

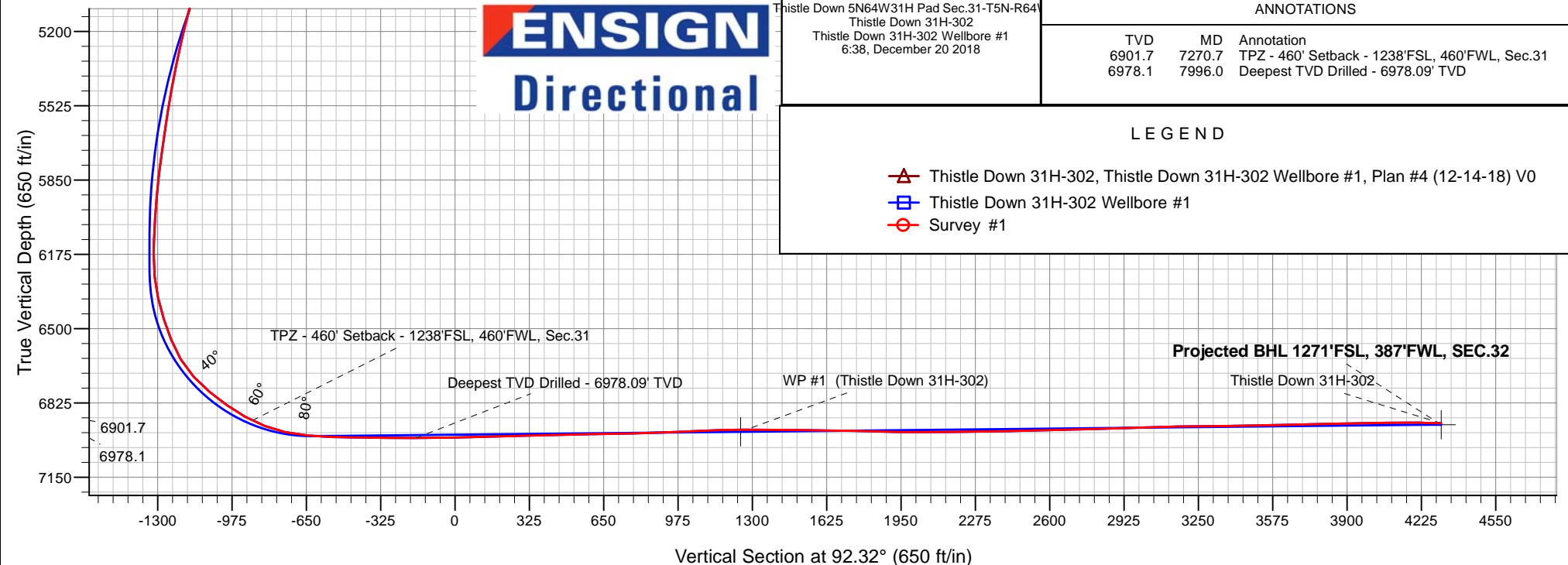
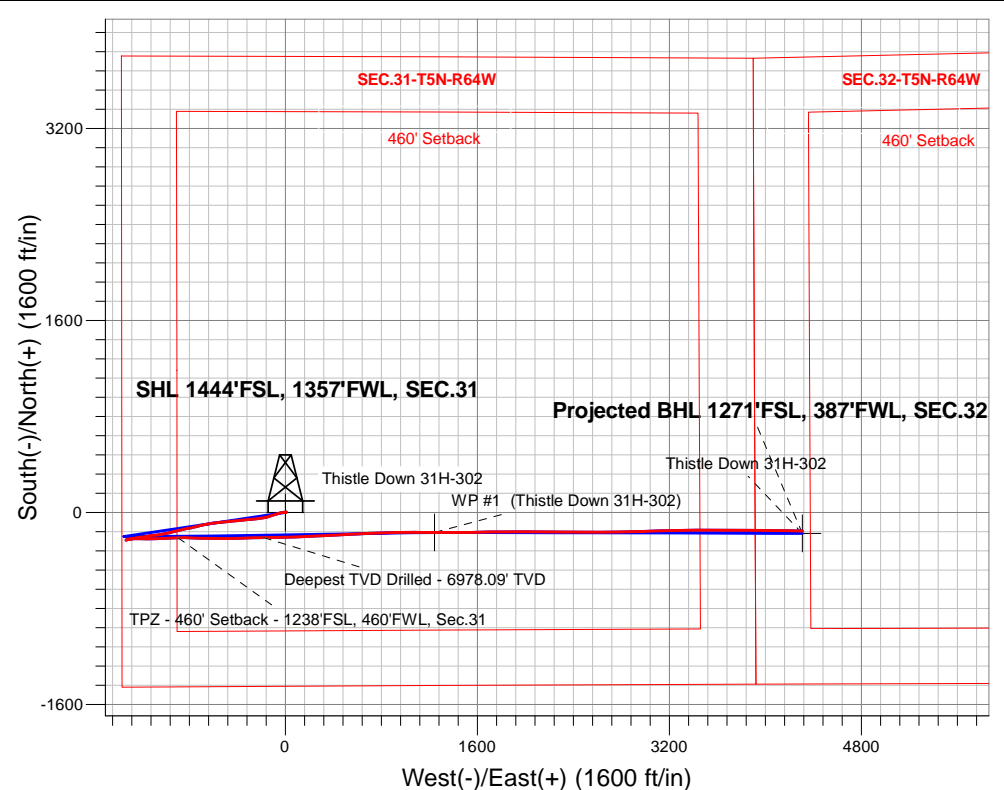
PDC Energy Inc. DJ Basin

