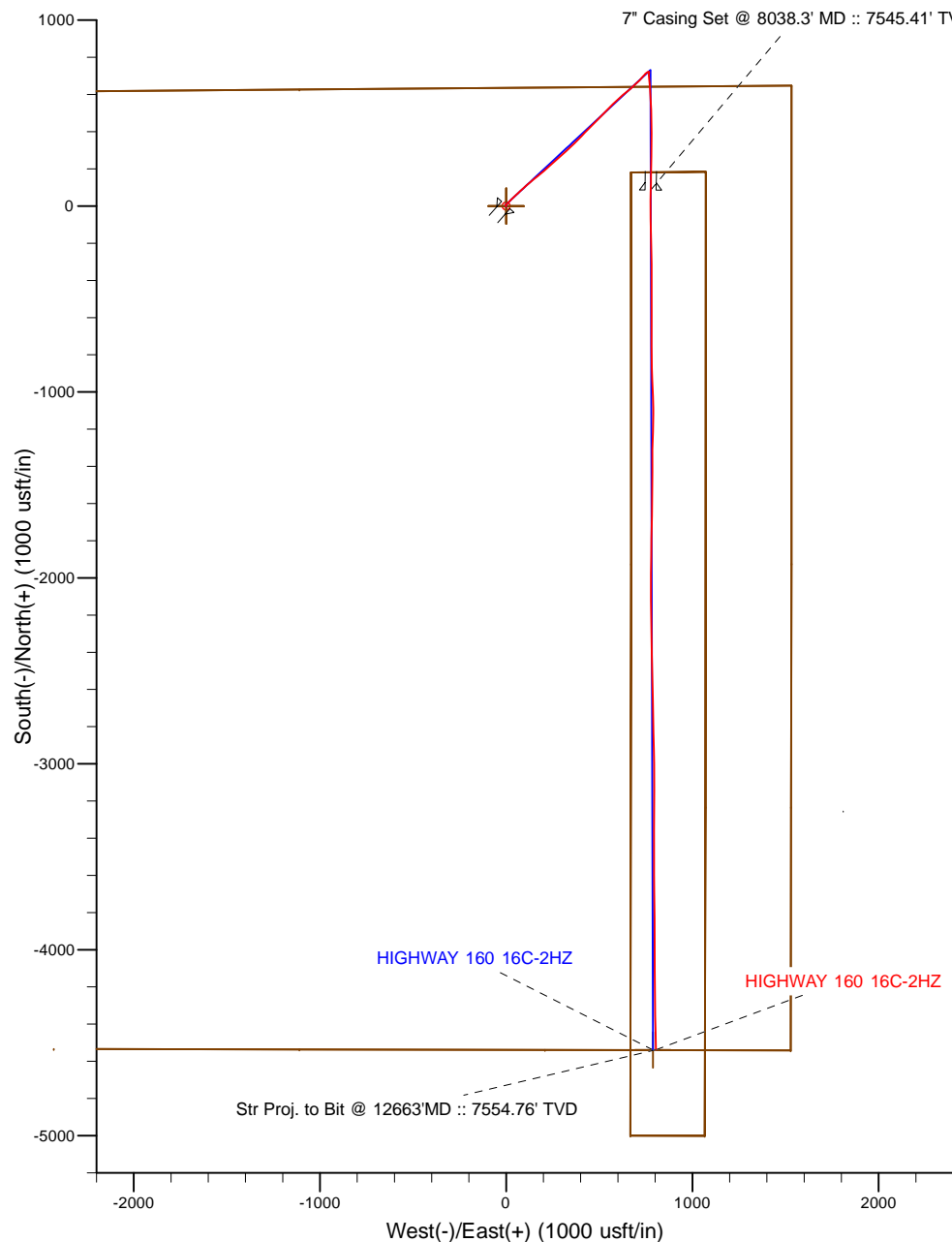
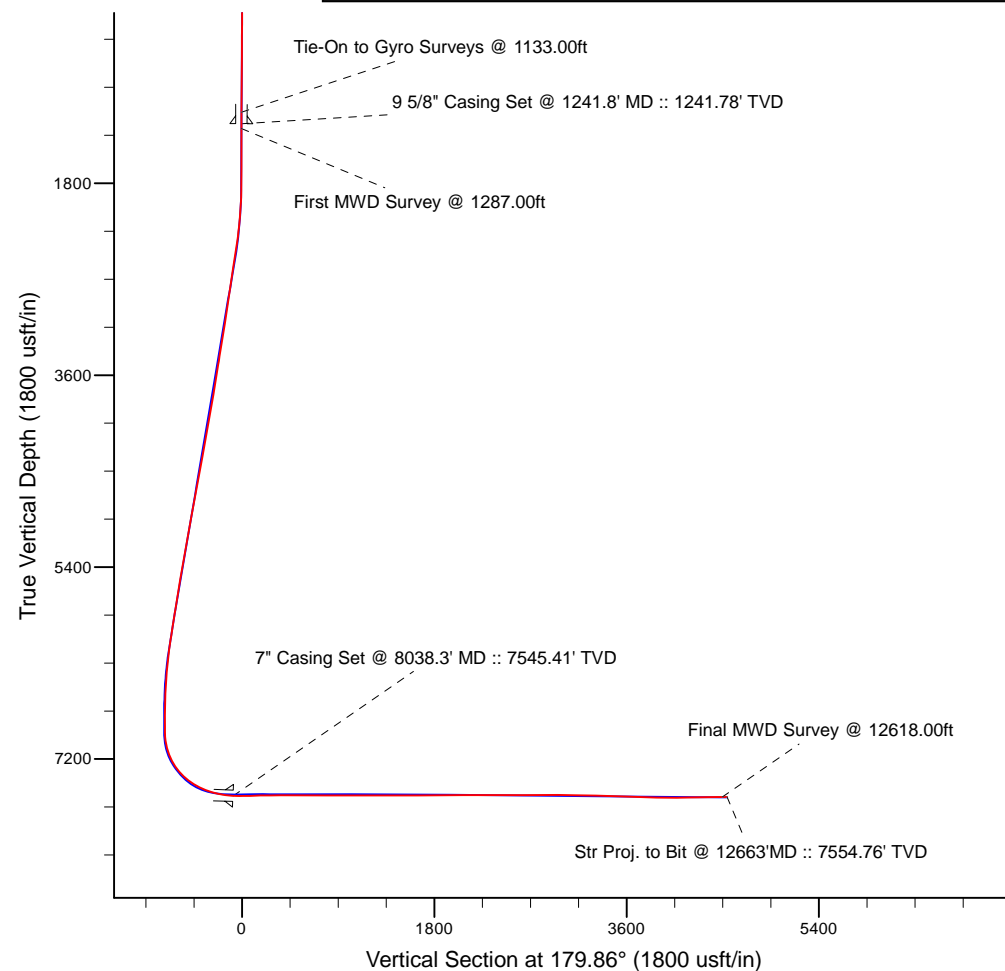


