



Well: Hudson S-13 HU (slot A)  
 Site: Hudson Alt North  
 Project: Marshall County, West Virginia NAD83 UTM 17N  
 Design: rev10  
 Rig: Nabors X08

SECTION DETAILS

MD	Inc	Azi	TVD	+N/-S	+E/-W	Dlog	TFace	V Sect	Annotation
10624.00	9.32	354.17	10568.12	858.41	-157.21	0.00	0.000	-812.86	Survey @ 10624.00 MD 10568.12 TVD
10750.55	9.32	354.17	10693.00	878.80	-159.29	0.00	0.000	-831.30	KOP Begin 6°/100' build/turn
11718.05	49.30	150.41	11559.24	615.50	29.87	6.00	158.870	-507.88	Begin 6°/100' build/turn
11753.18	50.00	147.65	11583.28	591.25	44.43	5.97	-72.489	-479.60	Begin 8°/100' build/turn
12241.41	89.00	150.01	11751.00	206.87	275.52	8.00	3.746	-31.14	Begin 89.00° lateral
23635.96	89.00	150.01	11950.00	-9660.56	5970.25	0.00	0.000	1356.51	PBHLTD 23635.96 MD 11950.00 TVD

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	V Sect	Annotation
180.00	0.09	138.41	180.00	-0.11	0.09	0.14	MWD surveys
23566.00	90.24	146.84	11945.76	-9604.20	5956.72	11301.46	Survey @ 23566.00 MD 11945.76 TVD
23630.00	90.24	146.84	11945.49	-9657.78	5991.73	11365.44	Survey Proj. to 23630.00 MD 11945.49 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=1346+33 @ 1379.00ft (Nabors X08)

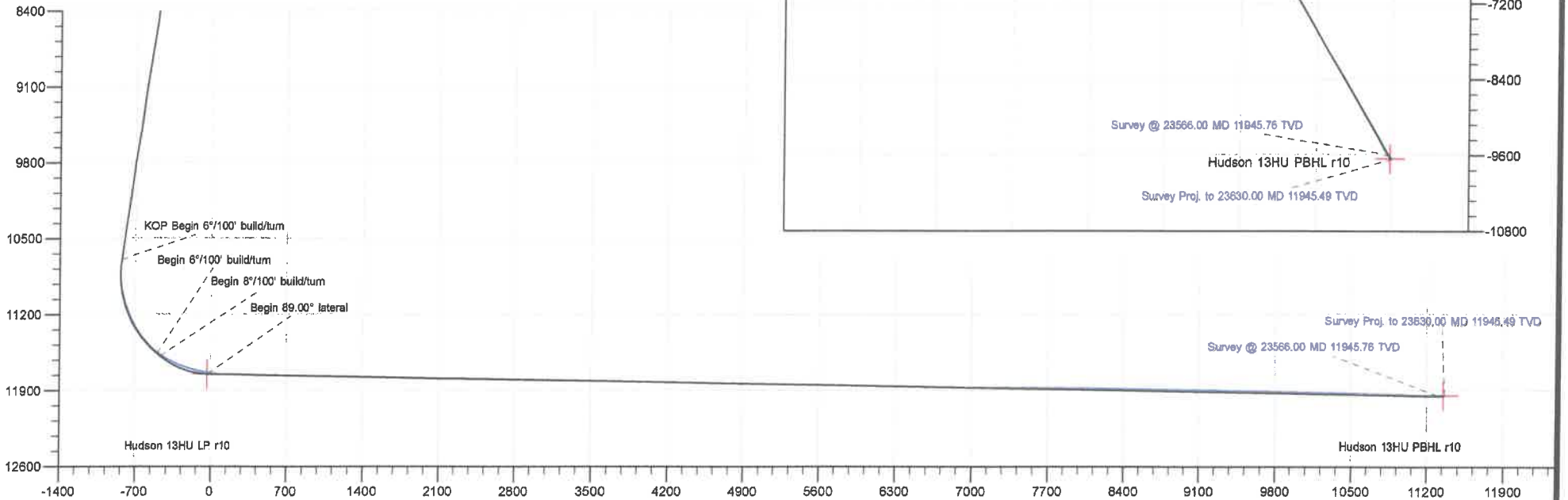
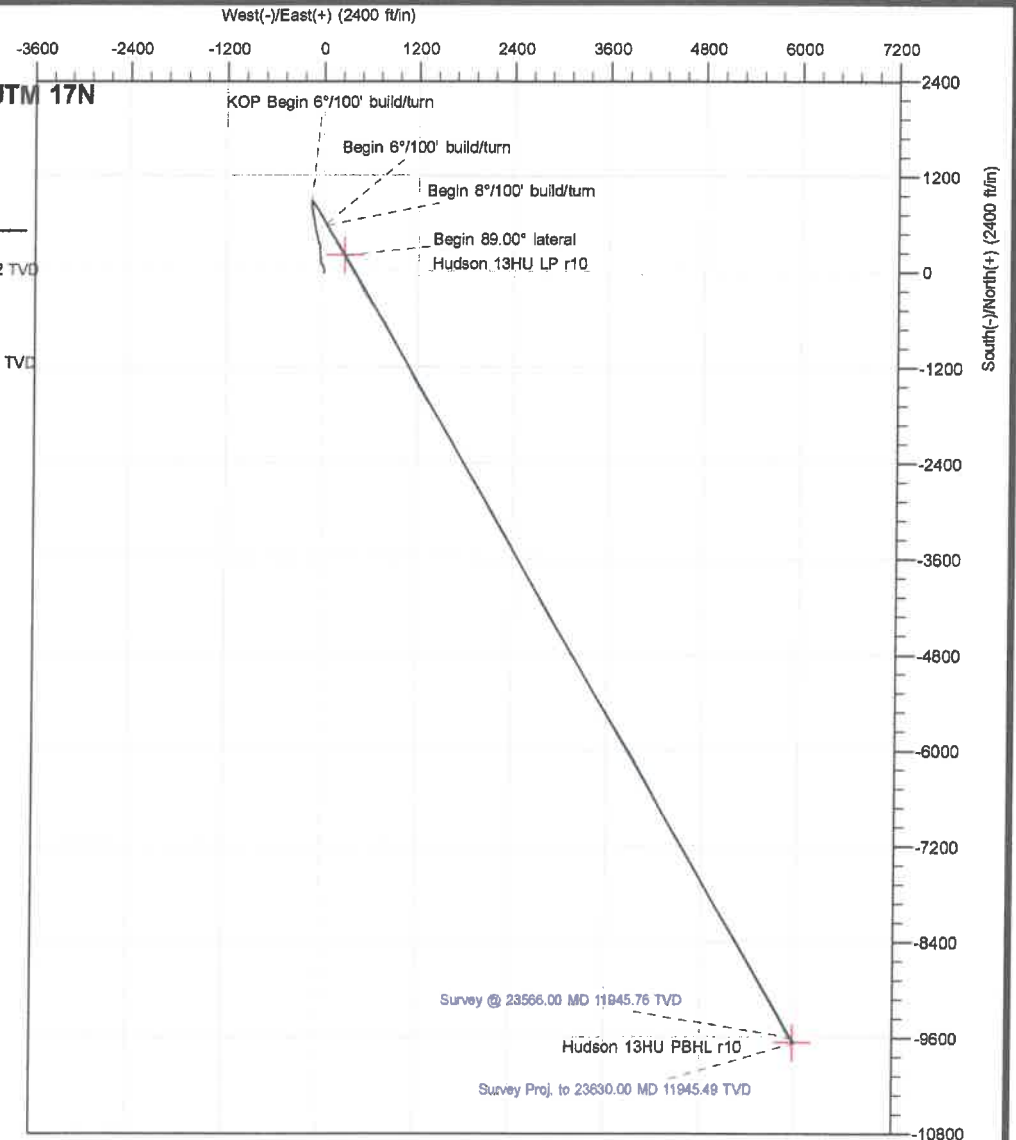
Northing	Easting	Latitude	Longitude
14464513.216	1732301.054	39.828667000	-80.672718000

al Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.901°



Azimuths to Grid North  
 True North: -0.21°  
 Magnetic North: -8.90°

Magnetic Field  
 Strength: 51728.3nT  
 Dip Angle: 66.53°  
 Date: 10/27/2021  
 Model: IGRF2020



Vertical Section at 148.28° (1400 ft/in)



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Hudson S-13 HU (slot A)
<b>Project:</b>	Marshall County, West Virginia NAD83 UTM 17N	<b>TVD Reference:</b>	RKB=1346+33 @ 1379.00ft (Nabors X08)
<b>Site:</b>	Hudson Alt North	<b>MD Reference:</b>	RKB=1346+33 @ 1379.00ft (Nabors X08)
<b>Well:</b>	Hudson S-13 HU (slot A)	<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_Dec2220_v16

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

<b>Site</b>	Hudson Alt North				
<b>Site Position:</b>		<b>Northing:</b>	14,464,552.095 usft	<b>Latitude:</b>	39.828774000
<b>From:</b>	Lat/Long	<b>Easting:</b>	1,732,278.451 usft	<b>Longitude:</b>	-80.672718000
<b>Position Uncertainty:</b>	0.00 ft	<b>Slot Radius:</b>	13-3/16 "		

<b>Well</b>	Hudson S-13 HU (slot A)					
<b>Well Position</b>	<b>+N/-S</b>	0.00 ft	<b>Northing:</b>	14,464,513.216 usft	<b>Latitude:</b>	39.828667000
	<b>+E/-W</b>	0.00 ft	<b>Easting:</b>	1,732,301.054 usft	<b>Longitude:</b>	-80.672718000
<b>Position Uncertainty</b>	0.00 ft		<b>Wellhead Elevation:</b>	ft	<b>Ground Level:</b>	1,346.00 ft
<b>Grid Convergence:</b>	0.210 °					

<b>Wellbore</b>	Original Hole				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	IGRF2020	10/27/2021	-8.691	66.530	51,726.30280734

<b>Design</b>	Surveys Original Hole				
<b>Audit Notes:</b>					
<b>Version:</b>	1.0	<b>Phase:</b>	ACTUAL	<b>Tie On Depth:</b>	0.00
<b>Vertical Section:</b>	<b>Depth From (TVD) (ft)</b>	<b>+N/-S (ft)</b>	<b>+E/-W (ft)</b>	<b>Direction (°)</b>	
	0.00	0.00	0.00	148.28	

<b>Survey Program</b>	<b>Date</b>	11/18/2021			
<b>From (ft)</b>	<b>To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
180.00	1,109.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,168.00	2,834.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,965.00	10,624.00	MWD (Original Hole)	MWD	MWD - Standard	
10,713.00	23,566.00	MWD lat (Original Hole)	MWD	MWD - Standard	
23,630.00	23,630.00	Projection (Original Hole)	MWD	MWD - Standard	

<b>Survey</b>	<b>Measured Depth (ft)</b>	<b>Inclination (°)</b>	<b>Azimuth (°)</b>	<b>Vertical Depth (ft)</b>	<b>+N/-S (ft)</b>	<b>+E/-W (ft)</b>	<b>Vertical Section (ft)</b>	<b>Dogleg Rate (°/100ft)</b>	<b>Build Rate (°/100ft)</b>	<b>Turn Rate (°/100ft)</b>
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180.00	0.09	138.41	180.00	-0.11	0.09	0.14	0.05	0.05	0.00
	<b>MWD surveys</b>									
	211.00	0.13	208.01	211.00	-0.15	0.09	0.18	0.42	0.13	224.52
	241.00	0.09	46.30	241.00	-0.17	0.09	0.19	0.72	-0.13	-539.03
	272.00	0.18	10.70	272.00	-0.10	0.12	0.15	0.38	0.29	-114.84



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**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:** Well Hudson S-13 HU (slot A)  
**TVD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**MD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**North Reference:** Grid  
**Survey Calculation Method:** Minimum Curvature  
**Database:** DB\_Dec2220\_v16

