





Cathedral Energy Services

Survey Report

Company:	Anadarko Petroleum Corporation	Local Co-ordinate Reference:	Well USA Fed 2N-36HZ
Project:	DJ Wattenberg	TVD Reference:	KB=13' @ 5008.0ft (Ensign #123)
Site:	USA FED 3 Pad (S36-T3N-R66W)	MD Reference:	KB=13' @ 5008.0ft (Ensign #123)
Well:	USA Fed 2N-36HZ	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Project	DJ Wattenberg		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Northern Zone		

Site		USA FED 3 Pad (S36-T3N-R66W)			
Site Position:		Northing:	1,308,044.64 ft	Latitude:	40.176359
From:	Lat/Long	Easting:	3,217,159.19 ft	Longitude:	-104.722860
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence:	0.50 °

Well	USA Fed 2N-36HZ					
Well Position	+N/-S	0.0 ft	Northing:	1,308,044.62 ft	Latitude:	40.176359
	+E/-W	0.0 ft	Easting:	3,217,159.19 ft	Longitude:	-104.722860
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	4,995.0 ft

Wellbore	HZ				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	10/21/2013	8.51	66.80	52,769

Design	FINAL				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W	Direction	
	(ft)	(ft)	(ft)	(°)	
	0.0	0.0	0.0	354.34	

Survey Program	Date	11/14/2013			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
113.0	811.0	Survey #1 (HZ)	Gyro	Gyro	
980.0	11,764.0	Survey #2 (HZ)	MWD	Geolink MWD	

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Formations / Comments	
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00		
113.0	0.22	0.33	113.0	0.2	0.0	0.2	0.19	0.19		
213.0	0.38	309.14	213.0	0.6	-0.3	0.6	0.30	0.16		
313.0	0.40	254.14	313.0	0.7	-0.8	0.8	0.36	0.02		
413.0	0.38	255.60	413.0	0.6	-1.5	0.7	0.02	-0.02		
513.0	0.45	255.90	513.0	0.4	-2.2	0.6	0.07	0.07		
613.0	0.44	227.68	613.0	0.0	-2.9	0.3	0.22	-0.01		
713.0	0.33	261.11	713.0	-0.3	-3.4	0.1	0.25	-0.11		
811.0	0.16	26.67	811.0	-0.2	-3.7	0.2	0.45	-0.17		
980.0	0.40	199.00	980.0	-0.5	-3.7	-0.2	0.33	0.14		
1,073.0	2.50	225.30	1,073.0	-2.3	-5.3	-1.8	2.31	2.26		
1,167.0	5.60	211.70	1,166.7	-7.6	-9.2	-6.7	3.43	3.30		

