

Survey Report

Company:	Petroleum Development Corp.	Local Co-ordinate Reference:	Well BERNHARDT 6O-443
Project:	Weld County	TVD Reference:	13' KB @ 4726.0usft (ENSIGN 124)
Site:	S6-T4N-R66W	MD Reference:	13' KB @ 4726.0usft (ENSIGN 124)
Well:	BERNHARDT 6O-443	North Reference:	True
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

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

Site		S6-T4N-R66W			
Site Position:		Northing:	1,367,096.68 usft	Latitude:	40.339120
From:	Lat/Long	Easting:	3,187,949.64 usft	Longitude:	-104.825760
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.44 °

Well	BERNHARDT 6O-443					
Well Position	+N/-S	0.0 usft	Northing:	1,367,111.69 usft	Latitude:	40.339160
	+E/-W	0.0 usft	Easting:	3,188,008.07 usft	Longitude:	-104.825550
Position Uncertainty		0.0 usft	Wellhead Elevation:	0.0 usft	Ground Level:	4,713.0 usft

Wellbore	HZ				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	5/3/2015	8.67	66.88	52,646

Design	FINAL				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.0	0.0	0.0	180.00	

Survey Program	Date	7/14/2015			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
159.0	11,842.0	Survey #1 (HZ)	MWD	Geolink MWD	

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments	
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00		
159.0	0.50	335.83	159.0	0.6	-0.3	-0.6	0.31	0.31		
252.0	0.80	342.63	252.0	1.6	-0.6	-1.6	0.33	0.32		
344.0	0.70	350.70	344.0	2.8	-0.9	-2.8	0.16	-0.11		
436.0	0.50	355.70	436.0	3.7	-1.0	-3.7	0.22	-0.22		
529.0	1.00	80.00	529.0	4.3	-0.3	-4.3	1.15	0.54		
621.0	2.00	74.00	620.9	4.9	2.1	-4.9	1.10	1.09		
714.0	3.10	63.10	713.8	6.5	5.9	-6.5	1.29	1.18		
807.0	4.70	55.60	806.6	9.7	11.2	-9.7	1.80	1.72		
896.0	4.30	51.90	895.4	13.9	16.9	-13.9	0.56	-0.45		
942.0	4.20	50.90	941.2	16.0	19.5	-16.0	0.27	-0.22		
1,035.0	7.40	56.50	1,033.7	21.4	27.2	-21.4	3.49	3.44		
1,128.0	10.80	56.80	1,125.6	29.5	39.5	-29.5	3.66	3.66		