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)
303.00	0.31	2.79	303.00	0.03	0.13	0.05	0.43	0.42	-25.52
333.00	0.31	289.84	333.00	0.14	0.06	-0.08	1.23	0.00	-243.17
363.00	0.26	50.95	363.00	0.21	0.04	-0.16	1.66	-0.17	403.70
394.00	0.26	335.37	394.00	0.31	0.06	-0.23	1.03	0.00	-243.81
425.00	0.31	8.85	425.00	0.46	0.05	-0.37	0.55	0.16	108.00
455.00	0.26	64.49	455.00	0.57	0.12	-0.42	0.90	-0.17	185.47
486.00	0.35	12.55	486.00	0.69	0.21	-0.48	0.90	0.29	-167.55
517.00	0.13	359.89	517.00	0.82	0.23	-0.58	0.73	-0.71	-40.84
547.00	0.22	80.40	547.00	0.87	0.28	-0.59	0.79	0.30	268.37
578.00	0.09	333.43	578.00	0.90	0.33	-0.59	0.84	-0.42	-345.06
609.00	0.48	14.83	609.00	1.04	0.35	-0.70	1.34	1.26	133.55
639.00	0.35	356.90	639.00	1.26	0.38	-0.87	0.61	-0.43	-59.77
670.00	0.26	350.31	670.00	1.42	0.36	-1.02	0.31	-0.29	-21.26
701.00	0.31	338.71	701.00	1.57	0.32	-1.17	0.25	0.16	-37.42
732.00	0.31	28.19	731.99	1.72	0.33	-1.29	0.84	0.00	159.61
763.00	0.66	6.39	762.99	1.97	0.39	-1.47	1.26	1.13	-70.32
794.00	0.66	1.38	793.99	2.33	0.41	-1.76	0.19	0.00	-16.16
826.00	0.44	29.24	825.99	2.62	0.48	-1.98	1.06	-0.69	87.06
857.00	0.53	13.60	856.99	2.86	0.57	-2.14	0.51	0.29	-50.45
888.00	0.62	32.67	887.99	3.14	0.69	-2.31	0.68	0.29	61.52
919.00	0.40	32.23	918.99	3.38	0.84	-2.43	0.71	-0.71	-1.42
950.00	0.48	33.64	949.99	3.58	0.97	-2.53	0.26	0.26	4.55
981.00	0.79	20.10	980.98	3.88	1.12	-2.72	1.10	1.00	-43.68
1,012.00	0.75	30.21	1,011.98	4.26	1.29	-2.94	0.46	-0.13	32.61
1,043.00	0.66	54.21	1,042.98	4.54	1.54	-3.05	0.99	-0.29	77.42
1,074.00	0.70	38.65	1,073.98	4.79	1.80	-3.13	0.61	0.13	-50.19
1,109.00	0.79	71.08	1,108.97	5.04	2.16	-3.15	1.21	0.26	92.66
1,168.00	0.83	45.77	1,167.97	5.47	2.86	-3.15	0.61	0.07	-42.90
1,262.00	0.66	4.37	1,261.96	6.48	3.38	-3.73	0.59	-0.18	-44.04
1,356.00	0.44	355.05	1,355.96	7.38	3.39	-4.49	0.25	-0.23	-9.91
1,449.00	0.48	338.71	1,448.95	8.10	3.22	-5.20	0.15	0.04	-17.57
1,544.00	0.57	268.22	1,543.95	8.46	2.61	-5.82	0.64	0.09	-74.20
1,639.00	0.57	224.01	1,638.95	8.10	1.81	-5.94	0.45	0.00	-46.54
1,733.00	0.70	198.61	1,732.94	7.22	1.30	-5.46	0.33	0.14	-27.02
1,827.00	0.44	175.23	1,826.94	6.32	1.14	-4.77	0.37	-0.28	-24.87
1,921.00	0.44	127.68	1,920.93	5.74	1.46	-4.11	0.38	0.00	-50.59
2,015.00	0.97	89.01	2,014.93	5.53	2.54	-3.37	0.73	0.56	-41.14
2,110.00	1.58	76.97	2,109.90	5.84	4.62	-2.54	0.70	0.64	-12.67
2,204.00	2.33	48.23	2,203.85	7.40	7.31	-2.46	1.29	0.80	-30.57
2,298.00	2.11	41.02	2,297.78	9.98	9.87	-3.30	0.38	-0.23	-7.67
2,393.00	1.76	31.97	2,392.72	12.54	11.79	-4.47	0.49	-0.37	-9.53
2,486.00	1.58	3.40	2,485.69	15.03	12.62	-6.15	0.91	-0.19	-30.72
2,580.00	2.20	337.48	2,579.64	17.99	12.01	-8.99	1.11	0.66	-27.57
2,675.00	2.07	317.88	2,674.57	20.95	10.16	-12.48	0.78	-0.14	-20.63



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**Survey Calculation Method:** Minimum Curvature  
**Database:** DB\_Dec2220\_v16

**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)
2,770.00	1.10	287.55	2,769.54	22.50	8.14	-14.86	1.32	-1.02	-31.93
2,834.00	0.53	249.58	2,833.53	22.58	7.28	-15.38	1.18	-0.89	-59.33
2,965.00	0.48	226.56	2,964.52	21.99	6.31	-15.39	0.16	-0.04	-17.57
3,058.00	0.53	246.33	3,057.52	21.55	5.63	-15.37	0.19	0.05	21.26
3,153.00	0.26	271.38	3,152.52	21.38	5.01	-15.55	0.33	-0.28	26.37
3,247.00	1.80	359.10	3,246.50	22.86	4.78	-16.93	1.92	1.64	93.32
3,340.00	3.52	9.38	3,339.40	27.14	5.22	-20.34	1.91	1.85	11.05
3,437.00	5.32	6.22	3,436.11	34.55	6.19	-26.13	1.87	1.86	-3.26
3,531.00	6.24	354.61	3,529.63	43.96	6.19	-34.15	1.58	0.98	-12.35
3,625.00	7.03	338.44	3,623.01	54.40	3.59	-44.39	2.15	0.84	-17.20
3,719.00	5.98	329.21	3,716.41	63.96	-1.03	-54.95	1.57	-1.12	-9.82
3,813.00	5.67	323.15	3,809.92	71.88	-6.32	-64.47	0.73	-0.33	-6.45
3,907.00	6.42	324.38	3,903.40	79.87	-12.17	-74.34	0.81	0.80	1.31
4,001.00	4.53	331.24	3,996.97	87.40	-17.01	-83.29	2.12	-2.01	7.30
4,096.00	4.00	336.95	4,091.70	93.73	-20.12	-90.31	0.71	-0.56	6.01
4,190.00	4.70	334.22	4,185.43	100.22	-23.07	-97.38	0.78	0.74	-2.90
4,284.00	6.06	333.43	4,279.02	108.12	-26.97	-106.15	1.45	1.45	-0.84
4,378.00	5.63	332.55	4,372.53	116.65	-31.31	-115.69	0.47	-0.46	-0.94
4,472.00	4.83	337.39	4,466.13	124.40	-34.96	-124.20	0.97	-0.85	5.15
4,566.00	4.48	350.13	4,559.83	131.67	-37.11	-131.51	1.16	-0.37	13.55
4,660.00	4.26	6.92	4,653.56	138.75	-37.32	-137.65	1.38	-0.23	17.86
4,755.00	5.84	0.15	4,748.19	147.09	-36.88	-144.51	1.77	1.66	-7.13
4,849.00	4.61	6.92	4,841.80	155.62	-36.42	-151.52	1.46	-1.31	7.20
4,943.00	4.88	5.34	4,935.47	163.35	-35.59	-157.66	0.32	0.29	-1.68
5,036.00	6.06	3.31	5,028.05	172.19	-34.94	-164.84	1.29	1.27	-2.18
5,133.00	5.27	356.55	5,124.57	181.75	-34.91	-172.96	1.06	-0.81	-6.97
5,226.00	4.61	346.88	5,217.23	189.65	-36.01	-180.26	1.14	-0.71	-10.40
5,320.00	5.45	341.61	5,310.87	197.57	-38.28	-188.18	1.02	0.89	-5.61
5,414.00	5.63	338.44	5,404.43	206.09	-41.38	-197.07	0.38	0.19	-3.37
5,509.00	5.27	333.61	5,499.00	214.33	-45.03	-206.00	0.61	-0.38	-5.08
5,603.00	4.31	346.70	5,592.67	221.64	-47.77	-213.65	1.54	-1.02	13.93
5,698.00	3.65	355.84	5,687.44	228.13	-48.81	-219.71	0.96	-0.69	9.62
5,792.00	4.53	356.99	5,781.20	234.82	-49.22	-225.62	0.94	0.94	1.22
5,886.00	5.27	353.91	5,874.86	242.82	-49.87	-232.77	0.84	0.79	-3.28
5,979.00	5.01	4.90	5,967.49	251.11	-49.98	-239.88	1.09	-0.28	11.82
6,073.00	4.79	6.13	6,061.14	259.11	-49.21	-246.27	0.26	-0.23	1.31
6,167.00	6.59	10.26	6,154.68	268.32	-47.83	-253.38	1.96	1.91	4.39
6,261.00	5.27	355.32	6,248.18	277.93	-47.22	-261.24	2.15	-1.40	-15.89
6,356.00	5.45	342.49	6,342.77	286.58	-48.93	-269.50	1.27	0.19	-13.51
6,450.00	4.39	350.31	6,436.42	294.38	-50.88	-277.16	1.33	-1.13	8.32
6,544.00	3.34	4.46	6,530.21	300.66	-51.27	-282.71	1.50	-1.12	15.05
6,638.00	4.66	11.05	6,623.98	307.14	-50.33	-287.72	1.48	1.40	7.01
6,733.00	4.83	11.05	6,718.65	314.85	-48.82	-293.49	0.18	0.18	0.00