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Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Formations / Comments
1,260.0	6.10	203.00	1,259.2	-16.0	-13.5	-14.6	1.09	0.54	
1,354.0	8.40	209.30	1,352.5	-26.6	-18.8	-24.6	2.59	2.45	
1,447.0	10.30	208.60	1,444.2	-39.8	-26.1	-37.1	2.05	2.04	
1,541.0	10.50	217.50	1,536.7	-54.0	-35.3	-50.3	1.72	0.21	
1,634.0	13.50	224.70	1,627.7	-68.5	-48.1	-63.4	3.60	3.23	
1,728.0	15.60	223.20	1,718.6	-85.5	-64.5	-78.7	2.27	2.23	
1,821.0	15.10	219.90	1,808.3	-103.9	-80.8	-95.4	1.08	-0.54	
1,911.0	14.00	216.00	1,895.4	-121.7	-94.7	-111.8	1.64	-1.22	
2,001.0	15.90	218.20	1,982.4	-140.2	-108.8	-128.8	2.20	2.11	
2,091.0	14.50	215.80	2,069.2	-159.0	-123.0	-146.1	1.71	-1.56	
2,181.0	14.80	217.20	2,156.3	-177.3	-136.5	-163.0	0.52	0.33	
2,271.0	15.60	227.60	2,243.2	-194.6	-152.4	-178.7	3.15	0.89	
2,361.0	13.50	225.80	2,330.3	-210.1	-168.9	-192.4	2.39	-2.33	
2,451.0	13.70	225.50	2,417.8	-224.9	-184.0	-205.7	0.24	0.22	
2,541.0	15.60	218.90	2,504.8	-241.8	-199.2	-221.0	2.81	2.11	
2,631.0	13.40	218.50	2,592.0	-259.4	-213.3	-237.1	2.45	-2.44	
2,722.0	12.40	217.20	2,680.7	-275.4	-225.8	-251.8	1.14	-1.10	
2,811.0	13.50	214.60	2,767.4	-291.6	-237.5	-266.8	1.40	1.24	
2,901.0	15.00	212.50	2,854.6	-310.1	-249.7	-283.9	1.76	1.67	
2,992.0	17.50	212.10	2,942.0	-331.6	-263.3	-304.0	2.75	2.75	
3,081.0	16.30	209.90	3,027.1	-353.7	-276.6	-324.8	1.53	-1.35	
3,172.0	17.30	213.90	3,114.3	-376.0	-290.5	-345.6	1.68	1.10	
3,262.0	16.30	211.90	3,200.4	-397.9	-304.7	-365.9	1.28	-1.11	
3,352.0	15.60	211.20	3,287.0	-418.9	-317.6	-385.6	0.81	-0.78	
3,442.0	15.80	214.60	3,373.6	-439.4	-330.8	-404.6	1.05	0.22	
3,532.0	15.80	217.20	3,460.2	-459.2	-345.2	-423.0	0.79	0.00	
3,622.0	12.70	215.90	3,547.4	-477.0	-358.4	-439.4	3.46	-3.44	
3,712.0	13.20	219.40	3,635.1	-493.0	-370.8	-454.0	1.03	0.56	
3,802.0	12.30	216.80	3,722.9	-508.6	-383.0	-468.3	1.19	-1.00	
3,892.0	12.40	215.70	3,810.8	-524.1	-394.4	-482.7	0.28	0.11	
3,982.0	11.30	207.50	3,898.9	-539.8	-404.1	-497.3	2.23	-1.22	
4,072.0	9.80	203.10	3,987.4	-554.6	-411.2	-511.4	1.89	-1.67	
4,162.0	8.20	213.10	4,076.3	-567.1	-417.7	-523.1	2.48	-1.78	
4,252.0	6.70	212.40	4,165.5	-576.9	-424.0	-532.3	1.67	-1.67	
4,342.0	4.00	232.40	4,255.1	-583.2	-429.3	-538.1	3.60	-3.00	
4,432.0	2.90	278.10	4,345.0	-584.8	-434.1	-539.2	3.18	-1.22	
4,522.0	1.80	321.10	4,434.9	-583.4	-437.2	-537.5	2.23	-1.22	
4,702.0	2.60	316.40	4,614.8	-578.2	-441.8	-531.9	0.46	0.44	
4,882.0	1.60	8.10	4,794.7	-572.8	-444.3	-526.2	1.13	-0.56	
5,062.0	2.30	325.10	4,974.6	-567.3	-446.0	-520.6	0.87	0.39	
5,242.0	2.60	308.90	5,154.4	-561.8	-451.2	-514.6	0.42	0.17	
5,422.0	1.90	292.80	5,334.3	-558.1	-457.1	-510.3	0.52	-0.39	
5,602.0	2.30	272.60	5,514.2	-556.8	-463.5	-508.4	0.46	0.22	
5,782.0	1.30	271.20	5,694.1	-556.6	-469.1	-507.6	0.56	-0.56	
5,963.0	1.20	257.40	5,875.0	-556.9	-473.0	-507.6	0.17	-0.06	
6,143.0	1.80	274.50	6,055.0	-557.1	-477.7	-507.3	0.41	0.33	
6,323.0	0.70	219.40	6,234.9	-557.8	-481.2	-507.6	0.84	-0.61	
6,503.0	0.50	213.90	6,414.9	-559.3	-482.4	-509.0	0.12	-0.11	
6,593.0	0.50	224.30	6,504.9	-559.9	-482.9	-509.5	0.10	0.00	
6,683.0	0.50	245.10	6,594.9	-560.3	-483.5	-509.9	0.20	0.00	
6,728.0	6.40	3.20	6,639.8	-557.9	-483.5	-507.5	14.78	13.11	
6,773.0	12.80	6.60	6,684.2	-550.4	-482.8	-500.2	14.27	14.22	
6,818.0	13.00	6.00	6,728.0	-540.4	-481.7	-490.3	0.53	0.44	