Project: Weld County, CO (NAD 83)  
 Site: Sec. 2-T1N-R66W  
 Well: HIGHWAY 160 16C-2HZ  
 Wellbore: Plan B  
 Design: Actual Field Surveys



LEGEND

- △— HIGHWAY 160 16C-2HZ, Plan B, Rev B2 V0
- Actual Field Surveys



7" Casing: ~556.14' FNL, ~755.57' FEL  
 Lat/Long: 40.085851 N, -104.737537 E  
 State Planes - CO Northern: 1,275,037.47' N, 3,213,335.17' E  
 Location: Sec. 2-T1N-R66W

BHL: ~2.57' FSL, ~723.27' FEL  
 Lat/Long: 40.073160 N, -104.737437 E  
 State Planes - CO Northern: 1,270,414.64' N, 3,213,402.94' E  
 Location: Sec. 2-T1N-R66W

WELL DETAILS: HIGHWAY 160 16C-2HZ	
Ground Level:	5102.00
RKB = 13' @ 5115.00usft (Ensign 132)	
Design: Actual Field Surveys (HIGHWAY 160 16C-2HZ/Plan B)	
Created By: Clint Eshelman	Date: 12/4/2013
Reviewed: _____	Date: _____

# Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 2-T1N-R66W

HIGHWAY 160 16C-2HZ

Plan B

Design: Actual Field Surveys

## Sperry Drilling Services

### Standard Report

04 December, 2013

Well Coordinates: 1,274,944.42 N, 3,212,559.26 E (40° 05' 08.21" N, 104° 44' 25.13" W)

Ground Level: 5,102.00 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 HIGHWAY 160 16C-2HZ

RKB = 13' @ 5115.00usft (Ensign 132)

N

True

API - US Survey Feet - Custom

**HALLIBURTON**

**Design Report for HIGHWAY 160 16C-2HZ - 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
13.00	0.00	0.00	13.00	0.00	0.00	0.00	0.00
113.00	0.39	292.35	113.00	0.13	-0.31	-0.13	0.39
213.00	0.35	307.89	213.00	0.45	-0.87	-0.45	0.11
313.00	0.38	314.97	313.00	0.87	-1.35	-0.87	0.05
413.00	0.48	332.40	412.99	1.47	-1.77	-1.48	0.16
513.00	0.32	1.90	512.99	2.12	-1.96	-2.13	0.26
613.00	0.24	7.63	612.99	2.61	-1.92	-2.62	0.08
713.00	0.53	13.91	712.99	3.27	-1.78	-3.27	0.29
813.00	0.21	345.00	812.98	3.89	-1.72	-3.90	0.36
913.00	0.25	359.77	912.98	4.29	-1.77	-4.29	0.07
1,013.00	0.32	8.85	1,012.98	4.78	-1.73	-4.79	0.08
1,113.00	0.25	4.30	1,112.98	5.28	-1.67	-5.28	0.07
1,133.00	0.28	27.19	1,132.98	5.36	-1.64	-5.37	0.55
<b>Tie-On to Gyro Surveys @ 1133.00ft</b>							
1,241.80	0.06	41.51	1,241.78	5.64	-1.48	-5.65	0.20
<b>9 5/8" Casing Set @ 1241.8' MD :: 1241.78' TVD</b>							
1,287.00	0.04	175.53	1,286.98	5.64	-1.47	-5.65	0.20
<b>First MWD Survey @ 1287.00ft</b>							
1,660.00	0.30	275.63	1,659.98	5.61	-2.43	-5.62	0.08
1,843.00	0.93	45.61	1,842.97	6.70	-1.84	-6.70	0.63
1,934.00	3.77	46.59	1,933.89	9.27	0.86	-9.27	3.12
2,026.00	5.42	47.99	2,025.59	14.26	6.29	-14.24	1.80
2,118.00	7.14	48.84	2,117.03	20.93	13.82	-20.89	1.87
2,210.00	8.42	43.03	2,208.18	29.61	22.72	-29.56	1.63
2,302.00	10.06	44.39	2,298.99	40.28	32.94	-40.20	1.80
2,393.00	11.51	46.96	2,388.38	52.16	45.13	-52.05	1.68
2,484.00	12.69	46.63	2,477.35	65.22	59.04	-65.07	1.30
2,576.00	13.69	46.49	2,566.93	79.65	74.28	-79.47	1.09
2,668.00	11.98	46.24	2,656.62	93.75	89.07	-93.54	1.86
2,759.00	13.80	50.56	2,745.33	107.18	104.28	-106.93	2.26
2,851.00	12.22	48.33	2,834.97	120.63	120.02	-120.33	1.80
2,943.00	12.85	51.27	2,924.77	133.50	135.28	-133.17	0.97
3,035.00	14.26	51.18	3,014.21	147.01	152.09	-146.63	1.53
3,126.00	12.48	50.67	3,102.74	160.26	168.43	-159.85	1.96
3,218.00	14.10	49.93	3,192.27	173.78	184.69	-173.33	1.77
3,310.00	14.83	49.53	3,281.35	188.63	202.23	-188.14	0.80
3,405.00	13.52	47.78	3,373.46	203.99	219.70	-203.45	1.45
3,500.00	14.80	48.60	3,465.57	219.48	237.03	-218.90	1.36
3,595.00	12.74	45.19	3,557.84	234.88	253.56	-234.26	2.33
3,691.00	14.14	51.49	3,651.21	249.65	270.25	-248.99	2.11
3,786.00	13.48	48.12	3,743.47	264.26	287.57	-263.56	1.10
3,881.00	13.00	44.49	3,835.94	279.28	303.30	-278.54	1.01
3,976.00	14.39	48.83	3,928.24	294.67	319.68	-293.89	1.82
4,071.00	14.60	48.13	4,020.22	310.44	337.48	-309.61	0.29
4,166.00	15.34	47.74	4,111.99	326.88	355.70	-326.01	0.79
4,261.00	13.08	43.92	4,204.08	343.07	372.46	-342.16	2.57
4,356.00	14.86	43.15	4,296.27	359.71	388.25	-358.76	1.88
4,451.00	15.66	44.67	4,387.92	377.71	405.59	-376.72	0.94
4,545.00	14.12	43.88	4,478.76	395.00	422.46	-393.97	1.65

