



Survey Report - Geographic



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Heaven Hill 3-4 HM (I)
<b>Project:</b>	Marshall County, West Virginia	<b>TVD Reference:</b>	RKB=1326+26 @ 1352.00usft
<b>Site:</b>	Heaven Hill 3	<b>MD Reference:</b>	RKB=1326+26 @ 1352.00usft
<b>Well:</b>	Heaven Hill 3-4 HM (I)	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Original Hole	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Surveys Original Hole	<b>Database:</b>	DB_Jul2216ct_v14

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

<b>Site</b>	Heaven Hill 3
<b>Site Position:</b>	Northing: 14,457,178.77 usft      Latitude: 39.80857655
<b>From:</b>	Eastng: 1,726,571.98 usft      Longitude: -80.69319108
<b>Position Uncertainty:</b>	Slot Radius: 0.00 usft      Grid Convergence: 0.20 °

<b>Well</b>	Heaven Hill 3-4 HM (I)
<b>Well Position</b>	+N-S 0.00 usft      Northing: 14,457,177.31 usft      Latitude: 39.80857655
	+E-W 0.00 usft      Eastng: 1,726,578.31 usft      Longitude: -80.69319108
<b>Position Uncertainty</b>	Wellhead Elevation: 0.00 usft      Ground Level: 1,326.00 usft

<b>Wellbore</b>	Original Hole
<b>Magnetics</b>	Model Name      Sample Date      Declination (°)      Dip Angle (°)      Field Strength (nT)
	IGRF2015      9/9/2018      -8.74      66.87      52,040.48468304

<b>Design</b>	Surveys Original Hole
<b>Audit Notes:</b>	
<b>Version:</b>	1.0      Phase: ACTUAL      Tie On Depth: 0.00
<b>Vertical Section:</b>	Depth From (TVD)      +N-S (usft)      +E-W (usft)      Direction (°)
	(usft)      0.00      0.00      0.00      150.24

<b>Survey Program</b>	Date	9/17/2018
<b>From (usft)</b>	To (usft)	Survey (Wellbore)
159.00	1,143.00	MWD surf (Original Hole)
1,191.00	6,561.00	MWD int (Original Hole)
6,662.00	17,826.00	MWD lat (Original Hole)
17,877.00	17,877.00	Projection (Original Hole)

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<b>Survey</b>									
<b>Measured Depth (usft)</b>	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N-S (usft)	+E-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
0.00	0.00	0.00	0.00	0.00	0.00	14,457,177.31	1,726,578.31	39.80857655	-80.69319108
159.00	0.54	9.11	159.00	0.74	0.12	14,457,178.05	1,726,578.43	39.80857658	-80.69319065
<b>MWD surveys</b>									
190.00	0.62	39.65	190.00	1.01	0.25	14,457,178.33	1,726,578.56	39.80857933	-80.69319018
221.00	0.67	45.93	220.99	1.27	0.49	14,457,178.58	1,726,578.80	39.80858003	-80.69318933
251.00	0.59	37.77	250.99	1.51	0.71	14,457,178.82	1,726,579.02	39.80858070	-80.69318854
281.00	0.29	68.83	280.99	1.66	0.87	14,457,178.97	1,726,579.19	39.80858111	-80.69318795
311.00	0.59	37.50	310.99	1.81	1.04	14,457,179.12	1,726,579.35	39.80858152	-80.69318736
342.00	0.60	98.03	341.99	1.92	1.30	14,457,179.23	1,726,579.61	39.80858180	-80.69318644



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**Project:** Marshall County, West Virginia  
**Site:** Heaven Hill 3  
**Well:** Heaven Hill 3-4 HM (I)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:**  
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**MD Reference:** RKB=1326+26 @ 1352.00usft  
**North Reference:** RKB=1326+26 @ 1352.00usft  
**Survey Calculation Method:** Grid  
**Database:** Minimum Curvature  
 DB\_Jul2216dt\_v14

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**JUL 10 2020**  
**WV Department of**  
**Environmental Protection**

