





Cathedral Energy Services

Survey Report



Company:	EnCana Oil & Gas (USA) Inc	Local Co-ordinate Reference:	Well Marcus State 3A-36H
Project:	DJ Wattenberg	TVD Reference:	KBE @ 5053.0ft (Ensign 135)
Site:	S36 T2N-R66W (Marcus State)	MD Reference:	KBE @ 5053.0ft (Ensign 135)
Well:	Marcus State 3A-36H	North Reference:	True
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		S36 T2N-R66W (Marcus State)			
Site Position:		Northing:	1,275,942.66 ft	Latitude:	40.088280
From:	Lat/Long	Easting:	3,215,403.58 ft	Longitude:	-104.730140
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence:	0.50 °

Well	Marcus State 3A-36H					
Well Position	+N/-S	0.0 ft	Northing:	1,275,942.64 ft	Latitude:	40.088280
	+E/-W	0.0 ft	Easting:	3,215,403.58 ft	Longitude:	-104.730140
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	5,040.0 ft

Wellbore	HZ				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	8/6/2013	8.53	66.73	52,744

Design	FINAL				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.0	0.0	0.0	0.00	

Survey Program	Date	8/19/2013			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
142.0	12,142.0	Survey #1 (HZ)	Geolink 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		
142.0	0.30	119.50	142.0	-0.2	0.3	-0.2	0.21	0.21		
234.0	0.70	247.50	234.0	-0.5	0.0	-0.5	1.00	0.43		
326.0	1.90	264.90	326.0	-0.9	-2.0	-0.9	1.36	1.30		
418.0	3.20	268.30	417.9	-1.1	-6.1	-1.1	1.42	1.41		
510.0	3.70	257.40	509.7	-1.8	-11.6	-1.8	0.89	0.54		
602.0	4.30	250.10	601.5	-3.6	-17.7	-3.6	0.85	0.65		
694.0	5.10	250.30	693.2	-6.2	-24.8	-6.2	0.87	0.87		
787.0	5.60	252.10	785.8	-9.0	-33.0	-9.0	0.57	0.54		
878.0	6.60	251.60	876.3	-12.0	-42.2	-12.0	1.10	1.10		
970.0	8.20	252.30	967.5	-15.6	-53.5	-15.6	1.74	1.74		
1,062.0	9.50	255.40	1,058.4	-19.6	-67.1	-19.6	1.50	1.41		
1,154.0	10.10	254.20	1,149.0	-23.7	-82.2	-23.7	0.69	0.65		