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**North Reference:** Grid  
**Survey Calculation Method:** Minimum Curvature  
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Survey										
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6,827.00	5.63	2.00	6,812.26	323.34	-47.90	-300.23	1.22	0.85	-9.63	
6,918.00	4.26	355.23	6,902.92	331.17	-48.03	-306.96	1.63	-1.51	-7.44	
7,013.00	3.43	348.81	6,997.71	337.48	-48.87	-312.76	0.98	-0.87	-6.76	
7,107.00	4.92	343.98	7,091.45	344.11	-50.53	-319.28	1.63	1.59	-5.14	
7,201.00	6.55	337.30	7,184.98	352.93	-53.71	-328.45	1.87	1.73	-7.11	
7,295.00	8.31	329.65	7,278.19	363.74	-59.22	-340.54	2.14	1.87	-8.14	
7,389.00	7.25	332.29	7,371.32	374.85	-65.41	-353.25	1.19	-1.13	2.81	
7,483.00	6.72	345.91	7,464.63	385.44	-69.50	-364.41	1.84	-0.56	14.49	
7,577.00	6.77	354.09	7,557.98	396.28	-71.41	-374.64	1.02	0.05	8.70	
7,672.00	8.26	354.00	7,652.17	408.64	-72.70	-385.83	1.57	1.57	-0.09	
7,765.00	8.61	347.85	7,744.16	422.09	-74.87	-398.40	1.04	0.38	-6.61	
7,860.00	10.33	348.29	7,837.86	437.38	-78.09	-413.11	1.81	1.81	0.46	
7,953.00	9.71	343.98	7,929.45	453.09	-81.95	-428.50	1.05	-0.67	-4.63	
8,048.00	8.09	341.78	8,023.30	467.14	-86.25	-442.71	1.74	-1.71	-2.32	
8,142.00	9.36	347.93	8,116.21	480.90	-89.92	-456.34	1.67	1.35	6.54	
8,236.00	10.90	348.55	8,208.74	497.08	-93.28	-471.88	1.64	1.64	0.66	
8,330.00	9.84	348.64	8,301.21	513.67	-96.63	-487.74	1.13	-1.13	0.10	
8,425.00	8.00	345.56	8,395.05	528.03	-99.87	-501.67	2.00	-1.94	-3.24	
8,519.00	7.29	343.01	8,488.22	540.07	-103.25	-513.68	0.84	-0.76	-2.71	
8,613.00	8.17	346.26	8,581.36	552.26	-106.58	-525.80	1.04	0.94	3.46	
8,708.00	8.88	348.46	8,675.31	566.00	-109.65	-539.11	0.82	0.75	2.32	
8,802.00	9.80	351.54	8,768.07	581.02	-112.28	-553.27	1.11	0.98	3.28	
8,896.00	9.27	352.50	8,860.77	596.44	-114.44	-567.52	0.59	-0.56	1.02	
8,992.00	9.10	351.80	8,955.54	611.62	-116.53	-581.53	0.21	-0.18	-0.73	
9,085.00	9.18	348.11	9,047.36	626.16	-119.11	-595.26	0.64	0.09	-3.97	
9,179.00	8.88	347.67	9,140.19	640.59	-122.20	-609.15	0.33	-0.32	-0.47	
9,273.00	7.29	348.90	9,233.26	653.53	-124.90	-621.58	1.70	-1.69	1.31	
9,365.00	7.82	352.77	9,324.46	665.47	-126.81	-632.74	0.80	0.58	4.21	
9,458.00	8.96	350.75	9,416.46	678.89	-128.77	-645.19	1.27	1.23	-2.17	
9,552.00	8.66	350.40	9,509.35	693.09	-131.13	-658.51	0.32	-0.32	-0.37	
9,646.00	9.89	348.46	9,602.12	707.98	-133.93	-672.64	1.35	1.31	-2.06	
9,740.00	9.71	350.04	9,694.75	723.70	-136.91	-687.58	0.34	-0.19	1.68	
9,834.00	9.62	353.38	9,787.42	739.31	-139.19	-702.06	0.60	-0.10	3.55	
9,928.00	8.79	354.35	9,880.20	754.26	-140.80	-715.62	0.90	-0.88	1.03	
10,022.00	8.09	354.61	9,973.19	767.99	-142.13	-728.00	0.75	-0.74	0.28	
10,116.00	7.65	348.64	10,066.30	780.71	-143.98	-739.79	0.99	-0.47	-6.35	
10,210.00	9.23	347.06	10,159.28	794.19	-146.90	-752.80	1.70	1.68	-1.68	
10,303.00	9.45	347.85	10,251.05	808.92	-150.18	-767.05	0.27	0.24	0.85	
10,397.00	9.05	350.92	10,343.83	823.77	-152.97	-781.15	0.68	-0.43	3.27	
10,492.00	8.44	353.65	10,437.72	838.08	-154.92	-794.34	0.78	-0.64	2.87	
10,586.00	9.14	353.38	10,530.62	852.35	-156.55	-807.34	0.75	0.74	-0.29	
10,624.00	9.32	354.17	10,568.12	858.41	-157.21	-812.84	0.58	0.47	2.08	
10,713.00	9.98	2.88	10,655.87	873.28	-157.55	-825.67	1.80	0.74	9.79	



**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia NAD83 UTM 17N  
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**Well:** Hudson S-13 HU (slot A)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:** Well Hudson S-13 HU (slot A)  
**TVD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**MD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**North Reference:** Grid  
**Survey Calculation Method:** Minimum Curvature  
**Database:** DB\_Dec2220\_v16

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)
10,760.00	9.45	4.64	10,702.20	881.19	-157.03	-832.13	1.29	-1.13	3.74
10,807.00	8.31	20.10	10,748.64	888.23	-155.55	-837.34	5.60	-2.43	32.89
10,854.00	7.08	46.12	10,795.23	893.43	-152.30	-840.05	7.78	-2.62	55.36
10,901.00	7.30	80.92	10,841.88	895.91	-147.26	-839.51	9.14	0.47	74.04
10,948.00	8.31	103.34	10,888.46	895.60	-141.00	-835.95	6.77	2.15	47.70
10,995.00	9.32	122.85	10,934.91	892.75	-134.50	-830.11	6.68	2.15	41.51
11,042.00	10.24	143.68	10,981.24	887.32	-128.83	-822.51	7.73	1.96	44.32
11,088.00	12.79	147.63	11,026.31	879.72	-123.68	-813.34	5.80	5.54	8.59
11,136.00	15.25	147.37	11,072.88	869.91	-117.43	-801.71	5.13	5.13	-0.54
11,182.00	17.80	149.04	11,116.98	858.79	-110.55	-788.63	5.64	5.54	3.63
11,229.00	20.09	150.09	11,161.43	845.63	-102.83	-773.38	4.93	4.87	2.23
11,276.00	23.12	150.80	11,205.12	830.57	-94.30	-756.09	6.47	6.45	1.51
11,323.00	26.07	150.36	11,247.85	813.54	-84.69	-736.54	6.29	6.28	-0.94
11,370.00	29.01	150.18	11,289.52	794.67	-73.91	-714.83	6.26	6.26	-0.38
11,417.00	31.43	150.36	11,330.13	774.13	-62.18	-691.19	5.15	5.15	0.38
11,463.00	33.41	150.45	11,368.96	752.69	-50.00	-666.54	4.31	4.30	0.20
11,510.00	36.04	150.80	11,407.58	729.36	-36.87	-639.80	5.61	5.60	0.74
11,558.00	39.69	150.89	11,445.47	703.63	-22.52	-610.37	7.61	7.60	0.19
11,605.00	42.95	150.80	11,480.77	676.53	-7.41	-579.37	6.94	6.94	-0.19
11,652.00	46.46	149.92	11,514.17	647.81	8.95	-546.34	7.58	7.47	-1.87
11,699.00	50.02	149.74	11,545.46	617.50	26.57	-511.30	7.58	7.57	-0.38
11,745.00	53.98	150.18	11,573.78	586.13	44.71	-475.07	8.64	8.61	0.96
11,792.00	57.63	150.62	11,600.19	552.33	63.90	-436.23	7.80	7.77	0.94
11,840.00	61.89	150.53	11,624.36	516.22	84.27	-394.80	8.88	8.88	-0.19
11,887.00	65.63	150.36	11,645.13	479.55	105.06	-352.68	7.96	7.96	-0.36
11,935.00	68.09	150.09	11,663.99	441.25	126.98	-308.57	5.15	5.13	-0.56
11,982.00	69.45	149.39	11,681.01	403.41	149.06	-264.78	3.21	2.89	-1.49
12,029.00	72.48	149.48	11,696.34	365.16	171.65	-220.36	6.45	6.45	0.19
12,076.00	74.51	150.09	11,709.69	326.22	194.32	-175.32	4.49	4.32	1.30
12,124.00	77.10	149.74	11,721.46	285.95	217.65	-128.81	5.44	5.40	-0.73
12,171.00	78.99	149.48	11,731.20	246.29	240.91	-82.84	4.06	4.02	-0.55
12,218.00	80.62	149.57	11,739.52	206.43	264.37	-36.60	3.47	3.47	0.19
12,265.00	82.37	149.74	11,746.47	166.31	287.85	9.87	3.74	3.72	0.36
12,312.00	84.57	149.30	11,751.81	126.07	311.54	56.55	4.77	4.68	-0.94
12,359.00	87.47	149.39	11,755.07	85.74	335.44	103.43	6.17	6.17	0.19
12,407.00	87.60	149.30	11,757.14	44.49	359.89	151.37	0.33	0.27	-0.19
12,501.00	89.23	150.53	11,759.74	-36.81	406.99	245.29	2.17	1.73	1.31
12,595.00	89.19	151.94	11,761.03	-119.20	452.22	339.16	1.50	-0.04	1.50
12,690.00	88.66	151.59	11,762.82	-202.88	497.15	433.97	0.67	-0.56	-0.37
12,784.00	88.44	148.42	11,765.20	-284.26	544.13	527.88	3.38	-0.23	-3.37
12,846.00	88.81	148.78	11,766.68	-337.16	576.42	589.86	0.83	0.60	0.58
12,908.00	89.87	145.44	11,767.40	-389.21	610.08	651.84	5.65	1.71	-5.39
12,939.00	88.55	144.73	11,767.83	-414.63	627.82	682.78	4.83	-4.26	-2.29
12,970.00	88.11	146.14	11,768.73	-440.15	645.40	713.73	4.76	-1.42	4.55



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**Local Co-ordinate Reference:** Well Hudson S-13 HU (slot A)  
**TVD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**MD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**North Reference:** Grid  
**Survey Calculation Method:** Minimum Curvature  
**Database:** DB\_Dec2220\_v16

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)
13,002.00	88.90	146.14	11,769.56	-466.71	663.22	745.70	2.47	2.47	0.00
13,033.00	89.08	145.44	11,770.11	-492.34	680.65	776.66	2.33	0.58	-2.26
13,065.00	88.64	145.08	11,770.75	-518.63	698.88	808.61	1.78	-1.38	-1.13
13,096.00	88.46	145.61	11,771.53	-544.12	716.50	839.56	1.81	-0.58	1.71
13,127.00	87.67	146.84	11,772.58	-569.88	733.73	870.52	4.71	-2.55	3.97
13,158.00	87.52	147.37	11,773.88	-595.88	750.55	901.49	1.78	-0.48	1.71
13,250.00	90.37	150.89	11,775.57	-674.82	797.73	993.44	4.92	3.10	3.83
13,345.00	89.32	152.03	11,775.83	-758.27	843.12	1,088.29	1.63	-1.11	1.20
13,439.00	89.19	152.29	11,777.05	-841.38	887.01	1,182.07	0.31	-0.14	0.28
13,533.00	89.19	151.76	11,778.38	-924.39	931.10	1,275.86	0.56	0.00	-0.56
13,627.00	89.49	151.15	11,779.46	-1,006.96	976.02	1,369.71	0.72	0.32	-0.65
13,721.00	87.65	150.97	11,781.81	-1,089.19	1,021.49	1,463.56	1.97	-1.96	-0.19
13,816.00	88.00	151.32	11,785.42	-1,172.34	1,067.30	1,558.37	0.52	0.37	0.37
13,909.00	88.13	150.97	11,788.56	-1,253.74	1,112.15	1,651.20	0.40	0.14	-0.38
14,003.00	88.88	150.27	11,791.01	-1,335.62	1,158.25	1,745.09	1.09	0.80	-0.74
14,097.00	89.05	150.18	11,792.71	-1,417.20	1,204.93	1,839.02	0.20	0.18	-0.10
14,191.00	88.84	149.74	11,794.44	-1,498.56	1,251.98	1,932.97	0.52	-0.22	-0.47
14,286.00	89.63	149.57	11,795.70	-1,580.54	1,299.97	2,027.93	0.85	0.83	-0.18
14,380.00	89.19	148.69	11,796.67	-1,661.22	1,348.19	2,121.91	1.05	-0.47	-0.94
14,474.00	89.80	148.25	11,797.50	-1,741.33	1,397.35	2,215.91	0.80	0.65	-0.47
14,568.00	89.80	148.42	11,797.83	-1,821.34	1,446.69	2,309.91	0.18	0.00	0.18
14,663.00	89.23	149.65	11,798.63	-1,902.80	1,495.57	2,404.89	1.43	-0.60	1.29
14,756.00	88.92	149.74	11,800.14	-1,983.08	1,542.49	2,497.85	0.35	-0.33	0.10
14,851.00	88.70	149.83	11,802.11	-2,065.15	1,590.29	2,592.80	0.25	-0.23	0.09
14,946.00	89.67	150.62	11,803.46	-2,147.60	1,637.46	2,687.73	1.32	1.02	0.83
15,040.00	89.41	150.62	11,804.21	-2,229.51	1,683.57	2,781.65	0.28	-0.28	0.00
15,135.00	89.19	150.27	11,805.37	-2,312.14	1,730.43	2,876.58	0.44	-0.23	-0.37
15,229.00	88.84	150.53	11,806.99	-2,393.86	1,776.85	2,970.50	0.46	-0.37	0.28
15,323.00	88.48	150.36	11,809.19	-2,475.61	1,823.21	3,064.41	0.42	-0.38	-0.18
15,418.00	88.35	150.27	11,811.82	-2,558.11	1,870.24	3,159.31	0.17	-0.14	-0.09
15,511.00	89.19	150.45	11,813.81	-2,638.92	1,916.22	3,252.23	0.92	0.90	0.19
15,604.00	89.05	150.45	11,815.24	-2,719.81	1,962.08	3,345.15	0.15	-0.15	0.00
15,699.00	89.49	150.27	11,816.45	-2,802.38	2,009.06	3,440.08	0.50	0.46	-0.19
15,792.00	89.54	150.62	11,817.24	-2,883.27	2,054.93	3,533.01	0.38	0.05	0.38
15,887.00	89.23	150.53	11,818.26	-2,966.01	2,101.60	3,627.93	0.34	-0.33	-0.09
15,980.00	88.97	150.45	11,819.72	-3,046.94	2,147.40	3,720.85	0.29	-0.28	-0.09
16,075.00	89.32	149.39	11,821.14	-3,129.13	2,195.01	3,815.79	1.17	0.37	-1.12
16,168.00	88.97	149.57	11,822.52	-3,209.24	2,242.23	3,908.76	0.42	-0.38	0.19
16,263.00	89.32	149.39	11,823.94	-3,291.07	2,290.47	4,003.73	0.41	0.37	-0.19
16,358.00	88.97	149.92	11,825.36	-3,373.04	2,338.46	4,098.69	0.67	-0.37	0.56
16,451.00	90.20	149.74	11,826.03	-3,453.44	2,385.20	4,191.66	1.34	1.32	-0.19
16,545.00	89.10	149.74	11,826.61	-3,534.63	2,432.57	4,285.62	1.17	-1.17	0.00
16,639.00	88.75	149.57	11,828.37	-3,615.74	2,480.05	4,379.58	0.41	-0.37	-0.18