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
360.00	0.48	50.91	379.99	1.99	1.62	14,457,179.30	1,726,579.93	39.80859200	-80.69318530
410.00	0.66	47.99	409.99	2.22	1.88	14,457,179.53	1,726,580.19	39.80858263	-80.69318436
440.00	0.55	54.19	439.98	2.45	2.16	14,457,179.77	1,726,580.48	39.80858327	-80.69318334
471.00	0.37	86.10	470.98	2.55	2.39	14,457,179.86	1,726,580.70	39.80858352	-80.69318256
501.00	0.45	22.49	500.98	2.66	2.53	14,457,179.98	1,726,580.84	39.80858384	-80.69318205
531.00	0.28	46.33	530.98	2.82	2.62	14,457,180.14	1,726,580.94	39.80858428	-80.69318170
561.00	0.46	96.13	560.98	2.86	2.80	14,457,180.17	1,726,581.11	39.80858438	-80.69318108
591.00	0.61	48.88	590.98	2.95	3.04	14,457,180.26	1,726,581.35	39.80858463	-80.69318023
622.00	0.43	112.01	621.98	3.02	3.27	14,457,180.33	1,726,581.58	39.80858481	-80.69317940
652.00	0.30	83.29	651.98	2.98	3.45	14,457,180.30	1,726,581.76	39.80858471	-80.69317875
683.00	0.20	126.94	682.98	2.96	3.58	14,457,180.27	1,726,581.89	39.80858465	-80.69317831
713.00	0.41	45.21	712.98	3.00	3.69	14,457,180.32	1,726,582.01	39.80858477	-80.69317769
744.00	0.30	25.38	743.98	3.16	3.81	14,457,180.47	1,726,582.12	39.80858518	-80.69317748
774.00	0.39	53.18	773.98	3.29	3.92	14,457,180.60	1,726,582.24	39.80858555	-80.69317707
804.00	0.43	36.01	803.98	3.44	4.07	14,457,180.75	1,726,582.38	39.80858596	-80.69317654
835.00	0.24	26.73	834.97	3.59	4.17	14,457,180.91	1,726,582.48	39.80858638	-80.69317619
866.00	0.29	39.61	865.97	3.71	4.25	14,457,181.02	1,726,582.56	39.80858670	-80.69317591
896.00	0.42	39.95	897.97	3.86	4.37	14,457,181.18	1,726,582.69	39.80858712	-80.69317546
929.00	0.38	43.65	928.97	4.03	4.52	14,457,181.34	1,726,582.83	39.80858756	-80.69317494
961.00	0.26	59.43	960.97	4.14	4.65	14,457,181.45	1,726,582.97	39.80858787	-80.69317446
982.00	0.26	17.98	981.97	4.21	4.71	14,457,181.52	1,726,583.02	39.80858807	-80.69317426
1,087.00	0.19	107.87	1,086.97	4.38	4.95	14,457,181.69	1,726,583.26	39.80858854	-80.69317340
1,143.00	0.28	70.35	1,142.97	4.40	5.17	14,457,181.71	1,726,583.48	39.80858858	-80.69317283
1,191.00	0.27	74.59	1,190.97	4.47	5.39	14,457,181.78	1,726,583.70	39.80858877	-80.69317185
1,286.00	0.08	107.94	1,285.97	4.51	5.66	14,457,181.82	1,726,583.98	39.80858888	-80.69317085
1,381.00	0.63	141.08	1,380.97	4.08	6.06	14,457,181.39	1,726,584.37	39.80858950	-80.69316947
1,475.00	1.87	137.02	1,474.94	2.56	7.43	14,457,179.87	1,726,585.74	39.80858770	-80.69316481
1,568.00	3.02	142.28	1,567.86	-0.49	9.96	14,457,176.82	1,726,588.27	39.80857511	-80.69315562
