







Cathedral Energy Services

Survey Report

Company:	EnCana Oil & Gas (USA) Inc	Local Co-ordinate Reference:	Well ALP FEE 24-12A
Project:	Mamm Creek	TVD Reference:	KB=22' @ 5702.0ft (Nabors M15)
Site:	J24NW Pad	MD Reference:	KB=22' @ 5702.0ft (Nabors M15)
Well:	ALP FEE 24-12A	North Reference:	True
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Project	Mamm Creek		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Central Zone		

Site		J24NW Pad			
Site Position:		Northing:	1,618,899.86 ft	Latitude:	39.511614
From:	Lat/Long	Easting:	2,373,314.58 ft	Longitude:	-107.721441
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence:	-1.40 °

Well		ALP FEE 24-12A				
Well Position	+N/-S	0.0 ft	Northing:	1,618,846.62 ft	Latitude:	39.511460
	+E/-W	0.0 ft	Easting:	2,373,196.72 ft	Longitude:	-107.721854
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	5,680.0 ft

Wellbore	OH				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	7/22/2013	9.96	65.74	52,084

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	262.88	

Survey Program	Date	7/31/2013			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
121.0	8,266.0	Survey #1 (OH)	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		
121.0	0.60	43.50	121.0	0.5	0.4	-0.5	0.50	0.50		
151.0	0.50	24.10	151.0	0.7	0.6	-0.7	0.70	-0.33		
182.0	0.80	307.60	182.0	0.9	0.5	-0.6	2.71	0.97		
213.0	1.40	293.20	213.0	1.2	0.0	-0.1	2.12	1.94		
243.0	2.50	270.00	243.0	1.4	-1.0	0.9	4.44	3.67		
274.0	3.60	258.40	273.9	1.2	-2.7	2.5	4.05	3.55		
304.0	4.90	260.00	303.8	0.8	-4.8	4.7	4.35	4.33		
335.0	6.70	259.60	334.7	0.2	-7.9	7.8	5.81	5.81		
365.0	8.20	260.30	364.4	-0.5	-11.8	11.7	5.01	5.00		
396.0	9.70	263.50	395.1	-1.1	-16.5	16.5	5.10	4.84		
426.0	11.40	264.70	424.5	-1.7	-22.0	22.0	5.71	5.67		
457.0	12.70	262.30	454.9	-2.4	-28.4	28.5	4.49	4.19		