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1,177.0	9.90	253.90	1,171.7	-24.8	-86.0	-24.8	0.90	-0.87	
1,286.0	9.80	251.50	1,279.1	-30.3	-103.8	-30.3	0.39	-0.09	
1,378.0	8.70	250.10	1,369.9	-35.2	-117.8	-35.2	1.22	-1.20	
1,470.0	10.60	254.80	1,460.6	-39.7	-132.5	-39.7	2.23	2.07	
1,562.0	10.60	253.80	1,551.0	-44.3	-148.8	-44.3	0.20	0.00	
1,654.0	10.40	253.20	1,641.5	-49.1	-164.9	-49.1	0.25	-0.22	
1,746.0	10.50	251.60	1,732.0	-54.1	-180.8	-54.1	0.33	0.11	
1,838.0	10.10	257.00	1,822.5	-58.6	-196.6	-58.6	1.14	-0.43	
1,930.0	10.10	252.40	1,913.0	-62.8	-212.1	-62.8	0.88	0.00	
2,025.0	9.60	259.00	2,006.7	-66.9	-227.8	-66.9	1.30	-0.53	
2,120.0	9.10	255.00	2,100.4	-70.3	-242.9	-70.3	0.86	-0.53	
2,214.0	8.80	253.00	2,193.2	-74.4	-256.9	-74.4	0.46	-0.32	
2,309.0	9.20	260.00	2,287.1	-77.8	-271.4	-77.8	1.23	0.42	
2,404.0	8.60	259.80	2,380.9	-80.4	-285.8	-80.4	0.63	-0.63	
2,498.0	9.70	255.80	2,473.7	-83.6	-300.4	-83.6	1.35	1.17	
2,593.0	9.10	254.80	2,567.5	-87.5	-315.4	-87.5	0.65	-0.63	
2,688.0	8.20	253.40	2,661.4	-91.4	-329.2	-91.4	0.97	-0.95	
2,783.0	8.40	252.70	2,755.4	-95.4	-342.3	-95.4	0.24	0.21	
2,878.0	9.10	260.60	2,849.3	-98.7	-356.3	-98.7	1.46	0.74	
2,972.0	9.70	261.40	2,942.0	-101.1	-371.5	-101.1	0.65	0.64	
3,067.0	9.80	251.10	3,035.7	-104.9	-387.1	-104.9	1.84	0.11	
3,162.0	10.80	248.50	3,129.1	-110.8	-403.0	-110.8	1.16	1.05	
3,256.0	9.90	247.30	3,221.6	-117.1	-418.6	-117.1	0.98	-0.96	
3,351.0	9.70	248.30	3,315.2	-123.2	-433.6	-123.2	0.28	-0.21	
3,446.0	8.40	244.30	3,409.0	-129.2	-447.3	-129.2	1.52	-1.37	
3,541.0	9.50	251.50	3,502.9	-134.7	-461.0	-134.7	1.65	1.16	
3,635.0	10.50	252.30	3,595.4	-139.8	-476.5	-139.8	1.07	1.06	
3,730.0	10.30	251.10	3,688.9	-145.2	-492.8	-145.2	0.31	-0.21	
3,825.0	10.50	250.10	3,782.3	-150.9	-509.0	-150.9	0.28	0.21	
3,919.0	10.60	257.40	3,874.7	-155.7	-525.5	-155.7	1.42	0.11	
4,014.0	8.90	255.80	3,968.4	-159.4	-541.1	-159.4	1.81	-1.79	
4,109.0	10.50	258.30	4,062.0	-162.9	-556.7	-162.9	1.74	1.68	
4,203.0	9.80	259.60	4,154.5	-166.1	-573.0	-166.1	0.78	-0.74	
4,298.0	10.30	259.30	4,248.1	-169.1	-589.3	-169.1	0.53	0.53	
4,393.0	9.80	251.50	4,341.6	-173.3	-605.3	-173.3	1.52	-0.53	
4,488.0	11.60	258.50	4,435.0	-177.8	-622.3	-177.8	2.33	1.89	
4,582.0	10.30	254.90	4,527.2	-181.8	-639.7	-181.8	1.56	-1.38	
4,677.0	11.40	255.90	4,620.6	-186.3	-657.0	-186.3	1.17	1.16	
4,772.0	10.30	253.10	4,713.9	-191.1	-674.2	-191.1	1.28	-1.16	
4,867.0	9.20	252.30	4,807.5	-195.9	-689.6	-195.9	1.17	-1.16	
4,961.0	10.90	256.20	4,900.0	-200.3	-705.4	-200.3	1.95	1.81	
5,056.0	10.00	251.40	4,993.5	-205.0	-721.9	-205.0	1.32	-0.95	
5,150.0	10.20	262.30	5,086.0	-208.8	-737.9	-208.8	2.04	0.21	
5,245.0	9.00	259.60	5,179.7	-211.2	-753.5	-211.2	1.35	-1.26	
5,340.0	10.10	257.90	5,273.4	-214.3	-769.0	-214.3	1.20	1.16	
5,435.0	8.20	254.50	5,367.1	-217.9	-783.7	-217.9	2.08	-2.00	
5,529.0	8.70	252.20	5,460.1	-221.8	-796.9	-221.8	0.64	0.53	
5,624.0	8.80	252.40	5,554.0	-226.2	-810.7	-226.2	0.11	0.11	
5,719.0	9.80	260.80	5,647.8	-229.7	-825.6	-229.7	1.77	1.05	
5,813.0	8.90	263.70	5,740.5	-231.8	-840.7	-231.8	1.08	-0.96	
5,908.0	9.50	254.40	5,834.3	-234.7	-855.6	-234.7	1.69	0.63	
6,002.0	10.00	249.80	5,927.0	-239.6	-870.7	-239.6	0.98	0.53	
6,097.0	8.90	243.10	6,020.7	-245.8	-885.0	-245.8	1.64	-1.16	



