	0.00	16.00	0.00	0.00	0.00	0.00
116.00	0.46	184.60	116.00	-0.40	-0.03	0.40	0.46
216.00	0.30	179.99	216.00	-1.06	-0.06	1.06	0.16
316.00	0.36	168.18	316.00	-1.63	0.00	1.63	0.09
416.00	0.35	177.52	415.99	-2.24	0.08	2.24	0.06
516.00	0.21	190.39	515.99	-2.73	0.06	2.73	0.15
616.00	0.21	192.17	615.99	-3.09	-0.01	3.09	0.01
716.00	0.32	238.34	715.99	-3.41	-0.29	3.41	0.23
816.00	0.31	230.79	815.99	-3.73	-0.74	3.72	0.04
916.00	0.36	241.11	915.99	-4.05	-1.22	4.04	0.08
1,016.00	0.33	222.23	1,015.99	-4.42	-1.69	4.40	0.12
1,116.00	0.44	215.28	1,115.98	-4.95	-2.11	4.92	0.12
1,216.00	0.41	228.27	1,215.98	-5.50	-2.59	5.46	0.10
1,289.00	0.46	245.31	1,288.98	-5.79	-3.06	5.75	0.19
<b>Tie-On to Gyro Surveys @ 1289.00ft</b>							
1,353.30	0.46	245.31	1,353.28	-6.01	-3.53	5.96	0.00
<b>9 5/8" Casing Set @ 1353.3' MD :: 1353.28' TVD</b>							
1,389.00	0.46	245.31	1,388.97	-6.13	-3.79	6.08	0.00
1,489.00	0.60	230.00	1,488.97	-6.63	-4.55	6.57	0.20
1,589.00	0.60	230.00	1,588.97	-7.31	-5.35	7.23	0.00
1,667.00	0.60	230.00	1,666.96	-7.83	-5.98	7.75	0.00
1,737.00	1.53	135.00	1,736.95	-8.73	-5.60	8.65	2.42
1,758.00	1.70	133.70	1,757.94	-9.14	-5.18	9.07	0.83
1,850.00	4.58	126.22	1,849.80	-12.26	-1.22	12.24	3.16
<b>First MWD Survey @ 1850.00ft</b>							
1,941.00	6.88	117.21	1,940.34	-16.90	6.55	16.98	2.71
2,032.00	8.99	111.06	2,030.46	-21.94	18.04	22.18	2.50
2,123.00	10.94	106.40	2,120.09	-26.94	32.96	27.38	2.32
2,215.00	11.35	106.17	2,210.35	-31.92	50.03	32.59	0.45
2,306.00	10.64	107.24	2,299.68	-36.91	66.65	37.80	0.81
2,397.00	9.84	107.97	2,389.23	-41.80	82.07	42.89	0.89
2,489.00	10.30	113.37	2,479.81	-47.48	97.10	48.78	1.14
2,580.00	11.46	114.43	2,569.18	-54.45	112.80	55.96	1.29
2,672.00	10.85	114.77	2,659.44	-61.86	128.98	63.59	0.67
2,764.00	10.77	115.37	2,749.81	-69.17	144.61	71.11	0.15
2,856.00	10.72	112.27	2,840.19	-76.09	160.30	78.24	0.63
2,948.00	11.80	108.68	2,930.42	-82.35	177.13	84.72	1.40
3,131.00	11.28	110.56	3,109.72	-94.63	211.61	97.46	0.35
3,315.00	10.10	111.41	3,290.53	-106.84	243.48	110.10	0.65
3,486.00	9.92	111.14	3,458.92	-117.62	271.18	121.26	0.11
3,657.00	10.81	108.90	3,627.13	-128.13	300.09	132.15	0.57
3,828.00	10.25	104.53	3,795.26	-137.14	329.99	141.56	0.57
3,998.00	11.22	101.05	3,962.28	-144.11	360.87	148.94	0.69
4,170.00	9.98	103.50	4,131.34	-150.79	391.78	156.05	0.77
4,341.00	9.27	117.19	4,299.96	-160.55	418.45	166.16	1.40
4,511.00	11.43	123.89	4,467.19	-176.20	444.61	182.16	1.45
4,682.00	10.43	121.83	4,635.08	-193.81	471.83	200.13	0.63
4,853.00	11.65	114.45	4,802.92	-209.12	500.70	215.83	1.09

