

Survey Report

Company:	Crestone Peak Resources	Local Co-ordinate Reference:	Well Herren 1D-33H-H367
Project:	Sec 33 T3N-R67W	TVD Reference:	WELL @ 4871.0ft (Original Well Elev)
Site:	Herren Pad	MD Reference:	WELL @ 4871.0ft (Original Well Elev)
Well:	Herren 1D-33H-H367	North Reference:	True
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Project	Sec 33 T3N-R67W, Weld County, CO		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Northern Zone		

Site		Herren Pad			
Site Position:		Northing:	1,310,206.92 ft	Latitude:	40.183282
From:	Map	Easting:	3,171,259.40 ft	Longitude:	-104.887065
Position Uncertainty:	0.0 ft	Slot Radius:	13.200 in	Grid Convergence:	0.40 °

Well	Herren 1D-33H-H367					
Well Position	+N/-S	0.0 ft	Northing:	1,310,192.78 ft	Latitude:	40.183244
	+E/-W	0.0 ft	Easting:	3,171,245.26 ft	Longitude:	-104.887116
Position Uncertainty		0.0 ft	Wellhead Elevation:	ft	Ground Level:	4,848.0 ft

Wellbore	OH				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM_FILE	12/11/2018	8.40	66.57	52,131.90000000

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	293.81	

Survey Program	Date	1/1/2019			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
97.0	1,952.0	Survey #1 (OH)	GYRO-MWD	OWSG Gyro MWD	
2,073.0	12,050.0	Survey #2 (OH)	MWD+HDGM	OWSG MWD + HDGM	

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		
97.0	0.18	263.94	97.0	0.0	-0.2	0.1	0.19	0.19		
177.0	0.53	191.78	177.0	-0.4	-0.4	0.2	0.63	0.44		
272.0	0.53	243.46	272.0	-1.0	-0.8	0.4	0.49	0.00		
366.0	0.53	143.00	366.0	-1.6	-1.0	0.3	0.87	0.00		
441.0	1.21	62.19	441.0	-1.5	-0.1	-0.5	1.65	0.91		
535.0	2.90	39.45	534.9	0.8	2.3	-1.8	1.96	1.80		
650.0	4.93	17.67	649.7	7.8	5.7	-2.1	2.16	1.77		
724.0	6.76	23.02	723.3	14.8	8.4	-1.7	2.58	2.47		
818.0	8.93	20.48	816.4	26.8	13.1	-1.2	2.34	2.31		
913.0	10.46	17.82	910.0	41.9	18.3	0.2	1.68	1.61		
1,008.0	12.43	15.93	1,003.1	59.9	23.7	2.5	2.11	2.07		