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

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments
1,220.0	12.40	56.00	1,215.7	39.8	54.9	-39.8	1.75	1.74	
1,313.0	14.90	54.10	1,306.0	52.4	72.8	-52.4	2.73	2.69	
1,405.0	14.70	50.80	1,395.0	66.7	91.5	-66.7	0.94	-0.22	
1,498.0	14.70	48.90	1,484.9	81.9	109.5	-81.9	0.52	0.00	
1,591.0	14.50	47.50	1,574.9	97.5	127.0	-97.5	0.44	-0.22	
1,684.0	14.10	45.70	1,665.1	113.3	143.7	-113.3	0.64	-0.43	
1,776.0	15.70	51.50	1,754.0	128.9	161.4	-128.9	2.38	1.74	
1,867.0	15.50	48.60	1,841.6	144.6	180.2	-144.6	0.88	-0.22	
1,959.0	15.20	46.80	1,930.3	161.0	198.2	-161.0	0.61	-0.33	
2,051.0	15.10	44.50	2,019.1	177.8	215.4	-177.8	0.66	-0.11	
2,143.0	15.20	44.90	2,107.9	194.9	232.3	-194.9	0.16	0.11	
2,235.0	14.20	39.10	2,196.9	212.2	247.9	-212.2	1.93	-1.09	
2,327.0	13.90	35.50	2,286.2	229.9	261.5	-229.9	1.00	-0.33	
2,420.0	15.10	41.90	2,376.2	248.0	276.1	-248.0	2.15	1.29	
2,515.0	15.40	39.50	2,467.9	267.0	292.3	-267.0	0.74	0.32	
2,611.0	15.60	43.50	2,560.4	286.2	309.3	-286.2	1.13	0.21	
2,706.0	15.60	51.10	2,651.9	303.5	328.1	-303.5	2.15	0.00	
2,801.0	14.50	60.80	2,743.7	317.3	348.4	-317.3	2.89	-1.16	
2,897.0	14.00	58.30	2,836.7	329.3	368.8	-329.3	0.83	-0.52	
2,993.0	13.10	56.70	2,930.0	341.3	387.7	-341.3	1.02	-0.94	
3,088.0	12.30	56.00	3,022.7	352.9	405.1	-352.9	0.86	-0.84	
3,183.0	13.70	57.20	3,115.3	364.6	423.0	-364.6	1.50	1.47	
3,279.0	12.50	56.60	3,208.8	376.5	441.2	-376.5	1.26	-1.25	
3,374.0	13.60	52.90	3,301.3	388.9	458.7	-388.9	1.45	1.16	
3,470.0	12.10	50.70	3,394.9	402.1	475.5	-402.1	1.64	-1.56	
3,565.0	12.70	61.10	3,487.7	413.5	492.3	-413.5	2.43	0.63	
3,660.0	14.10	53.30	3,580.1	425.4	510.8	-425.4	2.40	1.47	
3,756.0	16.50	53.60	3,672.7	440.5	531.1	-440.5	2.50	2.50	
3,851.0	16.60	54.10	3,763.8	456.5	553.0	-456.5	0.18	0.11	
3,947.0	17.70	47.00	3,855.5	474.5	574.7	-474.5	2.46	1.15	
4,042.0	16.50	47.40	3,946.3	493.4	595.2	-493.4	1.27	-1.26	
4,137.0	15.60	37.50	4,037.6	512.7	612.9	-512.7	3.03	-0.95	
4,233.0	14.30	39.40	4,130.4	532.1	628.3	-532.1	1.45	-1.35	
4,328.0	13.80	45.40	4,222.5	549.1	643.8	-549.1	1.62	-0.53	
4,424.0	12.40	42.50	4,316.0	564.8	659.0	-564.8	1.61	-1.46	
4,519.0	13.10	48.20	4,408.7	579.5	673.9	-579.5	1.51	0.74	
4,615.0	12.20	48.20	4,502.4	593.5	689.6	-593.5	0.94	-0.94	
4,710.0	10.50	49.20	4,595.5	605.8	703.6	-605.8	1.80	-1.79	
4,806.0	11.60	46.10	4,689.7	618.2	717.2	-618.2	1.30	1.15	
4,901.0	12.40	40.10	4,782.7	632.7	730.6	-632.7	1.56	0.84	
4,996.0	12.40	49.80	4,875.5	647.1	745.0	-647.1	2.19	0.00	
5,091.0	13.00	50.10	4,968.1	660.5	761.0	-660.5	0.64	0.63	
5,187.0	11.40	50.50	5,062.0	673.5	776.6	-673.5	1.67	-1.67	
5,282.0	12.40	49.70	5,154.9	686.0	791.6	-686.0	1.07	1.05	
5,378.0	13.20	50.10	5,248.5	699.7	807.9	-699.7	0.84	0.83	
5,473.0	11.10	49.00	5,341.4	712.7	823.1	-712.7	2.22	-2.21	
5,568.0	9.60	43.20	5,434.9	724.5	835.4	-724.5	1.92	-1.58	
5,664.0	9.10	56.00	5,529.6	734.5	847.2	-734.5	2.22	-0.52	
5,759.0	6.80	52.80	5,623.7	742.1	857.9	-742.1	2.46	-2.42	
5,855.0	5.80	52.60	5,719.1	748.5	866.3	-748.5	1.04	-1.04	
5,950.0	4.80	50.50	5,813.7	754.0	873.2	-754.0	1.07	-1.05	
6,046.0	4.20	45.90	5,909.4	759.0	878.8	-759.0	0.73	-0.62	
6,141.0	3.20	46.40	6,004.2	763.2	883.2	-763.2	1.05	-1.05	