**Design Report for HIGHWAY 160 16C-2HZ - Actual Field Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
4,640.00	13.82	44.27	4,570.95	411.48	438.41	-410.41	0.33
4,736.00	15.26	46.99	4,663.87	428.31	455.66	-427.19	1.66
4,831.00	13.54	43.46	4,755.89	444.91	472.45	-443.75	2.03
4,926.00	14.40	44.72	4,848.08	461.37	488.41	-460.18	0.96
5,021.00	15.13	43.37	4,939.94	478.78	505.24	-477.54	0.85
5,116.00	13.85	42.15	5,031.92	496.22	521.38	-494.95	1.39
5,211.00	13.75	43.32	5,124.17	512.87	536.76	-511.56	0.31
5,306.00	14.57	47.00	5,216.29	529.23	553.24	-527.88	1.28
5,401.00	13.08	47.04	5,308.53	544.71	569.85	-543.31	1.57
5,496.00	14.22	46.16	5,400.85	560.12	586.13	-558.68	1.22
5,592.00	15.33	47.74	5,493.67	576.82	604.03	-575.34	1.23
5,687.00	12.20	46.85	5,585.94	592.13	620.65	-590.61	3.30
5,782.00	14.01	51.99	5,678.46	606.08	637.04	-604.52	2.26
5,877.00	15.75	50.30	5,770.27	621.40	656.02	-619.79	1.89
5,972.00	12.97	46.54	5,862.30	636.97	673.68	-635.32	3.09
6,067.00	13.23	47.84	5,954.82	651.60	689.48	-649.91	0.41
6,162.00	13.20	48.11	6,047.31	666.14	705.61	-664.41	0.07
6,257.00	10.10	42.50	6,140.34	679.53	719.32	-677.77	3.47
6,353.00	8.79	40.59	6,235.04	691.30	729.78	-689.52	1.40
6,448.00	8.15	41.28	6,329.00	701.88	738.94	-700.07	0.68
6,543.00	7.13	43.47	6,423.16	711.22	747.44	-709.39	1.12
6,638.00	5.21	55.96	6,517.61	717.91	755.07	-716.06	2.45
6,733.00	3.67	73.57	6,612.32	721.18	761.56	-719.32	2.15
6,828.00	1.63	65.33	6,707.22	722.61	765.71	-720.74	2.18
6,923.00	0.33	30.32	6,802.20	723.41	767.08	-721.53	1.45
7,018.00	0.40	8.48	6,897.20	723.97	767.26	-722.10	0.16
7,066.00	0.57	174.79	6,945.20	723.90	767.31	-722.02	2.01
7,113.00	4.60	182.30	6,992.14	721.78	767.25	-719.91	8.59
7,161.00	8.94	181.00	7,039.80	716.13	767.11	-714.25	9.05
7,209.00	13.90	180.64	7,086.83	706.63	766.98	-704.75	10.33
7,257.00	18.83	177.08	7,132.87	693.12	767.31	-691.24	10.48
7,304.00	22.73	175.48	7,176.81	676.49	768.42	-674.61	8.38
7,352.00	27.45	174.85	7,220.27	656.21	770.14	-654.33	9.85
7,399.00	33.35	175.88	7,260.79	632.51	772.04	-630.63	12.60
7,447.00	37.77	176.90	7,299.83	604.66	773.79	-602.77	9.29
7,494.00	43.01	176.02	7,335.61	574.28	775.68	-572.38	11.21
7,542.00	47.21	176.10	7,369.48	540.36	778.01	-538.46	8.75
7,589.00	51.35	177.62	7,400.14	504.80	779.95	-502.89	9.14
7,637.00	57.76	178.50	7,427.96	465.74	781.26	-463.83	13.44
7,684.00	61.86	180.16	7,451.59	425.13	781.72	-423.22	9.24
7,732.00	65.98	180.99	7,472.69	382.03	781.29	-380.12	8.72
7,779.00	68.58	180.75	7,490.84	338.68	780.63	-336.77	5.55
7,827.00	72.04	181.47	7,507.01	293.50	779.75	-291.60	7.35
7,874.00	75.39	180.88	7,520.19	248.41	778.83	-246.50	7.23
7,922.00	78.30	180.79	7,531.11	201.68	778.15	-199.77	6.07
7,969.00	81.90	180.77	7,539.19	155.39	777.52	-153.49	7.66
8,001.00	84.60	180.61	7,542.95	123.61	777.13	-121.72	8.45
8,038.30	87.83	180.68	7,545.41	86.40	776.71	-84.51	8.65
<b>7" Casing Set @ 8038.3' MD :: 7545.41' TVD</b>							
8,047.00	88.58	180.70	7,545.68	77.71	776.61	-75.81	8.65
8,129.00	91.42	180.18	7,545.68	-4.28	775.98	6.18	3.52