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

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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
1,102.0	14.99	16.12	1,094.4	81.3	29.9	5.5	2.72	2.72	
1,197.0	17.16	16.70	1,185.7	106.6	37.3	8.9	2.29	2.28	
1,291.0	19.02	21.80	1,275.1	134.1	47.0	11.1	2.60	1.98	
1,386.0	18.73	20.97	1,365.0	162.7	58.2	12.4	0.42	-0.31	
1,480.0	16.71	20.14	1,454.5	189.5	68.3	14.0	2.17	-2.15	
1,575.0	15.61	21.15	1,545.8	214.2	77.6	15.5	1.20	-1.16	
1,669.0	15.84	22.35	1,636.2	237.9	87.0	16.4	0.42	0.24	
1,763.0	15.38	21.26	1,726.8	261.3	96.4	17.3	0.58	-0.49	
1,857.0	16.20	20.43	1,817.2	285.3	105.5	18.6	0.90	0.87	
1,952.0	16.89	20.58	1,908.3	310.6	115.0	20.2	0.73	0.73	
2,073.0	15.29	19.84	2,024.5	342.1	126.6	22.3	1.33	-1.32	
2,167.0	16.26	19.22	2,115.0	366.1	135.1	24.2	1.05	1.03	
2,261.0	17.97	18.17	2,204.8	392.3	144.0	26.7	1.85	1.82	
2,355.0	18.55	19.66	2,294.1	420.2	153.5	29.2	0.79	0.62	
2,449.0	18.46	24.41	2,383.3	447.8	164.7	30.1	1.61	-0.10	
2,544.0	15.73	23.18	2,474.0	473.4	176.0	30.1	2.90	-2.87	
2,639.0	18.11	25.02	2,564.9	498.6	187.3	29.9	2.57	2.51	
2,733.0	19.47	21.95	2,653.9	526.4	199.4	30.1	1.79	1.45	
2,827.0	18.46	20.45	2,742.8	554.8	210.4	31.5	1.19	-1.07	
2,921.0	16.57	17.29	2,832.5	581.6	219.6	33.9	2.25	-2.01	
3,015.0	16.57	17.90	2,922.6	607.1	227.7	36.8	0.19	0.00	
3,110.0	17.36	20.72	3,013.4	633.3	236.9	38.9	1.20	0.83	
3,205.0	17.31	21.42	3,104.1	659.7	247.1	40.3	0.23	-0.05	
3,299.0	17.14	22.91	3,193.9	685.5	257.5	41.1	0.50	-0.18	
3,394.0	17.75	24.23	3,284.5	711.6	268.9	41.2	0.77	0.64	
3,488.0	17.36	24.23	3,374.1	737.4	280.6	41.0	0.41	-0.41	
3,583.0	16.13	21.51	3,465.1	762.6	291.2	41.4	1.53	-1.29	
3,677.0	15.51	21.77	3,555.6	786.5	300.7	42.4	0.66	-0.66	
3,795.0	17.10	22.74	3,668.8	817.1	313.2	43.3	1.37	1.35	
3,890.0	17.97	20.36	3,759.4	843.7	323.7	44.4	1.19	0.92	
3,984.0	20.44	22.30	3,848.2	872.5	335.0	45.7	2.71	2.63	
4,079.0	19.07	20.10	3,937.6	902.4	346.6	47.2	1.64	-1.44	
4,174.0	17.27	18.17	4,027.8	930.4	356.4	49.6	2.00	-1.89	
4,268.0	17.10	17.81	4,117.6	956.8	365.0	52.4	0.21	-0.18	
4,363.0	17.31	17.38	4,208.4	983.6	373.4	55.4	0.26	0.22	
4,457.0	17.58	19.48	4,298.1	1,010.4	382.4	58.1	0.73	0.29	
4,552.0	19.16	23.26	4,388.2	1,038.2	393.3	59.3	2.08	1.66	
4,646.0	21.53	24.76	4,476.3	1,068.0	406.6	59.2	2.58	2.52	
4,741.0	19.25	20.28	4,565.4	1,098.6	419.3	59.8	2.91	-2.40	
4,835.0	16.70	12.72	4,654.8	1,126.3	427.7	63.4	3.67	-2.71	
4,930.0	16.88	20.63	4,745.8	1,152.5	435.6	66.8	2.41	0.19	
5,024.0	18.59	24.14	4,835.3	1,179.0	446.5	67.5	2.14	1.82	
5,118.0	16.66	22.47	4,924.9	1,205.1	457.8	67.7	2.12	-2.05	
5,213.0	14.85	22.91	5,016.3	1,228.9	467.7	68.2	1.91	-1.91	
5,308.0	14.68	25.90	5,108.2	1,250.9	477.7	67.9	0.82	-0.18	
5,403.0	15.91	26.34	5,199.8	1,273.4	488.8	66.9	1.30	1.29	
5,497.0	18.02	19.13	5,289.7	1,298.7	499.2	67.5	3.17	2.24	
5,592.0	18.77	17.29	5,379.9	1,327.2	508.6	70.5	1.00	0.79	
5,686.0	18.63	19.84	5,468.9	1,355.8	518.2	73.2	0.88	-0.15	
5,781.0	18.33	23.35	5,559.0	1,383.7	529.3	74.4	1.21	-0.32	
5,875.0	16.35	18.87	5,648.7	1,409.8	539.4	75.7	2.54	-2.11	
5,969.0	14.59	22.30	5,739.3	1,433.3	548.2	77.1	2.11	-1.87	
6,064.0	15.29	20.72	5,831.1	1,456.1	557.1	78.1	0.85	0.74	