1,663.00	3.60	144.01	1,662.70	-4.88	13.24	14,457,172.43	1,726,591.56	39.80856301	-80.69314398
1,758.00	4.08	138.61	1,757.49	-9.83	17.23	14,457,167.48	1,726,595.54	39.80854939	-80.69312985
1,851.00	3.77	138.32	1,850.27	-14.80	21.45	14,457,162.71	1,726,599.76	39.80853626	-80.69311488
1,946.00	3.64	152.60	1,945.07	-19.61	24.92	14,457,157.70	1,726,603.23	39.80852247	-80.69310280
2,040.00	3.95	160.86	2,038.67	-25.32	27.35	14,457,152.00	1,726,605.66	39.80850677	-80.69309400
2,135.00	3.60	148.04	2,133.66	-30.94	30.00	14,457,146.38	1,726,608.31	39.80849131	-80.69308483
2,230.00	4.24	139.04	2,228.44	-36.12	33.88	14,457,141.19	1,726,612.20	39.80847704	-80.69307087
2,322.00	4.52	139.44	2,320.17	-41.44	38.47	14,457,136.87	1,726,616.78	39.80846238	-80.69305480
2,417.00	3.10	139.30	2,414.96	-46.23	42.58	14,457,131.06	1,726,620.89	39.80844918	-80.69304003
2,511.00	2.10	157.54	2,508.86	-49.75	44.89	14,457,127.56	1,726,623.21	39.80843949	-80.69303183
2,606.00	2.10	169.75	2,603.80	-53.07	45.87	14,457,124.24	1,726,624.18	39.80843036	-80.69302840
2,701.00	2.37	162.24	2,698.73	-56.66	46.78	14,457,120.65	1,726,625.09	39.80842051	-80.69302520
2,777.00	2.79	149.22	2,774.65	-59.74	48.20	14,457,117.57	1,726,626.52	39.80841203	-80.69302016
2,875.00	2.90	144.82	2,872.53	-63.82	50.85	14,457,113.49	1,726,629.17	39.80840081	-80.69301078
2,969.00	2.66	143.40	2,966.42	-67.51	53.52	14,457,109.80	1,726,631.84	39.80839064	-80.69300132
3,065.00	4.69	138.10	3,062.22	-72.22	57.47	14,457,105.09	1,726,635.79	39.80837761	-80.69298731
3,159.00	7.53	132.83	3,155.67	-79.27	64.56	14,457,098.04	1,726,642.87	39.80835824	-80.69296217
3,254.00	8.88	135.95	3,249.70	-86.78	74.22	14,457,088.54	1,726,652.53	39.80833205	-80.69292788
3,348.00	9.55	148.28	3,342.49	-100.62	83.37	14,457,076.69	1,726,661.68	39.80829945	-80.69289546
3,442.00	10.64	151.54	3,435.04	-114.89	91.60	14,457,062.43	1,726,669.92	39.80826018	-80.69286631
3,536.00	12.09	149.34	3,527.19	-130.98	100.76	14,457,046.33	1,726,679.07	39.80821569	-80.69283390
3,632.00	13.93	149.39	3,620.73	-149.58	111.77	14,457,027.73	1,726,690.08	39.80816472	-80.69279492
3,727.00	15.74	152.14	3,712.56	-170.82	123.62	14,457,006.50	1,726,701.93	39.80810629	-80.69275300
3,821.00	17.91	154.96	3,802.53	-195.19	135.69	14,456,982.13	1,726,714.01	39.80803925	-80.69271029
3,916.00	20.24	156.85	3,892.31	-223.53	148.34	14,456,953.78	1,726,726.65	39.80796128	-80.69266561
4,010.00	23.19	155.37	3,979.63	-255.32	162.45	14,456,922.00	1,726,740.76	39.80787386	-80.69261576
4,105.00	24.36	153.47	4,066.56	-289.85	178.99	14,456,887.46	1,726,757.31	39.80777987	-80.69255727