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**North Reference:** Grid  
**Survey Calculation Method:** Minimum Curvature  
**Database:** DB\_Dec2220\_v16

**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)
16,733.00	88.53	149.39	11,830.60	-3,696.69	2,527.77	4,473.53	0.30	-0.23	-0.19
16,827.00	89.19	150.89	11,832.47	-3,778.19	2,574.56	4,567.46	1.74	0.70	1.60
16,922.00	88.92	150.97	11,834.04	-3,861.22	2,620.71	4,662.34	0.30	-0.28	0.08
17,016.00	88.79	150.97	11,835.92	-3,943.39	2,666.32	4,756.22	0.14	-0.14	0.00
17,110.00	88.84	152.38	11,837.86	-4,026.11	2,710.91	4,850.03	1.50	0.05	1.50
17,204.00	88.57	152.64	11,839.99	-4,109.48	2,754.29	4,943.75	0.40	-0.29	0.28
17,298.00	88.88	151.76	11,842.08	-4,192.61	2,798.12	5,037.51	0.99	0.33	-0.94
17,391.00	88.62	149.57	11,844.11	-4,273.66	2,843.66	5,130.40	2.37	-0.28	-2.35
17,485.00	89.49	148.60	11,845.66	-4,354.29	2,891.95	5,224.38	1.39	0.93	-1.03
17,579.00	89.54	148.42	11,846.45	-4,434.45	2,941.05	5,318.37	0.20	0.05	-0.19
17,673.00	88.70	147.02	11,847.90	-4,513.91	2,991.24	5,412.36	1.74	-0.89	-1.49
17,767.00	89.32	148.95	11,849.52	-4,593.59	3,041.07	5,506.34	2.16	0.66	2.05
17,862.00	88.97	148.78	11,850.94	-4,674.90	3,090.18	5,601.32	0.41	-0.37	-0.18
17,956.00	88.79	149.39	11,852.78	-4,755.53	3,138.47	5,695.29	0.68	-0.19	0.65
18,050.00	88.97	150.89	11,854.61	-4,837.03	3,185.26	5,789.22	1.61	0.19	1.60
18,144.00	88.35	150.36	11,856.81	-4,918.92	3,231.35	5,883.12	0.87	-0.66	-0.56
18,237.00	89.10	150.01	11,858.88	-4,999.59	3,277.58	5,976.04	0.89	0.81	-0.38
18,331.00	88.75	150.27	11,860.64	-5,081.10	3,324.37	6,069.97	0.46	-0.37	0.28
18,425.00	88.62	149.92	11,862.80	-5,162.56	3,371.23	6,163.90	0.40	-0.14	-0.37
18,520.00	89.76	149.04	11,864.14	-5,244.39	3,419.46	6,258.87	1.52	1.20	-0.93
18,614.00	89.54	148.78	11,864.72	-5,324.89	3,468.00	6,352.86	0.36	-0.23	-0.28
18,708.00	89.14	148.16	11,865.80	-5,405.00	3,517.16	6,446.85	0.78	-0.43	-0.66
18,803.00	88.88	148.07	11,867.44	-5,485.66	3,567.33	6,541.84	0.29	-0.27	-0.09
18,897.00	89.45	149.22	11,868.81	-5,565.92	3,616.24	6,635.83	1.37	0.61	1.22
18,991.00	89.63	149.13	11,869.57	-5,646.64	3,664.40	6,729.81	0.21	0.19	-0.10
19,086.00	89.19	149.30	11,870.55	-5,728.25	3,713.02	6,824.79	0.50	-0.46	0.18
19,179.00	88.88	149.39	11,872.11	-5,808.24	3,760.43	6,917.76	0.35	-0.33	0.10
19,274.00	88.57	149.39	11,874.23	-5,889.98	3,808.79	7,012.72	0.33	-0.33	0.00
19,368.00	89.19	150.18	11,876.06	-5,971.19	3,856.09	7,106.67	1.07	0.66	0.84
19,463.00	89.85	150.53	11,876.86	-6,053.75	3,903.08	7,201.61	0.79	0.69	0.37
19,556.00	89.58	150.18	11,877.32	-6,134.58	3,949.08	7,294.54	0.48	-0.29	-0.38
19,650.00	89.41	150.53	11,878.15	-6,216.27	3,995.57	7,388.48	0.41	-0.18	0.37
19,744.00	90.02	150.71	11,878.62	-6,298.18	4,041.68	7,482.40	0.68	0.65	0.19
19,839.00	89.63	150.45	11,878.91	-6,380.93	4,088.35	7,577.32	0.49	-0.41	-0.27
19,933.00	90.33	151.41	11,878.94	-6,463.09	4,134.02	7,671.22	1.26	0.74	1.02
20,027.00	89.36	150.97	11,879.19	-6,545.45	4,179.32	7,765.09	1.13	-1.03	-0.47
20,121.00	89.05	152.38	11,880.50	-6,628.19	4,223.91	7,858.92	1.54	-0.33	1.50
20,215.00	88.97	151.85	11,882.12	-6,711.26	4,267.87	7,952.69	0.57	-0.09	-0.56
20,309.00	89.05	150.97	11,883.75	-6,793.78	4,312.85	8,046.54	0.94	0.09	-0.94
20,403.00	88.53	150.71	11,885.73	-6,875.85	4,358.64	8,140.42	0.62	-0.55	-0.28
20,497.00	89.49	150.89	11,887.36	-6,957.89	4,404.49	8,234.32	1.04	1.02	0.19
20,592.00	89.58	150.53	11,888.13	-7,040.74	4,450.96	8,329.23	0.39	0.09	-0.38
20,687.00	89.27	151.32	11,889.08	-7,123.77	4,497.13	8,424.12	0.89	-0.33	0.83





**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia NAD83 UTM 17N  
**Site:** Hudson Alt North  
**Well:** Hudson S-13 HU (slot A)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:** Well Hudson S-13 HU (slot A)  
**TVD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**MD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**North Reference:** Grid  
**Survey Calculation Method:** Minimum Curvature  
**Database:** DB\_Dec2220\_v16

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)
20,781.00	88.48	151.76	11,890.93	-7,206.39	4,541.91	8,517.95	0.96	-0.84	0.47
20,874.00	88.44	150.45	11,893.43	-7,287.78	4,586.83	8,610.80	1.41	-0.04	-1.41
20,969.00	88.84	149.30	11,895.68	-7,369.93	4,634.50	8,705.74	1.28	0.42	-1.21
21,063.00	89.01	148.86	11,897.44	-7,450.55	4,682.79	8,799.71	0.50	0.18	-0.47
21,157.00	88.97	149.13	11,899.10	-7,531.11	4,731.20	8,893.69	0.29	-0.04	0.29
21,250.00	88.84	149.83	11,900.88	-7,611.21	4,778.42	8,986.65	0.77	-0.14	0.75
21,344.00	88.62	148.95	11,902.96	-7,692.09	4,826.28	9,080.61	0.96	-0.23	-0.94
21,438.00	90.29	149.04	11,903.86	-7,772.65	4,874.69	9,174.59	1.78	1.78	0.10
21,531.00	89.63	149.13	11,903.92	-7,852.44	4,922.47	9,267.58	0.72	-0.71	0.10
21,625.00	88.57	149.30	11,905.40	-7,933.18	4,970.58	9,361.56	1.14	-1.13	0.18
21,718.00	89.01	149.04	11,907.36	-8,013.02	5,018.23	9,454.53	0.55	0.47	-0.28
21,813.00	88.75	149.57	11,909.22	-8,094.70	5,066.71	9,549.49	0.62	-0.27	0.56
21,907.00	89.45	149.57	11,910.69	-8,175.74	5,114.32	9,643.46	0.74	0.74	0.00
22,001.00	88.13	149.57	11,912.68	-8,256.77	5,161.91	9,737.41	1.40	-1.40	0.00
22,095.00	88.66	149.30	11,915.31	-8,337.68	5,209.70	9,831.35	0.63	0.56	-0.29
22,189.00	89.49	148.69	11,916.83	-8,418.24	5,258.11	9,925.33	1.10	0.88	-0.65
22,283.00	88.92	149.48	11,918.13	-8,498.87	5,306.40	10,019.31	1.04	-0.61	0.84
22,377.00	89.58	149.30	11,919.36	-8,579.77	5,354.26	10,113.29	0.73	0.70	-0.19
22,470.00	88.75	149.74	11,920.72	-8,659.90	5,401.43	10,206.25	1.01	-0.89	0.47
22,564.00	87.38	150.89	11,923.89	-8,741.52	5,447.95	10,300.14	1.90	-1.46	1.22
22,658.00	88.22	150.89	11,927.50	-8,823.58	5,493.64	10,393.97	0.89	0.89	0.00
22,753.00	88.84	150.97	11,929.94	-8,906.59	5,539.79	10,488.84	0.66	0.65	0.08
22,847.00	88.31	150.36	11,932.28	-8,988.51	5,585.83	10,582.73	0.86	-0.56	-0.65
22,940.00	88.48	149.48	11,934.88	-9,068.95	5,632.42	10,675.65	0.96	0.18	-0.95
23,034.00	89.67	149.04	11,936.40	-9,149.73	5,680.46	10,769.62	1.35	1.27	-0.47
23,129.00	88.75	149.22	11,937.71	-9,231.27	5,729.20	10,864.60	0.99	-0.97	0.19
23,223.00	89.36	149.22	11,939.26	-9,312.01	5,777.29	10,958.58	0.65	0.65	0.00
23,317.00	88.26	149.39	11,941.21	-9,392.82	5,825.27	11,052.54	1.18	-1.17	0.18
23,411.00	88.44	148.60	11,943.92	-9,473.36	5,873.67	11,146.49	0.86	0.19	-0.84
23,505.00	89.49	147.28	11,945.62	-9,553.01	5,923.55	11,240.47	1.79	1.12	-1.40
23,566.00	90.24	146.84	11,945.76	-9,604.20	5,956.72	11,301.46	1.43	1.23	-0.72
<b>Survey @ 23566.00 MD 11945.76 TVD</b>									
23,630.00	90.24	146.84	11,945.49	-9,657.78	5,991.73	11,365.44	0.00	0.00	0.00
<b>Survey Proj. to 23630.00 MD 11945.49 TVD</b>									