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6,192.0	8.90	247.30	6,114.5	-252.0	-898.3	-252.0	0.68	0.00	
6,287.0	9.50	254.30	6,208.3	-256.9	-912.6	-256.9	1.34	0.63	
6,381.0	9.60	260.30	6,301.0	-260.3	-927.8	-260.3	1.06	0.11	
6,476.0	10.80	255.00	6,394.5	-264.0	-944.2	-264.0	1.60	1.26	
6,571.0	8.90	249.30	6,488.1	-268.9	-959.7	-268.9	2.25	-2.00	
6,665.0	10.00	250.70	6,580.8	-274.1	-974.2	-274.1	1.20	1.17	
6,760.0	9.40	251.20	6,674.5	-279.4	-989.4	-279.4	0.64	-0.63	
6,855.0	10.10	248.30	6,768.1	-284.9	-1,004.4	-284.9	0.90	0.74	
6,950.0	10.10	249.40	6,861.6	-291.0	-1,020.0	-291.0	0.20	0.00	
6,981.0	9.10	247.70	6,892.2	-292.8	-1,024.8	-292.8	3.35	-3.23	
7,013.0	10.20	260.30	6,923.7	-294.3	-1,029.9	-294.3	7.42	3.44	
7,044.0	14.50	278.40	6,954.0	-294.2	-1,036.5	-294.2	18.51	13.87	
7,076.0	18.50	289.50	6,984.7	-291.9	-1,045.2	-291.9	15.86	12.50	
7,107.0	21.20	299.10	7,013.9	-287.5	-1,054.8	-287.5	13.63	8.71	
7,139.0	24.00	311.10	7,043.4	-280.4	-1,064.7	-280.4	16.82	8.75	
7,170.0	26.20	324.00	7,071.5	-270.7	-1,073.5	-270.7	18.98	7.10	
7,202.0	28.30	335.30	7,100.0	-258.1	-1,080.8	-258.1	17.42	6.56	
7,234.0	32.20	342.60	7,127.6	-243.1	-1,086.6	-243.1	16.73	12.19	
7,265.0	35.60	345.30	7,153.4	-226.5	-1,091.3	-226.5	11.99	10.97	
7,297.0	37.20	345.60	7,179.1	-208.1	-1,096.1	-208.1	5.03	5.00	
7,328.0	39.30	346.10	7,203.5	-189.5	-1,100.8	-189.5	6.85	6.77	
7,360.0	42.10	348.00	7,227.7	-169.1	-1,105.5	-169.1	9.57	8.75	
7,391.0	45.80	350.40	7,250.0	-148.0	-1,109.5	-148.0	13.09	11.94	
7,423.0	48.00	354.30	7,271.9	-124.9	-1,112.6	-124.9	11.24	6.87	
7,454.0	49.60	355.40	7,292.3	-101.6	-1,114.7	-101.6	5.81	5.16	
7,486.0	52.30	355.10	7,312.5	-76.9	-1,116.7	-76.9	8.47	8.44	
7,518.0	54.80	355.60	7,331.5	-51.2	-1,118.8	-51.2	7.91	7.81	
7,549.0	57.30	355.20	7,348.8	-25.6	-1,120.9	-25.6	8.14	8.06	
7,581.0	59.60	355.20	7,365.5	1.6	-1,123.1	1.6	7.19	7.19	
7,612.0	60.70	356.00	7,381.0	28.4	-1,125.2	28.4	4.20	3.55	
7,644.0	62.30	357.10	7,396.2	56.5	-1,126.9	56.5	5.84	5.00	
7,675.0	64.60	358.30	7,410.1	84.2	-1,128.0	84.2	8.19	7.42	
7,707.0	67.30	357.60	7,423.1	113.4	-1,129.1	113.4	8.67	8.44	
7,738.0	70.10	356.40	7,434.4	142.2	-1,130.6	142.2	9.73	9.03	
7,770.0	73.50	356.00	7,444.4	172.5	-1,132.6	172.5	10.69	10.62	
7,802.0	77.30	355.60	7,452.5	203.4	-1,134.8	203.4	11.94	11.87	
7,833.0	80.90	356.00	7,458.3	233.8	-1,137.1	233.8	11.68	11.61	
7,865.0	84.70	357.40	7,462.3	265.5	-1,138.9	265.5	12.64	11.87	
7,868.0	85.50	357.60	7,462.6	268.4	-1,139.0	268.4	27.48	26.67	
7,954.0	89.10	358.80	7,466.6	354.3	-1,141.7	354.3	4.41	4.19	
8,017.0	91.20	358.50	7,466.5	417.3	-1,143.2	417.3	3.37	3.33	
8,080.0	89.60	359.50	7,466.0	480.3	-1,144.3	480.3	2.99	-2.54	
8,143.0	90.20	0.40	7,466.1	543.3	-1,144.4	543.3	1.72	0.95	
8,206.0	89.20	1.00	7,466.5	606.2	-1,143.6	606.2	1.85	-1.59	
8,301.0	89.50	2.00	7,467.5	701.2	-1,141.1	701.2	1.10	0.32	
8,396.0	86.60	2.60	7,470.8	796.1	-1,137.3	796.1	3.12	-3.05	
8,491.0	87.40	2.30	7,475.7	890.8	-1,133.2	890.8	0.90	0.84	
8,586.0	88.40	2.60	7,479.2	985.7	-1,129.2	985.7	1.10	1.05	
8,680.0	89.70	1.80	7,480.8	1,079.6	-1,125.6	1,079.6	1.62	1.38	
8,775.0	89.40	1.30	7,481.5	1,174.6	-1,123.0	1,174.6	0.61	-0.32	
8,870.0	88.50	1.50	7,483.3	1,269.5	-1,120.7	1,269.5	0.97	-0.95	
8,965.0	89.50	2.10	7,484.9	1,364.5	-1,117.7	1,364.5	1.23	1.05	
9,059.0	89.30	2.60	7,485.9	1,458.4	-1,113.9	1,458.4	0.57	-0.21	



