



Cathedral Energy Services

Survey Report

Company:	Whiting Petroleum Corporation	Local Co-ordinate Reference:	Well Razor #27I-2213A
Project:	Weld County, CO	TVD Reference:	HZ @ 4773.3ft
Site:	S27-T10N-R58W	MD Reference:	HZ @ 4773.3ft
Well:	Razor #27I-2213A	North Reference:	True
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	HZ	Database:	USA EDM 5000 Multi Users DB

Project	Weld County, CO		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Northern Zone		

Site		S27-T10N-R58W			
Site Position:		Northing:	1,541,650.73 ft	Latitude:	40° 48' 30.938 N
From:	Lat/Long	Easting:	3,455,691.89 ft	Longitude:	103° 51' 13.799 W
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence:	1.06 °

Well	Razor #27I-2213A					
Well Position	+N/-S	0.0 ft	Northing:	1,541,816.42 ft	Latitude:	40° 48' 32.090 N
	+E/-W	0.0 ft	Easting:	3,458,329.13 ft	Longitude:	103° 50' 39.469 W
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	4,756.5 ft

Wellbore	HZ				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	11/16/2013	8.06	67.44	53,182

Design	HZ				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.0	0.0	0.0	328.48	

Survey Program	Date	11/26/2013			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
172.0	5,838.0	Survey #1 (HZ)	ISCWSA MWD	MWD - ISCWSA	

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		
172.0	0.44	251.07	172.0	-0.2	-0.6	0.1	0.26	0.26		
263.0	0.70	272.99	263.0	-0.3	-1.5	0.5	0.37	0.29		
720.0	0.57	249.10	720.0	-1.0	-6.4	2.5	0.06	-0.03		
903.0	0.40	301.50	903.0	-1.0	-7.8	3.3	0.25	-0.09		
994.0	0.97	312.58	994.0	-0.3	-8.7	4.3	0.64	0.63		
1,085.0	1.76	331.35	1,084.9	1.5	-9.9	6.4	0.99	0.87		
1,177.0	2.59	345.06	1,176.9	4.7	-11.1	9.8	1.06	0.90		
1,585.0	2.73	355.17	1,584.4	23.3	-14.3	27.4	0.12	0.03		
1,671.0	2.64	351.65	1,670.3	27.3	-14.8	31.0	0.22	-0.10		
1,762.0	2.59	345.77	1,761.2	31.4	-15.6	34.9	0.30	-0.05		
1,853.0	3.38	2.64	1,852.1	36.1	-16.0	39.1	1.29	0.87		
1,945.0	3.12	351.74	1,944.0	41.2	-16.2	43.6	0.73	-0.28		

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Well:	Razor #27I-2213A	North Reference:	True
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	HZ	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
2,037.0	3.47	352.97	2,035.8	46.5	-16.9	48.5	0.39	0.38	
2,128.0	3.34	343.66	2,126.7	51.8	-18.0	53.5	0.62	-0.14	
2,220.0	4.44	0.36	2,218.4	57.9	-18.7	59.1	1.70	1.20	
2,312.0	4.13	0.27	2,310.2	64.8	-18.7	65.0	0.34	-0.34	
2,403.0	3.91	0.80	2,401.0	71.1	-18.6	70.4	0.25	-0.24	
2,494.0	3.87	358.69	2,491.8	77.3	-18.6	75.7	0.16	-0.04	
2,585.0	3.65	359.92	2,582.6	83.3	-18.7	80.8	0.26	-0.24	
2,677.0	3.34	0.09	2,674.4	88.9	-18.7	85.6	0.34	-0.34	
2,769.0	3.34	358.51	2,766.2	94.3	-18.8	90.2	0.10	0.00	
2,859.0	3.16	0.09	2,856.1	99.4	-18.8	94.5	0.22	-0.20	
2,950.0	2.51	355.87	2,947.0	103.9	-19.0	98.4	0.75	-0.71	
3,041.0	2.11	345.94	3,037.9	107.5	-19.5	101.8	0.62	-0.44	
3,133.0	1.98	347.88	3,129.8	110.7	-20.3	104.9	0.16	-0.14	
3,224.0	3.69	2.73	3,220.7	115.1	-20.5	108.8	2.03	1.88	
3,316.0	3.56	351.65	3,312.5	120.9	-20.7	113.9	0.77	-0.14	
3,408.0	3.60	345.41	3,404.4	126.5	-21.9	119.3	0.43	0.04	
3,500.0	3.65	345.24	3,496.2	132.2	-23.4	124.9	0.06	0.05	
3,591.0	3.12	10.90	3,587.0	137.4	-23.6	129.5	1.75	-0.58	
3,683.0	2.46	17.93	3,678.9	141.7	-22.5	132.6	0.81	-0.72	
3,774.0	2.90	38.59	3,769.8	145.4	-20.5	134.7	1.16	0.48	
3,866.0	2.46	41.93	3,861.7	148.7	-17.7	136.0	0.51	-0.48	
3,958.0	2.42	350.95	3,953.6	152.1	-16.7	138.4	2.28	-0.04	
4,050.0	1.93	343.04	4,045.6	155.5	-17.5	141.7	0.62	-0.53	
4,141.0	1.36	352.71	4,136.5	158.0	-18.1	144.1	0.69	-0.63	
4,232.0	2.29	1.06	4,227.5	160.9	-18.2	146.6	1.06	1.02	
4,323.0	2.07	3.17	4,318.4	164.3	-18.0	149.5	0.26	-0.24	
4,414.0	1.80	349.11	4,409.4	167.4	-18.2	152.2	0.60	-0.30	
4,505.0	1.10	352.45	4,500.3	169.7	-18.6	154.3	0.77	-0.77	
4,596.0	2.29	357.46	4,591.3	172.3	-18.8	156.7	1.32	1.31	
4,688.0	1.76	9.14	4,683.2	175.6	-18.7	159.4	0.73	-0.58	
4,779.0	2.55	335.75	4,774.2	178.8	-19.3	162.5	1.59	0.87	
4,870.0	2.64	324.76	4,865.1	182.4	-21.3	166.6	0.55	0.10	
4,962.0	2.59	334.96	4,957.0	186.0	-23.4	170.8	0.51	-0.05	
5,053.0	1.54	317.46	5,047.9	188.7	-25.1	174.0	1.33	-1.15	
5,145.0	5.19	330.65	5,139.8	193.3	-28.0	179.4	4.03	3.97	
5,236.0	14.99	333.90	5,229.2	207.5	-35.2	195.2	10.78	10.77	
5,327.0	22.15	336.36	5,315.5	233.8	-47.3	224.0	7.91	7.87	
5,419.0	27.65	333.72	5,398.9	268.8	-63.7	262.5	6.10	5.98	
5,480.0	32.48	335.75	5,451.7	296.5	-76.7	292.8	8.09	7.92	
5,511.0	35.96	336.10	5,477.3	312.4	-83.8	310.1	11.24	11.23	
5,541.0	39.21	337.33	5,501.1	329.2	-91.0	328.2	11.12	10.83	
5,572.0	41.41	335.75	5,524.7	347.6	-99.0	348.1	7.82	7.10	
5,602.0	44.00	335.31	5,546.7	366.1	-107.4	368.3	8.69	8.63	
5,632.0	47.74	334.60	5,567.6	385.6	-116.6	389.7	12.58	12.47	
5,663.0	51.25	333.55	5,587.8	406.8	-126.9	413.1	11.61	11.32	
5,693.0	55.60	332.90	5,605.6	428.3	-137.7	437.1	14.60	14.50	
5,724.0	60.20	332.30	5,622.1	451.6	-149.8	463.3	14.93	14.84	
5,755.0	64.90	332.10	5,636.4	475.9	-162.6	490.7	15.17	15.16	
5,785.0	69.50	331.60	5,648.0	500.3	-175.7	518.3	15.41	15.33	Last Cathedral Survey @ 5,785' MD Projection to Bit @ 5,838'
5,838.0	69.50	331.60	5,666.6	544.0	-199.3	567.9	0.00	0.00	

