



Well: Hillrock 10 HM (N)
Site: Hillrock/Simms
Project: Marshall County, West Virginia
Design: rev2

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSEct	Annotation
1	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.000	0.00	
2	1318.00	0.00	0.000	1318.00	0.00	0.00	0.00	0.000	0.00	KOP Begin 3°/100' build
3	2370.38	31.57	116.716	2317.92	-127.08	252.50	3.00	116.716	252.53	Begin 31.57° tangent
4	6939.96	31.57	116.716	6211.16	-1202.66	2389.54	0.00	0.000	2389.83	Begin 8°/100' build/turn
5	7209.75	50.00	134.346	6415.22	-1307.89	2528.17	8.00	39.102	2556.96	Begin 10°/100' build/turn
6	7629.66	89.10	151.164	6560.00	-1618.22	2754.66	10.00	25.622	2941.14	Begin 89.10° lateral
7	16887.26	89.10	151.164	6705.00	-9726.94	7219.06	0.00	0.000	2113.14	PBHL/TD 16887.26 MD/6705.00 TVD

Geodetic System: Universal Transverse Mercator (US Survey Feet)
 Datum: NAD83 West Virginia - HARN
 Ellipsoid: GRS 1980
 Zone: Zone 17N (84 W to 78 W)

System Datum: Mean Sea Level
 Depth Reference: RKB=1219+18 @ 1237.00ft (Precision 528)

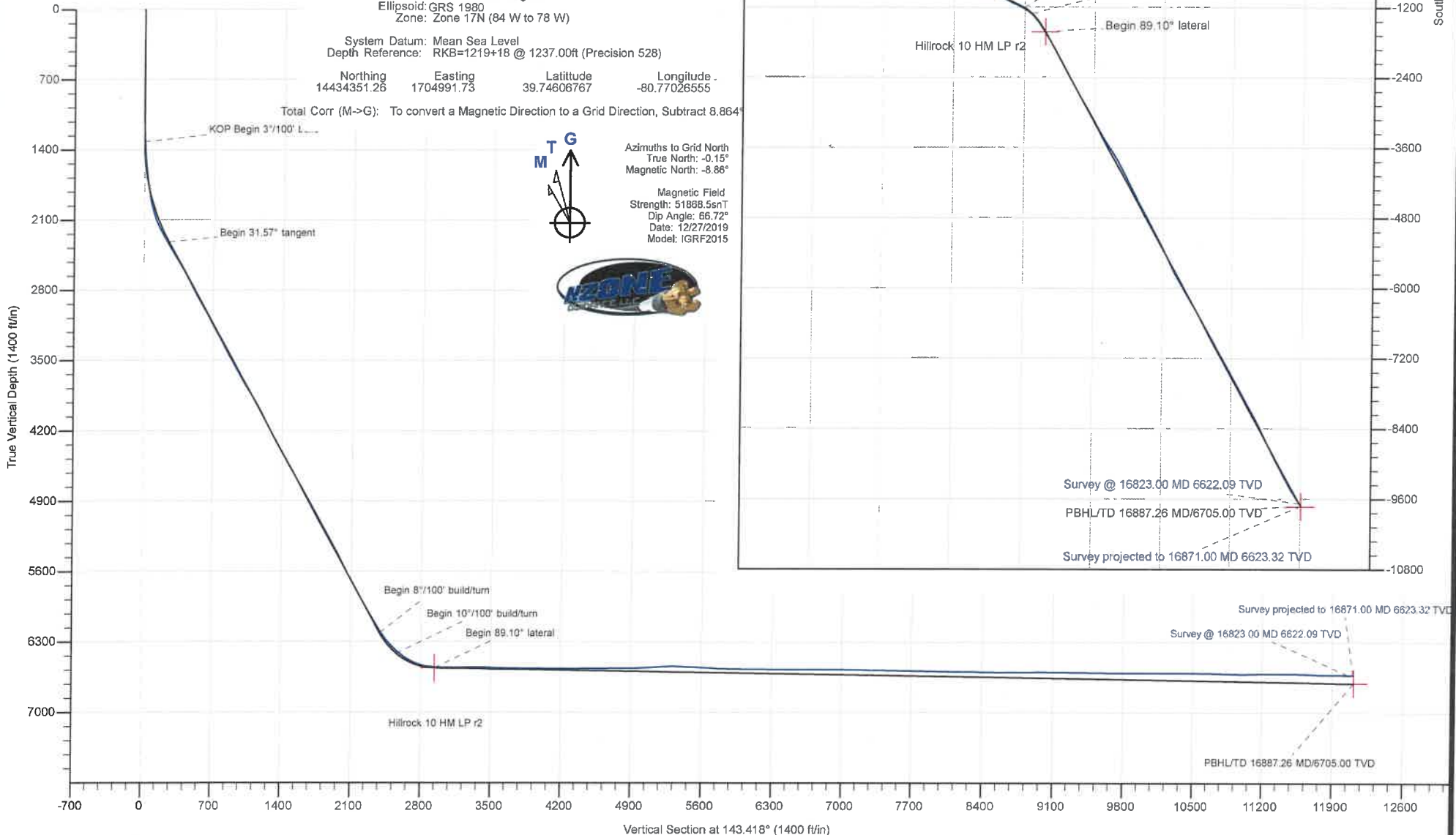
Northing	Easting	Latitude	Longitude
14434351.26	1704991.73	39.74606767	-80.77026555