Well Name: **Thistle Down 31H-302**

Surface Location: Thistle Down 5N64W31H Pad Sec.31-T5N-R64W
North American Datum 1983 , US State Plane 1983, Colorado Northern Zone
Ground Elevation: 4804.0
+N/-S+E/-W Northing Easting Latitude Longitude Slot
0.0 0.0 1372500.873251619.71 40.352400 -104.597170
Original Well Elev WELL @ 4827.0ft (Original Well Elev)

FINAL SURVEY

Projected Bottom Hole Location
12,487'MD 6914'TVD 155'S & 4308'E of SHL
88.65 degree Incl @ 91.85 degree AZM





PDC Energy Inc. DJ Basin

SEC.31-T5N-R64W

Thistle Down 5N64W31H Pad Sec.31-T5N-R64W

Thistle Down 31H-302

Thistle Down 31H-302 Wellbore #1

Survey: Survey #1

Standard Survey Report

20 December, 2018

Company:	PDC Energy Inc. DJ Basin	Local Co-ordinate Reference:	Well Thistle Down 31H-302
Project:	SEC.31-T5N-R64W	TVD Reference:	WELL @ 4827.0ft (Original Well Elev)
Site:	Thistle Down 5N64W31H Pad Sec.31-T5N-R64W	MD Reference:	WELL @ 4827.0ft (Original Well Elev)
Well:	Thistle Down 31H-302	North Reference:	True
Wellbore:	Thistle Down 31H-302 Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Thistle Down 31H-302 Wellbore #1	Database:	US_EDM

Project	SEC.31-T5N-R64W, Weld County, CO		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		Using Well Reference Point
Map Zone:	Colorado Northern Zone		Using geodetic scale factor

Site		Thistle Down 5N64W31H Pad Sec.31-T5N-R64W			
Site Position:		Northing:	1,372,559.16 usft	Latitude:	40.352560
From:	Lat/Long	Easting:	3,251,619.12 usft	Longitude:	-104.597170
Position Uncertainty:	0.0 ft	Slot Radius:	13-3/16 "	Grid Convergence:	0.58 °