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Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
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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
6,158.0	16.26	14.30	5,921.6	1,480.4	564.8	81.0	2.12	1.03	
6,252.0	16.22	16.50	6,011.8	1,505.8	571.8	84.8	0.66	-0.04	
6,347.0	15.95	26.60	6,103.1	1,530.2	581.4	85.9	2.96	-0.28	
6,441.0	16.74	19.84	6,193.3	1,554.5	591.8	86.2	2.19	0.84	
6,536.0	19.12	9.11	6,283.8	1,582.7	598.9	91.1	4.28	2.51	
6,631.0	20.79	350.48	6,373.1	1,614.7	598.5	104.3	6.89	1.76	
6,678.0	22.50	341.34	6,416.8	1,631.5	594.3	114.9	8.03	3.64	
6,725.0	23.91	333.78	6,460.0	1,648.6	587.2	128.3	7.01	3.00	
6,772.0	26.94	328.16	6,502.5	1,666.2	577.4	144.4	8.23	6.45	
6,820.0	29.31	327.28	6,544.8	1,685.3	565.3	163.2	5.01	4.94	
6,867.0	32.30	325.87	6,585.2	1,705.4	552.0	183.4	6.54	6.36	
6,914.0	36.17	324.90	6,624.0	1,727.1	537.0	206.0	8.32	8.23	
6,961.0	39.60	324.29	6,661.1	1,750.6	520.3	230.8	7.34	7.30	
7,009.0	43.20	318.49	6,697.1	1,775.4	500.4	258.9	10.95	7.50	
7,056.0	44.65	314.53	6,731.0	1,799.0	478.0	289.0	6.61	3.09	
7,104.0	45.66	309.88	6,764.9	1,821.8	452.8	321.2	7.18	2.10	
7,151.0	46.54	305.57	6,797.4	1,842.5	426.0	354.1	6.87	1.87	
7,198.0	46.93	302.23	6,829.7	1,861.6	397.6	387.8	5.24	0.83	
7,245.0	47.37	296.69	6,861.6	1,878.6	367.6	422.1	8.69	0.94	
7,293.0	49.09	290.10	6,893.6	1,892.7	334.8	457.8	10.84	3.58	
7,340.0	50.58	282.72	6,924.0	1,902.8	300.4	493.4	12.41	3.17	
7,387.0	53.44	279.64	6,952.9	1,910.0	264.0	529.5	7.98	6.09	
7,434.0	55.85	273.84	6,980.1	1,914.5	226.0	566.1	11.29	5.13	
7,482.0	58.32	269.18	7,006.2	1,915.5	185.7	603.4	9.64	5.15	
7,529.0	61.39	265.93	7,029.8	1,913.8	145.1	639.8	8.85	6.53	
7,576.0	66.89	264.17	7,050.3	1,910.1	103.0	676.9	12.18	11.70	
7,623.0	70.66	263.38	7,067.3	1,905.3	59.5	714.8	8.17	8.02	
7,671.0	73.30	263.47	7,082.2	1,900.1	14.1	754.1	5.50	5.50	
7,718.0	74.97	263.82	7,095.0	1,895.1	-30.8	793.2	3.62	3.55	
7,765.0	77.48	264.35	7,106.2	1,890.4	-76.2	832.9	5.45	5.34	
7,775.7	78.25	264.81	7,108.4	1,889.4	-86.6	842.0	8.34	7.18	TPZ - 7775.7' MD (382 FNL, 460 FEL)
7,812.0	80.86	266.37	7,115.0	1,886.7	-122.2	873.5	8.34	7.19	
7,859.0	85.17	268.13	7,120.7	1,884.4	-168.8	915.2	9.89	9.17	
7,906.0	87.58	268.92	7,123.7	1,883.2	-215.7	957.6	5.40	5.13	
7,954.0	90.22	268.48	7,124.6	1,882.1	-263.6	1,001.0	5.58	5.50	
8,049.0	89.12	270.50	7,125.2	1,881.3	-358.6	1,087.6	2.42	-1.16	
8,143.0	88.20	272.08	7,127.4	1,883.4	-452.6	1,174.4	1.94	-0.98	
8,238.0	87.45	272.08	7,131.0	1,886.9	-547.4	1,262.6	0.79	-0.79	
8,332.0	88.64	272.70	7,134.2	1,890.8	-641.3	1,350.0	1.43	1.27	
8,427.0	91.14	272.96	7,134.4	1,895.5	-736.2	1,438.7	2.65	2.63	
8,521.0	90.92	272.96	7,132.7	1,900.3	-830.0	1,526.6	0.23	-0.23	
8,616.0	91.01	272.79	7,131.1	1,905.1	-924.9	1,615.3	0.20	0.09	
8,710.0	91.19	272.52	7,129.3	1,909.4	-1,018.8	1,702.9	0.35	0.19	
8,804.0	91.23	272.43	7,127.3	1,913.5	-1,112.7	1,790.5	0.10	0.04	
8,898.0	91.06	271.91	7,125.4	1,917.1	-1,206.6	1,877.8	0.58	-0.18	
8,993.0	89.91	271.73	7,124.6	1,920.1	-1,301.5	1,965.9	1.23	-1.21	
9,088.0	90.13	271.91	7,124.6	1,923.1	-1,396.5	2,054.0	0.30	0.23	
9,182.0	89.47	271.82	7,124.9	1,926.2	-1,490.4	2,141.2	0.71	-0.70	
9,277.0	89.82	271.82	7,125.5	1,929.2	-1,585.4	2,229.3	0.37	0.37	
9,371.0	89.91	271.64	7,125.7	1,932.0	-1,679.4	2,316.4	0.21	0.10	
9,465.0	89.30	271.56	7,126.4	1,934.6	-1,773.3	2,403.4	0.65	-0.65	
9,560.0	91.41	271.99	7,125.8	1,937.6	-1,868.3	2,491.5	2.27	2.22	
9,654.0	92.51	269.80	7,122.6	1,939.0	-1,962.2	2,578.0	2.61	1.17	