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.864



Azimuths to Grid North
 True North: -0.15°
 Magnetic North: -8.86°

Magnetic Field
 Strength: 51868.5nT
 Dip Angle: 66.72°
 Date: 12/27/2019
 Model: IGRF2015



ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	VSEct	Annotation
189.00	0.23	97.670	189.00	-0.05	0.38	0.26	MWD surveys
16823.00	88.53	147.670	6622.09	-9678.92	7192.28	12058.62	Survey @ 16823.00 MD 6622.09 TVD
16871.00	88.53	147.670	6623.32	-9719.47	7217.94	12106.47	Survey projected to 16871.00 MD 6623.32 TVD

West(-)/East(+) (2400 ft/in)

South(-)/North(+) (2400 ft/in)

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Hillrock 10 HM (N)
Project:	Marshall County, West Virginia	TVD Reference:	RKB=1219+18 @ 1237.00ft (Precision 528)
Site:	Hillrock/Simms	MD Reference:	RKB=1219+18 @ 1237.00ft (Precision 528)
Well:	Hillrock 10 HM (N)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Project	Marshall County, West Virginia		
Map System:	Universal Transverse Mercator (US Survey Feet)	System Datum:	Mean Sea Level
Geo Datum:	NAD83 West Virginia - HARN		
Map Zone:	Zone 17N (84 W to 78 W)		

Site	Hillrock/Simms				
Site Position:		Northing:	14,434,279.29 usft	Latitude:	39.74587001
From:	Lat/Long	Easting:	1,704,992.60 usft	Longitude:	-80.77026312
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "	Grid Convergence:	0.147 °

Well	Hillrock 10 HM (N)					
Well Position	+N-S	0.00 ft	Northing:	14,434,351.26 usft	Latitude:	39.74606767
	+E-W	0.00 ft	Easting:	1,704,991.73 usft	Longitude:	-80.77026555
Position Uncertainty		0.00 ft	Wellhead Elevation:	ft	Ground Level:	1,219.00 ft

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	12/27/2019	-8.717	66.721	51,868.49846979

Design	Surveys Original Hole				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:		Depth From (TVD) (ft)	+N-S (ft)	+E-W (ft)	Direction (°)
		0.00	0.00	0.00	143.418

Survey Program	Date	1/16/2020			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
189.00	933.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,076.00	2,777.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,874.00	16,823.00	MWD (Original Hole)	MWD	MWD - Standard	
16,871.00	16,871.00	Projection (Original Hole)	MWD	MWD - Standard	

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	
0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
189.00	0.23	97.670	189.00	-0.05	0.38	0.26	0.12	0.12	0.00	
MWD surveys										
219.00	0.24	107.570	219.00	-0.08	0.50	0.36	0.14	0.03	33.00	
251.00	0.47	120.650	251.00	-0.16	0.67	0.53	0.76	0.72	40.88	
296.00	0.14	292.790	296.00	-0.24	0.78	0.66	1.35	-0.73	382.53	
342.00	0.15	158.310	342.00	-0.27	0.75	0.67	0.58	0.02	-292.35	
387.00	0.19	93.550	387.00	-0.33	0.85	0.77	0.41	0.09	-143.91	