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9,123.0	89.80	2.00	7,486.4	1,522.3	-1,111.3	1,522.3	1.22	0.78	
9,186.0	90.20	359.90	7,486.4	1,585.3	-1,110.2	1,585.3	3.39	0.63	
9,249.0	89.50	358.60	7,486.6	1,648.3	-1,111.1	1,648.3	2.34	-1.11	
9,343.0	90.50	358.60	7,486.6	1,742.3	-1,113.4	1,742.3	1.06	1.06	
9,438.0	89.80	359.80	7,486.3	1,837.3	-1,114.7	1,837.3	1.46	-0.74	
9,533.0	89.40	0.10	7,487.0	1,932.3	-1,114.8	1,932.3	0.53	-0.42	
9,628.0	88.40	359.90	7,488.8	2,027.2	-1,114.8	2,027.2	1.07	-1.05	
9,722.0	89.10	358.50	7,490.9	2,121.2	-1,116.1	2,121.2	1.66	0.74	
9,817.0	89.80	359.30	7,491.8	2,216.2	-1,117.9	2,216.2	1.12	0.74	
9,911.0	89.10	0.00	7,492.7	2,310.2	-1,118.5	2,310.2	1.05	-0.74	
10,006.0	88.20	359.80	7,494.9	2,405.1	-1,118.6	2,405.1	0.97	-0.95	
10,101.0	88.20	0.60	7,497.9	2,500.1	-1,118.3	2,500.1	0.84	0.00	
10,196.0	88.40	0.80	7,500.7	2,595.1	-1,117.2	2,595.1	0.30	0.21	
10,290.0	89.70	0.70	7,502.3	2,689.0	-1,115.9	2,689.0	1.39	1.38	
10,385.0	88.20	0.10	7,504.0	2,784.0	-1,115.3	2,784.0	1.70	-1.58	
10,480.0	88.70	358.70	7,506.6	2,879.0	-1,116.3	2,879.0	1.56	0.53	
10,574.0	89.80	357.80	7,507.8	2,972.9	-1,119.1	2,972.9	1.51	1.17	
10,669.0	90.70	358.60	7,507.4	3,067.9	-1,122.1	3,067.9	1.27	0.95	
10,763.0	90.30	358.50	7,506.6	3,161.8	-1,124.5	3,161.8	0.44	-0.43	
10,858.0	91.60	357.80	7,505.0	3,256.8	-1,127.6	3,256.8	1.55	1.37	
10,953.0	91.40	358.80	7,502.5	3,351.7	-1,130.4	3,351.7	1.07	-0.21	
11,048.0	90.30	357.90	7,501.1	3,446.6	-1,133.1	3,446.6	1.50	-1.16	
11,142.0	91.60	357.80	7,499.6	3,540.6	-1,136.6	3,540.6	1.39	1.38	
11,237.0	90.70	358.60	7,497.7	3,635.5	-1,139.6	3,635.5	1.27	-0.95	
11,332.0	89.90	359.40	7,497.2	3,730.5	-1,141.3	3,730.5	1.19	-0.84	
11,426.0	89.50	0.10	7,497.7	3,824.5	-1,141.7	3,824.5	0.86	-0.43	
11,521.0	89.90	0.10	7,498.1	3,919.5	-1,141.5	3,919.5	0.42	0.42	
11,616.0	89.90	1.30	7,498.3	4,014.5	-1,140.4	4,014.5	1.26	0.00	
11,710.0	91.40	2.80	7,497.2	4,108.4	-1,137.0	4,108.4	2.26	1.60	
11,805.0	91.10	5.60	7,495.2	4,203.1	-1,130.0	4,203.1	2.96	-0.32	
11,868.0	90.40	7.70	7,494.4	4,265.7	-1,122.7	4,265.7	3.51	-1.11	
11,931.0	88.70	8.50	7,494.8	4,328.0	-1,113.9	4,328.0	2.98	-2.70	
11,994.0	88.00	6.60	7,496.7	4,390.5	-1,105.6	4,390.5	3.21	-1.11	
12,058.0	89.00	3.80	7,498.3	4,454.2	-1,099.8	4,454.2	4.64	1.56	
12,092.0	88.50	3.00	7,499.1	4,488.1	-1,097.8	4,488.1	2.77	-1.47	Last Cathedral Survey @ 12,092' MD Projection to Bit @ 12,142' MD
12,142.0	88.50	3.00	7,500.4	4,538.0	-1,095.2	4,538.0	0.00	0.00	