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9,749.0	93.34	269.45	7,117.7	1,938.4	-2,057.1	2,664.5	0.95	0.87	
9,843.0	94.13	269.09	7,111.6	1,937.2	-2,150.9	2,749.9	0.92	0.84	
9,937.0	92.68	268.04	7,106.0	1,934.9	-2,244.7	2,834.7	1.90	-1.54	
10,032.0	91.19	268.22	7,102.8	1,931.8	-2,339.5	2,920.3	1.58	-1.57	
10,126.0	90.31	269.01	7,101.6	1,929.5	-2,433.5	3,005.3	1.26	-0.94	
10,221.0	89.03	270.76	7,102.1	1,929.3	-2,528.5	3,092.2	2.28	-1.35	
10,315.0	89.08	270.32	7,103.7	1,930.2	-2,622.5	3,178.5	0.47	0.05	
10,409.0	89.47	269.18	7,104.9	1,929.8	-2,716.5	3,264.3	1.28	0.41	
10,504.0	89.74	268.57	7,105.5	1,927.9	-2,811.5	3,350.5	0.70	0.28	
10,598.0	89.82	269.80	7,105.9	1,926.6	-2,905.4	3,435.9	1.31	0.09	
10,693.0	89.17	269.36	7,106.7	1,925.9	-3,000.4	3,522.6	0.83	-0.68	
10,787.0	89.43	268.83	7,107.9	1,924.4	-3,094.4	3,607.9	0.63	0.28	
10,882.0	89.25	268.74	7,109.0	1,922.4	-3,189.4	3,694.0	0.21	-0.19	
10,977.0	89.03	269.80	7,110.4	1,921.2	-3,284.4	3,780.4	1.14	-0.23	
11,071.0	88.95	269.53	7,112.0	1,920.6	-3,378.4	3,866.2	0.30	-0.09	
11,166.0	87.85	269.01	7,114.7	1,919.4	-3,473.3	3,952.6	1.28	-1.16	
11,261.0	87.63	270.41	7,118.4	1,918.9	-3,568.2	4,039.2	1.49	-0.23	
11,355.0	86.44	270.24	7,123.3	1,919.5	-3,662.1	4,125.3	1.28	-1.27	
11,450.0	85.65	269.36	7,129.9	1,919.1	-3,756.9	4,211.9	1.24	-0.83	
11,544.0	86.75	270.24	7,136.1	1,918.8	-3,850.7	4,297.6	1.50	1.17	
11,639.0	88.90	271.82	7,139.7	1,920.5	-3,945.6	4,385.1	2.81	2.26	
11,733.0	91.54	271.64	7,139.3	1,923.4	-4,039.5	4,472.2	2.82	2.81	
11,828.0	91.27	270.85	7,137.0	1,925.4	-4,134.5	4,559.9	0.88	-0.28	
11,923.0	90.92	270.24	7,135.2	1,926.3	-4,229.4	4,647.1	0.74	-0.37	
11,980.0	90.84	270.59	7,134.3	1,926.7	-4,286.4	4,699.4	0.63	-0.14	LAST SURVEY - 11980.0' MD
12,050.0	90.84	270.59	7,133.3	1,927.5	-4,356.4	4,763.8	0.00	0.00	PTB - 12050.0' MD (397 FNL, 466 FWL)