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Well:	Hillrock 10 HM (N)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
431.00	0.07	9.890	431.00	-0.31	0.92	0.80	0.44	-0.27	-190.14
476.00	0.41	129.260	476.00	-0.38	1.05	0.94	1.00	0.76	265.27
521.00	0.21	331.170	521.00	-0.41	1.14	1.01	1.36	-0.44	-351.31
566.00	0.09	314.610	566.00	-0.32	1.07	0.89	0.28	-0.27	-36.80
614.00	0.32	233.110	614.00	-0.37	0.94	0.86	0.67	0.48	-169.79
659.00	0.28	133.880	659.00	-0.52	0.92	0.97	1.02	-0.09	-220.51
705.00	0.10	196.430	705.00	-0.64	0.99	1.10	0.54	-0.39	135.98
750.00	0.16	189.090	750.00	-0.74	0.97	1.17	0.14	0.13	-16.31
799.00	0.21	56.460	799.00	-0.76	1.03	1.22	0.69	0.10	-270.67
893.00	0.21	90.250	893.00	-0.66	1.35	1.33	0.13	0.00	35.95
933.00	0.27	123.350	933.00	-0.71	1.50	1.47	0.37	0.15	82.75
1,076.00	0.98	107.480	1,075.99	-1.27	2.95	2.77	0.51	0.50	-11.10
1,172.00	1.11	113.810	1,171.97	-1.89	4.58	4.25	0.18	0.14	6.59
1,266.00	1.23	118.940	1,265.95	-2.74	6.30	5.96	0.17	0.13	5.46
1,360.00	2.35	118.490	1,359.90	-4.15	8.87	8.62	1.19	1.19	-0.48
1,454.00	3.97	117.060	1,453.76	-6.55	13.47	13.29	1.73	1.72	-1.52
1,548.00	6.14	114.920	1,547.39	-10.15	20.92	20.62	2.32	2.31	-2.28
1,644.00	8.31	111.690	1,642.62	-14.88	32.03	31.03	2.30	2.26	-3.36
1,739.00	10.27	105.960	1,736.37	-19.74	46.55	43.60	2.28	2.06	-6.03
1,833.00	12.42	102.530	1,828.53	-24.24	64.48	57.89	2.40	2.29	-3.65
1,927.00	15.71	101.790	1,919.70	-29.04	86.81	75.05	3.51	3.50	-0.79
2,022.00	19.31	108.700	2,010.29	-36.70	114.29	97.59	4.37	3.79	7.27
2,116.00	22.10	120.000	2,098.25	-50.54	144.34	126.60	5.17	2.97	12.02
2,211.00	27.95	125.420	2,184.30	-72.40	177.99	164.21	6.61	6.16	5.71
2,306.00	32.23	122.990	2,266.48	-99.11	217.41	209.15	4.68	4.51	-2.56
2,401.00	33.13	118.970	2,346.45	-125.48	261.37	256.53	2.47	0.95	-4.23
2,496.00	33.67	116.770	2,425.77	-149.91	307.60	303.70	1.40	0.57	-2.32
2,590.00	33.34	114.890	2,504.15	-172.52	354.30	349.69	1.16	-0.35	-2.00
2,684.00	31.87	117.340	2,583.34	-194.79	399.78	394.68	2.10	-1.56	2.61
2,777.00	30.64	117.400	2,662.84	-216.98	442.63	438.03	1.32	-1.32	0.06
2,874.00	29.85	115.900	2,746.64	-238.90	486.29	481.65	1.13	-0.81	-1.55
2,969.00	30.29	120.810	2,828.86	-261.50	528.14	524.74	2.63	0.46	5.17
3,065.00	32.62	121.750	2,910.75	-287.52	570.94	571.14	2.48	2.43	0.98
3,159.00	32.58	121.490	2,989.94	-314.07	614.07	618.17	0.15	-0.04	-0.28
3,253.00	32.31	111.010	3,069.33	-336.32	659.14	662.89	5.98	-0.29	-11.15
3,348.00	31.58	111.970	3,149.94	-354.72	705.91	705.55	0.94	-0.77	1.01
3,443.00	31.28	116.720	3,231.02	-375.12	751.01	748.81	2.63	-0.32	5.00
3,537.00	29.38	119.620	3,312.15	-397.50	792.86	791.71	2.55	-2.02	3.09
3,631.00	30.59	117.070	3,393.57	-419.78	834.21	834.25	1.87	1.29	-2.71
3,726.00	32.34	116.750	3,474.60	-442.22	878.42	878.62	1.85	1.84	-0.34
3,820.00	32.66	117.280	3,553.88	-465.16	923.42	923.86	0.46	0.34	0.56
3,915.00	31.90	116.460	3,634.20	-488.09	968.67	969.24	0.92	-0.80	-0.86
4,009.00	31.75	117.740	3,714.07	-510.67	1,012.80	1,013.67	0.74	-0.16	1.36