**Design Report for SACK 37N-6HZ - Actual Field Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
5,022.00	13.61	112.57	4,967.83	-223.82	534.60	230.98	1.18
5,193.00	12.33	100.54	5,134.49	-234.88	571.13	242.54	1.74
5,364.00	10.65	97.21	5,302.06	-240.20	604.76	248.31	1.06
5,535.00	10.77	102.21	5,470.09	-245.57	636.05	254.09	0.55
5,706.00	10.13	105.61	5,638.25	-252.99	666.15	261.92	0.52
5,877.00	8.94	107.60	5,806.88	-261.06	693.30	270.35	0.72
6,047.00	9.93	103.43	5,974.58	-268.46	720.15	278.11	0.71
6,218.00	7.20	99.92	6,143.66	-273.73	745.05	283.72	1.62
6,388.00	5.84	109.55	6,312.56	-278.46	763.70	288.70	1.02
6,559.00	3.95	110.12	6,482.93	-283.39	777.43	293.82	1.11
6,730.00	2.55	115.78	6,653.65	-287.08	786.38	297.62	0.84
6,901.00	2.00	151.44	6,824.53	-291.35	791.24	301.96	0.87
7,072.00	1.29	151.21	6,995.46	-295.66	793.59	306.30	0.42
7,157.00	2.20	165.05	7,080.42	-298.07	794.47	308.72	1.17
7,200.00	4.32	178.10	7,123.34	-300.49	794.74	311.14	5.19
7,243.00	9.03	188.85	7,166.04	-305.45	794.27	316.09	11.29
7,286.00	11.44	191.29	7,208.35	-312.96	792.92	323.59	5.69
7,328.00	15.34	190.68	7,249.21	-322.51	791.07	333.11	9.29
7,371.00	18.51	188.99	7,290.34	-334.84	788.95	345.42	7.46
7,414.00	23.46	187.10	7,330.47	-350.09	786.83	360.63	11.62
7,457.00	28.54	187.27	7,369.11	-368.79	784.47	379.29	11.82
7,500.00	33.34	185.05	7,405.98	-390.76	782.12	401.23	11.47
7,543.00	38.48	182.93	7,440.80	-415.91	780.40	426.36	12.30
7,586.00	41.81	181.79	7,473.66	-443.60	779.27	454.04	7.93
7,629.00	44.35	180.81	7,505.07	-472.96	778.61	483.38	6.11
7,671.00	47.88	180.31	7,534.18	-503.23	778.32	513.64	8.45
7,714.00	51.50	178.94	7,561.99	-536.01	778.54	546.42	8.76
7,757.00	54.27	178.78	7,587.94	-570.29	779.22	580.71	6.45
7,800.00	56.87	178.71	7,612.25	-605.74	780.00	616.17	6.05
7,843.00	62.18	178.03	7,634.05	-642.77	781.06	653.21	12.42
7,886.00	66.87	179.44	7,652.54	-681.57	781.91	692.02	11.30
7,928.00	71.63	179.56	7,667.41	-720.84	782.25	731.28	11.34
7,971.00	76.66	178.55	7,679.16	-762.18	782.94	772.63	11.91
8,013.00	80.12	177.32	7,687.61	-803.29	784.42	813.76	8.72
8,069.00	85.35	177.49	7,694.69	-858.76	786.93	869.26	9.34
8,112.30	87.03	177.92	7,697.57	-901.93	788.66	912.45	4.01
<b>7" Casing Set @ 8112.3' MD :: 7696.79' TVD</b>							
8,172.00	89.35	178.51	7,699.45	-961.57	790.52	972.10	4.01
8,309.00	90.55	177.91	7,699.57	-1,098.50	794.80	1,109.08	0.98
8,477.00	90.77	177.97	7,697.64	-1,266.38	800.84	1,277.02	0.14
8,647.00	89.88	178.60	7,696.67	-1,436.29	805.93	1,447.00	0.64
8,817.00	90.55	179.44	7,696.03	-1,606.27	808.84	1,616.99	0.63
8,988.00	90.18	178.89	7,694.94	-1,777.24	811.33	1,787.99	0.39
9,158.00	89.91	178.80	7,694.81	-1,947.21	814.75	1,957.98	0.17
9,329.00	89.48	178.96	7,695.72	-2,118.17	818.10	2,128.98	0.27
9,501.00	89.04	179.97	7,697.94	-2,290.15	819.70	2,300.96	0.64
9,672.00	90.34	179.51	7,698.87	-2,461.14	820.48	2,471.94	0.81
9,843.00	89.45	178.75	7,699.18	-2,632.12	823.08	2,642.94	0.68
10,013.00	90.00	178.37	7,700.00	-2,802.06	827.35	2,812.93	0.39
10,182.00	88.58	178.74	7,702.09	-2,970.99	831.61	2,981.90	0.87
10,353.00	88.86	179.22	7,705.91	-3,141.92	834.65	3,152.85	0.32