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Site: Heaven Hill 3
Well: Heaven Hill 3-4 HM (I)
Wellbore: Original Hole
Design: Surveys Original Hole

Local Co-ordinate Reference:
TVD Reference:
MD Reference:
North Reference:
Survey Calculation Method:
Database:

Well Heaven Hill 3-4 HM (I)
RKB=1326+26 @ 1352.00usft
RKB=1326+26 @ 1352.00usft
Grid
Minimum Curvature
DB\_Jul2216dt\_v14

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Survey

WV Dept.
Environment

Table with columns: Measured Depth (usft), Inclination (°), Azimuth (°), Vertical Depth (usft), +N/-S (usft), +E/-W (usft), Map Northing (usft), Map Easting (usft), Latitude, Longitude. Contains 38 rows of survey data.



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Survey

Table with columns: Measured Depth (usft), Inclination (°), Azimuth (°), Vertical Depth (usft), +N/-S (usft), +E/-W (usft), Map Northing (usft), Map Easting (usft), Latitude, Longitude. Includes a header for 'WV Department of Environmental Protection'.



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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map		Map Easting (usft)	Latitude	Longitude
						Map Northing (usft)	Map Easting (usft)			
13,678.00	89.10	150.70	6,891.76	-7,128.16	4,043.86	14,450,048.15	1,730,622.18	39,78896191	-80.67888275	
13,773.00	90.60	151.10	6,892.01	-7,211.17	4,090.06	14,449,966.15	1,730,666.38	39,78873350	-80.67871934	
13,868.00	90.80	150.50	6,890.85	-7,294.09	4,136.41	14,449,883.23	1,730,714.72	39,78850532	-80.67855543	
13,963.00	90.40	150.80	6,889.85	-7,376.89	4,182.97	14,449,800.43	1,730,761.28	39,78827747	-80.67839075	
14,057.00	89.90	150.70	6,889.61	-7,458.90	4,228.90	14,449,718.41	1,730,807.21	39,78805178	-80.67822829	
14,153.00	89.50	150.40	6,890.11	-7,542.50	4,276.10	14,449,634.82	1,730,854.41	39,78782175	-80.67806135	
14,247.00	90.30	149.70	6,890.28	-7,623.94	4,323.02	14,449,553.37	1,730,901.34	39,78759761	-80.67789534	
14,341.00	91.80	150.50	6,888.55	-7,705.41	4,369.87	14,449,471.90	1,730,948.19	39,78737341	-80.67772962	
14,436.00	92.20	150.30	6,885.24	-7,787.97	4,416.77	14,449,389.35	1,730,995.08	39,78714624	-80.67756374	
14,531.00	90.60	149.90	6,882.92	-7,870.29	4,464.11	14,449,307.02	1,731,042.42	39,78691967	-80.67739628	
14,625.00	90.40	149.60	6,882.10	-7,951.49	4,511.46	14,449,225.82	1,731,089.77	39,78669622	-80.67722876	
14,720.00	90.10	149.60	6,881.68	-8,033.43	4,559.53	14,449,143.88	1,731,137.85	39,78647072	-80.67705869	
14,815.00	88.90	149.60	6,882.51	-8,115.36	4,607.61	14,449,061.95	1,731,185.92	39,78624523	-80.67688863	
14,910.00	88.70	150.10	6,884.50	-8,197.49	4,655.31	14,448,979.82	1,731,233.62	39,78601921	-80.67671987	
15,003.00	89.10	150.20	6,886.29	-8,278.14	4,701.59	14,448,899.17	1,731,279.90	39,78579728	-80.67655617	
15,098.00	89.60	150.20	6,887.20	-8,360.57	4,748.80	14,448,816.74	1,731,327.11	39,78557042	-80.67638918	
15,193.00	89.70	149.50	6,887.61	-8,442.72	4,796.51	14,448,734.59	1,731,374.83	39,78534436	-80.67622039	
15,287.00	89.50	148.90	6,888.02	-8,523.46	4,844.65	14,448,653.85	1,731,422.96	39,78512214	-80.67605010	
15,380.00	89.10	149.40	6,888.91	-8,603.30	4,892.33	14,448,574.02	1,731,470.65	39,78490241	-80.67588138	
15,474.00	90.20	150.50	6,889.49	-8,684.66	4,939.40	14,448,492.66	1,731,517.71	39,78467851	-80.67571489	
15,568.00	90.30	150.50	6,889.08	-8,766.47	4,985.69	14,448,410.84	1,731,564.00	39,78445337	-80.67555118	
15,663.00	90.30	150.50	6,888.58	-8,849.15	5,032.47	14,448,328.16	1,731,610.78	39,78422584	-80.67538573	
15,757.00	90.00	150.60	6,888.34	-8,931.01	5,078.69	14,448,246.31	1,731,657.00	39,78400059	-80.67522228	