Cathedral Energy Services

Survey Report



Company:	EnCana Oil & Gas (USA) Inc	Local Co-ordinate Reference:	Well Marcus State 3A-36H
Project:	DJ Wattenberg	TVD Reference:	KBE @ 5053.0ft (Ensign 135)
Site:	S36 T2N-R66W (Marcus State)	MD Reference:	KBE @ 5053.0ft (Ensign 135)
Well:	Marcus State 3A-36H	North Reference:	True
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Targets									
Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
Marcus State 3A-36H 1C - survey misses target center by 15.8ft at 10627.7ft MD (7507.8 TVD, 3026.6 N, -1121.0 E) - Point	0.00	0.00	7,492.0	3,026.5	-1,121.8	1,278,959.31	3,214,255.57	40.096588	-104.734150
Marcus State 3A-36H Pf - survey misses target center by 46.8ft at 12142.0ft MD (7500.4 TVD, 4538.0 N, -1095.2 E) - Point	0.00	0.00	7,467.0	4,557.2	-1,121.8	1,280,489.90	3,214,242.30	40.100790	-104.734150
Marcus State 3A-36H Pf - survey misses target center by 33.8ft at 12142.0ft MD (7500.4 TVD, 4538.0 N, -1095.2 E) - Point	0.00	0.00	7,492.0	4,557.2	-1,121.8	1,280,489.90	3,214,242.30	40.100790	-104.734150
Marcus State 3A-36H Pf - survey misses target center by 33.4ft at 12142.0ft MD (7500.4 TVD, 4538.0 N, -1095.2 E) - Point	0.00	0.00	7,507.0	4,557.2	-1,121.8	1,280,489.90	3,214,242.30	40.100790	-104.734150
Marcus State 3A-36H 93 - survey misses target center by 11.1ft at 9327.5ft MD (7486.7 TVD, 1726.7 N, -1113.0 E) - Point	0.00	0.00	7,480.0	1,726.5	-1,121.8	1,277,659.36	3,214,266.85	40.093019	-104.734150
Marcus State 3A-36H 93 - survey misses target center by 23.4ft at 9327.5ft MD (7486.7 TVD, 1726.7 N, -1113.0 E) - Point	0.00	0.00	7,465.0	1,726.5	-1,121.8	1,277,659.36	3,214,266.85	40.093019	-104.734150
Marcus State 3A-36H 1C - survey misses target center by 1.1ft at 10627.7ft MD (7507.8 TVD, 3026.6 N, -1121.0 E) - Point	0.00	0.00	7,507.0	3,026.5	-1,121.8	1,278,959.31	3,214,255.57	40.096588	-104.734150

Survey Annotations				
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
12,092.0	7,499.1	4,488.1	-1,097.8	Last Cathedral Survey @ 12,092' MD
12,142.0	7,500.4	4,538.0	-1,095.2	Projection to Bit @ 12,142' MD

Checked By: _____ Approved By: _____ Date: _____