**Design Report for SACK 37N-6HZ - Actual Field Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
10,524.00	90.18	181.59	7,707.34	-3,312.89	833.44	3,323.79	1.59
10,694.00	87.90	181.13	7,710.19	-3,482.81	829.41	3,493.64	1.37
10,865.00	88.80	179.34	7,715.12	-3,653.73	828.71	3,664.54	1.17
11,036.00	89.08	177.98	7,718.28	-3,824.65	832.71	3,835.49	0.81
11,206.00	89.66	177.58	7,720.15	-3,994.51	839.29	4,005.43	0.41
11,378.00	89.60	179.41	7,721.26	-4,166.44	843.81	4,177.40	1.06
11,548.00	89.66	179.58	7,722.36	-4,336.43	845.31	4,347.40	0.11
11,719.00	90.28	179.70	7,722.45	-4,507.42	846.38	4,518.39	0.37
11,890.00	89.08	179.04	7,723.40	-4,678.41	848.26	4,689.38	0.80
12,061.00	90.15	179.44	7,724.55	-4,849.39	850.53	4,860.38	0.67
12,232.00	90.40	178.88	7,723.73	-5,020.36	853.04	5,031.37	0.36
12,401.00	89.63	178.18	7,723.69	-5,189.31	857.37	5,200.36	0.62
12,569.00	89.91	179.22	7,724.36	-5,357.26	861.18	5,368.35	0.64
12,637.00	90.28	179.21	7,724.25	-5,425.25	862.11	5,436.35	0.54
<b>Final MWD Survey @ 12637.00' MD :: 7724.25' TVD</b>							
12,680.00	90.28	179.21	7,724.04	-5,468.25	862.71	5,479.35	0.00
<b>Straight Line Projection to Bit @ 12680.00' MD :: 7724.04' TVD - Current MWD Survey - Sack 37N-6HZ_TOE</b>							

**Design Annotations**

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
1,289.00	1,288.98	-5.79	-3.06	Tie-On to Gyro Surveys @ 1289.00ft
1,850.00	1,849.80	-12.26	-1.22	First MWD Survey @ 1850.00ft
12,637.00	7,724.25	-5,425.25	862.11	Final MWD Survey @ 12637.00' MD :: 7724.25' TVD
12,680.00	7,724.04	-5,468.25	862.71	Straight Line Projection to Bit @ 12680.00' MD :: 7724.04' TVD
12,680.00	7,724.04	-5,468.25	862.71	Current MWD Survey

**Vertical Section Information**

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/_S (usft)	+E/-W (usft)	
User	No Target (Freehand)	179.23	Slot	0.00	0.00	0.00

**Survey tool program**

From (usft)	To (usft)	Survey/Plan	Survey Tool
16.00	1,289.00	MS Energy Gyro Surveys	NS-GYRO-MS
1,389.00	1,789.00	Magnetic Interfered Surveys	MWD_Interp Azi
1,850.00	8,069.00	MWD Vertical/Build Survey	MWD+IFR1
8,172.00	12,680.00	MWD Lateral Surveys	MWD+IFR1+SC

**Casing Details**

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,353.30	1,353.28	9 5/8" Casing Set @ 1353.3' MD :: 1353.28' TVD	9-5/8	13-1/2
8,112.30	7,697.57	7" Casing Set @ 8112.3' MD :: 7696.79' TVD	7	8-3/4

## Design Report for SACK 37N-6HZ - Actual Field 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
Sack 37N-6HZ_SHL - actual wellpath hits target center - Point	0.00	0.00	0.00	0.00	0.00	1,244,346.30	3,159,537.51	40.002710	-104.930509
Sack 37N-6HZ_LD - actual wellpath hits target center - Polygon	0.00	0.00	0.00	0.00	0.00	1,244,346.30	3,159,537.51	40.002710	-104.930509
Point 1				0.00	-2.70	125.58	1,244,344.41	3,159,663.10	
Point 2				0.00	-3.25	1,045.62	1,244,349.77	3,160,583.10	
Point 3				0.00	-863.27	1,049.93	1,243,489.82	3,160,592.93	
Point 4				0.00	-863.30	1,485.85	1,243,492.59	3,161,028.83	
Point 5				0.00	-5,502.41	1,511.68	1,238,853.90	3,161,084.45	
Point 6				0.00	-5,500.90	591.62	1,238,849.50	3,160,164.43	
Point 7				0.00	-863.23	565.80	1,243,486.75	3,160,108.83	
Point 8				0.00	-863.20	129.89	1,243,483.98	3,159,672.94	
Sack 37N-6HZ_SEC - actual wellpath hits target center - Polygon	0.00	0.00	0.00	0.00	0.00	1,244,346.30	3,159,537.51	40.002710	-104.930509
Point 1				0.00	9,743.17	-3,382.16	1,254,067.22	3,156,092.97	
Point 2				0.00	9,719.97	-769.10	1,254,060.80	3,158,706.03	
Point 3				0.00	9,696.54	1,875.09	1,254,054.35	3,161,350.23	
Point 4				0.00	7,050.16	1,871.60	1,251,408.10	3,161,363.73	
Point 5				0.00	4,415.58	1,883.34	1,248,773.73	3,161,392.39	
Point 6				0.00	4,424.06	-753.82	1,248,765.28	3,158,755.32	
Point 7				0.00	4,432.54	-3,376.98	1,248,756.91	3,156,132.25	
Point 8				0.00	4,424.06	-753.82	1,248,765.28	3,158,755.32	
Point 9				0.00	4,415.58	1,883.34	1,248,773.73	3,161,392.39	
Point 10				0.00	1,775.84	1,900.28	1,246,134.25	3,161,426.28	
Point 11				0.00	-863.33	1,909.91	1,243,495.28	3,161,452.86	
Point 12				0.00	-863.13	-730.09	1,243,478.53	3,158,813.01	
Point 13				0.00	-862.85	-3,369.46	1,243,461.86	3,156,173.78	
Point 14				0.00	-863.13	-730.09	1,243,478.53	3,158,813.01	
Point 15				0.00	-863.33	1,909.91	1,243,495.28	3,161,452.86	
Point 16				0.00	-864.12	2,348.22	1,243,497.31	3,161,891.15	
Point 17				0.00	-3,322.47	2,355.63	1,241,039.14	3,161,914.35	
Point 18				0.00	-5,963.82	2,370.86	1,238,398.03	3,161,946.54	
Point 19				0.00	-5,959.52	-261.64	1,238,385.42	3,159,314.16	
Point 20				0.00	-5,955.59	-2,723.09	1,238,373.55	3,156,852.82	
Point 21				0.00	-3,349.79	-2,745.50	1,240,979.06	3,156,813.67	
Point 22				0.00	-862.47	-2,753.66	1,243,466.19	3,156,789.54	
Point 23				0.00	-862.85	-3,369.46	1,243,461.86	3,156,173.78	
Point 24				0.00	4,432.54	-3,376.98	1,248,756.91	3,156,132.25	
Sack 37N-6HZ_TOE - actual wellpath misses target center by 41.79usft at 12680.00usft MD (7724.04 TVD, -5468.25 N, 862.71 E) - Point	0.00	0.00	7,745.00	-5,501.00	878.00	1,238,851.24	3,160,450.79	39.987609	-104.927376