15,852.00	89.80	149.80	6,888.50	-9,013.44	5,125.90	14,448,163.87	1,731,704.21	39,78377372	-80.67505529	
15,947.00	90.30	148.50	6,888.42	-9,095.00	5,174.61	14,448,082.31	1,731,752.92	39,78354926	-80.67488295	
16,042.00	90.30	149.30	6,887.92	-9,176.34	5,223.25	14,448,000.97	1,731,801.99	39,78332538	-80.67470934	
16,136.00	89.80	149.30	6,887.84	-9,257.42	5,271.68	14,447,919.89	1,731,849.56	39,78310725	-80.67454107	
16,231.00	88.90	151.30	6,888.92	-9,340.18	5,317.88	14,447,837.14	1,731,896.19	39,78287452	-80.67437616	
16,325.00	88.90	151.30	6,890.72	-9,422.61	5,363.01	14,447,754.70	1,731,941.32	39,78264767	-80.67421658	
16,420.00	88.30	151.10	6,893.04	-9,505.84	5,408.76	14,447,671.48	1,731,987.08	39,78241866	-80.67405480	
16,515.00	88.50	151.40	6,895.69	-9,589.09	5,454.44	14,447,588.22	1,732,032.75	39,78218956	-80.67389330	
16,609.00	88.30	150.30	6,898.32	-9,671.15	5,500.21	14,447,506.16	1,732,078.52	39,78196374	-80.67373145	
16,704.00	88.40	149.30	6,901.05	-9,753.23	5,547.98	14,447,424.09	1,732,126.29	39,78173788	-80.67356250	
16,798.00	89.00	150.70	6,903.19	-9,834.61	5,594.96	14,447,342.70	1,732,173.27	39,78151391	-80.67339631	
16,893.00	89.00	150.20	6,904.85	-9,917.24	5,641.81	14,447,260.07	1,732,220.12	39,78128852	-80.67323084	
16,988.00	89.20	150.40	6,906.34	-9,999.75	5,688.87	14,447,177.56	1,732,267.18	39,78105945	-80.67306420	
17,083.00	88.60	149.80	6,908.16	-10,082.09	5,736.22	14,447,095.23	1,732,314.53	39,78083285	-80.67289674	
17,177.00	88.40	151.50	6,910.62	-10,163.99	5,782.27	14,447,013.32	1,732,360.59	39,78060746	-80.67273388	
17,271.00	90.20	153.80	6,911.77	-10,247.47	5,825.45	14,446,928.84	1,732,403.76	39,78037778	-80.67258128	
17,366.00	91.00	151.80	6,910.78	-10,331.95	5,868.87	14,446,845.36	1,732,447.18	39,78014533	-80.67242794	
17,460.00	91.30	151.70	6,908.89	-10,414.74	5,913.35	14,446,762.57	1,732,491.67	39,77991753	-80.67227059	
17,555.00	89.90	150.60	6,907.89	-10,497.94	5,959.19	14,446,679.37	1,732,537.50	39,77968857	-80.67210853	
17,650.00	89.80	150.40	6,908.14	-10,580.63	6,005.97	14,446,596.69	1,732,584.28	39,77946103	-80.67194310	
17,744.00	89.00	150.00	6,909.13	-10,662.19	6,052.68	14,446,515.12	1,732,630.99	39,77923657	-80.67177790	
17,826.00	88.80	149.80	6,910.70	-10,733.12	6,093.80	14,446,444.19	1,732,672.11	39,77904136	-80.67163248	
<b>Survey @ 17826.00 MD 6910.70 TVD</b>										
17,877.00	88.80	149.80	6,911.77	-10,777.19	6,119.44	14,446,400.13	1,732,697.76	39,77892008	-80.67154177	
<b>Survey projected to 17877.00 MD 6911.77 TVD</b>										

WV Department of  
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**TUG HILL**  
OPERATING

Survey Report - Geographic



**Company:**

**Project:** Tug Hill Operating LLC  
Marshall County, West Virginia  
**Site:** Heaven Hill 3  
**Well:** Heaven Hill 3-4 HM (1)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:**

**TVD Reference:** Well Heaven Hill 3-4 HM (1)  
**MD Reference:** RKB=1326+26 @ 1352.00usft  
**North Reference:** RKB=1326+26 @ 1352.00usft  
**Survey Calculation Method:** Grid  
**Database:** Minimum Curvature  
DB\_Jul2216ct\_v14

**Design Annotations**

Measured Depth (usft)	Vertical Depth (usft)	+N/-S (usft)	Local Coordinates +E/-W (usft)	Comment
159.00	159.00	0.74	0.12	MWD surveys
17,826.00	6,910.70	-10,733.12	6,093.80	Survey @ 17826.00 MD 6910.70 TVD
17,877.00	6,911.77	-10,777.19	6,119.44	Survey projected to 17877.00 MD 6911.77 TVD

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**JUL 1 0 2020**

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