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
180.00	180.00	-0.11	0.09	MWD surveys
23,566.00	11,945.76	-9,604.20	5,956.72	Survey @ 23566.00 MD 11945.76 TVD
23,630.00	11,945.49	-9,657.78	5,991.73	Survey Proj. to 23630.00 MD 11945.49 TVD



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Hudson S-13 HU (slot A)
<b>Project:</b>	Marshall County, West Virginia NAD83 UTM 17N	<b>TVD Reference:</b>	RKB=1346+33 @ 1379.00ft (Nabors X08)
<b>Site:</b>	Hudson Alt North	<b>MD Reference:</b>	RKB=1346+33 @ 1379.00ft (Nabors X08)
<b>Well:</b>	Hudson S-13 HU (slot A)	<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_Dec2220_v16

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

<b>Site</b>	Hudson Alt North				
<b>Site Position:</b>		<b>Northing:</b>	14,464,552.095 usft	<b>Latitude:</b>	39.828774000
<b>From:</b>	Lat/Long	<b>Easting:</b>	1,732,278.451 usft	<b>Longitude:</b>	-80.672798000
<b>Position Uncertainty:</b>	0.00 ft	<b>Slot Radius:</b>	13-3/16 "	<b>Grid Convergence:</b>	0.210 °

<b>Well</b>	Hudson S-13 HU (slot A)					
<b>Well Position</b>	+N/-S	0.00 ft	<b>Northing:</b>	14,464,513.216 usft	<b>Latitude:</b>	39.828667000
	+E/-W	0.00 ft	<b>Easting:</b>	1,732,301.054 usft	<b>Longitude:</b>	-80.672718000
<b>Position Uncertainty</b>	0.00 ft	<b>Wellhead Elevation:</b>	ft	<b>Ground Level:</b>	1,346.00 ft	

<b>Wellbore</b>	Original Hole				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	IGRF2020	10/27/2021	-8.691	66.530	51,726.30280734

<b>Design</b>	Surveys Original Hole				
<b>Audit Notes:</b>					
<b>Version:</b>	1.0	<b>Phase:</b>	ACTUAL	<b>Tie On Depth:</b>	0.00
<b>Vertical Section:</b>	<b>Depth From (TVD) (ft)</b>	<b>+N/-S (ft)</b>	<b>+E/-W (ft)</b>	<b>Direction (°)</b>	
	0.00	0.00	0.00	148.28	

<b>Survey Program</b>	Date 11/18/2021			
<b>From (ft)</b>	<b>To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>
180.00	1,109.00	MWD surf (Original Hole)	MWD	MWD - Standard
1,168.00	2,834.00	MWD int (Original Hole)	MWD	MWD - Standard
2,965.00	10,624.00	MWD (Original Hole)	MWD	MWD - Standard
10,713.00	23,566.00	MWD lat (Original Hole)	MWD	MWD - Standard
23,630.00	23,630.00	Projection (Original Hole)	MWD	MWD - Standard

<b>Survey</b>										
<b>Measured Depth (ft)</b>	<b>Inclination (°)</b>	<b>Azimuth (°)</b>	<b>Vertical Depth (ft)</b>	<b>+N/-S (ft)</b>	<b>+E/-W (ft)</b>	<b>Map Northing (usft)</b>	<b>Map Easting (usft)</b>	<b>Latitude</b>	<b>Longitude</b>	
0.00	0.00	0.00	0.00	0.00	0.00	14,464,513.216	1,732,301.054	39.828667000	-80.672718000	
180.00	0.09	138.41	180.00	-0.11	0.09	14,464,513.110	1,732,301.148	39.828666709	-80.672717667	
<b>MWD surveys</b>										
211.00	0.13	208.01	211.00	-0.15	0.09	14,464,513.061	1,732,301.147	39.828666574	-80.672717669	
241.00	0.09	46.30	241.00	-0.17	0.09	14,464,513.047	1,732,301.148	39.828666536	-80.672717665	
272.00	0.18	10.70	272.00	-0.10	0.12	14,464,513.112	1,732,301.175	39.828666713	-80.672717569	
303.00	0.31	2.79	303.00	0.03	0.13	14,464,513.243	1,732,301.188	39.828667075	-80.672717521	



**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia NAD83 UTM 17N  
**Site:** Hudson Alt North  
**Well:** Hudson S-13 HU (slot A)  
**Wellbore:** Original Hole  
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**Local Co-ordinate Reference:** Well Hudson S-13 HU (slot A)  
**TVD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**MD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**North Reference:** Grid  
**Survey Calculation Method:** Minimum Curvature  
**Database:** DB\_Dec2220\_v16

**Survey**

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
333.00	0.31	289.84	333.00	0.14	0.06	14,464,513.352	1,732,301.116	39.828667374	-80.672717777
363.00	0.26	50.95	363.00	0.21	0.04	14,464,513.422	1,732,301.092	39.828667567	-80.672717860
394.00	0.26	335.37	394.00	0.31	0.06	14,464,513.530	1,732,301.118	39.828667864	-80.672717768
425.00	0.31	8.85	425.00	0.46	0.05	14,464,513.677	1,732,301.101	39.828668268	-80.672717825
455.00	0.26	54.49	455.00	0.57	0.12	14,464,513.787	1,732,301.175	39.828668568	-80.672717560
486.00	0.35	12.55	486.00	0.69	0.21	14,464,513.909	1,732,301.259	39.828668904	-80.672717259
517.00	0.13	359.89	517.00	0.82	0.23	14,464,514.037	1,732,301.280	39.828669254	-80.672717185
547.00	0.22	80.40	547.00	0.87	0.28	14,464,514.081	1,732,301.336	39.828669373	-80.672716982
578.00	0.09	333.43	578.00	0.90	0.33	14,464,514.112	1,732,301.384	39.828669460	-80.672716811
609.00	0.48	14.83	609.00	1.04	0.35	14,464,514.260	1,732,301.407	39.828669864	-80.672716730
639.00	0.35	356.90	639.00	1.26	0.38	14,464,514.473	1,732,301.434	39.828670449	-80.672716630
670.00	0.26	350.31	670.00	1.42	0.36	14,464,514.637	1,732,301.417	39.828670899	-80.672716688
701.00	0.31	338.71	701.00	1.57	0.32	14,464,514.784	1,732,301.375	39.828671304	-80.672716837
732.00	0.31	28.19	731.99	1.72	0.33	14,464,514.936	1,732,301.384	39.828671722	-80.672716802
763.00	0.66	6.39	762.99	1.97	0.39	14,464,515.187	1,732,301.443	39.828672411	-80.672716587
794.00	0.66	1.38	793.99	2.33	0.41	14,464,515.543	1,732,301.467	39.828673389	-80.672716497
826.00	0.44	29.24	825.99	2.62	0.48	14,464,515.835	1,732,301.532	39.828674188	-80.672716263
857.00	0.53	13.60	856.99	2.88	0.57	14,464,516.078	1,732,301.624	39.828674855	-80.672715933
888.00	0.62	32.67	887.99	3.14	0.69	14,464,516.359	1,732,301.748	39.828675625	-80.672715487
919.00	0.40	32.23	918.99	3.38	0.84	14,464,516.591	1,732,301.896	39.828676262	-80.672714956
950.00	0.48	33.64	949.99	3.58	0.97	14,464,516.791	1,732,302.026	39.828676809	-80.672714491
981.00	0.79	20.10	980.98	3.88	1.12	14,464,517.100	1,732,302.171	39.828677656	-80.672713969
1,012.00	0.75	30.21	1,011.98	4.26	1.29	14,464,517.476	1,732,302.347	39.828678687	-80.672713339
1,043.00	0.66	54.21	1,042.98	4.54	1.54	14,464,517.756	1,732,302.594	39.828679452	-80.672712456
1,074.00	0.70	38.65	1,073.98	4.79	1.80	14,464,518.008	1,732,302.857	39.828680143	-80.672711516
1,109.00	0.79	71.08	1,108.97	5.04	2.16	14,464,518.253	1,732,303.219	39.828680812	-80.672710224
1,168.00	0.83	45.77	1,167.97	5.47	2.86	14,464,518.683	1,732,303.910	39.828681986	-80.672707757
1,262.00	0.66	4.37	1,261.96	6.48	3.38	14,464,519.698	1,732,304.439	39.828684768	-80.672705859
1,356.00	0.44	355.05	1,355.96	7.38	3.39	14,464,520.597	1,732,304.449	39.828687238	-80.672705812
1,449.00	0.48	338.71	1,448.95	8.10	3.22	14,464,521.316	1,732,304.276	39.828689213	-80.672706416
1,544.00	0.57	268.22	1,543.95	8.46	2.61	14,464,521.672	1,732,303.660	39.828690197	-80.672708608
1,639.00	0.57	224.01	1,638.95	8.10	1.81	14,464,521.317	1,732,302.859	39.828689232	-80.672711485
1,733.00	0.70	198.61	1,732.94	7.22	1.30	14,464,520.437	1,732,302.351	39.828686819	-80.672713286
1,827.00	0.44	175.23	1,826.94	6.32	1.14	14,464,519.533	1,732,302.198	39.828684338	-80.672713843
1,921.00	0.44	127.68	1,920.93	5.74	1.46	14,464,518.953	1,732,302.513	39.828682741	-80.672712727
2,015.00	0.97	89.01	2,014.93	5.53	2.54	14,464,518.746	1,732,303.595	39.828682162	-80.672708878
2,110.00	1.58	76.97	2,109.90	5.84	4.62	14,464,519.055	1,732,305.675	39.828682990	-80.672701465
2,204.00	2.33	48.23	2,203.85	7.40	7.31	14,464,520.620	1,732,308.362	39.828687262	-80.672691872
2,298.00	2.11	41.02	2,297.78	9.98	9.87	14,464,523.199	1,732,310.923	39.828694317	-80.672682717
2,393.00	1.76	31.97	2,392.72	12.54	11.79	14,464,525.756	1,732,312.843	39.828701320	-80.672675844
2,486.00	1.58	3.40	2,485.69	15.03	12.62	14,464,528.247	1,732,313.676	39.828708154	-80.672672847
2,580.00	2.20	337.48	2,579.64	17.99	12.01	14,464,531.208	1,732,313.081	39.828716290	-80.672674996
2,675.00	2.07	317.88	2,674.57	20.95	10.16	14,464,534.165	1,732,311.212	39.828724429	-80.672668154
2,770.00	1.10	287.55	2,769.54	22.50	8.14	14,464,535.712	1,732,309.192	39.828728699	-80.672688719
2,834.00	0.53	249.58	2,833.53	22.58	7.28	14,464,535.794	1,732,308.329	39.828728933	-80.672691793
2,965.00	0.48	226.56	2,964.52	21.99	6.31	14,464,535.205	1,732,307.363	39.828727326	-80.672695242
3,058.00	0.53	246.33	3,057.52	21.55	5.63	14,464,534.765	1,732,306.686	39.828726123	-80.672697658
3,153.00	0.26	271.38	3,152.52	21.38	5.01	14,464,534.594	1,732,306.068	39.828725659	-80.672699861
3,247.00	1.80	359.10	3,246.50	22.86	4.78	14,464,536.075	1,732,305.832	39.828729730	-80.672700684
3,340.00	3.52	9.38	3,339.40	27.14	5.22	14,464,540.353	1,732,306.274	39.828741472	-80.672699053
3,437.00	5.32	6.22	3,436.11	34.55	6.19	14,464,547.762	1,732,307.247	39.828761809	-80.672695492
3,531.00	6.24	354.61	3,529.63	43.96	6.19	14,464,557.180	1,732,307.239	39.828787675	-80.672695397
3,625.00	7.03	338.44	3,623.01	54.40	3.59	14,464,567.617	1,732,304.645	39.828816363	-80.672704500
3,719.00	5.98	329.21	3,716.41	63.96	-1.03	14,464,577.174	1,732,300.024	39.828842654	-80.672720633