**Directional Difficulty Index**

Average Dogleg over Survey:	1.38 °/100usft	Maximum Dogleg over Survey:	12.42 °/100usft at 7,843.00 usft
Net Tortousity applicable to Plans:	0.44 °/100usft	Directional Difficulty Index:	6.238

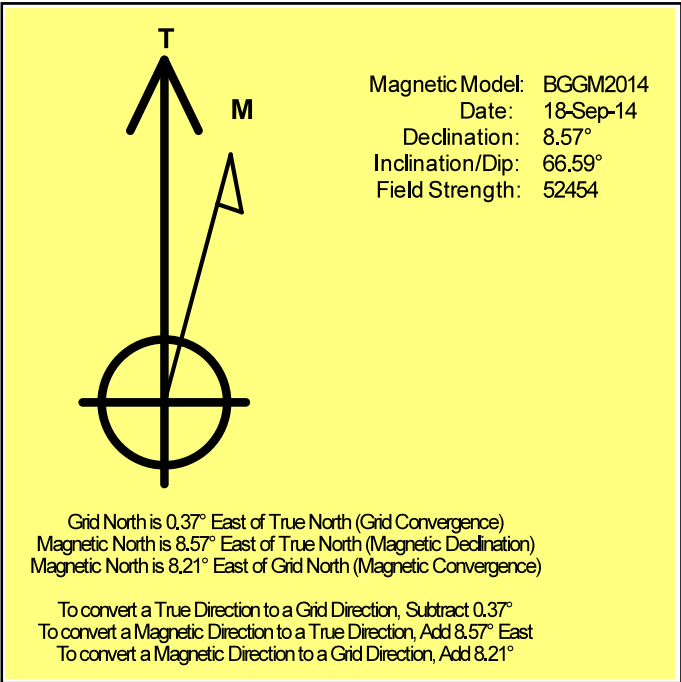
**Audit Info**

**North Reference Sheet for Sec. 31-T1N-R67W - SACK 37N-6HZ - Plan A**

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to True North Reference.  
 Vertical Depths are relative to RKB = 16' @ 5056.00usft (Xtreme 22). Northing and Easting are relative to SACK 37N-6HZ  
 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: 0.99996617

Grid Coordinates of Well: 1,244,346.30 usft N, 3,159,537.51 usft E  
 Geographical Coordinates of Well: 40° 00' 09.76" N, 104° 55' 49.83" W  
 Grid Convergence at Surface is: 0.37°

Based upon Minimum Curvature type calculations, at a Measured Depth of 12,680.00usft  
 the Bottom Hole Displacement is 5,535.88usft in the Direction of 171.03° ( True).  
 Magnetic Convergence at surface is: -8.21° (18 September 2014, , BGGM2014)





# Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 31-T1N-R67W

SACK 37N-6HZ

API # 05-123-39426 JOB # 901557475

Plan A

Design: Actual Field Surveys

## Sperry Drilling Services

### Geodetic Report

27 January, 2015

Well Coordinates: 1,244,346.30 N, 3,159,537.51 E (40° 00' 09.76" N, 104° 55' 49.83" W)

