



Cathedral Energy Services

Survey Report

Company:	EnCana Oil & Gas (USA) Inc	Local Co-ordinate Reference:	Well Chavez 4B-4H
Project:	DJ Wattenberg	TVD Reference:	KBE @ 4929.0ft (Original Well Elev)
Site:	SWSE S4-T1N-R65W (Chavez)	MD Reference:	KBE @ 4929.0ft (Original Well Elev)
Well:	Chavez 4B-4H	North Reference:	True
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	HZ	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		SWSE S4-T1N-R65W (Chavez)			
Site Position:		Northing:	1,270,891.54 ft	Latitude:	40.073960
From:	Lat/Long	Easting:	3,233,697.16 ft	Longitude:	-104.664930
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence:	0.54 °

Well	Chavez 4B-4H					
Well Position	+N/-S	0.0 ft	Northing:	1,270,891.79 ft	Latitude:	40.073960
	+E/-W	0.0 ft	Easting:	3,233,725.14 ft	Longitude:	-104.664830
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	4,916.0 ft

Wellbore	HZ				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	7/1/2012	8.64	66.77	52,860

Design	HZ				
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	0.00	

Survey Program	Date	7/14/2012			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
104.0	11,460.0	Survey #1 (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	
104.0	0.70	158.30	104.0	-0.6	0.2	-0.6	0.67	0.67	
166.0	0.80	163.60	166.0	-1.4	0.5	-1.4	0.20	0.16	
259.0	1.00	162.60	259.0	-2.8	0.9	-2.8	0.22	0.22	
352.0	0.80	163.90	352.0	-4.2	1.3	-4.2	0.22	-0.22	
445.0	1.10	165.50	445.0	-5.6	1.7	-5.6	0.32	0.32	
538.0	1.40	172.80	537.9	-7.6	2.1	-7.6	0.36	0.32	
631.0	1.00	180.90	630.9	-9.6	2.2	-9.6	0.47	-0.43	
724.0	1.50	188.90	723.9	-11.6	2.0	-11.6	0.57	0.54	
817.0	1.40	170.80	816.9	-13.9	2.0	-13.9	0.50	-0.11	
881.0	1.00	171.70	880.8	-15.2	2.2	-15.2	0.63	-0.62	
1,008.0	1.40	176.00	1,007.8	-17.9	2.5	-17.9	0.32	0.31	
1,101.0	0.70	146.00	1,100.8	-19.5	2.9	-19.5	0.93	-0.75	