Company: Tug Hill Operating LLC  
 Project: Marshall County, West Virginia NAD83 UTM 17N  
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 Well: Hudson S-13 HU (slot A)  
 Wellbore: Original Hole  
 Design: Surveys Original Hole

Local Co-ordinate Reference: Well Hudson S-13 HU (slot A)  
 TVD Reference: RKB=1346+33 @ 1379.00ft (Nabors X08)  
 MD Reference: RKB=1346+33 @ 1379.00ft (Nabors X08)  
 North Reference: Grid  
 Survey Calculation Method: Minimum Curvature  
 Database: DB\_Dec2220\_v16

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
3,813.00	5.67	323.15	3,809.92	71.88	-6.32	14,464,585.096	1,732,294.733	39.828864464	-80.672739577
3,907.00	6.42	324.38	3,903.40	79.87	-12.17	14,464,593.084	1,732,288.887	39.82886459	-80.672760294
4,001.00	4.53	331.24	3,996.97	87.40	-17.01	14,464,600.611	1,732,284.040	39.828907179	-80.672777461
4,096.00	4.00	336.95	4,091.70	93.73	-20.12	14,464,606.949	1,732,280.938	39.828924615	-80.672788429
4,190.00	4.70	334.22	4,185.43	100.22	-23.07	14,464,613.433	1,732,277.979	39.828942453	-80.672798883
4,284.00	6.06	333.43	4,279.02	108.12	-26.97	14,464,621.339	1,732,274.085	39.828964204	-80.672812651
4,378.00	5.63	332.55	4,372.53	116.65	-31.31	14,464,629.869	1,732,269.740	39.828987672	-80.672828016
4,472.00	4.83	337.39	4,466.13	124.40	-34.96	14,464,637.614	1,732,266.093	39.829008978	-80.672840905
4,566.00	4.48	350.13	4,559.83	131.67	-37.11	14,464,644.884	1,732,263.942	39.829028966	-80.672848471
4,660.00	4.26	6.92	4,653.56	138.75	-37.32	14,464,651.967	1,732,263.733	39.829048419	-80.672849122
4,755.00	5.84	0.15	4,748.19	147.09	-36.88	14,464,660.304	1,732,264.171	39.829071309	-80.672847454
4,849.00	4.61	6.92	4,841.80	155.62	-36.42	14,464,668.836	1,732,264.639	39.829094737	-80.672845677
4,943.00	4.88	5.34	4,935.47	163.35	-35.59	14,464,676.567	1,732,265.466	39.829115959	-80.672842630
5,036.00	6.06	3.31	5,028.05	172.19	-34.94	14,464,685.407	1,732,266.118	39.829140228	-80.672840194
5,133.00	5.27	356.55	5,124.57	181.75	-34.91	14,464,694.965	1,732,266.145	39.829166478	-80.672839971
5,226.00	4.61	346.88	5,217.23	189.65	-36.01	14,464,702.869	1,732,265.040	39.829188193	-80.672843806
5,320.00	5.45	341.61	5,310.87	197.57	-38.28	14,464,710.784	1,732,262.774	39.829209952	-80.672851773
5,414.00	5.63	338.44	5,404.43	206.09	-41.38	14,464,719.308	1,732,259.671	39.829233393	-80.672862713
5,509.00	5.27	333.61	5,499.00	214.33	-45.03	14,464,727.550	1,732,256.020	39.829256065	-80.672875613
5,603.00	4.31	346.70	5,592.67	221.84	-47.77	14,464,734.855	1,732,253.288	39.829276153	-80.672885247
5,698.00	3.65	355.84	5,687.44	228.13	-48.81	14,464,741.345	1,732,252.248	39.829293987	-80.672888869
5,792.00	4.53	356.99	5,781.20	234.82	-49.22	14,464,748.036	1,732,251.836	39.829312367	-80.672890249
5,886.00	5.27	353.91	5,874.86	242.82	-49.87	14,464,756.036	1,732,251.183	39.829334342	-80.672892470
5,979.00	5.01	4.90	5,967.49	251.11	-49.98	14,464,764.329	1,732,251.076	39.829357118	-80.672892741
6,073.00	4.79	6.13	6,061.14	259.11	-49.21	14,464,772.321	1,732,251.846	39.829379057	-80.672889895
6,167.00	6.59	10.26	6,154.68	268.32	-47.83	14,464,781.532	1,732,253.226	39.829404338	-80.672884860
6,261.00	5.27	355.32	6,248.18	277.93	-47.22	14,464,791.143	1,732,253.835	39.829430726	-80.672882567
6,356.00	5.45	342.49	6,342.77	286.58	-48.93	14,464,799.794	1,732,252.121	39.829454501	-80.672888557
6,450.00	4.39	350.31	6,436.42	294.38	-50.88	14,464,807.597	1,732,250.173	39.829475951	-80.672895397
6,544.00	3.34	4.46	6,530.21	300.86	-51.27	14,464,813.874	1,732,249.780	39.829493192	-80.672896713
6,638.00	4.66	11.05	6,623.98	307.14	-50.33	14,464,820.352	1,732,250.725	39.829510972	-80.672893264
6,733.00	4.83	11.05	6,718.65	314.85	-48.82	14,464,828.065	1,732,252.231	39.829532138	-80.672887798
6,827.00	5.63	2.00	6,812.26	323.34	-47.90	14,464,836.557	1,732,253.150	39.829555451	-80.672884413
6,918.00	4.26	355.23	6,902.92	331.17	-48.03	14,464,844.387	1,732,253.025	39.829576954	-80.672884757
7,013.00	3.43	348.81	6,997.71	337.48	-48.87	14,464,850.691	1,732,252.180	39.829594275	-80.672887684
7,107.00	4.92	343.98	7,091.45	344.11	-50.53	14,464,857.324	1,732,250.522	39.829612509	-80.672893504
7,201.00	6.55	337.30	7,184.98	352.93	-53.71	14,464,866.145	1,732,247.340	39.829636765	-80.672904722
7,295.00	8.31	329.65	7,278.19	363.74	-59.22	14,464,876.954	1,732,241.839	39.829668505	-80.672924178
7,389.00	7.25	332.29	7,371.32	374.85	-65.41	14,464,888.067	1,732,235.648	39.829697087	-80.672946083
7,483.00	6.72	345.91	7,464.63	385.44	-69.50	14,464,898.654	1,732,231.551	39.829726200	-80.672960539
7,577.00	6.77	354.09	7,557.98	396.28	-71.41	14,464,909.499	1,732,229.641	39.829756004	-80.672967199
7,672.00	8.26	354.00	7,652.17	408.64	-72.70	14,464,921.856	1,732,228.351	39.829789952	-80.672971633
7,765.00	8.61	347.85	7,744.16	422.09	-74.87	14,464,935.306	1,732,226.188	39.829826910	-80.672979164
7,860.00	10.33	348.29	7,837.86	437.38	-78.09	14,464,950.599	1,732,222.962	39.829868941	-80.672990455
7,953.00	9.71	343.98	7,929.45	453.09	-81.95	14,464,966.303	1,732,219.105	39.829912104	-80.673003988
8,048.00	8.09	341.78	8,023.30	467.14	-86.25	14,464,980.353	1,732,214.804	39.829950734	-80.673019125
8,142.00	9.36	347.93	8,116.21	480.90	-89.92	14,464,994.112	1,732,211.137	39.829988555	-80.673032007
8,236.00	10.90	348.55	8,208.74	497.08	-93.28	14,465,010.298	1,732,207.775	39.830033040	-80.673043774
8,330.00	9.84	348.64	8,301.21	513.67	-96.63	14,465,026.884	1,732,204.428	39.830078622	-80.673055478
8,425.00	8.00	345.56	8,395.05	528.03	-99.87	14,465,041.246	1,732,201.180	39.830118096	-80.673066859
8,519.00	7.29	343.01	8,488.22	540.07	-103.25	14,465,053.284	1,732,197.806	39.830151189	-80.673078720
8,613.00	8.17	346.26	8,581.36	552.26	-106.58	14,465,065.476	1,732,194.477	39.830184705	-80.673090419
8,708.00	8.88	348.46	8,675.31	568.00	-109.65	14,465,079.218	1,732,191.407	39.830222473	-80.673101176
8,802.00	9.80	351.54	8,768.07	581.02	-112.28	14,465,094.239	1,732,188.779	39.830263752	-80.673110343



**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia NAD83 UTM 17N  
**Site:** Hudson Alt North  
**Well:** Hudson S-13 HU (slot A)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:** Well Hudson S-13 HU (slot A)  
**TVD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**MD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**North Reference:** Grid  
**Survey Calculation Method:** Minimum Curvature  
**Database:** DB\_Dec2220\_v16