Ground Level: 5,040.00 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 SACK 37N-6HZ

RKB = 16' @ 5056.00usft (Xtreme 22)

N

True

Dec-Deg - API - US Survey Feet - Custom

**HALLIBURTON**

## Design Report for SACK 37N-6HZ - Actual Field Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Geographic Coordinates		UTM Coordinates	
				+N/-S (usft)	+E/-W (usft)	Latitude (usft)	Longitude (usft)	Northing (usft)	Easting (usft)
0.00	0.00	0.00	0.00	0.00	0.00	40.002710	-104.930509	1,244,346.30	3,159,537.51
16.00	0.00	0.00	16.00	0.00	0.00	40.002710	-104.930509	1,244,346.30	3,159,537.51
116.00	0.46	184.60	116.00	-0.40	-0.03	40.002709	-104.930509	1,244,345.90	3,159,537.48
216.00	0.30	179.99	216.00	-1.06	-0.06	40.002707	-104.930509	1,244,345.24	3,159,537.45
316.00	0.36	168.18	316.00	-1.63	0.00	40.002706	-104.930509	1,244,344.67	3,159,537.52
416.00	0.35	177.52	415.99	-2.24	0.08	40.002704	-104.930509	1,244,344.06	3,159,537.60
516.00	0.21	190.39	515.99	-2.73	0.06	40.002703	-104.930509	1,244,343.57	3,159,537.59
616.00	0.21	192.17	615.99	-3.09	-0.01	40.002702	-104.930509	1,244,343.21	3,159,537.52
716.00	0.32	238.34	715.99	-3.41	-0.29	40.002701	-104.930510	1,244,342.88	3,159,537.24
816.00	0.31	230.79	815.99	-3.73	-0.74	40.002700	-104.930512	1,244,342.56	3,159,536.80
916.00	0.36	241.11	915.99	-4.05	-1.22	40.002699	-104.930514	1,244,342.24	3,159,536.32
1,016.00	0.33	222.23	1,015.99	-4.42	-1.69	40.002698	-104.930515	1,244,341.87	3,159,535.85
1,116.00	0.44	215.28	1,115.98	-4.95	-2.11	40.002696	-104.930517	1,244,341.34	3,159,535.44
1,216.00	0.41	228.27	1,215.98	-5.50	-2.59	40.002695	-104.930519	1,244,340.79	3,159,534.95
1,289.00	0.46	245.31	1,288.98	-5.79	-3.06	40.002694	-104.930520	1,244,340.49	3,159,534.49
1,353.30	0.46	245.31	1,353.28	-6.01	-3.53	40.002694	-104.930522	1,244,340.27	3,159,534.03
1,389.00	0.46	245.31	1,388.97	-6.13	-3.79	40.002693	-104.930523	1,244,340.15	3,159,533.77
1,489.00	0.60	230.00	1,488.97	-6.63	-4.55	40.002692	-104.930526	1,244,339.64	3,159,533.00
1,589.00	0.60	230.00	1,588.97	-7.31	-5.35	40.002690	-104.930528	1,244,338.96	3,159,532.21
1,667.00	0.60	230.00	1,666.96	-7.83	-5.98	40.002689	-104.930531	1,244,338.43	3,159,531.58
1,737.00	1.53	135.00	1,736.95	-8.73	-5.60	40.002686	-104.930529	1,244,337.54	3,159,531.97
1,758.00	1.70	133.70	1,757.94	-9.14	-5.18	40.002685	-104.930528	1,244,337.13	3,159,532.40
1,850.00	4.58	126.22	1,849.80	-12.26	-1.22	40.002676	-104.930514	1,244,334.04	3,159,536.37
1,941.00	6.88	117.21	1,940.34	-16.90	6.55	40.002664	-104.930486	1,244,329.45	3,159,544.18
2,032.00	8.99	111.06	2,030.46	-21.94	18.04	40.002650	-104.930445	1,244,324.47	3,159,555.69
2,123.00	10.94	106.40	2,120.09	-26.94	32.96	40.002636	-104.930392	1,244,319.58	3,159,570.64
2,215.00	11.35	106.17	2,210.35	-31.92	50.03	40.002622	-104.930331	1,244,314.70	3,159,587.74
2,306.00	10.64	107.24	2,299.68	-36.91	66.65	40.002609	-104.930271	1,244,309.82	3,159,604.40
2,397.00	9.84	107.97	2,389.23	-41.80	82.07	40.002595	-104.930216	1,244,305.03	3,159,619.85
2,489.00	10.30	113.37	2,479.81	-47.48	97.10	40.002580	-104.930163	1,244,299.44	3,159,634.91
2,580.00	11.46	114.43	2,569.18	-54.45	112.80	40.002561	-104.930107	1,244,292.58	3,159,650.66
2,672.00	10.85	114.77	2,659.44	-61.86	128.98	40.002540	-104.930049	1,244,285.27	3,159,666.89
2,764.00	10.77	115.37	2,749.81	-69.17	144.61	40.002520	-104.929993	1,244,278.06	3,159,682.56
2,856.00	10.72	112.27	2,840.19	-76.09	160.30	40.002501	-104.929937	1,244,271.24	3,159,698.29
2,948.00	11.80	108.68	2,930.42	-82.35	177.13	40.002484	-104.929877	1,244,265.09	3,159,715.16
3,131.00	11.28	110.56	3,109.72	-94.63	211.61	40.002450	-104.929754	1,244,253.04	3,159,749.72
3,315.00	10.10	111.41	3,290.53	-106.84	243.48	40.002417	-104.929640	1,244,241.03	3,159,781.67
3,486.00	9.92	111.14	3,458.92	-117.62	271.18	40.002387	-104.929541	1,244,230.42	3,159,809.43
3,657.00	10.81	108.90	3,627.13	-128.13	300.09	40.002358	-104.929438	1,244,220.10	3,159,838.41
3,828.00	10.25	104.53	3,795.26	-137.14	329.99	40.002334	-104.929331	1,244,211.29	3,159,868.37
3,998.00	11.22	101.05	3,962.28	-144.11	360.87	40.002314	-104.929221	1,244,204.52	3,159,899.28
4,170.00	9.98	103.50	4,131.34	-150.79	391.78	40.002296	-104.929111	1,244,198.03	3,159,930.24