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4,104.00	33.03	119.680	3,794.29	-535.13	1,057.42	1,059.90	1.74	1.35	2.04
4,199.00	34.06	118.380	3,873.47	-560.59	1,103.32	1,107.71	1.32	1.08	-1.37
4,294.00	31.98	114.660	3,953.13	-583.74	1,149.60	1,153.87	3.06	-2.19	-3.92
4,389.00	31.33	115.350	4,033.99	-604.81	1,194.78	1,197.72	0.78	-0.68	0.73
4,482.00	31.16	115.260	4,113.50	-625.43	1,238.39	1,240.27	0.19	-0.18	-0.10
4,577.00	31.62	117.080	4,194.60	-647.26	1,282.80	1,284.26	1.11	0.48	1.92
4,673.00	32.04	117.080	4,276.16	-670.30	1,327.88	1,329.63	0.44	0.44	0.00
4,768.00	30.17	114.920	4,357.50	-691.84	1,371.97	1,373.20	2.29	-1.97	-2.27
4,862.00	30.29	117.000	4,438.72	-712.55	1,414.51	1,415.19	1.12	0.13	2.21
4,958.00	31.89	118.580	4,520.93	-735.68	1,458.35	1,459.89	1.87	1.67	1.65
5,053.00	33.29	118.620	4,600.97	-760.17	1,503.28	1,506.33	1.47	1.47	0.04
5,147.00	31.44	117.270	4,680.37	-783.76	1,547.72	1,551.76	2.11	-1.97	-1.44
5,241.00	32.71	117.210	4,760.02	-806.61	1,592.10	1,596.56	1.35	1.35	-0.06
5,336.00	33.94	115.740	4,839.39	-829.86	1,638.82	1,643.07	1.55	1.29	-1.55
5,432.00	32.89	117.330	4,919.53	-853.47	1,686.12	1,690.22	1.42	-1.09	1.66
5,527.00	30.94	117.150	5,000.16	-876.46	1,730.77	1,735.29	2.06	-2.05	-0.19
5,622.00	31.32	117.060	5,081.48	-898.84	1,774.49	1,779.31	0.40	0.40	-0.09
5,718.00	31.67	116.700	5,163.34	-921.51	1,819.22	1,824.18	0.41	0.36	-0.38
5,812.00	31.69	118.520	5,243.33	-944.39	1,862.96	1,868.62	1.02	0.02	1.94
5,907.00	30.82	117.570	5,324.55	-967.57	1,906.46	1,913.15	1.05	-0.92	-1.00
6,002.00	30.48	114.540	5,406.28	-988.84	1,949.95	1,956.16	1.66	-0.36	-3.19
6,097.00	29.38	114.980	5,488.61	-1,008.69	1,992.99	1,997.75	1.18	-1.16	0.46
6,192.00	28.88	119.410	5,571.60	-1,029.80	2,034.11	2,039.20	2.33	-0.53	4.66
6,287.00	30.12	121.130	5,654.29	-1,053.39	2,074.50	2,082.21	1.58	1.31	1.81
6,382.00	31.01	120.060	5,736.09	-1,077.97	2,116.08	2,126.74	1.10	0.94	-1.13
6,477.00	31.44	116.890	5,817.33	-1,101.43	2,159.36	2,171.37	1.79	0.45	-3.34
6,572.00	33.05	116.450	5,897.68	-1,124.18	2,204.66	2,216.63	1.71	1.69	-0.46
6,666.00	34.00	116.220	5,976.04	-1,147.21	2,251.19	2,262.85	1.02	1.01	-0.24
6,761.00	34.63	114.580	6,054.50	-1,170.17	2,299.56	2,310.13	1.18	0.66	-1.73
6,806.00	34.73	115.420	6,091.51	-1,180.99	2,322.77	2,332.64	1.09	0.22	1.87
6,901.00	33.76	114.630	6,170.04	-1,203.61	2,371.21	2,379.67	1.12	-1.02	-0.83
6,996.00	38.64	122.360	6,246.72	-1,230.52	2,420.31	2,430.55	7.03	5.14	8.14
7,090.00	43.74	126.930	6,317.45	-1,265.78	2,471.12	2,489.14	6.30	5.43	4.86
7,186.00	48.18	133.700	6,384.21	-1,310.48	2,523.57	2,556.30	6.86	4.63	7.05
7,280.00	53.85	139.940	6,443.36	-1,363.81	2,573.39	2,628.81	7.93	6.03	6.64
7,376.00	63.38	143.810	6,493.31	-1,428.27	2,623.80	2,710.62	10.50	9.93	4.03
7,470.00	73.36	146.270	6,527.92	-1,499.82	2,673.75	2,797.84	10.89	10.62	2.62
7,566.00	83.38	148.200	6,547.25	-1,578.80	2,724.55	2,891.53	10.62	10.44	2.01
7,615.00	88.26	148.460	6,550.82	-1,620.38	2,750.20	2,940.21	9.97	9.96	0.53
7,661.00	88.44	147.760	6,552.14	-1,659.42	2,774.49	2,986.04	1.57	0.39	-1.52
7,756.00	89.80	148.820	6,553.60	-1,740.23	2,824.41	3,080.68	1.81	1.43	1.12
7,851.00	90.68	150.310	6,553.20	-1,822.13	2,872.53	3,175.13	1.82	0.93	1.57
7,945.00	90.64	149.780	6,552.12	-1,903.57	2,919.47	3,268.49	0.57	-0.04	-0.56
8,040.00	90.20	151.450	6,551.42	-1,986.34	2,966.08	3,362.74	1.82	-0.46	1.76