Well	Thistle Down 31H-302					
Well Position	+N/-S	0.0 ft	Northing:	1,372,500.87 usft	Latitude:	40.352400
	+E/-W	0.0 ft	Easting:	3,251,619.71 usft	Longitude:	-104.597170
Position Uncertainty		0.0 ft	Wellhead Elevation:	0.0 ft	Ground Level:	4,804.0 ft

Wellbore	Thistle Down 31H-302 Wellbore #1				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	12/14/2018	8.17	66.83	52,183

Design	Thistle Down 31H-302 Wellbore #1				
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	92.32	

Survey Program	Date	12/20/2018			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
155.0	12,487.0	Survey #1 (Thistle Down 31H-302 Wellbor	MWD	MWD - Standard	

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	0.00	
1.0	0.00	47.00	1.0	0.0	0.0	0.0	0.26	0.26	0.00	
SHL 1444'FSL, 1357'FWL, SEC.31										
155.0	0.40	47.00	155.0	0.4	0.4	0.4	0.26	0.26	0.00	
250.0	0.50	49.10	250.0	0.9	1.0	0.9	0.11	0.11	2.21	
345.0	0.50	72.70	345.0	1.3	1.7	1.6	0.22	0.00	24.84	
440.0	0.60	71.40	440.0	1.5	2.5	2.5	0.11	0.11	-1.37	
536.0	0.60	80.10	536.0	1.8	3.5	3.4	0.09	0.00	9.06	
631.0	0.60	78.90	631.0	2.0	4.5	4.4	0.01	0.00	-1.26	
822.0	0.80	72.40	822.0	2.6	6.7	6.6	0.11	0.10	-3.40	

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Site:	Thistle Down 5N64W31H Pad Sec.31-T5N-R64W	MD Reference:	WELL @ 4827.0ft (Original Well Elev)
Well:	Thistle Down 31H-302	North Reference:	True
Wellbore:	Thistle Down 31H-302 Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Thistle Down 31H-302 Wellbore #1	Database:	US_EDM