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Well:	BERNHARDT 6O-443	North Reference:	True
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments
6,236.0	2.70	47.80	6,099.1	766.6	886.8	-766.6	0.53	-0.53	
6,332.0	1.40	349.20	6,195.0	769.2	888.2	-769.2	2.40	-1.35	
6,427.0	1.40	135.80	6,290.0	769.5	888.8	-769.5	2.82	0.00	
6,523.0	1.10	136.50	6,386.0	768.0	890.3	-768.0	0.31	-0.31	
6,618.0	1.50	132.80	6,480.9	766.5	891.8	-766.5	0.43	0.42	
6,665.0	1.70	142.40	6,527.9	765.5	892.7	-765.5	0.71	0.43	
6,714.0	2.00	175.00	6,576.9	764.1	893.2	-764.1	2.20	0.61	
6,761.0	7.90	189.50	6,623.7	760.1	892.8	-760.1	12.73	12.55	
6,809.0	11.80	193.00	6,671.0	752.1	891.1	-752.1	8.22	8.12	
6,856.0	14.30	190.80	6,716.8	741.7	888.9	-741.7	5.42	5.32	
6,905.0	20.00	183.90	6,763.6	727.4	887.2	-727.4	12.33	11.63	
6,952.0	24.10	182.00	6,807.1	709.8	886.4	-709.8	8.85	8.72	
7,000.0	27.60	179.40	6,850.3	688.8	886.1	-688.8	7.66	7.29	
7,047.0	32.20	178.30	6,891.1	665.4	886.6	-665.4	9.86	9.79	
7,096.0	35.60	179.90	6,931.7	638.1	887.0	-638.1	7.17	6.94	
7,143.0	40.00	183.80	6,968.9	609.3	886.0	-609.3	10.65	9.36	
7,191.0	43.40	182.60	7,004.7	577.4	884.3	-577.4	7.28	7.08	
7,238.0	48.60	179.90	7,037.3	543.7	883.6	-543.7	11.81	11.06	
7,286.0	54.10	177.60	7,067.3	506.2	884.4	-506.2	12.05	11.46	
7,333.0	59.50	179.30	7,093.0	466.9	885.5	-466.9	11.88	11.49	
7,382.0	63.40	181.50	7,116.4	423.9	885.1	-423.9	8.88	7.96	
7,429.0	66.80	181.40	7,136.2	381.3	884.1	-381.3	7.24	7.23	
7,477.0	74.80	178.80	7,152.0	336.0	884.0	-336.0	17.43	16.67	
7,524.0	79.30	179.30	7,162.5	290.2	884.8	-290.2	9.63	9.57	
7,572.0	81.90	180.90	7,170.4	242.8	884.7	-242.8	6.34	5.42	
7,607.0	83.70	180.50	7,174.8	208.1	884.3	-208.1	5.27	5.14	
7,708.0	88.20	181.30	7,181.9	107.4	882.7	-107.4	4.52	4.46	
7,772.0	88.20	181.40	7,183.9	43.5	881.2	-43.5	0.16	0.00	
7,867.0	88.20	180.20	7,186.9	-51.5	879.8	51.5	1.26	0.00	
7,963.0	88.70	179.70	7,189.5	-147.4	879.9	147.4	0.74	0.52	
8,058.0	88.90	179.50	7,191.5	-242.4	880.6	242.4	0.30	0.21	
8,153.0	90.10	179.20	7,192.3	-337.4	881.7	337.4	1.30	1.26	
8,249.0	90.30	179.20	7,192.0	-433.4	883.0	433.4	0.21	0.21	
8,344.0	88.60	177.80	7,192.9	-528.4	885.5	528.4	2.32	-1.79	
8,439.0	90.10	178.80	7,194.0	-623.3	888.3	623.3	1.90	1.58	
8,535.0	90.30	178.30	7,193.6	-719.3	890.7	719.3	0.56	0.21	
8,630.0	90.40	180.80	7,193.0	-814.3	891.5	814.3	2.63	0.11	
8,725.0	90.30	181.40	7,192.5	-909.2	889.7	909.2	0.64	-0.11	
8,821.0	90.30	180.70	7,192.0	-1,005.2	887.9	1,005.2	0.73	0.00	
8,916.0	90.50	180.00	7,191.3	-1,100.2	887.3	1,100.2	0.77	0.21	
9,012.0	90.00	180.90	7,190.9	-1,196.2	886.6	1,196.2	1.07	-0.52	
9,107.0	90.10	179.90	7,190.8	-1,291.2	885.9	1,291.2	1.06	0.11	
9,203.0	89.40	179.90	7,191.2	-1,387.2	886.1	1,387.2	0.73	-0.73	
9,298.0	87.90	179.60	7,193.5	-1,482.2	886.5	1,482.2	1.61	-1.58	
9,393.0	88.50	179.90	7,196.4	-1,577.1	886.9	1,577.1	0.71	0.63	
9,489.0	89.70	181.00	7,197.9	-1,673.1	886.2	1,673.1	1.70	1.25	
9,584.0	89.40	181.40	7,198.7	-1,768.1	884.2	1,768.1	0.53	-0.32	
9,679.0	90.40	182.40	7,198.9	-1,863.0	881.0	1,863.0	1.49	1.05	
9,775.0	90.00	180.70	7,198.5	-1,959.0	878.4	1,959.0	1.82	-0.42	
9,870.0	89.60	181.40	7,198.9	-2,054.0	876.7	2,054.0	0.85	-0.42	
9,966.0	89.20	179.50	7,199.9	-2,150.0	875.9	2,150.0	2.02	-0.42	
10,061.0	90.10	179.30	7,200.4	-2,245.0	876.9	2,245.0	0.97	0.95	
10,156.0	90.70	179.10	7,199.8	-2,339.9	878.2	2,339.9	0.67	0.63	