**Design Report for HIGHWAY 160 16C-2HZ - Actual Field Surveys**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
8,199.00	91.29	179.59	7,544.03	-74.26	776.12	76.16	0.86
8,295.00	91.02	178.82	7,542.09	-170.23	777.45	172.13	0.85
8,390.00	90.96	178.04	7,540.45	-265.18	780.05	267.09	0.82
8,484.00	90.96	180.02	7,538.88	-359.15	781.64	361.06	2.11
8,579.00	88.61	179.69	7,539.23	-454.14	781.88	456.05	2.50
8,675.00	89.63	180.55	7,540.71	-550.13	781.68	552.04	1.39
8,770.00	89.44	180.09	7,541.48	-645.12	781.15	647.03	0.52
8,865.00	89.88	179.99	7,542.04	-740.12	781.09	742.03	0.47
8,960.00	90.25	179.07	7,541.94	-835.12	781.87	837.02	1.04
9,055.00	90.37	177.30	7,541.42	-930.06	784.87	931.98	1.87
9,150.00	89.81	178.02	7,541.27	-1,024.98	788.75	1,026.91	0.96
9,246.00	89.66	180.06	7,541.72	-1,120.96	790.36	1,122.89	2.13
9,341.00	89.78	182.13	7,542.18	-1,215.94	788.55	1,217.86	2.18
9,436.00	89.72	181.06	7,542.60	-1,310.90	785.90	1,312.82	1.13
9,531.00	89.63	179.55	7,543.13	-1,405.90	785.40	1,407.81	1.59
9,627.00	90.15	180.46	7,543.32	-1,501.89	785.39	1,503.81	1.09
9,722.00	91.14	181.32	7,542.25	-1,596.87	783.91	1,598.78	1.38
9,817.00	91.36	180.50	7,540.18	-1,691.84	782.40	1,693.75	0.89
9,912.00	90.52	181.26	7,538.62	-1,786.81	780.95	1,788.72	1.19
10,007.00	90.40	180.98	7,537.86	-1,881.79	779.09	1,883.69	0.32
10,102.00	90.06	180.47	7,537.47	-1,976.78	777.89	1,978.68	0.65
10,197.00	89.82	179.91	7,537.57	-2,071.78	777.57	2,073.68	0.64
10,388.00	90.31	178.68	7,537.36	-2,262.76	779.92	2,264.66	0.69
10,483.00	89.85	179.19	7,537.22	-2,357.75	781.69	2,359.65	0.72
10,578.00	89.97	178.37	7,537.37	-2,452.72	783.71	2,454.63	0.87
10,673.00	89.72	179.13	7,537.63	-2,547.70	785.78	2,549.61	0.84
10,768.00	90.12	179.04	7,537.76	-2,642.69	787.30	2,644.60	0.43
10,863.00	90.18	178.18	7,537.51	-2,737.66	789.60	2,739.58	0.91
10,959.00	90.86	178.98	7,536.64	-2,833.62	791.98	2,835.55	1.09
11,054.00	89.91	178.86	7,536.00	-2,928.60	793.77	2,930.53	1.01
11,149.00	88.83	179.20	7,537.05	-3,023.58	795.38	3,025.52	1.19
11,244.00	88.98	180.29	7,538.86	-3,118.56	795.80	3,120.50	1.16
11,434.00	88.98	180.31	7,542.25	-3,308.53	794.81	3,310.46	0.01
11,529.00	88.09	180.24	7,544.68	-3,403.50	794.35	3,405.43	0.94
11,624.00	88.33	179.96	7,547.64	-3,498.45	794.19	3,500.38	0.39
11,720.00	87.47	179.29	7,551.16	-3,594.38	794.82	3,596.31	1.14
11,815.00	87.72	179.29	7,555.15	-3,689.29	795.99	3,691.23	0.26
11,910.00	87.41	179.76	7,559.18	-3,784.20	796.78	3,786.14	0.59
12,005.00	89.23	179.58	7,561.97	-3,879.16	797.33	3,881.09	1.93
12,100.00	90.52	180.48	7,562.18	-3,974.15	797.28	3,976.09	1.66
12,195.00	90.52	179.61	7,561.31	-4,069.15	797.20	4,071.08	0.92
12,290.00	90.65	178.94	7,560.34	-4,164.13	798.40	4,166.07	0.72
12,385.00	90.71	179.89	7,559.22	-4,259.12	799.37	4,261.06	1.00
12,480.00	90.89	179.16	7,557.89	-4,354.11	800.16	4,356.05	0.79
12,575.00	90.92	178.49	7,556.39	-4,449.08	802.11	4,451.02	0.71
12,618.00	91.11	178.10	7,555.63	-4,492.05	803.39	4,494.00	1.01
<b>Final MWD Survey @ 12618.00ft</b>							
12,663.00	91.11	178.10	7,554.76	-4,537.02	804.88	4,538.97	0.00
<b>Str Proj. to Bit @ 12663'MD :: 7554.76' TVD</b>							

## Design Report for HIGHWAY 160 16C-2HZ - Actual Field Surveys

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
1,133.00	1,132.98	5.36	-1.64	Tie-On to Gyro Surveys @ 1133.00ft
1,287.00	1,286.98	5.64	-1.47	First MWD Survey @ 1287.00ft
12,618.00	7,555.63	-4,492.05	803.39	Final MWD Survey @ 12618.00ft
12,663.00	7,554.76	-4,537.02	804.88	Str Proj. to Bit @ 12663'MD :: 7554.76' TVD

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/_S (usft)	+E/-W (usft)	
User	No Target (Freehand)	179.86	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
13.00	1,133.00	MS Energy Gyros	NS-GYRO-MS
1,287.00	8,001.00	MWD Vertical/Build Surveys	MWD+IFR1+SC
8,047.00	12,618.00	MWD Lateral Surveys	MWD+IFR1+SC

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,241.80	1,241.78	9 5/8" Casing Set @ 1241.8' MD :: 1241.78' TVD	9-5/8	13-1/2
8,038.30	7,545.41	7" Casing Set @ 8038.3' MD :: 7545.41' TVD	7	8-3/4

**Design Report for HIGHWAY 160 16C-2HZ - 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
HIGHWAY 160 16C-2H	0.00	0.00	0.00	0.00	0.00	1,274,944.42	3,212,559.26	40° 5' 8.210 N	104° 44' 25.127 W
- actual wellpath hits target center									
- Polygon									
Point 1				0.00	606.75	-3,753.90	1,275,518.97	3,208,800.44	
Point 2				0.00	627.68	-1,110.68	1,275,562.54	3,211,443.29	
Point 3				0.00	648.54	1,532.39	1,275,606.04	3,214,085.98	
Point 4				0.00	-1,923.60	1,532.00	1,273,034.09	3,214,107.62	
Point 5				0.00	-3,232.60	1,530.22	1,271,725.18	3,214,117.05	
Point 6				0.00	-4,540.99	1,528.17	1,270,416.87	3,214,126.21	
Point 7				0.00	-4,538.64	208.53	1,270,407.91	3,212,806.65	
Point 8				0.00	-4,535.89	-1,110.91	1,270,399.36	3,211,487.29	
Point 9				0.00	-4,533.41	-2,430.37	1,270,390.53	3,210,167.91	
Point 10				0.00	-4,530.83	-3,749.72	1,270,381.81	3,208,848.64	
Point 11				0.00	-1,925.60	-3,734.42	1,272,986.98	3,208,841.62	
Point 12				0.00	606.75	-3,753.90	1,275,518.97	3,208,800.44	
HIGHWAY 160 16C-2H	0.00	0.00	0.00	0.00	0.00	1,274,944.42	3,212,559.26	40° 5' 8.210 N	104° 44' 25.127 W
- actual wellpath hits target center									
- Point									
HIGHWAY 160 16C-2H	0.00	0.00	0.00	0.00	0.00	1,274,944.42	3,212,559.26	40° 5' 8.210 N	104° 44' 25.127 W
- actual wellpath hits target center									
- Polygon									
Point 1				0.00	181.71	670.94	1,275,131.87	3,213,228.59	
Point 2				0.00	184.88	1,072.31	1,275,138.47	3,213,629.90	
Point 3				0.00	-3,232.21	1,070.19	1,271,721.62	3,213,657.06	
Point 4				0.00	-5,000.18	1,066.91	1,269,953.76	3,213,668.92	
Point 5				0.00	-4,999.47	667.05	1,269,951.04	3,213,269.09	
Point 6				0.00	-1,924.03	671.21	1,273,026.29	3,213,246.90	
Point 7				0.00	181.71	670.94	1,275,131.87	3,213,228.59	
HIGHWAY 160 16C-2H	0.00	0.00	7,560.00	-4,538.68	788.25	1,270,412.84	3,213,386.33	40° 4' 23.358 N	104° 44' 14.987 W
- actual wellpath misses target center by 17.52usft at 12663.00usft MD (7554.76 TVD, -4537.02 N, 804.88 E)									
- Point									