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Wellbore:	OH	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
488.0	13.80	262.80	485.0	-3.4	-35.5	35.6	3.57	3.55	
579.0	14.80	262.80	573.2	-6.2	-57.8	58.1	1.10	1.10	
671.0	15.80	262.70	662.0	-9.2	-81.8	82.4	1.09	1.09	
764.0	16.50	262.90	751.3	-12.5	-107.5	108.2	0.76	0.75	
855.0	17.50	262.00	838.3	-16.0	-133.9	134.8	1.14	1.10	
948.0	20.20	261.80	926.3	-20.2	-163.6	164.9	2.90	2.90	
1,040.0	24.00	263.90	1,011.5	-24.5	-198.0	199.5	4.22	4.13	
1,132.0	27.20	263.80	1,094.5	-28.7	-237.5	239.2	3.48	3.48	
1,223.0	28.70	264.30	1,174.9	-33.1	-279.9	281.9	1.67	1.65	
1,275.0	29.20	264.10	1,220.4	-35.7	-304.9	307.0	0.98	0.96	
1,344.0	28.70	265.10	1,280.8	-38.8	-338.2	340.4	1.01	-0.72	
1,439.0	28.50	265.10	1,364.2	-42.7	-383.5	385.8	0.21	-0.21	
1,534.0	28.80	263.40	1,447.5	-47.3	-428.8	431.4	0.91	0.32	
1,629.0	29.10	263.70	1,530.7	-52.5	-474.5	477.4	0.35	0.32	
1,724.0	29.40	264.10	1,613.6	-57.4	-520.7	523.8	0.38	0.32	
1,820.0	28.90	261.20	1,697.4	-63.4	-567.0	570.5	1.56	-0.52	
1,914.0	27.50	264.00	1,780.2	-69.1	-611.1	614.9	2.05	-1.49	
2,009.0	27.70	263.80	1,864.4	-73.8	-654.8	658.9	0.23	0.21	
2,103.0	27.30	264.20	1,947.8	-78.3	-698.0	702.3	0.47	-0.43	
2,198.0	27.60	264.40	2,032.1	-82.7	-741.6	746.1	0.33	0.32	
2,292.0	27.60	265.50	2,115.4	-86.5	-785.0	789.6	0.54	0.00	
2,386.0	27.60	263.00	2,198.7	-90.9	-828.3	833.2	1.23	0.00	
2,482.0	27.10	262.30	2,284.0	-96.5	-872.0	877.3	0.62	-0.52	
2,577.0	27.20	263.40	2,368.5	-101.9	-915.0	920.6	0.54	0.11	
2,672.0	27.50	261.20	2,452.9	-107.7	-958.3	964.2	1.11	0.32	
2,766.0	27.20	261.60	2,536.4	-114.2	-1,001.0	1,007.4	0.37	-0.32	
2,861.0	27.70	261.50	2,620.7	-120.6	-1,044.3	1,051.2	0.53	0.53	
2,955.0	27.70	261.80	2,703.9	-127.0	-1,087.5	1,094.9	0.15	0.00	
3,050.0	27.40	261.30	2,788.2	-133.4	-1,131.0	1,138.8	0.40	-0.32	
3,144.0	27.80	263.50	2,871.5	-139.2	-1,174.1	1,182.3	1.16	0.43	
3,240.0	28.90	263.60	2,955.9	-144.3	-1,219.4	1,227.9	1.15	1.15	
3,335.0	28.80	264.30	3,039.2	-149.1	-1,265.0	1,273.8	0.37	-0.11	
3,429.0	28.40	263.90	3,121.7	-153.8	-1,309.8	1,318.7	0.47	-0.43	
3,534.0	27.80	264.00	3,214.3	-159.0	-1,359.0	1,368.2	0.57	-0.57	
3,619.0	27.20	263.00	3,289.7	-163.4	-1,398.0	1,407.4	0.89	-0.71	
3,715.0	27.40	261.50	3,375.0	-169.4	-1,441.6	1,451.5	0.75	0.21	
3,809.0	29.40	262.40	3,457.7	-175.6	-1,485.9	1,496.2	2.18	2.13	
3,905.0	29.40	261.90	3,541.3	-182.0	-1,532.5	1,543.3	0.26	0.00	
4,000.0	29.30	263.10	3,624.1	-188.1	-1,578.7	1,589.8	0.63	-0.11	
4,095.0	28.80	262.70	3,707.2	-193.8	-1,624.5	1,636.0	0.56	-0.53	
4,190.0	28.80	264.70	3,790.4	-198.8	-1,670.0	1,681.7	1.01	0.00	
4,286.0	28.60	264.10	3,874.6	-203.3	-1,715.8	1,727.8	0.37	-0.21	
4,381.0	27.80	264.60	3,958.4	-207.8	-1,760.5	1,772.7	0.88	-0.84	
4,477.0	27.00	264.20	4,043.6	-212.1	-1,804.5	1,816.9	0.86	-0.83	
4,570.0	27.80	263.70	4,126.2	-216.6	-1,847.0	1,859.6	0.90	0.86	
4,665.0	26.90	261.60	4,210.5	-222.2	-1,890.3	1,903.3	1.39	-0.95	
4,759.0	25.70	261.60	4,294.8	-228.2	-1,931.5	1,944.9	1.28	-1.28	
4,855.0	25.10	263.10	4,381.5	-233.7	-1,972.3	1,986.1	0.92	-0.62	
4,951.0	23.80	262.80	4,468.9	-238.6	-2,011.8	2,025.8	1.36	-1.35	
5,046.0	23.20	262.20	4,556.0	-243.5	-2,049.3	2,063.7	0.68	-0.63	
5,141.0	22.30	262.90	4,643.7	-248.3	-2,085.7	2,100.4	0.99	-0.95	
5,237.0	19.60	270.10	4,733.3	-250.5	-2,119.9	2,134.6	3.88	-2.81	
5,331.0	17.20	268.60	4,822.5	-250.9	-2,149.6	2,164.1	2.60	-2.55	