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1,194.0	4.20	120.80	1,193.7	-21.7	6.2	-21.7	3.85	3.76	
1,287.0	4.70	126.80	1,286.4	-25.7	12.1	-25.7	0.73	0.54	
1,380.0	7.70	117.70	1,378.9	-30.9	20.7	-30.9	3.38	3.23	
1,473.0	9.60	103.90	1,470.8	-35.7	33.7	-35.7	3.01	2.04	
1,569.0	10.10	106.80	1,565.4	-40.0	49.6	-40.0	0.73	0.52	
1,664.0	9.80	105.10	1,659.0	-44.5	65.4	-44.5	0.44	-0.32	
1,759.0	9.90	105.50	1,752.6	-48.8	81.0	-48.8	0.13	0.11	
1,854.0	9.70	103.40	1,846.2	-52.9	96.7	-52.9	0.43	-0.21	
1,949.0	8.80	100.10	1,940.0	-56.0	111.6	-56.0	1.10	-0.95	
2,044.0	7.50	107.30	2,034.0	-59.1	124.7	-59.1	1.74	-1.37	
2,139.0	7.10	101.10	2,128.2	-62.1	136.4	-62.1	0.93	-0.42	
2,234.0	7.30	114.80	2,222.5	-65.7	147.6	-65.7	1.82	0.21	
2,329.0	6.30	117.00	2,316.8	-70.6	157.7	-70.6	1.09	-1.05	
2,425.0	5.60	110.00	2,412.3	-74.6	166.8	-74.6	1.05	-0.73	
2,520.0	6.30	117.80	2,506.8	-78.7	175.8	-78.7	1.12	0.74	
2,615.0	5.10	113.20	2,601.3	-82.7	184.3	-82.7	1.35	-1.26	
2,710.0	7.10	110.60	2,695.8	-86.5	193.7	-86.5	2.12	2.11	
2,805.0	7.30	111.10	2,790.0	-90.7	204.8	-90.7	0.22	0.21	
2,900.0	7.20	116.70	2,884.3	-95.6	215.8	-95.6	0.75	-0.11	
2,994.0	7.30	118.80	2,977.5	-101.1	226.2	-101.1	0.30	0.11	
3,089.0	6.40	112.80	3,071.8	-106.0	236.4	-106.0	1.21	-0.95	
3,184.0	6.90	122.50	3,166.2	-111.2	246.1	-111.2	1.29	0.53	
3,279.0	9.80	122.40	3,260.2	-118.6	257.8	-118.6	3.05	3.05	
3,374.0	8.20	116.90	3,354.0	-126.0	270.6	-126.0	1.91	-1.68	
3,469.0	7.10	109.60	3,448.2	-131.0	282.2	-131.0	1.54	-1.16	
3,564.0	6.30	112.60	3,542.5	-135.0	292.5	-135.0	0.92	-0.84	
3,659.0	7.50	123.20	3,636.8	-140.4	302.5	-140.4	1.84	1.26	
3,755.0	7.00	118.40	3,732.1	-146.6	312.9	-146.6	0.82	-0.52	
3,850.0	5.60	115.90	3,826.5	-151.4	322.2	-151.4	1.50	-1.47	
3,945.0	6.70	109.60	3,920.9	-155.2	331.6	-155.2	1.36	1.16	
4,040.0	8.00	109.60	4,015.2	-159.3	343.0	-159.3	1.37	1.37	
4,135.0	7.30	105.10	4,109.3	-163.1	355.1	-163.1	0.97	-0.74	
4,230.0	8.80	105.80	4,203.4	-166.7	367.9	-166.7	1.58	1.58	
4,325.0	9.40	113.90	4,297.2	-171.8	382.0	-171.8	1.49	0.63	
4,420.0	8.00	112.80	4,391.1	-177.5	395.2	-177.5	1.48	-1.47	
4,516.0	8.60	119.60	4,486.1	-183.6	407.6	-183.6	1.20	0.62	
4,611.0	7.90	118.20	4,580.1	-190.2	419.5	-190.2	0.77	-0.74	
4,706.0	7.50	119.80	4,674.2	-196.4	430.6	-196.4	0.48	-0.42	
4,801.0	7.40	117.70	4,768.4	-202.3	441.4	-202.3	0.31	-0.11	
4,896.0	6.70	117.50	4,862.7	-207.7	451.8	-207.7	0.74	-0.74	
4,991.0	3.90	113.80	4,957.3	-211.6	459.6	-211.6	2.97	-2.95	
5,086.0	2.90	112.60	5,052.1	-213.8	464.8	-213.8	1.06	-1.05	
5,181.0	2.20	114.90	5,147.0	-215.5	468.7	-215.5	0.74	-0.74	
5,276.0	2.10	113.80	5,242.0	-217.0	471.9	-217.0	0.11	-0.11	
5,371.0	2.00	106.80	5,336.9	-218.1	475.1	-218.1	0.28	-0.11	
5,466.0	1.80	117.60	5,431.9	-219.3	478.0	-219.3	0.43	-0.21	
5,561.0	0.60	38.30	5,526.8	-219.6	479.7	-219.6	1.88	-1.26	
5,657.0	0.50	39.80	5,622.8	-218.9	480.2	-218.9	0.11	-0.10	
5,752.0	0.40	75.30	5,717.8	-218.5	480.8	-218.5	0.31	-0.11	
5,847.0	0.90	31.80	5,812.8	-217.8	481.5	-217.8	0.70	0.53	
5,942.0	0.80	46.20	5,907.8	-216.7	482.4	-216.7	0.25	-0.11	
6,037.0	0.60	255.00	6,002.8	-216.4	482.4	-216.4	1.43	-0.21	
6,132.0	0.30	245.60	6,097.8	-216.6	481.7	-216.6	0.32	-0.32	