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Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments
10,252.0	91.20	180.40	7,198.2	-2,435.9	878.7	2,435.9	1.45	0.52	
10,347.0	90.70	180.50	7,196.6	-2,530.9	877.9	2,530.9	0.54	-0.53	
10,443.0	91.00	179.60	7,195.2	-2,626.9	877.8	2,626.9	0.99	0.31	
10,538.0	91.50	180.90	7,193.1	-2,721.9	877.4	2,721.9	1.47	0.53	
10,634.0	89.30	179.10	7,192.4	-2,817.9	877.4	2,817.9	2.96	-2.29	
10,729.0	89.70	178.90	7,193.3	-2,912.8	879.1	2,912.8	0.47	0.42	
10,824.0	88.50	177.50	7,194.8	-3,007.8	882.1	3,007.8	1.94	-1.26	
10,920.0	89.00	178.30	7,196.9	-3,103.7	885.6	3,103.7	0.98	0.52	
11,015.0	89.30	178.50	7,198.3	-3,198.6	888.2	3,198.6	0.38	0.32	
11,110.0	90.00	179.00	7,198.8	-3,293.6	890.3	3,293.6	0.91	0.74	
11,206.0	90.50	179.70	7,198.4	-3,389.6	891.4	3,389.6	0.90	0.52	
11,301.0	90.70	178.80	7,197.4	-3,484.6	892.6	3,484.6	0.97	0.21	
11,396.0	90.10	181.00	7,196.8	-3,579.6	892.8	3,579.6	2.40	-0.63	
11,492.0	89.60	180.30	7,197.0	-3,675.6	891.7	3,675.6	0.90	-0.52	
11,587.0	91.20	180.50	7,196.4	-3,770.6	891.0	3,770.6	1.70	1.68	
11,683.0	91.10	179.80	7,194.4	-3,866.5	890.8	3,866.5	0.74	-0.10	
11,790.0	90.70	177.80	7,192.8	-3,973.5	893.0	3,973.5	1.91	-0.37	LAST CES SURVEY @ 11,790' MD
11,842.0	90.50	177.50	7,192.2	-4,025.5	895.2	4,025.5	0.69	-0.38	PTB @ 11,842' MD (2131' FNL & 2065' FWL)

Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
BERNHARDT 6O-443 P	0.00	0.00	7,185.0	-4,047.3	881.0	1,363,071.25	3,188,919.86	40.328050	-104.822390
- hit/miss target									
- Shape									
- actual wellpath misses target center by 27.0usft at 11842.0usft MD (7192.2 TVD, -4025.5 N, 895.2 E)									
- Point									

Casing Points					
Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")	
7,637.0	7,177.7	7" (2078' FSL & 2064' FWL)	0	0	

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Comment	
11,790.0	7,192.8	-3,973.5	893.0	LAST CES SURVEY @ 11,790' MD	
11,842.0	7,192.2	-4,025.5	895.2	PTB @ 11,842' MD (2131' FNL & 2065' FWL)	

Checked By: _____ Approved By: _____ Date: _____