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8,135.00	88.40	152.420	6,552.59	-2,070.16	3,010.77	3,456.68	2.15	-1.89	1.02
8,229.00	88.04	151.980	6,555.50	-2,153.27	3,054.59	3,549.53	0.60	-0.38	-0.47
8,323.00	88.00	151.450	6,558.75	-2,236.00	3,099.10	3,642.49	0.57	-0.04	-0.56
8,417.00	89.36	151.360	6,560.92	-2,318.51	3,144.08	3,735.55	1.45	1.45	-0.10
8,512.00	89.63	151.280	6,561.76	-2,401.85	3,189.67	3,829.65	0.30	0.28	-0.08
8,607.00	89.19	151.010	6,562.73	-2,485.05	3,235.51	3,923.78	0.54	-0.46	-0.28
8,702.00	90.20	151.280	6,563.24	-2,568.25	3,281.36	4,017.92	1.10	1.06	0.28
8,798.00	90.07	150.750	6,563.01	-2,652.23	3,327.88	4,113.07	0.57	-0.14	-0.55
8,892.00	90.24	150.220	6,562.76	-2,734.03	3,374.19	4,206.36	0.59	0.18	-0.56
8,987.00	90.07	150.050	6,562.50	-2,816.41	3,421.49	4,300.70	0.25	-0.18	-0.18
9,082.00	90.24	150.050	6,562.24	-2,898.73	3,468.92	4,395.07	0.18	0.18	0.00
9,177.00	89.63	150.400	6,562.35	-2,981.19	3,516.10	4,489.40	0.74	-0.64	0.37
9,272.00	89.80	152.070	6,562.83	-3,064.46	3,561.81	4,583.51	1.77	0.18	1.76
9,367.00	91.38	151.280	6,561.85	-3,148.08	3,606.88	4,677.52	1.86	1.66	-0.83
9,464.00	90.68	149.690	6,560.10	-3,232.47	3,654.66	4,773.76	1.79	-0.72	-1.64
9,559.00	90.37	149.340	6,559.23	-3,314.34	3,702.85	4,868.22	0.49	-0.33	-0.37
9,654.00	91.43	148.990	6,557.74	-3,395.90	3,751.54	4,962.73	1.18	1.12	-0.37
9,749.00	92.66	147.760	6,554.35	-3,476.73	3,801.32	5,057.31	1.83	1.29	-1.29
9,833.00	94.81	146.270	6,548.88	-3,547.04	3,846.95	5,140.96	3.11	2.56	-1.77
9,940.00	92.00	145.210	6,542.52	-3,635.31	3,907.07	5,247.67	2.81	-2.63	-0.99
10,034.00	88.97	149.170	6,541.73	-3,714.28	3,957.99	5,341.43	5.30	-3.22	4.21
10,128.00	87.16	152.600	6,544.90	-3,796.34	4,003.69	5,434.57	4.12	-1.93	3.65
10,223.00	87.25	152.330	6,549.54	-3,880.48	4,047.55	5,528.27	0.30	0.09	-0.28
10,318.00	86.90	152.330	6,554.38	-3,964.51	4,091.61	5,622.00	0.37	-0.37	0.00
10,412.00	86.55	151.890	6,559.75	-4,047.45	4,135.51	5,714.77	0.60	-0.37	-0.47
10,507.00	87.96	153.300	6,564.30	-4,131.69	4,179.19	5,808.44	2.10	1.48	1.48
10,602.00	89.45	153.120	6,566.45	-4,216.47	4,221.99	5,902.03	1.58	1.57	-0.19
10,697.00	88.92	153.560	6,567.80	-4,301.36	4,264.61	5,995.60	0.73	-0.56	0.46
10,792.00	88.35	153.470	6,570.06	-4,386.37	4,306.97	6,089.10	0.61	-0.60	-0.09
10,887.00	89.76	152.950	6,571.63	-4,471.16	4,349.78	6,182.70	1.58	1.48	-0.55
10,982.00	89.45	151.540	6,572.29	-4,555.22	4,394.02	6,276.57	1.52	-0.33	-1.48
11,077.00	91.12	150.930	6,571.81	-4,638.49	4,439.73	6,370.69	1.87	1.76	-0.64
11,170.00	90.81	150.490	6,570.25	-4,719.59	4,485.22	6,462.92	0.58	-0.33	-0.47
11,266.00	90.15	150.490	6,569.44	-4,803.13	4,532.51	6,558.19	0.69	-0.69	0.00
11,360.00	89.58	151.450	6,569.66	-4,885.32	4,578.12	6,651.37	1.19	-0.61	1.02
11,455.00	89.19	151.800	6,570.68	-4,968.90	4,623.27	6,745.39	0.55	-0.41	0.37
11,550.00	89.93	153.650	6,571.41	-5,053.34	4,666.80	6,839.13	2.10	0.78	1.95
11,644.00	89.27	152.770	6,572.07	-5,137.24	4,709.17	6,931.76	1.17	-0.70	-0.94
11,739.00	89.01	151.890	6,573.50	-5,221.37	4,753.28	7,025.60	0.97	-0.27	-0.93
11,834.00	90.02	153.120	6,574.30	-5,305.63	4,797.13	7,119.40	1.68	1.06	1.29
11,929.00	88.70	153.830	6,575.36	-5,390.62	4,839.55	7,212.94	1.58	-1.39	0.75
12,024.00	90.02	154.180	6,576.42	-5,476.01	4,881.19	7,306.31	1.44	1.39	0.37
12,119.00	88.53	153.650	6,577.62	-5,561.32	4,922.95	7,399.71	1.66	-1.57	-0.56