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
8,896.00	9.27	352.50	8,860.77	596.44	-114.44	14,465,109.658	1,732,186.614	39.830306118	-80.673117854	
8,992.00	9.10	351.80	8,955.54	611.62	-116.53	14,465,124.838	1,732,184.521	39.830347827	-80.673125108	
9,085.00	9.18	348.11	9,047.36	626.16	-119.11	14,465,139.377	1,732,181.944	39.830387779	-80.673134100	
9,179.00	8.88	347.67	9,140.19	640.59	-122.20	14,465,153.802	1,732,178.850	39.830427425	-80.673144933	
9,273.00	7.29	348.90	9,233.26	653.53	-124.90	14,465,166.743	1,732,176.152	39.830462991	-80.673154373	
9,365.00	7.82	352.77	9,324.46	665.47	-126.81	14,465,178.680	1,732,174.241	39.830495792	-80.673161027	
9,458.00	8.96	350.75	9,416.46	678.89	-128.77	14,465,192.105	1,732,172.280	39.830532680	-80.673167835	
9,552.00	8.68	350.40	9,509.35	693.09	-131.13	14,465,206.308	1,732,169.924	39.830571707	-80.673176045	
9,646.00	9.89	348.46	9,602.12	707.98	-133.93	14,465,221.195	1,732,167.128	39.830612620	-80.673185808	
9,740.00	9.71	350.04	9,694.75	723.70	-136.91	14,465,236.912	1,732,164.142	39.830655812	-80.673196239	
9,834.00	9.62	353.38	9,787.42	739.31	-139.19	14,465,252.522	1,732,161.866	39.830698703	-80.673204145	
9,928.00	8.79	354.35	9,880.20	754.26	-140.80	14,465,267.472	1,732,160.253	39.830739774	-80.673209694	
10,022.00	8.09	354.81	9,973.19	767.99	-142.13	14,465,281.204	1,732,158.925	39.830777500	-80.673214247	
10,116.00	7.65	348.64	10,066.30	780.71	-143.98	14,465,293.923	1,732,157.071	39.830812449	-80.673220685	
10,210.00	9.23	347.06	10,159.28	794.19	-146.90	14,465,307.406	1,732,154.150	39.830849503	-80.673230913	
10,303.00	9.45	347.85	10,251.05	808.92	-150.18	14,465,322.138	1,732,150.873	39.830889996	-80.673242394	
10,397.00	9.05	350.92	10,343.83	823.77	-152.97	14,465,336.983	1,732,148.082	39.830930790	-80.673252142	
10,492.00	8.44	353.65	10,437.72	838.08	-154.92	14,465,351.290	1,732,146.132	39.830970100	-80.673258902	
10,586.00	9.14	353.38	10,530.62	852.35	-156.55	14,465,365.562	1,732,144.508	39.831009311	-80.673264500	
10,624.00	9.32	354.17	10,568.12	858.41	-157.21	14,465,371.621	1,732,143.848	39.831025957	-80.673266774	
10,713.00	9.98	2.86	10,655.87	873.28	-157.55	14,465,386.494	1,732,143.503	39.831066804	-80.673267808	
10,760.00	9.45	4.64	10,702.20	881.19	-157.03	14,465,394.407	1,732,144.020	39.831088530	-80.673265864	
10,807.00	8.31	20.10	10,748.64	888.23	-155.55	14,465,401.444	1,732,145.500	39.831107839	-80.673260502	
10,854.00	7.08	46.12	10,795.23	893.43	-152.30	14,465,406.643	1,732,148.756	39.831122084	-80.673248837	
10,901.00	7.30	80.92	10,841.88	895.91	-147.28	14,465,409.123	1,732,153.794	39.831128844	-80.673230857	
10,948.00	8.31	103.34	10,888.46	895.60	-141.00	14,465,408.810	1,732,160.049	39.831127923	-80.673208581	
10,995.00	9.32	122.85	10,934.91	892.75	-134.50	14,465,405.961	1,732,166.553	39.831120035	-80.673185452	
11,042.00	10.24	143.68	10,981.24	887.32	-128.83	14,465,400.529	1,732,172.227	39.831105060	-80.673165314	
11,088.00	12.79	147.63	11,026.31	879.72	-123.68	14,465,392.933	1,732,177.375	39.831084147	-80.673147073	
11,136.00	15.25	147.37	11,072.88	869.91	-117.43	14,465,383.128	1,732,183.625	39.831057158	-80.673124941	
11,182.00	17.80	149.04	11,116.98	858.79	-110.55	14,465,372.002	1,732,190.505	39.831026534	-80.673100579	
11,229.00	20.09	150.09	11,161.43	845.63	-102.83	14,465,358.842	1,732,198.227	39.830990318	-80.673073245	
11,276.00	23.12	150.80	11,205.12	830.57	-94.30	14,465,343.787	1,732,206.755	39.830948887	-80.673043062	
11,323.00	26.07	150.36	11,247.85	813.54	-84.69	14,465,328.752	1,732,216.367	39.830902009	-80.673009049	
11,370.00	29.01	150.18	11,289.52	794.67	-73.91	14,465,307.884	1,732,227.144	39.830850086	-80.672970907	
11,417.00	31.43	150.36	11,330.13	774.13	-62.18	14,465,287.343	1,732,238.873	39.830793557	-80.672929396	
11,463.00	33.41	150.45	11,368.96	752.69	-50.00	14,465,265.900	1,732,251.052	39.830734546	-80.672886296	
11,510.00	36.04	150.80	11,407.58	729.36	-36.87	14,465,242.570	1,732,264.181	39.830670345	-80.672839835	
11,558.00	39.69	150.89	11,445.47	703.63	-22.52	14,465,216.844	1,732,278.531	39.830599552	-80.672789056	
11,605.00	42.95	150.80	11,480.77	676.53	-7.41	14,465,189.747	1,732,293.648	39.830524986	-80.672735564	
11,652.00	46.46	149.92	11,514.17	647.81	8.95	14,465,161.020	1,732,310.003	39.830445930	-80.672677683	
11,699.00	50.02	149.74	11,545.46	617.50	26.57	14,465,130.716	1,732,327.621	39.830362531	-80.672615324	
11,745.00	53.98	150.18	11,573.78	586.13	44.71	14,465,099.341	1,732,345.760	39.830276186	-80.672551123	
11,792.00	57.63	150.62	11,600.19	552.33	63.90	14,465,065.544	1,732,364.956	39.830183177	-80.672483189	
11,840.00	61.89	150.53	11,624.36	516.22	84.27	14,465,029.433	1,732,385.324	39.830083806	-80.672411109	
11,887.00	65.63	150.36	11,645.13	479.55	105.06	14,464,992.769	1,732,406.116	39.829982908	-80.672337531	
11,935.00	68.09	150.09	11,663.99	441.25	126.98	14,464,954.461	1,732,428.033	39.829877486	-80.672259961	
11,982.00	69.45	149.39	11,681.01	403.41	149.06	14,464,916.622	1,732,450.111	39.829773349	-80.672181818	
12,029.00	72.48	149.48	11,696.34	365.16	171.65	14,464,878.370	1,732,472.701	39.829668072	-80.672101853	
12,076.00	74.51	150.09	11,709.69	326.22	194.32	14,464,839.431	1,732,495.377	39.829560907	-80.672021594	
12,124.00	77.10	149.74	11,721.46	285.95	217.65	14,464,799.169	1,732,518.702	39.829450105	-80.671939037	
12,171.00	78.99	149.48	11,731.20	246.29	240.91	14,464,759.508	1,732,541.962	39.829340953	-80.671856706	
12,218.00	80.62	149.57	11,739.52	206.43	264.37	14,464,719.642	1,732,565.422	39.829231235	-80.671773667	
12,265.00	82.37	149.74	11,746.47	166.31	287.85	14,464,679.529	1,732,588.904	39.829120838	-80.671690551	



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Hudson S-13 HU (slot A)
<b>Project:</b>	Marshall County, West Virginia NAD83 UTM 17N	<b>TVD Reference:</b>	RKB=1346+33 @ 1379.00ft (Nabors X08)
<b>Site:</b>	Hudson Alt North	<b>MD Reference:</b>	RKB=1346+33 @ 1379.00ft (Nabors X08)
<b>Well:</b>	Hudson S-13 HU (slot A)	<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_Dec2220_v16

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
12,312.00	84.57	149.30	11,751.81	126.07	311.54	14,464,639.290	1,732,612.588	39.829010093	-80.671606717	
12,359.00	87.47	149.39	11,755.07	85.74	335.44	14,464,598.960	1,732,636.492	39.828899097	-80.671522104	
12,407.00	87.60	149.30	11,757.14	44.49	359.89	14,464,557.706	1,732,660.943	39.828785558	-80.671435553	
12,501.00	89.23	150.53	11,759.74	-36.81	406.99	14,464,476.405	1,732,708.042	39.828561811	-80.671268856	
12,595.00	89.19	151.94	11,761.03	-119.20	452.22	14,464,394.014	1,732,753.271	39.828335091	-80.671108837	
12,690.00	88.66	151.59	11,762.82	-202.88	497.15	14,464,310.333	1,732,798.207	39.828104830	-80.670949882	
12,784.00	88.44	148.42	11,765.20	-284.26	544.13	14,464,228.959	1,732,845.178	39.827880884	-80.670783645	
12,846.00	88.81	148.78	11,766.68	-337.16	576.42	14,464,176.055	1,732,877.471	39.827735269	-80.670669317	
12,908.00	89.87	145.44	11,767.40	-389.21	610.08	14,464,124.004	1,732,911.132	39.827591986	-80.670550109	
12,939.00	88.55	144.73	11,767.83	-414.63	627.82	14,464,098.587	1,732,928.873	39.827522006	-80.670487253	
12,970.00	88.11	146.14	11,768.73	-440.15	645.40	14,464,073.071	1,732,946.452	39.827451754	-80.670424974	
13,002.00	88.90	146.14	11,769.56	-466.71	663.22	14,464,046.507	1,732,964.275	39.827378625	-80.670361841	
13,033.00	89.08	145.44	11,770.11	-492.34	680.65	14,464,020.875	1,732,981.702	39.827308056	-80.670300109	
13,065.00	88.64	145.08	11,770.75	-518.63	698.88	14,463,994.585	1,732,999.933	39.827235672	-80.670235518	
13,096.00	88.46	145.61	11,771.53	-544.12	716.50	14,463,969.093	1,733,017.555	39.827165486	-80.670173088	
13,127.00	87.67	146.84	11,772.58	-569.88	733.73	14,463,943.340	1,733,034.779	39.827094590	-80.670112079	
13,158.00	87.52	147.37	11,773.88	-595.88	750.55	14,463,917.333	1,733,051.600	39.827022999	-80.670052508	
13,250.00	90.37	150.89	11,775.57	-674.82	797.73	14,463,838.400	1,733,098.783	39.826805752	-80.669885492	
13,345.00	89.32	152.03	11,775.83	-758.27	843.12	14,463,754.947	1,733,144.170	39.826576111	-80.669724934	
13,439.00	89.19	152.29	11,777.05	-841.38	887.01	14,463,671.835	1,733,188.064	39.826347419	-80.669569687	
13,533.00	89.19	151.76	11,778.38	-924.39	931.10	14,463,588.827	1,733,232.154	39.826119014	-80.669413746	
13,627.00	89.49	151.15	11,779.46	-1,006.96	976.02	14,463,506.260	1,733,277.068	39.825891809	-80.669254861	
13,721.00	87.65	150.97	11,781.81	-1,089.19	1,021.49	14,463,424.027	1,733,322.538	39.825665518	-80.669093996	
13,816.00	88.00	151.32	11,785.42	-1,172.34	1,067.30	14,463,340.882	1,733,368.351	39.825436717	-80.668931920	
13,909.00	88.13	150.97	11,788.56	-1,253.74	1,112.15	14,463,259.475	1,733,413.206	39.825212700	-80.668773233	
14,003.00	88.88	150.27	11,791.01	-1,335.62	1,158.25	14,463,177.594	1,733,459.307	39.824987367	-80.668610121	
14,097.00	89.05	150.18	11,792.71	-1,417.20	1,204.93	14,463,096.018	1,733,505.979	39.824762863	-80.668444968	
14,191.00	88.84	149.74	11,794.44	-1,498.56	1,251.98	14,463,014.658	1,733,553.027	39.824538953	-80.668278472	
14,286.00	89.63	149.57	11,795.70	-1,580.54	1,299.97	14,462,932.682	1,733,601.017	39.824313337	-80.668108634	
14,380.00	89.19	148.69	11,796.67	-1,661.22	1,348.19	14,462,852.004	1,733,649.244	39.824091285	-80.667937934	
14,474.00	89.80	148.25	11,797.50	-1,741.33	1,397.35	14,462,771.885	1,733,698.399	39.823870760	-80.667763925	
14,568.00	89.80	148.42	11,797.83	-1,821.34	1,446.69	14,462,691.879	1,733,747.744	39.823650542	-80.667589237	
14,663.00	89.23	149.65	11,798.63	-1,902.80	1,495.57	14,462,610.424	1,733,796.620	39.823428347	-80.667416240	
14,756.00	88.92	149.74	11,800.14	-1,983.08	1,542.49	14,462,530.143	1,733,843.542	39.823205398	-80.667250189	
14,851.00	88.70	149.83	11,802.11	-2,065.15	1,590.29	14,462,448.067	1,733,891.340	39.822979511	-80.667081042	
14,946.00	89.67	150.62	11,803.46	-2,147.60	1,637.46	14,462,366.619	1,733,938.510	39.822752607	-80.666914135	
15,040.00	89.41	150.62	11,804.21	-2,229.51	1,683.57	14,462,283.711	1,733,984.625	39.822527199	-80.666750983	
15,135.00	89.19	150.27	11,805.37	-2,312.14	1,730.43	14,462,201.079	1,734,031.481	39.822299792	-80.666585201	
15,229.00	88.84	150.53	11,806.99	-2,393.86	1,776.85	14,462,119.359	1,734,077.904	39.822074894	-80.666420949	
15,323.00	88.48	150.36	11,809.19	-2,475.61	1,823.21	14,462,037.613	1,734,124.258	39.821849925	-80.666256948	
15,418.00	88.35	150.27	11,811.82	-2,558.11	1,870.24	14,461,955.112	1,734,171.287	39.821622878	-80.666090552	
15,511.00	89.19	150.45	11,813.81	-2,638.92	1,916.22	14,461,874.301	1,734,217.269	39.821400479	-80.665927864	
15,604.00	89.05	150.45	11,815.24	-2,719.81	1,962.08	14,461,793.407	1,734,263.129	39.821177857	-80.665765610	
15,699.00	89.49	150.27	11,816.45	-2,802.38	2,009.06	14,461,710.845	1,734,310.107	39.820950640	-80.665599399	
15,792.00	89.54	150.62	11,817.24	-2,883.27	2,054.93	14,461,629.949	1,734,355.978	39.820728011	-80.665437109	
15,887.00	89.23	150.53	11,818.26	-2,966.01	2,101.60	14,461,547.209	1,734,402.648	39.820500308	-80.665272003	
15,980.00	88.97	150.45	11,819.72	-3,046.94	2,147.40	14,461,466.285	1,734,448.451	39.820277599	-80.665109956	
16,075.00	89.32	149.39	11,821.14	-3,129.13	2,195.01	14,461,384.089	1,734,496.060	39.820051382	-80.664941498	
16,168.00	88.97	149.57	11,822.52	-3,209.24	2,242.23	14,461,303.983	1,734,543.284	39.819830907	-80.664774386	
16,263.00	89.32	149.39	11,823.94	-3,291.07	2,290.47	14,461,222.155	1,734,591.523	39.819605691	-80.664603680	
16,358.00	88.97	149.92	11,825.36	-3,373.04	2,338.46	14,461,140.180	1,734,639.512	39.819380074	-80.664433760	
16,451.00	90.20	149.74	11,826.03	-3,453.44	2,385.20	14,461,059.782	1,734,686.248	39.819158800	-80.664268499	
16,545.00	89.10	149.74	11,826.61	-3,534.63	2,432.57	14,460,978.592	1,734,733.615	39.818935347	-80.664100893	
16,639.00	88.75	149.57	11,828.37	-3,615.74	2,480.05	14,460,897.485	1,734,781.096	39.818712118	-80.663932884	