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Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Formations / Comments
6,863.0	15.60	3.40	6,771.6	-529.4	-480.8	-479.4	5.95	5.78	
6,908.0	22.50	6.30	6,814.1	-514.8	-479.5	-465.0	15.47	15.33	
6,953.0	26.80	4.70	6,855.0	-496.1	-477.7	-446.6	9.67	9.56	
6,998.0	32.60	4.60	6,894.1	-473.9	-475.9	-424.6	12.89	12.89	
7,043.0	32.60	2.40	6,932.0	-449.7	-474.4	-400.7	2.63	0.00	
7,088.0	35.50	4.20	6,969.3	-424.5	-473.0	-375.8	6.82	6.44	
7,133.0	40.30	5.50	7,004.8	-397.0	-470.6	-348.7	10.81	10.67	
7,178.0	42.50	4.70	7,038.5	-367.3	-468.0	-319.4	5.03	4.89	
7,223.0	46.10	4.10	7,070.7	-336.0	-465.6	-288.5	8.05	8.00	
7,268.0	50.20	3.70	7,100.8	-302.6	-463.3	-255.4	9.14	9.11	
7,313.0	56.40	3.50	7,127.6	-266.6	-461.0	-219.8	13.78	13.78	
7,358.0	61.30	3.30	7,150.9	-228.2	-458.8	-181.8	10.90	10.89	
7,403.0	65.20	3.80	7,171.2	-188.1	-456.3	-142.2	8.72	8.67	
7,448.0	69.20	3.70	7,188.6	-146.7	-453.6	-101.2	8.89	8.89	
7,493.0	73.10	4.00	7,203.1	-104.2	-450.7	-59.3	8.69	8.67	
7,538.0	76.00	3.50	7,215.1	-60.9	-447.9	-16.5	6.53	6.44	
7,583.0	78.00	2.60	7,225.2	-17.1	-445.5	26.9	4.85	4.44	
7,624.0	81.30	1.40	7,232.6	23.2	-444.1	66.8	8.55	8.05	
7,667.0	84.40	1.20	7,238.0	65.8	-443.2	109.2	7.22	7.21	
7,799.0	91.60	359.70	7,242.6	197.6	-442.1	240.3	5.57	5.45	
7,890.0	92.00	359.60	7,239.7	288.6	-442.7	330.8	0.45	0.44	
7,980.0	92.40	359.30	7,236.2	378.5	-443.6	420.4	0.56	0.44	
8,070.0	91.50	358.30	7,233.2	468.5	-445.4	510.1	1.49	-1.00	
8,160.0	90.50	357.70	7,231.6	558.4	-448.6	599.9	1.30	-1.11	
8,250.0	90.50	359.20	7,230.8	648.3	-451.0	689.6	1.67	0.00	
8,340.0	88.90	359.60	7,231.3	738.3	-452.0	779.3	1.83	-1.78	
8,520.0	90.60	2.40	7,232.1	918.3	-448.8	958.1	1.82	0.94	
8,700.0	90.10	2.60	7,231.0	1,098.1	-441.0	1,136.2	0.30	-0.28	
8,880.0	90.80	2.90	7,229.6	1,277.9	-432.3	1,314.3	0.42	0.39	
9,060.0	88.10	1.70	7,231.3	1,457.7	-425.1	1,492.5	1.64	-1.50	
9,240.0	88.00	359.20	7,237.4	1,637.6	-423.7	1,671.4	1.39	-0.06	
9,420.0	90.60	359.30	7,239.6	1,817.6	-426.0	1,850.7	1.45	1.44	
9,600.0	89.30	358.40	7,239.8	1,997.5	-429.7	2,030.1	0.88	-0.72	
9,780.0	89.00	359.50	7,242.5	2,177.5	-433.0	2,209.5	0.63	-0.17	
9,960.0	87.70	0.90	7,247.6	2,357.4	-432.3	2,388.5	1.06	-0.72	
10,140.0	88.80	1.80	7,253.1	2,537.2	-428.1	2,567.1	0.79	0.61	
10,321.0	89.40	2.00	7,256.0	2,718.1	-422.1	2,746.5	0.35	0.33	
10,501.0	90.90	1.10	7,255.5	2,898.0	-417.2	2,925.1	0.97	0.83	
10,681.0	90.20	0.90	7,253.8	3,078.0	-414.1	3,103.8	0.40	-0.39	
10,861.0	92.70	0.40	7,249.2	3,257.9	-412.0	3,282.7	1.42	1.39	
11,041.0	90.80	359.00	7,243.7	3,437.8	-413.0	3,461.8	1.31	-1.06	
11,221.0	90.80	355.90	7,241.2	3,617.6	-421.0	3,641.5	1.72	0.00	
11,401.0	88.40	356.30	7,242.5	3,797.2	-433.2	3,821.4	1.35	-1.33	
11,581.0	87.40	357.50	7,249.1	3,976.8	-443.0	4,001.1	0.87	-0.56	
11,709.0	87.60	358.70	7,254.6	4,104.6	-447.2	4,128.7	0.95	0.16	Last Cathedral Survey @ 11,709' MD
11,764.0	87.60	358.70	7,257.0	4,159.5	-448.4	4,183.5	0.00	0.00	Projection to Bit @ 11,764'