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Hillrock 10 HM (N)
Project:	Marshall County, West Virginia	TVD Reference:	RKB=1219+18 @ 1237.00ft (Precision 528)
Site:	Hillrock/Simms	MD Reference:	RKB=1219+18 @ 1237.00ft (Precision 528)
Well:	Hillrock 10 HM (N)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	
12,214.00	89.58	155.410	6,579.19	-5,647.07	4,963.80	7,492.91	2.16	1.11	1.85	
12,309.00	88.53	153.910	6,580.76	-5,732.92	5,004.45	7,586.07	1.93	-1.11	-1.58	
12,404.00	87.96	150.130	6,583.67	-5,816.76	5,048.99	7,679.94	4.02	-0.60	-3.98	
12,499.00	89.05	149.690	6,586.15	-5,898.92	5,096.61	7,774.30	1.24	1.15	-0.46	
12,593.00	88.66	149.960	6,588.03	-5,980.17	5,143.84	7,867.69	0.50	-0.41	0.29	
12,688.00	88.97	150.220	6,589.99	-6,062.50	5,191.20	7,962.03	0.43	0.33	0.27	
12,783.00	89.85	150.400	6,590.97	-6,145.02	5,238.26	8,056.34	0.95	0.93	0.19	
12,878.00	89.41	149.870	6,591.58	-6,227.40	5,285.56	8,150.68	0.73	-0.46	-0.56	
12,973.00	89.05	149.610	6,592.86	-6,309.45	5,333.43	8,245.10	0.47	-0.38	-0.27	
13,068.00	88.66	150.050	6,594.76	-6,391.57	5,381.16	8,339.48	0.62	-0.41	0.46	
13,163.00	89.71	149.260	6,596.11	-6,473.54	5,429.15	8,433.91	1.38	1.11	-0.83	
13,258.00	88.92	148.640	6,597.24	-6,554.92	5,478.15	8,528.46	1.06	-0.83	-0.65	
13,354.00	90.95	149.340	6,597.35	-6,637.20	5,527.60	8,624.00	2.24	2.11	0.73	
13,449.00	90.81	149.340	6,595.89	-6,718.91	5,576.04	8,718.48	0.15	-0.15	0.00	
13,544.00	90.46	149.260	6,594.84	-6,800.59	5,624.54	8,812.97	0.38	-0.37	-0.08	
13,639.00	90.15	150.840	6,594.33	-6,882.90	5,671.97	8,907.33	1.69	-0.33	1.66	
13,734.00	89.67	151.010	6,594.48	-6,965.93	5,718.13	9,001.52	0.54	-0.51	0.18	
13,829.00	89.10	151.280	6,595.50	-7,049.13	5,763.97	9,095.65	0.66	-0.60	0.28	
13,923.00	88.70	151.100	6,597.31	-7,131.48	5,809.27	9,188.77	0.47	-0.43	-0.19	
14,018.00	89.63	151.280	6,598.69	-7,214.71	5,855.04	9,282.89	1.00	0.98	0.19	
14,112.00	89.19	150.750	6,599.66	-7,296.93	5,900.59	9,376.06	0.73	-0.47	-0.56	
14,207.00	88.62	150.220	6,601.48	-7,379.59	5,947.38	9,470.32	0.82	-0.60	-0.56	
14,302.00	89.14	151.540	6,603.33	-7,462.56	5,993.60	9,564.49	1.49	0.55	1.39	
14,397.00	88.75	151.630	6,605.08	-7,546.10	6,038.80	9,658.51	0.42	-0.41	0.09	
14,492.00	90.86	150.930	6,605.41	-7,629.41	6,084.45	9,752.61	2.34	2.22	-0.74	
14,587.00	90.73	151.010	6,604.09	-7,712.46	6,130.54	9,846.78	0.16	-0.14	0.08	
14,682.00	90.37	151.100	6,603.18	-7,795.59	6,176.52	9,940.93	0.39	-0.38	0.09	
14,777.00	89.89	150.400	6,602.96	-7,878.48	6,222.94	10,035.16	0.89	-0.51	-0.74	
14,872.00	89.54	149.520	6,603.43	-7,960.72	6,270.49	10,129.53	1.00	-0.37	-0.93	
14,967.00	90.33	151.630	6,603.54	-8,043.46	6,317.16	10,223.79	2.37	0.83	2.22	
15,062.00	90.20	151.540	6,603.10	-8,127.01	6,362.37	10,317.82	0.17	-0.14	-0.09	
15,157.00	89.32	151.190	6,603.50	-8,210.39	6,407.89	10,411.91	1.00	-0.93	-0.37	
15,251.00	89.14	154.000	6,604.76	-8,293.82	6,451.15	10,504.69	3.00	-0.19	2.99	
15,346.00	89.27	154.350	6,606.08	-8,379.33	6,492.53	10,598.01	0.39	0.14	0.37	
15,440.00	88.75	154.270	6,607.70	-8,464.02	6,533.28	10,690.30	0.56	-0.55	-0.09	
15,534.00	88.48	154.620	6,609.98	-8,548.80	6,573.81	10,782.54	0.47	-0.29	0.37	
15,629.00	88.92	152.160	6,612.13	-8,633.71	6,616.35	10,876.07	2.63	0.46	-2.59	
15,723.00	88.35	152.420	6,614.37	-8,716.91	6,660.05	10,968.92	0.67	-0.61	0.28	
15,818.00	91.12	152.510	6,614.81	-8,801.14	6,703.96	11,062.73	2.92	2.92	0.09	
15,913.00	90.90	152.240	6,613.14	-8,885.29	6,748.00	11,156.56	0.37	-0.23	-0.28	
16,008.00	90.73	152.160	6,611.79	-8,969.32	6,792.31	11,250.43	0.20	-0.18	-0.08	
16,103.00	90.29	152.420	6,610.94	-9,053.42	6,836.48	11,344.29	0.54	-0.46	0.27	
16,198.00	89.76	152.330	6,610.90	-9,137.59	6,880.53	11,438.13	0.57	-0.56	-0.09	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Hillrock 10 HM (N)
Project:	Marshall County, West Virginia	TVD Reference:	RKB=1219+18 @ 1237.00ft (Precision 528)
Site:	Hillrock/Simms	MD Reference:	RKB=1219+18 @ 1237.00ft (Precision 528)
Well:	Hillrock 10 HM (N)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
16,293.00	89.10	151.450	6,611.84	-9,221.38	6,925.29	11,532.09	1.16	-0.69	-0.93
16,388.00	88.40	151.280	6,613.92	-9,304.74	6,970.80	11,626.16	0.76	-0.74	-0.18
16,483.00	87.82	150.840	6,617.05	-9,387.83	7,016.75	11,720.26	0.77	-0.61	-0.46
16,578.00	90.02	148.900	6,618.84	-9,469.97	7,064.42	11,814.63	3.09	2.32	-2.04
16,673.00	89.41	148.730	6,619.31	-9,551.24	7,113.61	11,909.21	0.67	-0.64	-0.18
16,768.00	88.79	148.380	6,620.80	-9,632.28	7,163.16	12,003.82	0.75	-0.65	-0.37
16,823.00	88.53	147.670	6,622.09	-9,678.92	7,192.28	12,058.62	1.37	-0.47	-1.29
Survey @ 16823.00 MD 6622.09 TVD									
16,871.00	88.53	147.670	6,623.32	-9,719.47	7,217.94	12,106.47	0.00	0.00	0.00
Survey projected to 16871.00 MD 6623.32 TVD									