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Wellbore:	OH	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
5,425.0	15.00	267.60	4,912.8	-251.7	-2,175.7	2,190.1	2.36	-2.34	
5,520.0	13.20	264.50	5,004.9	-253.3	-2,198.7	2,213.2	2.05	-1.89	
5,615.0	11.20	261.50	5,097.8	-255.7	-2,218.7	2,233.2	2.21	-2.11	
5,710.0	9.90	259.20	5,191.2	-258.6	-2,235.8	2,250.6	1.44	-1.37	
5,805.0	9.40	261.90	5,284.8	-261.2	-2,251.5	2,266.5	0.71	-0.53	
5,901.0	7.60	263.40	5,379.8	-263.0	-2,265.6	2,280.7	1.89	-1.87	
5,996.0	6.10	263.40	5,474.1	-264.3	-2,276.8	2,292.0	1.58	-1.58	
6,092.0	4.90	248.00	5,569.7	-266.4	-2,285.7	2,301.1	1.97	-1.25	
6,188.0	2.40	247.50	5,665.5	-268.7	-2,291.4	2,307.0	2.60	-2.60	
6,283.0	0.70	206.80	5,760.4	-270.0	-2,293.5	2,309.2	2.03	-1.79	
6,378.0	0.90	185.10	5,855.4	-271.3	-2,293.8	2,309.7	0.38	0.21	
6,473.0	1.10	175.60	5,950.4	-272.9	-2,293.8	2,309.9	0.27	0.21	
6,569.0	1.50	167.20	6,046.4	-275.1	-2,293.4	2,309.8	0.46	0.42	
6,665.0	1.40	175.60	6,142.4	-277.5	-2,293.1	2,309.8	0.24	-0.10	
6,760.0	0.30	28.60	6,237.3	-278.4	-2,292.9	2,309.7	1.75	-1.16	
6,855.0	0.50	43.60	6,332.3	-277.9	-2,292.5	2,309.2	0.24	0.21	
6,950.0	1.00	336.20	6,427.3	-276.8	-2,292.5	2,309.1	0.98	0.53	
7,045.0	1.00	328.40	6,522.3	-275.4	-2,293.3	2,309.7	0.14	0.00	
7,141.0	0.70	35.50	6,618.3	-274.2	-2,293.4	2,309.7	1.01	-0.31	
7,236.0	1.00	68.20	6,713.3	-273.4	-2,292.3	2,308.5	0.59	0.32	
7,332.0	1.40	89.80	6,809.3	-273.1	-2,290.3	2,306.5	0.62	0.42	
7,427.0	1.20	179.90	6,904.3	-274.1	-2,289.2	2,305.5	1.94	-0.21	
7,522.0	2.00	178.20	6,999.2	-276.7	-2,289.1	2,305.7	0.84	0.84	
7,616.0	2.10	179.50	7,093.2	-280.1	-2,289.0	2,306.1	0.12	0.11	
7,711.0	2.40	182.20	7,188.1	-283.8	-2,289.1	2,306.6	0.33	0.32	
7,806.0	1.20	182.80	7,283.0	-286.8	-2,289.2	2,307.1	1.26	-1.26	
7,902.0	1.10	186.10	7,379.0	-288.7	-2,289.4	2,307.5	0.12	-0.10	
7,997.0	1.30	199.40	7,474.0	-290.6	-2,289.8	2,308.2	0.36	0.21	
8,092.0	1.10	177.70	7,569.0	-292.6	-2,290.1	2,308.7	0.52	-0.21	
8,188.0	1.40	157.10	7,665.0	-294.6	-2,289.6	2,308.5	0.56	0.31	
8,216.0	1.30	153.40	7,693.0	-295.2	-2,289.4	2,308.3	0.47	-0.36	Last Cathedral Survey @ 8,216' MD
8,266.0	1.30	153.40	7,742.9	-296.2	-2,288.9	2,307.9	0.00	0.00	Projection to Bit @ 8,266'

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Project:	Mamm Creek	TVD Reference:	KB=22' @ 5702.0ft (Nabors M15)
Site:	J24NW Pad	MD Reference:	KB=22' @ 5702.0ft (Nabors M15)
Well:	ALP FEE 24-12A	North Reference:	True
Wellbore:	OH	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									
ALP FEE 24-12A PBHL	0.00	0.00	7,722.0	-284.4	-2,277.7	1,618,618.05	2,370,912.71	39.510679	-107.729927
- actual wellpath misses target center by 16.1ft at 8244.9ft MD (7721.9 TVD, -295.8 N, -2289.1 E)									
- Circle (radius 25.0)									
ALP FEE 24-12A TGT	0.00	0.00	5,797.0	-284.4	-2,277.7	1,618,618.05	2,370,912.71	39.510679	-107.729927
- actual wellpath misses target center by 21.1ft at 6319.7ft MD (5797.1 TVD, -270.5 N, -2293.6 E)									
- Point									

Design Annotations					
Measured Depth	Vertical Depth	Local Coordinates			
(ft)	(ft)	+N/-S	+E/-W		
		(ft)	(ft)	Comment	
8,216.0	7,693.0	-295.2	-2,289.4	Last Cathedral Survey @ 8,216' MD	
8,266.0	7,742.9	-296.2	-2,288.9	Projection to Bit @ 8,266'	

Checked By: _____ Approved By: _____ Date: _____