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
918.0	0.90	82.40	918.0	2.9	8.1	8.0	0.19	0.10	10.42	
1,013.0	1.10	269.30	1,012.9	3.0	7.9	7.8	2.10	0.21	-182.21	
1,108.0	3.30	271.80	1,107.9	3.0	4.3	4.2	2.32	2.32	2.63	
1,204.0	6.30	265.50	1,203.5	2.7	-3.7	-3.8	3.17	3.13	-6.56	
1,299.0	9.10	264.20	1,297.7	1.5	-16.4	-16.4	2.95	2.95	-1.37	
1,395.0	11.90	255.30	1,392.0	-1.7	-33.5	-33.4	3.36	2.92	-9.27	
1,585.0	12.20	253.90	1,577.9	-12.3	-71.8	-71.2	0.22	0.16	-0.74	
1,777.0	12.28	250.17	1,765.5	-24.8	-110.5	-109.4	0.41	0.04	-1.94	
1,873.0	13.83	251.38	1,859.0	-32.0	-130.9	-129.5	1.64	1.61	1.26	
1,968.0	15.39	255.50	1,950.9	-38.7	-153.9	-152.2	1.97	1.64	4.34	
2,063.0	16.77	262.35	2,042.2	-43.7	-179.7	-177.8	2.47	1.45	7.21	
2,158.0	18.98	262.58	2,132.6	-47.5	-208.6	-206.5	2.33	2.33	0.24	
2,253.0	18.47	262.18	2,222.6	-51.6	-238.8	-236.5	0.55	-0.54	-0.42	
2,348.0	17.68	262.45	2,312.9	-55.5	-268.0	-265.6	0.84	-0.83	0.28	
2,442.0	18.99	265.68	2,402.2	-58.6	-297.4	-294.8	1.76	1.39	3.44	
2,537.0	18.46	265.35	2,492.1	-60.9	-327.8	-325.1	0.57	-0.56	-0.35	
2,632.0	17.73	262.77	2,582.4	-64.0	-357.2	-354.3	1.14	-0.77	-2.72	
2,727.0	19.55	264.85	2,672.4	-67.2	-387.4	-384.3	2.04	1.92	2.19	
2,822.0	20.33	265.90	2,761.7	-69.8	-419.7	-416.5	0.90	0.82	1.11	
2,917.0	19.86	264.49	2,851.0	-72.6	-452.2	-448.9	0.71	-0.49	-1.48	
3,035.0	19.55	263.94	2,962.1	-76.6	-491.8	-488.3	0.31	-0.26	-0.47	
3,130.0	18.74	264.85	3,051.8	-79.6	-522.8	-519.1	0.91	-0.85	0.96	
3,225.0	17.85	264.58	3,142.0	-82.4	-552.5	-548.7	0.94	-0.94	-0.28	
3,321.0	17.08	262.63	3,233.6	-85.6	-581.1	-577.2	1.01	-0.80	-2.03	
3,416.0	16.03	262.95	3,324.6	-89.0	-608.0	-603.9	1.11	-1.11	0.34	
3,511.0	16.86	258.76	3,415.7	-93.3	-634.5	-630.2	1.52	0.87	-4.41	
3,606.0	15.96	258.14	3,506.9	-98.6	-660.8	-656.2	0.97	-0.95	-0.65	
3,702.0	16.46	259.43	3,599.1	-103.8	-687.1	-682.3	0.64	0.52	1.34	
3,798.0	18.30	256.03	3,690.7	-110.0	-715.1	-710.0	2.19	1.92	-3.54	
3,893.0	17.70	255.21	3,781.0	-117.3	-743.5	-738.1	0.69	-0.63	-0.86	
3,989.0	19.77	256.55	3,871.9	-124.8	-773.4	-767.7	2.20	2.16	1.40	
4,084.0	22.55	258.91	3,960.5	-132.0	-806.9	-800.9	3.06	2.93	2.48	
4,180.0	22.61	258.32	4,049.2	-139.3	-843.0	-836.7	0.24	0.06	-0.61	
4,276.0	21.70	257.35	4,138.1	-146.9	-878.4	-871.8	1.02	-0.95	-1.01	
4,371.0	20.81	257.02	4,226.6	-154.5	-912.0	-905.0	0.95	-0.94	-0.35	
4,466.0	19.86	255.71	4,315.7	-162.3	-944.1	-936.8	1.11	-1.00	-1.38	
4,562.0	19.16	255.47	4,406.2	-170.3	-975.2	-967.5	0.73	-0.73	-0.25	
4,657.0	18.52	255.90	4,496.1	-177.9	-1,004.9	-996.9	0.69	-0.67	0.45	
4,753.0	17.08	264.99	4,587.5	-182.8	-1,033.7	-1,025.5	3.26	-1.50	9.47	
4,848.0	16.32	264.11	4,678.5	-185.4	-1,060.9	-1,052.5	0.84	-0.80	-0.93	
4,943.0	15.52	263.56	4,769.9	-188.2	-1,086.8	-1,078.3	0.86	-0.84	-0.58	
5,039.0	14.86	261.54	4,862.5	-191.5	-1,111.7	-1,103.1	0.88	-0.69	-2.10	

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Well:	Thistle Down 31H-302	North Reference:	True
Wellbore:	Thistle Down 31H-302 Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Thistle Down 31H-302 Wellbore #1	Database:	US_EDM