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
189.00	189.00	-0.05	0.38	MWD surveys
16,823.00	6,622.09	-9,678.92	7,192.28	Survey @ 16823.00 MD 6622.09 TVD
16,871.00	6,623.32	-9,719.47	7,217.94	Survey projected to 16871.00 MD 6623.32 TVD

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Hillrock 10 HM (N)
Project:	Marshall County, West Virginia	TVD Reference:	RKB=1219+18 @ 1237.00ft (Precision 528)
Site:	Hillrock/Simms	MD Reference:	RKB=1219+18 @ 1237.00ft (Precision 528)
Well:	Hillrock 10 HM (N)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Project	Marshall County, West Virginia		
Map System:	Universal Transverse Mercator (US Survey Feet)	System Datum:	Mean Sea Level
Geo Datum:	NAD83 West Virginia - HARN		
Map Zone:	Zone 17N (84 W to 78 W)		

Site	Hillrock/Simms				
Site Position:		Northing:	14,434,279.29 usft	Latitude:	39.74587001
From:	Lat/Long	Easting:	1,704,992.60 usft	Longitude:	-80.77026312
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "	Grid Convergence:	0.147 °

Well	Hillrock 10 HM (N)					
Well Position	+N/-S	0.00 ft	Northing:	14,434,351.26 usft	Latitude:	39.74606767
	+E/-W	0.00 ft	Easting:	1,704,991.73 usft	Longitude:	-80.77026555
Position Uncertainty	0.00 ft	Wellhead Elevation:	ft	Ground Level:	1,219.00 ft	