**Directional Difficulty Index**

Average Dogleg over Survey:	1.75 °/100usft	Maximum Dogleg over Survey:	13.44 °/100usft at 7,637.00 usft
Net Tortousity applicable to Plans:	0.36 °/100usft	Directional Difficulty Index:	6.372

**Audit Info**

**North Reference Sheet for Sec. 2-T1N-R66W - HIGHWAY 160 16C-2HZ - Plan B**

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

Vertical Depths are relative to RKB = 13' @ 5115.00usft (Ensign 132). Northing and Easting are relative to HIGHWAY 160 16C-2HZ

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: 0.99996098

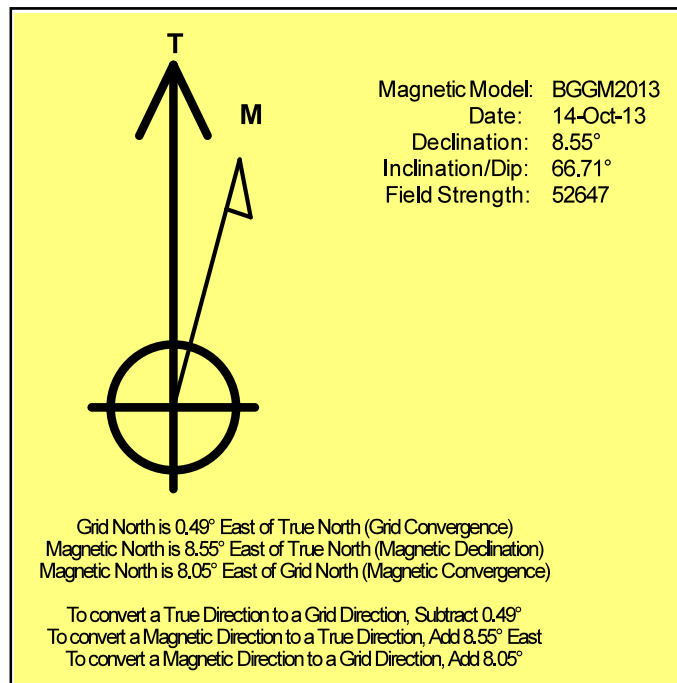
Grid Coordinates of Well: 1,274,944.42 usft N, 3,212,559.26 usft E

Geographical Coordinates of Well: 40° 05' 08.21" N, 104° 44' 25.13" W

Grid Convergence at Surface is: 0.49°

Based upon Minimum Curvature type calculations, at a Measured Depth of 12,663.00usft  
the Bottom Hole Displacement is 4,607.86usft in the Direction of 169.94° ( True).

Magnetic Convergence at surface is: -8.05° (14 October 2013, , BGGM2013)





# Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 2-T1N-R66W

HIGHWAY 160 16C-2HZ

Plan B

Design: Actual Field Surveys

## Sperry Drilling Services

### Geodetic Report

04 December, 2013

Well Coordinates: 1,274,944.42 N, 3,212,559.26 E (40° 05' 08.21" N, 104° 44' 25.13" W)

Ground Level: 5,102.00 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 HIGHWAY 160 16C-2HZ

RKB = 13' @ 5115.00usft (Ensign 132)