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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									
2213A BHL	0.00	0.00	5,649.3	8,105.5	-582.0	1,549,909.66	3,457,595.91	40° 49' 52.180 N	103° 50' 47.040 W
- actual wellpath misses target center by 7571.2ft at 5838.0ft MD (5666.6 TVD, 544.0 N, -199.3 E)									
- Point									
2213A LP P5	0.00	0.00	5,633.0	600.0	-572.0	1,542,405.64	3,457,746.00	40° 48' 38.019 N	103° 50' 46.908 W
- actual wellpath misses target center by 378.4ft at 5838.0ft MD (5666.6 TVD, 544.0 N, -199.3 E)									
- Point									
2213A Tgt PBHL 6(1,156	0.00	0.00	5,633.0	7,601.6	-581.5	1,549,405.84	3,457,605.81	40° 49' 47.200 N	103° 50' 47.034 W
- actual wellpath misses target center by 7068.0ft at 5838.0ft MD (5666.6 TVD, 544.0 N, -199.3 E)									
- Point									
LP	0.00	0.00	5,633.0	533.4	-327.2	1,542,343.62	3,457,992.03	40° 48' 37.361 N	103° 50' 43.724 W
- actual wellpath misses target center by 132.7ft at 5838.0ft MD (5666.6 TVD, 544.0 N, -199.3 E)									
- Point									
2213A BHL P4	0.00	0.00	5,625.3	8,105.5	-582.0	1,549,909.66	3,457,595.91	40° 49' 52.180 N	103° 50' 47.040 W
- actual wellpath misses target center by 7571.3ft at 5838.0ft MD (5666.6 TVD, 544.0 N, -199.3 E)									
- Point									
2213A Tgt P5(1,048' FEI	0.00	0.00	5,633.0	7,605.6	-471.5	1,549,411.93	3,457,715.71	40° 49' 47.240 N	103° 50' 45.603 W
- actual wellpath misses target center by 7067.0ft at 5838.0ft MD (5666.6 TVD, 544.0 N, -199.3 E)									
- Point									
2213A Tgt	0.00	0.00	5,649.3	7,605.6	-572.0	1,549,410.06	3,457,615.20	40° 49' 47.240 N	103° 50' 46.910 W
- actual wellpath misses target center by 7071.5ft at 5838.0ft MD (5666.6 TVD, 544.0 N, -199.3 E)									
- Point									
2213A Tgt P4	0.00	0.00	5,625.0	7,605.6	-572.0	1,549,410.06	3,457,615.20	40° 49' 47.240 N	103° 50' 46.910 W
- actual wellpath misses target center by 7071.6ft at 5838.0ft MD (5666.6 TVD, 544.0 N, -199.3 E)									
- Point									

Design Annotations					
Measured Depth	Vertical Depth	Local Coordinates			
(ft)	(ft)	+N/-S (ft)	+E/-W (ft)	Comment	
5,785.0	5,648.0	500.3	-175.7	Last Cathedral Survey @ 5,785' MD	
5,838.0	5,666.6	544.0	-199.3	Projection to Bit @ 5,838'	

Checked By: _____ Approved By: _____ Date: _____