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	12/27/2019	-8.717	66.721	51,868.49846979

Design	Surveys Original Hole				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.00	0.00	0.00	143.418	

Survey Program	Date	1/16/2020			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
189.00	933.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,076.00	2,777.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,874.00	16,823.00	MWD (Original Hole)	MWD	MWD - Standard	
16,871.00	16,871.00	Projection (Original Hole)	MWD	MWD - Standard	

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
0.00	0.00	0.000	0.00	0.00	0.00	14,434,351.26	1,704,991.73	39.74606767	-80.77026555	
189.00	0.23	97.670	189.00	-0.05	0.38	14,434,351.21	1,704,992.11	39.74606753	-80.77026421	
MWD surveys										
219.00	0.24	107.570	219.00	-0.08	0.50	14,434,351.18	1,704,992.23	39.74606745	-80.77026379	
251.00	0.47	120.650	251.00	-0.16	0.67	14,434,351.10	1,704,992.40	39.74606721	-80.77026316	
296.00	0.14	292.790	296.00	-0.24	0.78	14,434,351.02	1,704,992.51	39.74606701	-80.77026278	
342.00	0.15	158.310	342.00	-0.27	0.75	14,434,350.99	1,704,992.48	39.74606692	-80.77026288	
387.00	0.19	93.550	387.00	-0.33	0.85	14,434,350.93	1,704,992.58	39.74606676	-80.77026254	
431.00	0.07	9.890	431.00	-0.31	0.92	14,434,350.95	1,704,992.65	39.74606682	-80.77026226	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Hillrock 10 HM (N)
Project:	Marshall County, West Virginia	TVD Reference:	RKB=1219+18 @ 1237.00ft (Precision 528)
Site:	Hillrock/Simms	MD Reference:	RKB=1219+18 @ 1237.00ft (Precision 528)
Well:	Hillrock 10 HM (N)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
15,629.00	88.92	152.160	6,612.13	-8,633.71	6,616.35	14,425,717.57	1,711,608.07	39.72230805	-80.74681401
15,723.00	88.35	152.420	6,614.37	-8,716.91	6,660.05	14,425,634.37	1,711,651.76	39.72207923	-80.74665945
15,818.00	91.12	152.510	6,614.81	-8,801.14	6,703.96	14,425,550.14	1,711,695.68	39.72184757	-80.74650412
15,913.00	90.90	152.240	6,613.14	-8,885.29	6,748.00	14,425,465.99	1,711,739.72	39.72161611	-80.74634834
16,008.00	90.73	152.160	6,611.79	-8,969.32	6,792.31	14,425,381.96	1,711,784.02	39.72138501	-80.74619163
16,103.00	90.29	152.420	6,610.94	-9,053.42	6,836.48	14,425,297.86	1,711,828.19	39.72115370	-80.74603538
16,198.00	89.76	152.330	6,610.90	-9,137.59	6,880.53	14,425,213.69	1,711,872.24	39.72092220	-80.74587958
16,293.00	89.10	151.450	6,611.84	-9,221.38	6,925.29	14,425,129.90	1,711,917.00	39.72069174	-80.74572125
16,388.00	88.40	151.280	6,613.92	-9,304.74	6,970.80	14,425,046.54	1,711,962.52	39.72046245	-80.74556023
16,483.00	87.82	150.840	6,617.05	-9,387.83	7,016.75	14,424,963.45	1,712,008.46	39.72023390	-80.74539767
16,578.00	90.02	148.900	6,618.84	-9,469.97	7,064.42	14,424,881.31	1,712,056.14	39.72000795	-80.74522896
16,673.00	89.41	148.730	6,619.31	-9,551.24	7,113.61	14,424,800.04	1,712,105.33	39.71978437	-80.74505485
16,768.00	88.79	148.380	6,620.80	-9,632.28	7,163.16	14,424,719.00	1,712,154.88	39.71956143	-80.74487945
16,823.00	88.53	147.670	6,622.09	-9,678.92	7,192.28	14,424,672.36	1,712,184.00	39.71943311	-80.74477638
Survey @ 16823.00 MD 6622.09 TVD									
16,871.00	88.53	147.670	6,623.32	-9,719.47	7,217.94	14,424,631.81	1,712,209.66	39.71932156	-80.74468553
Survey projected to 16871.00 MD 6623.32 TVD									

Design Annotations				
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
189.00	189.00	-0.05	0.38	MWD surveys
16,823.00	6,622.09	-9,678.92	7,192.28	Survey @ 16823.00 MD 6622.09 TVD
16,871.00	6,623.32	-9,719.47	7,217.94	Survey projected to 16871.00 MD 6623.32 TVD