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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
6,227.0	0.40	269.00	6,192.8	-216.7	481.1	-216.7	0.18	0.11	
6,290.0	0.20	303.40	6,255.8	-216.6	480.8	-216.6	0.41	-0.32	
6,322.0	0.30	337.80	6,287.8	-216.5	480.8	-216.5	0.55	0.31	
6,354.0	2.00	7.10	6,319.8	-215.9	480.8	-215.9	5.45	5.31	
6,385.0	5.40	9.10	6,350.7	-213.9	481.1	-213.9	10.97	10.97	
6,417.0	8.90	8.80	6,382.5	-210.0	481.7	-210.0	10.94	10.94	
6,449.0	12.00	10.30	6,414.0	-204.3	482.7	-204.3	9.72	9.69	
6,480.0	15.20	8.20	6,444.1	-197.1	483.8	-197.1	10.44	10.32	
6,512.0	18.20	8.00	6,474.7	-188.0	485.1	-188.0	9.38	9.37	
6,544.0	20.50	6.60	6,504.9	-177.4	486.5	-177.4	7.33	7.19	
6,575.0	23.00	3.10	6,533.7	-166.0	487.4	-166.0	9.08	8.06	
6,607.0	26.00	0.20	6,562.8	-152.7	487.8	-152.7	10.10	9.37	
6,639.0	28.70	358.60	6,591.2	-138.0	487.6	-138.0	8.74	8.44	
6,670.0	31.00	0.70	6,618.1	-122.6	487.5	-122.6	8.15	7.42	
6,702.0	33.50	1.30	6,645.2	-105.6	487.8	-105.6	7.88	7.81	
6,734.0	35.50	359.60	6,671.6	-87.4	488.0	-87.4	6.94	6.25	
6,765.0	38.20	359.30	6,696.4	-68.8	487.8	-68.8	8.73	8.71	
6,797.0	41.10	359.10	6,721.0	-48.4	487.5	-48.4	9.07	9.06	
6,829.0	43.60	359.50	6,744.7	-26.9	487.2	-26.9	7.86	7.81	
6,860.0	44.80	2.00	6,766.9	-5.3	487.5	-5.3	6.83	3.87	
6,892.0	46.00	2.00	6,789.3	17.5	488.3	17.5	3.75	3.75	
6,924.0	47.80	2.60	6,811.2	40.8	489.3	40.8	5.79	5.62	
6,955.0	49.90	3.60	6,831.6	64.2	490.5	64.2	7.20	6.77	
6,987.0	52.00	3.40	6,851.8	89.0	492.0	89.0	6.58	6.56	
7,019.0	52.50	3.50	6,871.4	114.2	493.6	114.2	1.58	1.56	
7,051.0	54.30	3.50	6,890.4	139.9	495.1	139.9	5.62	5.62	
7,082.0	56.10	3.70	6,908.1	165.3	496.7	165.3	5.83	5.81	
7,114.0	58.50	3.50	6,925.4	192.1	498.4	192.1	7.52	7.50	
7,146.0	61.00	1.20	6,941.5	219.7	499.6	219.7	9.98	7.81	
7,177.0	64.70	0.30	6,955.7	247.3	499.9	247.3	12.21	11.94	
7,209.0	68.60	359.20	6,968.4	276.7	499.8	276.7	12.59	12.19	
7,241.0	71.70	0.00	6,979.2	306.8	499.6	306.8	9.97	9.69	
7,272.0	73.90	1.20	6,988.4	336.4	499.9	336.4	8.00	7.10	
7,304.0	77.00	1.40	6,996.4	367.4	500.6	367.4	9.71	9.69	
7,366.0	81.90	1.90	7,007.8	428.3	502.3	428.3	7.94	7.90	
7,397.0	82.20	1.70	7,012.1	459.0	503.3	459.0	1.16	0.97	
7,429.0	84.30	1.50	7,015.8	490.7	504.2	490.7	6.59	6.56	
7,461.0	86.60	1.00	7,018.4	522.6	504.9	522.6	7.35	7.19	
7,492.0	86.90	1.60	7,020.1	553.6	505.6	553.6	2.16	0.97	
7,524.0	88.30	1.50	7,021.5	585.5	506.5	585.5	4.39	4.37	
7,556.0	89.10	0.80	7,022.2	617.5	507.1	617.5	3.32	2.50	
7,587.0	89.30	0.10	7,022.6	648.5	507.3	648.5	2.35	0.65	
7,619.0	89.80	0.30	7,022.9	680.5	507.5	680.5	1.68	1.56	
7,651.0	90.20	0.40	7,022.9	712.5	507.7	712.5	1.29	1.25	
7,682.0	90.60	359.90	7,022.7	743.5	507.7	743.5	2.07	1.29	
7,746.0	90.20	358.90	7,022.2	807.5	507.1	807.5	1.68	-0.62	
7,808.0	89.50	359.60	7,022.4	869.5	506.2	869.5	1.60	-1.13	
7,841.0	89.50	358.90	7,022.7	902.5	505.8	902.5	2.12	0.00	
7,873.0	89.60	357.80	7,022.9	934.5	504.9	934.5	3.45	0.31	
7,904.0	89.30	357.40	7,023.2	965.4	503.6	965.4	1.61	-0.97	
7,936.0	89.30	357.00	7,023.6	997.4	502.0	997.4	1.25	0.00	
7,968.0	88.30	358.00	7,024.3	1,029.4	500.6	1,029.4	4.42	-3.12	
7,999.0	87.20	358.70	7,025.5	1,060.3	499.7	1,060.3	4.20	-3.55	
8,031.0	86.90	359.20	7,027.1	1,092.3	499.2	1,092.3	1.82	-0.94	