N

True

Dec-Deg - API - US Survey Feet - Custom

**HALLIBURTON**

## Design Report for HIGHWAY 160 16C-2HZ - 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	40.085614	-104.740313	1,274,944.42	3,212,559.26
13.00	0.00	0.00	13.00	0.00	0.00	40.085614	-104.740313	1,274,944.42	3,212,559.26
113.00	0.39	292.35	113.00	0.13	-0.31	40.085614	-104.740314	1,274,944.55	3,212,558.94
213.00	0.35	307.89	213.00	0.45	-0.87	40.085615	-104.740316	1,274,944.86	3,212,558.38
313.00	0.38	314.97	313.00	0.87	-1.35	40.085616	-104.740318	1,274,945.28	3,212,557.90
413.00	0.48	332.40	412.99	1.47	-1.77	40.085618	-104.740320	1,274,945.88	3,212,557.47
513.00	0.32	1.90	512.99	2.12	-1.96	40.085620	-104.740320	1,274,946.53	3,212,557.28
613.00	0.24	7.63	612.99	2.61	-1.92	40.085621	-104.740320	1,274,947.02	3,212,557.31
713.00	0.53	13.91	712.99	3.27	-1.78	40.085623	-104.740320	1,274,947.67	3,212,557.45
813.00	0.21	345.00	812.98	3.89	-1.72	40.085625	-104.740319	1,274,948.30	3,212,557.50
913.00	0.25	359.77	912.98	4.29	-1.77	40.085626	-104.740320	1,274,948.69	3,212,557.45
1,013.00	0.32	8.85	1,012.98	4.78	-1.73	40.085627	-104.740319	1,274,949.19	3,212,557.49
1,113.00	0.25	4.30	1,112.98	5.28	-1.67	40.085629	-104.740319	1,274,949.68	3,212,557.55
1,133.00	0.28	27.19	1,132.98	5.36	-1.64	40.085629	-104.740319	1,274,949.77	3,212,557.57
1,241.80	0.06	41.51	1,241.78	5.64	-1.48	40.085630	-104.740319	1,274,950.05	3,212,557.73
1,287.00	0.04	175.53	1,286.98	5.64	-1.47	40.085630	-104.740319	1,274,950.05	3,212,557.74
1,660.00	0.30	275.63	1,659.98	5.61	-2.43	40.085629	-104.740322	1,274,950.01	3,212,556.78
1,843.00	0.93	45.61	1,842.97	6.70	-1.84	40.085632	-104.740320	1,274,951.10	3,212,557.36
1,934.00	3.77	46.59	1,933.89	9.27	0.86	40.085640	-104.740310	1,274,953.70	3,212,560.04
2,026.00	5.42	47.99	2,025.59	14.26	6.29	40.085653	-104.740291	1,274,958.73	3,212,565.42
2,118.00	7.14	48.84	2,117.03	20.93	13.82	40.085672	-104.740264	1,274,965.47	3,212,572.90
2,210.00	8.42	43.03	2,208.18	29.61	22.72	40.085695	-104.740232	1,274,974.23	3,212,581.72
2,302.00	10.06	44.39	2,298.99	40.28	32.94	40.085725	-104.740196	1,274,984.98	3,212,591.85
2,393.00	11.51	46.96	2,388.38	52.16	45.13	40.085757	-104.740152	1,274,996.96	3,212,603.94
2,484.00	12.69	46.63	2,477.35	65.22	59.04	40.085793	-104.740102	1,275,010.14	3,212,617.73
2,576.00	13.69	46.49	2,566.93	79.65	74.28	40.085833	-104.740048	1,275,024.71	3,212,632.85
2,668.00	11.98	46.24	2,656.62	93.75	89.07	40.085871	-104.739995	1,275,038.93	3,212,647.52
2,759.00	13.80	50.56	2,745.33	107.18	104.28	40.085908	-104.739941	1,275,052.49	3,212,662.61
2,851.00	12.22	48.33	2,834.97	120.63	120.02	40.085945	-104.739884	1,275,066.07	3,212,678.24
2,943.00	12.85	51.27	2,924.77	133.50	135.28	40.085981	-104.739830	1,275,079.07	3,212,693.38
3,035.00	14.26	51.18	3,014.21	147.01	152.09	40.086018	-104.739770	1,275,092.72	3,212,710.08
3,126.00	12.48	50.67	3,102.74	160.26	168.43	40.086054	-104.739711	1,275,106.12	3,212,726.30
3,218.00	14.10	49.93	3,192.27	173.78	184.69	40.086091	-104.739653	1,275,119.77	3,212,742.45
3,310.00	14.83	49.53	3,281.35	188.63	202.23	40.086132	-104.739591	1,275,134.77	3,212,759.85
3,405.00	13.52	47.78	3,373.46	203.99	219.70	40.086174	-104.739528	1,275,150.28	3,212,777.19
3,500.00	14.80	48.60	3,465.57	219.48	237.03	40.086217	-104.739466	1,275,165.91	3,212,794.39
3,595.00	12.74	45.19	3,557.84	234.88	253.56	40.086259	-104.739407	1,275,181.46	3,212,810.79
3,691.00	14.14	51.49	3,651.21	249.65	270.25	40.086299	-104.739347	1,275,196.37	3,212,827.35
3,786.00	13.48	48.12	3,743.47	264.26	287.57	40.086339	-104.739286	1,275,211.13	3,212,844.54
3,881.00	13.00	44.49	3,835.94	279.28	303.30	40.086381	-104.739229	1,275,226.28	3,212,860.15
3,976.00	14.39	48.83	3,928.24	294.67	319.68	40.086423	-104.739171	1,275,241.81	3,212,876.39
4,071.00	14.60	48.13	4,020.22	310.44	337.48	40.086466	-104.739107	1,275,257.73	3,212,894.06

## Design Report for HIGHWAY 160 16C-2HZ - 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)
4,166.00	15.34	47.74	4,111.99	326.88	355.70	40.086511	-104.739042	1,275,274.32	3,212,912.13
4,261.00	13.08	43.92	4,204.08	343.07	372.46	40.086556	-104.738982	1,275,290.66	3,212,928.75
4,356.00	14.86	43.15	4,296.27	359.71	388.25	40.086601	-104.738926	1,275,307.43	3,212,944.39
4,451.00	15.66	44.67	4,387.92	377.71	405.59	40.086651	-104.738864	1,275,325.58	3,212,961.58
4,545.00	14.12	43.88	4,478.76	395.00	422.46	40.086698	-104.738803	1,275,343.01	3,212,978.30
4,640.00	13.82	44.27	4,570.95	411.48	438.41	40.086744	-104.738746	1,275,359.62	3,212,994.11
4,736.00	15.26	46.99	4,663.87	428.31	455.66	40.086790	-104.738685	1,275,376.60	3,213,011.21
4,831.00	13.54	43.46	4,755.89	444.91	472.45	40.086835	-104.738625	1,275,393.34	3,213,027.86
4,926.00	14.40	44.72	4,848.08	461.37	488.41	40.086881	-104.738568	1,275,409.95	3,213,043.68
5,021.00	15.13	43.37	4,939.94	478.78	505.24	40.086928	-104.738508	1,275,427.49	3,213,060.35
5,116.00	13.85	42.15	5,031.92	496.22	521.38	40.086976	-104.738450	1,275,445.07	3,213,076.35
5,211.00	13.75	43.32	5,124.17	512.87	536.76	40.087022	-104.738395	1,275,461.85	3,213,091.58
5,306.00	14.57	47.00	5,216.29	529.23	553.24	40.087067	-104.738336	1,275,478.35	3,213,107.93
5,401.00	13.08	47.04	5,308.53	544.71	569.85	40.087109	-104.738277	1,275,493.97	3,213,124.40
5,496.00	14.22	46.16	5,400.85	560.12	586.13	40.087152	-104.738218	1,275,509.52	3,213,140.55
5,592.00	15.33	47.74	5,493.67	576.82	604.03	40.087197	-104.738155	1,275,526.37	3,213,158.30
5,687.00	12.20	46.85	5,585.94	592.13	620.65	40.087239	-104.738095	1,275,541.83	3,213,174.79
5,782.00	14.01	51.99	5,678.46	606.08	637.04	40.087278	-104.738037	1,275,555.91	3,213,191.06
5,877.00	15.75	50.30	5,770.27	621.40	656.02	40.087320	-104.737969	1,275,571.39	3,213,209.91
5,972.00	12.97	46.54	5,862.30	636.97	673.68	40.087363	-104.737906	1,275,587.12	3,213,227.43
6,067.00	13.23	47.84	5,954.82	651.60	689.48	40.087403	-104.737849	1,275,601.88	3,213,243.10
6,162.00	13.20	48.11	6,047.31	666.14	705.61	40.087443	-104.737791	1,275,616.56	3,213,259.11
6,257.00	10.10	42.50	6,140.34	679.53	719.32	40.087479	-104.737742	1,275,630.06	3,213,272.70
6,353.00	8.79	40.59	6,235.04	691.30	729.78	40.087512	-104.737705	1,275,641.93	3,213,283.06
6,448.00	8.15	41.28	6,329.00	701.88	738.94	40.087541	-104.737672	1,275,652.58	3,213,292.13
6,543.00	7.13	43.47	6,423.16	711.22	747.44	40.087566	-104.737642	1,275,661.99	3,213,300.55
6,638.00	5.21	55.96	6,517.61	717.91	755.07	40.087585	-104.737615	1,275,668.75	3,213,308.12
6,733.00	3.67	73.57	6,612.32	721.18	761.56	40.087594	-104.737591	1,275,672.08	3,213,314.59
6,828.00	1.63	65.33	6,707.22	722.61	765.71	40.087598	-104.737577	1,275,673.54	3,213,318.72
6,923.00	0.33	30.32	6,802.20	723.41	767.08	40.087600	-104.737572	1,275,674.35	3,213,320.08
7,018.00	0.40	8.48	6,897.20	723.97	767.26	40.087601	-104.737571	1,275,674.91	3,213,320.26
7,066.00	0.57	174.79	6,945.20	723.90	767.31	40.087601	-104.737571	1,275,674.84	3,213,320.31
7,113.00	4.60	182.30	6,992.14	721.78	767.25	40.087595	-104.737571	1,275,672.72	3,213,320.27
7,161.00	8.94	181.00	7,039.80	716.13	767.11	40.087580	-104.737572	1,275,667.07	3,213,320.18
7,209.00	13.90	180.64	7,086.83	706.63	766.98	40.087554	-104.737572	1,275,657.57	3,213,320.13
7,257.00	18.83	177.08	7,132.87	693.12	767.31	40.087517	-104.737571	1,275,644.06	3,213,320.58
7,304.00	22.73	175.48	7,176.81	676.49	768.42	40.087471	-104.737567	1,275,627.44	3,213,321.82
7,352.00	27.45	174.85	7,220.27	656.21	770.14	40.087415	-104.737561	1,275,607.18	3,213,323.72
7,399.00	33.35	175.88	7,260.79	632.51	772.04	40.087350	-104.737554	1,275,583.50	3,213,325.82
7,447.00	37.77	176.90	7,299.83	604.66	773.79	40.087274	-104.737548	1,275,555.67	3,213,327.81
7,494.00	43.01	176.02	7,335.61	574.28	775.68	40.087190	-104.737541	1,275,525.30	3,213,329.96
7,542.00	47.21	176.10	7,369.48	540.36	778.01	40.087097	-104.737533	1,275,491.40	3,213,332.58