Cathedral Energy Services

Survey Report

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Site:	USA FED 3 Pad (S36-T3N-R66W)	MD Reference:	KB=13' @ 5008.0ft (Ensign #123)
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Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Targets									
Target Name	Dip Angle	Dip Dir.	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
- hit/miss target	(°)	(°)	(ft)	(ft)	(ft)	(ft)	(ft)		
- Shape									
USA Fed 2N-36HZ PBH	0.00	0.00	7,235.0	4,130.0	-409.1	1,312,174.63	3,216,750.10	40.187706	-104.724195
- actual wellpath misses target center by 49.8ft at 11709.0ft MD (7254.6 TVD, 4104.6 N, -447.2 E)									
- Point									
USA Fed 2N-36HZ VP	0.00	0.00	4,335.5	-569.5	-437.3	1,307,475.11	3,216,721.92	40.174806	-104.724443
- actual wellpath misses target center by 15.8ft at 4422.4ft MD (4335.4 TVD, -584.9 N, -433.6 E)									
- Point									

Casing Points					
Measured Depth	Vertical Depth	Name		Casing Diameter	Hole Diameter
(ft)	(ft)			(in)	(in)
7,723.0	7,241.9	7"		7.000	7.500

Design Annotations				
Measured Depth	Vertical Depth	Local Coordinates		Comment
(ft)	(ft)	+N/-S (ft)	+E/-W (ft)	
11,709.0	7,254.6	4,104.6	-447.2	Last Cathedral Survey @ 11,709' MD
11,764.0	7,257.0	4,159.5	-448.4	Projection to Bit @ 11,764'

Checked By: _____ Approved By: _____ Date: _____