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8,062.0	87.70	359.40	7,028.6	1,123.2	498.8	1,123.2	2.66	2.58	
8,094.0	88.50	0.60	7,029.7	1,155.2	498.8	1,155.2	4.51	2.50	
8,126.0	89.70	1.00	7,030.2	1,187.2	499.2	1,187.2	3.95	3.75	
8,189.0	90.10	0.00	7,030.3	1,250.2	499.8	1,250.2	1.71	0.63	
8,252.0	90.60	359.50	7,029.9	1,313.2	499.5	1,313.2	1.12	0.79	
8,315.0	89.80	357.80	7,029.7	1,376.2	498.0	1,376.2	2.98	-1.27	
8,379.0	89.90	357.80	7,029.8	1,440.1	495.6	1,440.1	0.16	0.16	
8,442.0	90.40	357.70	7,029.7	1,503.1	493.1	1,503.1	0.81	0.79	
8,505.0	90.50	358.00	7,029.2	1,566.0	490.7	1,566.0	0.50	0.16	
8,569.0	90.50	359.40	7,028.6	1,630.0	489.3	1,630.0	2.19	0.00	
8,632.0	89.10	358.00	7,028.8	1,693.0	487.8	1,693.0	3.14	-2.22	
8,695.0	89.50	357.30	7,029.6	1,755.9	485.3	1,755.9	1.28	0.63	
8,759.0	89.80	358.10	7,030.0	1,819.9	482.7	1,819.9	1.33	0.47	
8,822.0	90.20	357.40	7,030.0	1,882.8	480.2	1,882.8	1.28	0.63	
8,886.0	90.10	357.90	7,029.8	1,946.8	477.6	1,946.8	0.80	-0.16	
8,949.0	90.20	357.30	7,029.7	2,009.7	475.0	2,009.7	0.97	0.16	
9,013.0	90.10	358.70	7,029.5	2,073.7	472.7	2,073.7	2.19	-0.16	
9,076.0	89.50	0.00	7,029.7	2,136.7	472.0	2,136.7	2.27	-0.95	
9,139.0	89.10	0.00	7,030.5	2,199.7	472.0	2,199.7	0.63	-0.63	
9,203.0	90.00	1.30	7,031.0	2,263.7	472.7	2,263.7	2.47	1.41	
9,266.0	92.90	1.50	7,029.4	2,326.6	474.3	2,326.6	4.61	4.60	
9,330.0	92.20	1.60	7,026.5	2,390.5	476.0	2,390.5	1.10	-1.09	
9,393.0	90.10	1.00	7,025.3	2,453.5	477.4	2,453.5	3.47	-3.33	
9,425.0	89.50	359.80	7,025.4	2,485.5	477.7	2,485.5	4.19	-1.87	
9,456.0	89.30	358.50	7,025.7	2,516.5	477.2	2,516.5	4.24	-0.65	
9,488.0	89.20	359.10	7,026.1	2,548.5	476.5	2,548.5	1.90	-0.31	
9,520.0	88.80	358.50	7,026.7	2,580.5	475.9	2,580.5	2.25	-1.25	
9,552.0	89.60	358.50	7,027.1	2,612.5	475.0	2,612.5	2.50	2.50	
9,583.0	90.90	358.50	7,027.0	2,643.4	474.2	2,643.4	4.19	4.19	
9,615.0	91.30	358.40	7,026.4	2,675.4	473.3	2,675.4	1.29	1.25	
9,647.0	91.60	358.00	7,025.6	2,707.4	472.3	2,707.4	1.56	0.94	
9,678.0	90.90	357.60	7,024.9	2,738.4	471.1	2,738.4	2.60	-2.26	
9,710.0	91.00	357.70	7,024.4	2,770.3	469.8	2,770.3	0.44	0.31	
9,742.0	90.40	356.90	7,024.0	2,802.3	468.3	2,802.3	3.12	-1.87	
9,774.0	91.30	357.80	7,023.5	2,834.3	466.9	2,834.3	3.98	2.81	
9,807.0	91.20	358.20	7,022.8	2,867.2	465.7	2,867.2	1.25	-0.30	
9,870.0	90.00	358.90	7,022.1	2,930.2	464.1	2,930.2	2.21	-1.90	
9,934.0	91.60	358.50	7,021.2	2,994.2	462.7	2,994.2	2.58	2.50	
9,997.0	89.70	358.10	7,020.5	3,057.1	460.8	3,057.1	3.08	-3.02	
10,060.0	89.30	359.70	7,021.1	3,120.1	459.6	3,120.1	2.62	-0.63	
10,124.0	89.30	359.60	7,021.9	3,184.1	459.2	3,184.1	0.16	0.00	
10,187.0	90.10	359.30	7,022.2	3,247.1	458.6	3,247.1	1.36	1.27	
10,251.0	88.40	359.20	7,023.0	3,311.1	457.7	3,311.1	2.66	-2.66	
10,314.0	88.40	357.90	7,024.8	3,374.1	456.1	3,374.1	2.06	0.00	
10,377.0	88.80	358.40	7,026.3	3,437.0	454.1	3,437.0	1.02	0.63	
10,441.0	89.10	359.30	7,027.5	3,501.0	452.8	3,501.0	1.48	0.47	
10,504.0	89.40	359.60	7,028.3	3,564.0	452.2	3,564.0	0.67	0.48	
10,568.0	89.50	0.20	7,028.9	3,628.0	452.1	3,628.0	0.95	0.16	
10,631.0	89.30	359.70	7,029.6	3,691.0	452.1	3,691.0	0.85	-0.32	
10,694.0	90.00	0.30	7,030.0	3,754.0	452.1	3,754.0	1.46	1.11	
10,758.0	89.90	0.00	7,030.0	3,818.0	452.2	3,818.0	0.49	-0.16	
10,821.0	90.10	0.60	7,030.0	3,881.0	452.6	3,881.0	1.00	0.32	
10,884.0	90.40	0.20	7,029.8	3,944.0	453.0	3,944.0	0.79	0.48	