## Design Report for SACK 37N-6HZ - Actual Field Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Geographic Coordinates		UTM Coordinates	
				+N/-S (usft)	+E/-W (usft)	Latitude (usft)	Longitude (usft)	Northing (usft)	Easting (usft)
4,341.00	9.27	117.19	4,299.96	-160.55	418.45	40.002269	-104.929016	1,244,188.45	3,159,956.97
4,511.00	11.43	123.89	4,467.19	-176.20	444.61	40.002226	-104.928922	1,244,172.97	3,159,983.23
4,682.00	10.43	121.83	4,635.08	-193.81	471.83	40.002178	-104.928825	1,244,155.53	3,160,010.56
4,853.00	11.65	114.45	4,802.92	-209.12	500.70	40.002136	-104.928722	1,244,140.41	3,160,039.53
5,022.00	13.61	112.57	4,967.83	-223.82	534.60	40.002096	-104.928601	1,244,125.93	3,160,073.52
5,193.00	12.33	100.54	5,134.49	-234.88	571.13	40.002065	-104.928471	1,244,115.10	3,160,110.12
5,364.00	10.65	97.21	5,302.06	-240.20	604.76	40.002051	-104.928351	1,244,109.99	3,160,143.78
5,535.00	10.77	102.21	5,470.09	-245.57	636.05	40.002036	-104.928239	1,244,104.83	3,160,175.11
5,706.00	10.13	105.61	5,638.25	-252.99	666.15	40.002016	-104.928131	1,244,097.60	3,160,205.25
5,877.00	8.94	107.60	5,806.88	-261.06	693.30	40.001993	-104.928035	1,244,089.71	3,160,232.45
6,047.00	9.93	103.43	5,974.58	-268.46	720.15	40.001973	-104.927939	1,244,082.48	3,160,259.35
6,218.00	7.20	99.92	6,143.66	-273.73	745.05	40.001959	-104.927850	1,244,077.37	3,160,284.28
6,388.00	5.84	109.55	6,312.56	-278.46	763.70	40.001946	-104.927783	1,244,072.76	3,160,302.96
6,559.00	3.95	110.12	6,482.93	-283.39	777.43	40.001932	-104.927734	1,244,067.91	3,160,316.72
6,730.00	2.55	115.78	6,653.65	-287.08	786.38	40.001922	-104.927702	1,244,064.29	3,160,325.70
6,901.00	2.00	151.44	6,824.53	-291.35	791.24	40.001910	-104.927685	1,244,060.05	3,160,330.58
7,072.00	1.29	151.21	6,995.46	-295.66	793.59	40.001898	-104.927677	1,244,055.75	3,160,332.96
7,157.00	2.20	165.05	7,080.42	-298.07	794.47	40.001892	-104.927673	1,244,053.35	3,160,333.85
7,200.00	4.32	178.10	7,123.34	-300.49	794.74	40.001885	-104.927672	1,244,050.93	3,160,334.14
7,243.00	9.03	188.85	7,166.04	-305.45	794.27	40.001872	-104.927674	1,244,045.97	3,160,333.70
7,286.00	11.44	191.29	7,208.35	-312.96	792.92	40.001851	-104.927679	1,244,038.45	3,160,332.40
7,328.00	15.34	190.68	7,249.21	-322.51	791.07	40.001825	-104.927686	1,244,028.89	3,160,330.61
7,371.00	18.51	188.99	7,290.34	-334.84	788.95	40.001791	-104.927693	1,244,016.54	3,160,328.57
7,414.00	23.46	187.10	7,330.47	-350.09	786.83	40.001749	-104.927701	1,244,001.28	3,160,326.54
7,457.00	28.54	187.27	7,369.11	-368.79	784.47	40.001698	-104.927709	1,243,982.57	3,160,324.30
7,500.00	33.34	185.05	7,405.98	-390.76	782.12	40.001637	-104.927718	1,243,960.59	3,160,322.10
7,543.00	38.48	182.93	7,440.80	-415.91	780.40	40.001568	-104.927724	1,243,935.43	3,160,320.54
7,586.00	41.81	181.79	7,473.66	-443.60	779.27	40.001492	-104.927728	1,243,907.73	3,160,319.59
7,629.00	44.35	180.81	7,505.07	-472.96	778.61	40.001412	-104.927730	1,243,878.36	3,160,319.11
7,671.00	47.88	180.31	7,534.18	-503.23	778.32	40.001329	-104.927731	1,243,848.10	3,160,319.02
7,714.00	51.50	178.94	7,561.99	-536.01	778.54	40.001239	-104.927730	1,243,815.32	3,160,319.45
7,757.00	54.27	178.78	7,587.94	-570.29	779.22	40.001145	-104.927728	1,243,781.05	3,160,320.36
7,800.00	56.87	178.71	7,612.25	-605.74	780.00	40.001047	-104.927725	1,243,745.60	3,160,321.36
7,843.00	62.18	178.03	7,634.05	-642.77	781.06	40.000946	-104.927721	1,243,708.58	3,160,322.66
7,886.00	66.87	179.44	7,652.54	-681.57	781.91	40.000839	-104.927718	1,243,669.79	3,160,323.75
7,928.00	71.63	179.56	7,667.41	-720.84	782.25	40.000731	-104.927717	1,243,630.53	3,160,324.35
7,971.00	76.66	178.55	7,679.16	-762.18	782.94	40.000618	-104.927715	1,243,589.19	3,160,325.30
8,013.00	80.12	177.32	7,687.61	-803.29	784.42	40.000505	-104.927709	1,243,548.10	3,160,327.05
8,069.00	85.35	177.49	7,694.69	-858.76	786.93	40.000353	-104.927700	1,243,492.64	3,160,329.92
8,112.30	87.03	177.92	7,697.57	-901.93	788.66	40.000234	-104.927694	1,243,449.49	3,160,331.93
8,172.00	89.35	178.51	7,699.45	-961.57	790.52	40.000070	-104.927688	1,243,389.86	3,160,334.17
8,309.00	90.55	177.91	7,699.57	-1,098.50	794.80	39.999695	-104.927672	1,243,252.97	3,160,339.33