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
5,134.0	14.03	258.71	4,954.5	-195.5	-1,135.1	-1,126.2	1.15	-0.87	-2.98
5,230.0	13.82	260.03	5,047.7	-199.8	-1,157.8	-1,148.8	0.40	-0.22	1.38
5,325.0	14.40	264.50	5,139.8	-202.9	-1,180.7	-1,171.5	1.30	0.61	4.71
5,421.0	13.24	263.22	5,233.0	-205.3	-1,203.5	-1,194.2	1.25	-1.21	-1.33
5,516.0	11.98	260.98	5,325.7	-208.1	-1,224.1	-1,214.6	1.42	-1.33	-2.36
5,611.0	11.04	258.36	5,418.8	-211.5	-1,242.7	-1,233.1	1.13	-0.99	-2.76
5,707.0	9.71	257.75	5,513.3	-215.1	-1,259.6	-1,249.9	1.39	-1.39	-0.64
5,802.0	8.68	257.22	5,607.0	-218.4	-1,274.4	-1,264.6	1.09	-1.08	-0.56
5,897.0	8.23	259.27	5,701.0	-221.2	-1,288.1	-1,278.1	0.57	-0.47	2.16
5,993.0	7.87	259.14	5,796.1	-223.7	-1,301.3	-1,291.2	0.38	-0.38	-0.14
6,088.0	5.15	256.73	5,890.4	-226.0	-1,311.9	-1,301.6	2.88	-2.86	-2.54
6,183.0	4.10	252.74	5,985.1	-227.9	-1,319.3	-1,309.0	1.16	-1.11	-4.20
6,279.0	3.51	246.30	6,080.9	-230.1	-1,325.2	-1,314.8	0.76	-0.61	-6.71
6,374.0	1.09	335.24	6,175.8	-230.5	-1,328.3	-1,317.9	3.85	-2.55	93.62
6,470.0	6.38	60.02	6,271.6	-227.0	-1,324.0	-1,313.8	6.64	5.51	88.31
6,565.0	13.50	75.49	6,365.2	-221.6	-1,308.7	-1,298.7	7.94	7.49	16.28
6,661.0	17.41	89.43	6,457.7	-218.6	-1,283.5	-1,273.6	5.59	4.07	14.52
6,756.0	21.77	90.39	6,547.2	-218.6	-1,251.6	-1,241.8	4.60	4.59	1.01
6,852.0	30.38	91.22	6,633.3	-219.2	-1,209.5	-1,199.6	8.98	8.97	0.86
6,947.0	42.10	89.68	6,709.8	-219.6	-1,153.4	-1,143.6	12.37	12.34	-1.62
7,043.0	50.90	88.94	6,775.8	-218.7	-1,083.9	-1,074.1	9.18	9.17	-0.77
7,138.0	53.72	87.21	6,833.9	-216.1	-1,008.7	-999.2	3.30	2.97	-1.82
7,234.0	61.78	86.99	6,885.1	-212.0	-927.7	-918.4	8.40	8.40	-0.23
7,270.7	64.45	88.20	6,901.7	-210.7	-895.0	-885.8	7.84	7.27	3.29
TPZ - 460' Setback - 1238'FSL, 460'FWL, Sec.31									
7,330.0	68.78	90.04	6,925.2	-209.8	-840.6	-831.4	7.84	7.30	3.11
7,424.0	77.31	93.34	6,952.6	-212.6	-750.8	-741.6	9.67	9.07	3.51
7,520.0	84.95	91.33	6,967.4	-216.4	-656.1	-646.8	8.22	7.96	-2.09
7,554.2	86.04	90.43	6,970.1	-216.9	-622.0	-612.7	4.12	3.17	-2.63
LPL 1252'FSL, 733'FWL, SEC.31									
7,616.0	88.00	88.81	6,973.3	-216.5	-560.3	-551.1	4.12	3.18	-2.62
7,711.0	89.05	89.33	6,975.8	-215.0	-465.4	-456.3	1.23	1.11	0.55
7,806.0	89.50	88.86	6,977.0	-213.5	-370.4	-361.5	0.68	0.47	-0.49
7,902.0	89.92	88.85	6,977.5	-211.5	-274.4	-265.6	0.44	0.44	-0.01
7,996.0	89.31	88.52	6,978.1	-209.4	-180.4	-171.8	0.74	-0.65	-0.35
Deepest TVD Drilled - 6978.09' TVD									
8,093.0	91.29	88.52	6,977.6	-206.9	-83.5	-75.0	2.04	2.04	0.00
8,189.0	91.31	88.45	6,975.4	-204.3	12.5	20.7	0.08	0.02	-0.07
8,284.0	91.40	88.09	6,973.2	-201.5	107.4	115.4	0.39	0.09	-0.38
8,380.0	91.30	88.03	6,970.9	-198.2	203.3	211.2	0.12	-0.10	-0.06
8,475.0	91.45	87.94	6,968.6	-194.9	298.2	305.9	0.18	0.16	-0.09
8,571.0	91.61	87.21	6,966.1	-190.8	394.1	401.5	0.78	0.17	-0.76
8,666.0	91.34	86.63	6,963.6	-185.7	488.9	496.0	0.67	-0.28	-0.61