Cathedral Energy Services

Survey Report

Company:	EnCana Oil & Gas (USA) Inc	Local Co-ordinate Reference:	Well Chavez 4B-4H
Project:	DJ Wattenberg	TVD Reference:	KBE @ 4929.0ft (Original Well Elev)
Site:	SWSE S4-T1N-R65W (Chavez)	MD Reference:	KBE @ 4929.0ft (Original Well Elev)
Well:	Chavez 4B-4H	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
10,948.0	90.40	0.30	7,029.3	4,008.0	453.3	4,008.0	0.16	0.00	
11,011.0	90.20	0.20	7,029.0	4,071.0	453.6	4,071.0	0.35	-0.32	
11,074.0	89.70	359.90	7,029.0	4,134.0	453.6	4,134.0	0.93	-0.79	
11,137.0	89.10	359.40	7,029.7	4,197.0	453.2	4,197.0	1.24	-0.95	
11,200.0	88.30	359.00	7,031.1	4,260.0	452.3	4,260.0	1.42	-1.27	
11,264.0	88.70	359.10	7,032.8	4,323.9	451.3	4,323.9	0.64	0.62	
11,327.0	88.20	359.80	7,034.5	4,386.9	450.7	4,386.9	1.37	-0.79	
11,391.0	88.70	359.60	7,036.2	4,450.9	450.3	4,450.9	0.84	0.78	
11,410.0	88.80	359.20	7,036.6	4,469.8	450.1	4,469.8	2.17	0.53	Last Cathedral Survey @ 11,410' MD
11,460.0	89.06	358.15	7,037.6	4,519.8	449.0	4,519.8	2.16	0.52	Projection to Bit @ 11,460' MD

Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
- hit/miss target									
- Shape									
Chavez 4B-4H PBHL (6.	0.00	0.00	7,023.3	4,611.8	484.0	1,275,507.91	3,234,165.72	40.086620	-104.663100
- survey misses target center by 99.4ft at 11460.0ft MD (7037.6 TVD, 4519.8 N, 449.0 E)									
- Point									

Survey Annotations					
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment	
		+N/-S (ft)	+E/-W (ft)		
11,410.0	7,036.6	4,469.8	450.1	Last Cathedral Survey @ 11,410' MD	
11,460.0	7,037.6	4,519.8	449.0	Projection to Bit @ 11,460' MD	

Checked By: _____ Approved By: _____ Date: _____