## Design Report for SACK 37N-6HZ - Actual Field Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Geographic Coordinates		UTM Coordinates	
				+N/-S (usft)	+E/-W (usft)	Latitude (usft)	Longitude (usft)	Northing (usft)	Easting (usft)
8,477.00	90.77	177.97	7,697.64	-1,266.38	800.84	39.999234	-104.927651	1,243,085.14	3,160,346.44
8,647.00	89.88	178.60	7,696.67	-1,436.29	805.93	39.998767	-104.927633	1,242,915.26	3,160,352.62
8,817.00	90.55	179.44	7,696.03	-1,606.27	808.84	39.998301	-104.927622	1,242,745.32	3,160,356.62
8,988.00	90.18	178.89	7,694.94	-1,777.24	811.33	39.997831	-104.927613	1,242,574.36	3,160,360.21
9,158.00	89.91	178.80	7,694.81	-1,947.21	814.75	39.997365	-104.927601	1,242,404.43	3,160,364.73
9,329.00	89.48	178.96	7,695.72	-2,118.17	818.10	39.996895	-104.927589	1,242,233.50	3,160,369.17
9,501.00	89.04	179.97	7,697.94	-2,290.15	819.70	39.996423	-104.927584	1,242,061.54	3,160,371.88
9,672.00	90.34	179.51	7,698.87	-2,461.14	820.48	39.995954	-104.927581	1,241,890.56	3,160,373.75
9,843.00	89.45	178.75	7,699.18	-2,632.12	823.08	39.995485	-104.927572	1,241,719.61	3,160,377.45
10,013.00	90.00	178.37	7,700.00	-2,802.06	827.35	39.995018	-104.927556	1,241,549.71	3,160,382.81
10,182.00	88.58	178.74	7,702.09	-2,970.99	831.61	39.994554	-104.927541	1,241,380.81	3,160,388.16
10,353.00	88.86	179.22	7,705.91	-3,141.92	834.65	39.994085	-104.927530	1,241,209.91	3,160,392.30
10,524.00	90.18	181.59	7,707.34	-3,312.89	833.44	39.993616	-104.927535	1,241,038.94	3,160,392.19
10,694.00	87.90	181.13	7,710.19	-3,482.81	829.41	39.993149	-104.927549	1,240,869.01	3,160,389.24
10,865.00	88.80	179.34	7,715.12	-3,653.73	828.71	39.992680	-104.927552	1,240,698.09	3,160,389.64
11,036.00	89.08	177.98	7,718.28	-3,824.65	832.71	39.992211	-104.927537	1,240,527.21	3,160,394.74
11,206.00	89.66	177.58	7,720.15	-3,994.51	839.29	39.991745	-104.927514	1,240,357.40	3,160,402.41
11,378.00	89.60	179.41	7,721.26	-4,166.44	843.81	39.991273	-104.927498	1,240,185.51	3,160,408.03
11,548.00	89.66	179.58	7,722.36	-4,336.43	845.31	39.990806	-104.927492	1,240,015.54	3,160,410.62
11,719.00	90.28	179.70	7,722.45	-4,507.42	846.38	39.990337	-104.927489	1,239,844.56	3,160,412.79
11,890.00	89.08	179.04	7,723.40	-4,678.41	848.26	39.989867	-104.927482	1,239,673.60	3,160,415.77
12,061.00	90.15	179.44	7,724.55	-4,849.39	850.53	39.989398	-104.927474	1,239,502.64	3,160,419.14
12,232.00	90.40	178.88	7,723.73	-5,020.36	853.04	39.988929	-104.927465	1,239,331.69	3,160,422.74
12,401.00	89.63	178.18	7,723.69	-5,189.31	857.37	39.988465	-104.927450	1,239,162.78	3,160,428.16
12,569.00	89.91	179.22	7,724.36	-5,357.26	861.18	39.988004	-104.927436	1,238,994.86	3,160,433.05
12,637.00	90.28	179.21	7,724.25	-5,425.25	862.11	39.987817	-104.927433	1,238,926.88	3,160,434.42
12,680.00	90.28	179.21	7,724.04	-5,468.25	862.71	39.987699	-104.927431	1,238,883.89	3,160,435.29

### Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
1,289.00	1,288.98	-5.79	-3.06	Tie-On to Gyro Surveys @ 1289.00ft
1,850.00	1,849.80	-12.26	-1.22	First MWD Survey @ 1850.00ft
12,637.00	7,724.25	-5,425.25	862.11	Final MWD Survey @ 12637.00' MD :: 7724.25' TVD
12,680.00	7,724.04	-5,468.25	862.71	Straight Line Projection to Bit @ 12680.00' MD :: 7724.04' TVD
12,680.00	7,724.04	-5,468.25	862.71	Current MWD Survey

## Design Report for SACK 37N-6HZ - Actual Field Surveys

### Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/_S (usft)	Origin +E/-W (usft)	Start TVD (usft)
User	No Target (Freehand)	179.23	Slot	0.00	0.00	0.00

### Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
16.00	1,289.00	MS Energy Gyro Surveys	NS-GYRO-MS
1,389.00	1,789.00	Magnetic Interfered Surveys	MWD_Interp Azi
1,850.00	8,069.00	MWD Vertical/Build Survey	MWD+IFR1
8,172.00	12,680.00	MWD Lateral Surveys	MWD+IFR1+SC

### Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,353.30	1,353.28	9 5/8" Casing Set @ 1353.3' MD :: 1353.28' TVD	9-5/8	13-1/2
8,112.30	7,697.57	7" Casing Set @ 8112.3' MD :: 7696.79' TVD	7	8-3/4

### Design Targets

Shape	Target Name	TVD (')	Northing (')	Easting (')	+N/-S	+E/-W	Created	Updated
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### Directional Difficulty Index

Average Dogleg over Survey:	1.38 °/100usft	Maximum Dogleg over Survey:	12.42 °/100usft at 7,843.00 usft
Net Tortousity applicable to Plans:	0.44 °/100usft	Directional Difficulty Index:	6.238

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**Design Report for SACK 37N-6HZ - Actual Field Surveys**

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*Audit Info*



**North Reference Sheet for Sec. 31-T1N-R67W - SACK 37N-6HZ - Plan A**

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

Vertical Depths are relative to RKB = 16' @ 5056.00usft (Xtreme 22). Northing and Easting are relative to SACK 37N-6HZ

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: 0.99996617

Grid Coordinates of Well: 1,244,346.30 usft N, 3,159,537.51 usft E

Geographical Coordinates of Well: 40° 00' 09.76" N, 104° 55' 49.83" W

Grid Convergence at Surface is: 0.37°

Based upon Minimum Curvature type calculations, at a Measured Depth of 12,680.00usft

the Bottom Hole Displacement is 5,535.88usft in the Direction of 171.03° (True).

Magnetic Convergence at surface is: -8.21° (18 September 2014, , BGGM2014)