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Design:	Thistle Down 31H-302 Wellbore #1	Database:	US_EDM

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8,762.0	91.11	86.54	6,961.6	-180.0	584.7	591.5	0.26	-0.24	-0.09
8,858.0	91.01	86.31	6,959.8	-174.0	680.5	687.0	0.26	-0.10	-0.24
8,953.0	91.30	86.90	6,957.9	-168.4	775.3	781.5	0.69	0.31	0.62
9,049.0	92.02	90.16	6,955.1	-165.9	871.3	877.3	3.48	0.75	3.40
9,144.0	92.25	89.92	6,951.5	-166.0	966.2	972.1	0.35	0.24	-0.25
9,239.0	92.41	90.00	6,947.7	-165.9	1,061.1	1,067.0	0.19	0.17	0.08
9,335.0	92.25	89.68	6,943.8	-165.7	1,157.0	1,162.8	0.37	-0.17	-0.33
9,420.6	90.19	90.32	6,942.0	-165.7	1,242.6	1,248.3	2.52	-2.41	0.75
WP #1 (Thistle Down 31H-302)									
9,431.0	89.94	90.40	6,941.9	-165.7	1,253.0	1,258.7	2.52	-2.41	0.75
9,526.0	89.61	89.98	6,942.3	-166.1	1,348.0	1,353.6	0.56	-0.35	-0.44
9,621.0	89.46	90.01	6,943.1	-166.0	1,443.0	1,448.5	0.16	-0.16	0.03
9,717.0	89.30	89.60	6,944.1	-165.7	1,539.0	1,544.4	0.46	-0.17	-0.43
9,813.0	89.17	89.40	6,945.4	-164.9	1,635.0	1,640.3	0.25	-0.14	-0.21
9,908.0	88.85	88.88	6,947.1	-163.5	1,730.0	1,735.2	0.64	-0.34	-0.55
10,003.0	88.75	88.83	6,949.0	-161.6	1,824.9	1,830.0	0.12	-0.11	-0.05
10,098.0	88.44	88.72	6,951.4	-159.5	1,919.9	1,924.8	0.35	-0.33	-0.12
10,194.0	90.29	91.07	6,952.4	-159.4	2,015.9	2,020.7	3.12	1.93	2.45
10,290.0	90.25	90.79	6,952.0	-160.9	2,111.8	2,116.6	0.29	-0.04	-0.29
10,385.0	90.22	90.88	6,951.6	-162.3	2,206.8	2,211.6	0.10	-0.03	0.09
10,481.0	91.22	90.94	6,950.4	-163.8	2,302.8	2,307.6	1.04	1.04	0.06
10,577.0	91.39	90.15	6,948.2	-164.7	2,398.8	2,403.5	0.84	0.18	-0.82
10,672.0	91.22	89.87	6,946.0	-164.8	2,493.8	2,498.4	0.34	-0.18	-0.29
10,768.0	91.35	89.55	6,943.9	-164.3	2,589.7	2,594.3	0.36	0.14	-0.33
10,863.0	91.36	89.33	6,941.6	-163.3	2,684.7	2,689.1	0.23	0.01	-0.23
10,959.0	91.45	89.17	6,939.3	-162.1	2,780.7	2,784.9	0.19	0.09	-0.17
11,054.0	91.67	88.48	6,936.7	-160.1	2,875.6	2,879.7	0.76	0.23	-0.73
11,150.0	91.83	88.12	6,933.8	-157.3	2,971.5	2,975.4	0.41	0.17	-0.38
11,245.0	92.06	87.96	6,930.5	-154.0	3,066.4	3,070.1	0.29	0.24	-0.17
11,341.0	90.92	89.60	6,928.0	-152.0	3,162.3	3,165.9	2.08	-1.19	1.71
11,437.0	90.43	88.78	6,926.9	-150.6	3,258.3	3,261.8	0.99	-0.51	-0.85
11,532.0	90.15	88.32	6,926.4	-148.2	3,353.3	3,356.6	0.57	-0.29	-0.48
11,628.0	91.55	90.00	6,925.0	-146.8	3,449.3	3,452.4	2.28	1.46	1.75
11,723.0	91.63	90.54	6,922.4	-147.3	3,544.2	3,547.3	0.57	0.08	0.57
11,819.0	91.18	89.91	6,920.0	-147.7	3,640.2	3,643.2	0.81	-0.47	-0.66
11,914.0	91.20	90.17	6,918.0	-147.7	3,735.2	3,738.1	0.27	0.02	0.27
12,010.0	90.59	91.08	6,916.5	-148.8	3,831.2	3,834.0	1.14	-0.64	0.95
12,106.0	91.37	90.42	6,914.9	-150.0	3,927.1	3,930.0	1.06	0.81	-0.69
12,202.0	91.42	90.02	6,912.6	-150.4	4,023.1	4,025.9	0.42	0.05	-0.42
12,298.0	90.59	90.06	6,910.9	-150.5	4,119.1	4,121.8	0.87	-0.86	0.04
12,393.0	88.68	91.79	6,911.5	-152.0	4,214.1	4,216.8	2.71	-2.01	1.82
12,430.0	88.65	91.85	6,912.4	-153.2	4,251.0	4,253.8	0.18	-0.08	0.16
12,487.0	88.65	91.85	6,913.7	-155.0	4,308.0	4,310.7	0.00	0.00	0.00