## Design Report for HIGHWAY 160 16C-2HZ - 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)
7,589.00	51.35	177.62	7,400.14	504.80	779.95	40.087000	-104.737526	1,275,455.86	3,213,334.82
7,637.00	57.76	178.50	7,427.96	465.74	781.26	40.086893	-104.737521	1,275,416.82	3,213,336.47
7,684.00	61.86	180.16	7,451.59	425.13	781.72	40.086781	-104.737519	1,275,376.21	3,213,337.28
7,732.00	65.98	180.99	7,472.69	382.03	781.29	40.086663	-104.737521	1,275,333.11	3,213,337.21
7,779.00	68.58	180.75	7,490.84	338.68	780.63	40.086544	-104.737523	1,275,289.77	3,213,336.93
7,827.00	72.04	181.47	7,507.01	293.50	779.75	40.086420	-104.737527	1,275,244.58	3,213,336.43
7,874.00	75.39	180.88	7,520.19	248.41	778.83	40.086296	-104.737530	1,275,199.48	3,213,335.90
7,922.00	78.30	180.79	7,531.11	201.68	778.15	40.086168	-104.737532	1,275,152.75	3,213,335.62
7,969.00	81.90	180.77	7,539.19	155.39	777.52	40.086041	-104.737535	1,275,106.46	3,213,335.38
8,001.00	84.60	180.61	7,542.95	123.61	777.13	40.085953	-104.737536	1,275,074.68	3,213,335.27
8,038.30	87.83	180.68	7,545.41	86.40	776.71	40.085851	-104.737537	1,275,037.47	3,213,335.17
8,047.00	88.58	180.70	7,545.68	77.71	776.61	40.085827	-104.737538	1,275,028.78	3,213,335.14
8,129.00	91.42	180.18	7,545.68	-4.28	775.98	40.085602	-104.737540	1,274,946.79	3,213,335.21
8,199.00	91.29	179.59	7,544.03	-74.26	776.12	40.085410	-104.737540	1,274,876.82	3,213,335.95
8,295.00	91.02	178.82	7,542.09	-170.23	777.45	40.085147	-104.737535	1,274,780.86	3,213,338.11
8,390.00	90.96	178.04	7,540.45	-265.18	780.05	40.084886	-104.737526	1,274,685.94	3,213,341.52
8,484.00	90.96	180.02	7,538.88	-359.15	781.64	40.084628	-104.737520	1,274,592.00	3,213,343.92
8,579.00	88.61	179.69	7,539.23	-454.14	781.88	40.084367	-104.737519	1,274,497.01	3,213,344.97
8,675.00	89.63	180.55	7,540.71	-550.13	781.68	40.084104	-104.737520	1,274,401.03	3,213,345.60
8,770.00	89.44	180.09	7,541.48	-645.12	781.15	40.083843	-104.737522	1,274,306.04	3,213,345.88
8,865.00	89.88	179.99	7,542.04	-740.12	781.09	40.083582	-104.737522	1,274,211.05	3,213,346.63
8,960.00	90.25	179.07	7,541.94	-835.12	781.87	40.083322	-104.737519	1,274,116.07	3,213,348.22
9,055.00	90.37	177.30	7,541.42	-930.06	784.87	40.083061	-104.737508	1,274,021.15	3,213,352.04
9,150.00	89.81	178.02	7,541.27	-1,024.98	788.75	40.082800	-104.737495	1,273,926.27	3,213,356.73
9,246.00	89.66	180.06	7,541.72	-1,120.96	790.36	40.082537	-104.737489	1,273,830.31	3,213,359.16
9,341.00	89.78	182.13	7,542.18	-1,215.94	788.55	40.082276	-104.737495	1,273,735.33	3,213,358.16
9,436.00	89.72	181.06	7,542.60	-1,310.90	785.90	40.082016	-104.737505	1,273,640.35	3,213,356.33
9,531.00	89.63	179.55	7,543.13	-1,405.90	785.40	40.081755	-104.737507	1,273,545.36	3,213,356.64
9,627.00	90.15	180.46	7,543.32	-1,501.89	785.39	40.081491	-104.737507	1,273,449.37	3,213,357.45
9,722.00	91.14	181.32	7,542.25	-1,596.87	783.91	40.081231	-104.737512	1,273,354.38	3,213,356.79
9,817.00	91.36	180.50	7,540.18	-1,691.84	782.40	40.080970	-104.737517	1,273,259.41	3,213,356.10
9,912.00	90.52	181.26	7,538.62	-1,786.81	780.95	40.080709	-104.737523	1,273,164.43	3,213,355.45
10,007.00	90.40	180.98	7,537.86	-1,881.79	779.09	40.080448	-104.737529	1,273,069.45	3,213,354.41
10,102.00	90.06	180.47	7,537.47	-1,976.78	777.89	40.080188	-104.737533	1,272,974.45	3,213,354.02
10,197.00	89.82	179.91	7,537.57	-2,071.78	777.57	40.079927	-104.737535	1,272,879.46	3,213,354.52
10,388.00	90.31	178.68	7,537.36	-2,262.76	779.92	40.079403	-104.737526	1,272,688.51	3,213,358.50
10,483.00	89.85	179.19	7,537.22	-2,357.75	781.69	40.079142	-104.737520	1,272,593.55	3,213,361.08
10,578.00	89.97	178.37	7,537.37	-2,452.72	783.71	40.078881	-104.737513	1,272,498.60	3,213,363.92
10,673.00	89.72	179.13	7,537.63	-2,547.70	785.78	40.078620	-104.737505	1,272,403.65	3,213,366.81
10,768.00	90.12	179.04	7,537.76	-2,642.69	787.30	40.078360	-104.737500	1,272,308.68	3,213,369.14
10,863.00	90.18	178.18	7,537.51	-2,737.66	789.60	40.078099	-104.737492	1,272,213.74	3,213,372.25
10,959.00	90.86	178.98	7,536.64	-2,833.62	791.98	40.077836	-104.737483	1,272,117.80	3,213,375.46