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Company:	Crestone Peak Resources	Local Co-ordinate Reference:	Well Herren 1D-33H-H367
Project:	Sec 33 T3N-R67W	TVD Reference:	WELL @ 4871.0ft (Original Well Elev)
Site:	Herren Pad	MD Reference:	WELL @ 4871.0ft (Original Well Elev)
Well:	Herren 1D-33H-H367	North Reference:	True
Wellbore:	OH	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
Herren 1D-33H-H367 B1 - actual wellpath misses target center by 7.4ft at 12050.0ft MD (7133.3 TVD, 1927.5 N, -4356.4 E) - Point	0.00	0.00	7,130.0	1,925.5	-4,362.7	1,312,088.08	3,166,869.32	40.188528	-104.902732
Herren 1D-33H-H367 TF - actual wellpath misses target center by 25.5ft at 7773.5ft MD (7108.0 TVD, 1889.6 N, -84.4 E) - Point	0.00	0.00	7,090.0	1,871.6	-86.6	1,312,063.76	3,171,145.72	40.188381	-104.887426
Herren 1D 1689' TGT - actual wellpath misses target center by 5.3ft at 9380.7ft MD (7125.7 TVD, 1932.3 N, -1689.0 E) - Point	0.00	0.00	7,131.0	1,931.5	-1,689.0	1,312,112.57	3,169,542.95	40.188546	-104.893162
Herren 1D 2624' TGT - actual wellpath misses target center by 3.2ft at 10316.5ft MD (7103.7 TVD, 1930.2 N, -2624.0 E) - Point	0.00	0.00	7,101.0	1,932.0	-2,624.0	1,312,106.56	3,168,607.97	40.188547	-104.896508
Herren 1D 86' TGT - actual wellpath misses target center by 26.0ft at 7780.0ft MD (7109.3 TVD, 1889.0 N, -90.8 E) - Point	0.00	0.00	7,128.0	1,871.6	-86.0	1,312,063.72	3,171,146.33	40.188381	-104.887424

Design Annotations					
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates			
		+N/-S (ft)	+E/-W (ft)	Comment	
7,775.7	7,108.4	1,889.4	-86.6	TPZ - 7775.7' MD (382 FNL, 460 FEL)	
11,980.0	7,134.3	1,926.7	-4,286.4	LAST SURVEY - 11980.0' MD	
12,050.0	7,133.3	1,927.5	-4,356.4	PTB - 12050.0' MD (397 FNL, 466 FWL)	

Checked By: _____	Approved By: _____	Date: _____
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