Company:	PDC Energy Inc. DJ Basin	Local Co-ordinate Reference:	Well Thistle Down 31H-302
Project:	SEC.31-T5N-R64W	TVD Reference:	WELL @ 4827.0ft (Original Well Elev)
Site:	Thistle Down 5N64W31H Pad Sec.31-T5N-R64W	MD Reference:	WELL @ 4827.0ft (Original Well Elev)
Well:	Thistle Down 31H-302	North Reference:	True
Wellbore:	Thistle Down 31H-302 Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Thistle Down 31H-302 Wellbore #1	Database:	US_EDM

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
Projected BHL 1271'FSL, 387'FWL, SEC.32									

Design Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (usft)	Easting (usft)	Latitude	Longitude
SHL 1444'FSL, 1357'FW - hit/miss target - Shape - Point	0.00	0.00	1.0	0.0	0.0	1,372,500.87	3,251,619.71	40.352400	-104.597170
Projected BHL 1271'FSL - survey misses target center by 20.4ft at 12487.0ft MD (6913.7 TVD, -155.0 N, 4308.0 E) - Point	0.00	0.00	6,920.0	-174.4	4,308.0	1,372,370.33	3,255,929.07	40.351920	-104.581714
WP #1 (Thistle Down 3' - survey misses target center by 9.2ft at 9420.7ft MD (6942.0 TVD, -165.7 N, 1242.8 E) - Point	0.00	0.00	6,951.1	-166.3	1,242.8	1,372,347.24	3,252,864.05	40.351944	-104.592711

Survey Annotations					
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates			
		+N/-S (ft)	+E/-W (ft)	Comment	
7,270.7	6,901.7	-210.7	-895.0	TPZ - 460' Setback - 1238'FSL, 460'FWL, Sec.31	
7,996.0	6,978.1	-209.4	-180.4	Deepest TVD Drilled - 6978.09' TVD	

Checked By: _____	Approved By: _____	Date: _____
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