**Design Report for HIGHWAY 160 16C-2HZ - 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)
11,054.00	89.91	178.86	7,536.00	-2,928.60	793.77	40.077575	-104.737477	1,272,022.84	3,213,378.06
11,149.00	88.83	179.20	7,537.05	-3,023.58	795.38	40.077314	-104.737471	1,271,927.88	3,213,380.48
11,244.00	88.98	180.29	7,538.86	-3,118.56	795.80	40.077053	-104.737470	1,271,832.91	3,213,381.72
11,434.00	88.98	180.31	7,542.25	-3,308.53	794.81	40.076532	-104.737473	1,271,642.95	3,213,382.35
11,529.00	88.09	180.24	7,544.68	-3,403.50	794.35	40.076271	-104.737475	1,271,547.99	3,213,382.71
11,624.00	88.33	179.96	7,547.64	-3,498.45	794.19	40.076011	-104.737475	1,271,453.04	3,213,383.36
11,720.00	87.47	179.29	7,551.16	-3,594.38	794.82	40.075747	-104.737473	1,271,357.12	3,213,384.81
11,815.00	87.72	179.29	7,555.15	-3,689.29	795.99	40.075487	-104.737469	1,271,262.23	3,213,386.79
11,910.00	87.41	179.76	7,559.18	-3,784.20	796.78	40.075226	-104.737466	1,271,167.33	3,213,388.39
12,005.00	89.23	179.58	7,561.97	-3,879.16	797.33	40.074966	-104.737464	1,271,072.39	3,213,389.75
12,100.00	90.52	180.48	7,562.18	-3,974.15	797.28	40.074705	-104.737464	1,270,977.40	3,213,390.52
12,195.00	90.52	179.61	7,561.31	-4,069.15	797.20	40.074444	-104.737465	1,270,882.41	3,213,391.26
12,290.00	90.65	178.94	7,560.34	-4,164.13	798.40	40.074183	-104.737460	1,270,787.44	3,213,393.27
12,385.00	90.71	179.89	7,559.22	-4,259.12	799.37	40.073923	-104.737457	1,270,692.47	3,213,395.06
12,480.00	90.89	179.16	7,557.89	-4,354.11	800.16	40.073662	-104.737454	1,270,597.50	3,213,396.66
12,575.00	90.92	178.49	7,556.39	-4,449.08	802.11	40.073401	-104.737447	1,270,502.55	3,213,399.42
12,618.00	91.11	178.10	7,555.63	-4,492.05	803.39	40.073283	-104.737443	1,270,459.59	3,213,401.07
12,663.00	91.11	178.10	7,554.76	-4,537.02	804.88	40.073160	-104.737437	1,270,414.64	3,213,402.94

**Design Annotations**

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
1,133.00	1,132.98	5.36	-1.64	Tie-On to Gyro Surveys @ 1133.00ft
1,287.00	1,286.98	5.64	-1.47	First MWD Survey @ 1287.00ft
12,618.00	7,555.63	-4,492.05	803.39	Final MWD Survey @ 12618.00ft
12,663.00	7,554.76	-4,537.02	804.88	Str Proj. to Bit @ 12663'MD :: 7554.76' TVD

**Vertical Section Information**

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/-S (usft)	Origin +E/-W (usft)	Start TVD (usft)
User	No Target (Freehand)	179.86	Slot	0.00	0.00	0.00

**Survey tool program**

From (usft)	To (usft)	Survey/Plan	Survey Tool
13.00	1,133.00	MS Energy Gyros	NS-GYRO-MS

**Design Report for HIGHWAY 160 16C-2HZ - Actual Field Surveys****Survey tool program**

From (usft)	To (usft)	Survey/Plan	Survey Tool
1,287.00	8,001.00	MWD Vertical/Build Surveys	MWD+HFR1+SC
8,047.00	12,618.00	MWD Lateral Surveys	MWD+HFR1+SC

**Casing Details**

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,241.80	1,241.78	9 5/8" Casing Set @ 1241.8' MD :: 1241.78' TVD	9-5/8	13-1/2
8,038.30	7,545.41	7" Casing Set @ 8038.3' MD :: 7545.41' 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:	1.75 °/100usft	Maximum Dogleg over Survey:	13.44 °/100usft at 7,637.00 usft
Net Tortosity applicable to Plans:	0.36 °/100usft	Directional Difficulty Index:	6.372

**Audit Info**

North Reference Sheet for Sec. 2-T1N-R66W - HIGHWAY 160 16C-2HZ - Plan B

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to True North Reference .  
Vertical Depths are relative to RKB = 13' @ 5115.00usft (Ensign 132). Northing and Easting are relative to HIGHWAY 160 16C-2HZ  
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: 0.99996098

Grid Coordinates of Well: 1,274,944.42 usft N, 3,212,559.26 usft E  
Geographical Coordinates of Well: 40° 05' 08.21" N, 104° 44' 25.13" W  
Grid Convergence at Surface is: 0.49°

Based upon Minimum Curvature type calculations, at a Measured Depth of 12,663.00usft  
the Bottom Hole Displacement is 4,607.86usft in the Direction of 169.94° ( True).  
Magnetic Convergence at surface is: -8.05° (14 October 2013, , BGGM2013)