Company: Tug Hill Operating LLC  
 Project: Marshall County, West Virginia NAD83 UTM  
 17N  
 Site: Hudson Alt North  
 Well: Hudson S-13 HU (slot A)  
 Wellbore: Original Hole  
 Design: Surveys Original Hole

Local Co-ordinate Reference: Well Hudson S-13 HU (slot A)  
 TVD Reference: RKB=1346+33 @ 1379.00ft (Nabors X08)  
 MD Reference: RKB=1346+33 @ 1379.00ft (Nabors X08)  
 North Reference: Grid  
 Survey Calculation Method: Minimum Curvature  
 Database: DB\_Dec2220\_v16

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
16,733.00	88.53	149.39	11,830.60	-3,696.69	2,527.77	14,460,816.532	1,734,828.819	39.818489308	-80.663764009
16,827.00	89.19	150.89	11,832.47	-3,778.19	2,574.56	14,460,735.030	1,734,875.609	39.818265002	-80.663598468
16,922.00	88.92	150.97	11,834.04	-3,861.22	2,620.71	14,460,652.009	1,734,921.761	39.818036530	-80.663273905
17,016.00	88.79	150.97	11,835.92	-3,943.39	2,666.32	14,460,569.835	1,734,967.367	39.817810391	-80.663273905
17,110.00	88.84	152.38	11,837.86	-4,026.11	2,710.91	14,460,487.109	1,735,011.957	39.817582747	-80.663116218
17,204.00	88.57	152.64	11,839.99	-4,109.48	2,754.29	14,460,403.744	1,735,055.335	39.817353358	-80.662962854
17,298.00	88.88	151.76	11,842.08	-4,192.61	2,798.12	14,460,320.615	1,735,099.164	39.817124614	-80.662807884
17,391.00	88.62	149.57	11,844.11	-4,273.66	2,843.66	14,460,239.565	1,735,144.713	39.816901559	-80.662646764
17,485.00	89.49	148.60	11,845.66	-4,354.29	2,891.95	14,460,158.933	1,735,192.999	39.816679623	-80.662475889
17,579.00	89.54	148.42	11,846.45	-4,434.45	2,941.05	14,460,078.779	1,735,242.098	39.816458994	-80.662302114
17,673.00	88.70	147.02	11,847.90	-4,513.91	2,991.24	14,459,999.319	1,735,292.292	39.816240258	-80.662124433
17,767.00	89.32	146.95	11,849.52	-4,593.59	3,041.07	14,459,919.632	1,735,342.115	39.816020901	-80.661948076
17,862.00	88.97	148.78	11,850.94	-4,674.90	3,090.18	14,459,838.326	1,735,391.229	39.815797106	-80.661774265
17,956.00	88.79	149.39	11,852.78	-4,755.53	3,138.47	14,459,757.696	1,735,439.514	39.815575178	-80.661603402
18,050.00	88.97	150.89	11,854.61	-4,837.03	3,185.26	14,459,676.193	1,735,486.304	39.815350886	-80.661437872
18,144.00	88.35	150.36	11,856.81	-4,918.92	3,231.35	14,459,594.302	1,735,532.400	39.815125495	-80.661274821
18,237.00	89.10	150.01	11,858.88	-4,999.59	3,277.58	14,459,513.633	1,735,578.628	39.814903478	-80.661111286
18,331.00	88.75	150.27	11,860.64	-5,081.10	3,324.37	14,459,432.127	1,735,625.421	39.814679155	-80.660945752
18,425.00	88.62	149.92	11,862.80	-5,162.56	3,371.23	14,459,350.684	1,735,672.273	39.814454953	-80.660780005
18,520.00	89.76	149.04	11,864.14	-5,244.39	3,419.46	14,459,268.837	1,735,720.512	39.814229734	-80.660609328
18,614.00	89.54	148.78	11,864.72	-5,324.89	3,468.00	14,459,188.341	1,735,769.051	39.814008168	-80.660437564
18,708.00	89.14	148.16	11,865.80	-5,405.00	3,517.16	14,459,108.225	1,735,818.204	39.813787637	-80.660263609
18,803.00	88.88	148.07	11,867.44	-5,485.66	3,567.33	14,459,027.572	1,735,868.377	39.813565621	-80.660086032
18,897.00	89.45	149.22	11,868.81	-5,565.92	3,616.24	14,458,947.310	1,735,917.282	39.813344693	-80.659912963
18,991.00	89.63	149.13	11,869.57	-5,646.64	3,664.40	14,458,866.591	1,735,965.448	39.813122518	-80.659742537
19,086.00	89.19	149.30	11,870.55	-5,728.25	3,713.02	14,458,784.982	1,736,014.068	39.812897893	-80.659570505
19,179.00	88.88	149.39	11,872.11	-5,808.24	3,760.43	14,458,704.990	1,736,061.478	39.812677721	-80.659402759
19,274.00	88.57	149.39	11,874.23	-5,889.98	3,808.79	14,458,623.249	1,736,109.839	39.812452734	-80.659231653
19,368.00	89.19	150.18	11,876.06	-5,971.19	3,856.09	14,458,542.036	1,736,157.135	39.812229210	-80.659064337
19,463.00	89.85	150.53	11,876.86	-6,053.75	3,903.08	14,458,459.474	1,736,204.122	39.812001985	-80.658898137
19,556.00	89.58	150.18	11,877.32	-6,134.58	3,949.08	14,458,378.649	1,736,250.121	39.811779537	-80.658735432
19,650.00	89.41	150.53	11,878.15	-6,216.27	3,995.57	14,458,296.956	1,736,296.614	39.811554703	-80.658570984
19,744.00	90.02	150.71	11,878.62	-6,298.18	4,041.68	14,458,215.048	1,736,342.730	39.811329280	-80.658407882
19,839.00	89.63	150.45	11,878.91	-6,380.93	4,088.35	14,458,132.300	1,736,389.394	39.811101544	-80.658242839
19,933.00	90.33	151.41	11,878.94	-6,463.09	4,134.02	14,458,050.143	1,736,435.065	39.810875443	-80.658061324
20,027.00	89.36	150.97	11,879.19	-6,545.45	4,179.32	14,457,967.779	1,736,480.364	39.810648779	-80.657921142
20,121.00	89.05	152.38	11,880.50	-6,628.19	4,223.91	14,457,885.044	1,736,524.959	39.810421101	-80.657763471
20,215.00	88.97	151.85	11,882.12	-6,711.26	4,267.87	14,457,801.972	1,736,568.915	39.810192502	-80.657608077
20,309.00	89.05	150.97	11,883.75	-6,793.78	4,312.85	14,457,719.447	1,736,613.891	39.809965397	-80.657449050
20,403.00	88.53	150.71	11,885.73	-6,875.85	4,358.64	14,457,637.379	1,736,659.682	39.809739538	-80.657287114
20,497.00	89.49	150.89	11,887.36	-6,957.89	4,404.49	14,457,555.338	1,736,705.533	39.809513751	-80.657124864
20,592.00	89.58	150.53	11,888.13	-7,040.74	4,450.96	14,457,472.486	1,736,752.008	39.809285731	-80.656960604
20,687.00	89.27	151.32	11,889.08	-7,123.77	4,497.13	14,457,389.463	1,736,798.171	39.809057244	-80.656797360
20,781.00	88.48	151.76	11,890.93	-7,206.39	4,541.91	14,457,306.839	1,736,842.957	39.808829869	-80.656639014
20,874.00	88.44	150.45	11,893.43	-7,287.78	4,586.83	14,457,225.449	1,736,887.878	39.808605878	-80.656480172
20,969.00	88.84	149.30	11,895.68	-7,369.93	4,634.50	14,457,143.305	1,736,935.544	39.808379789	-80.656311570
21,063.00	89.01	148.86	11,897.44	-7,450.55	4,682.79	14,457,062.678	1,736,983.836	39.808157860	-80.656140714
21,157.00	88.97	149.13	11,899.10	-7,531.11	4,731.20	14,456,982.122	1,737,032.249	39.807936121	-80.655969430
21,250.00	88.84	149.83	11,900.88	-7,611.21	4,778.42	14,456,902.022	1,737,079.469	39.807715650	-80.655802388
21,344.00	88.62	148.95	11,902.96	-7,692.09	4,826.28	14,456,821.141	1,737,127.321	39.807493027	-80.655633108
21,438.00	90.29	149.04	11,903.86	-7,772.65	4,874.69	14,456,740.579	1,737,175.738	39.807271271	-80.655461814
21,531.00	89.63	149.13	11,903.92	-7,852.44	4,922.47	14,456,660.792	1,737,223.517	39.807051652	-80.655292777
21,625.00	88.57	149.30	11,905.40	-7,933.18	4,970.58	14,456,580.048	1,737,271.622	39.806829403	-80.655122600
21,718.00	89.01	149.04	11,907.36	-8,013.02	5,018.23	14,456,500.208	1,737,319.273	39.806609639	-80.654954025



**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia NAD83 UTM 17N  
**Site:** Hudson Alt North  
**Well:** Hudson S-13 HU (slot A)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:** Well Hudson S-13 HU (slot A)  
**TVD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**MD Reference:** RKB=1346+33 @ 1379.00ft (Nabors X08)  
**North Reference:** Grid  
**Survey Calculation Method:** Minimum Curvature  
**Database:** DB\_Dec2220\_v16

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
21,813.00	88.75	149.57	11,909.22	-8,094.70	5,066.71	14,456,418.534	1,737,367.757	39.806384829	-80.654782508
21,907.00	89.45	149.57	11,910.69	-8,175.74	5,114.32	14,456,337.493	1,737,415.361	39.808161768	-80.654614121
22,001.00	88.13	149.57	11,912.88	-8,256.77	5,161.91	14,456,256.482	1,737,462.959	39.805938732	-80.654445755
22,095.00	88.66	149.30	11,915.31	-8,337.68	5,209.70	14,456,175.555	1,737,510.740	39.805716036	-80.654276735
22,189.00	89.49	148.69	11,916.83	-8,418.24	5,258.11	14,456,094.998	1,737,559.154	39.805494292	-80.654105460
22,283.00	88.92	149.48	11,918.13	-8,498.87	5,306.40	14,456,014.361	1,737,607.442	39.805272333	-80.653934632
22,377.00	89.58	149.30	11,919.36	-8,579.77	5,354.26	14,455,933.467	1,737,655.302	39.805049671	-80.653765336
22,470.00	88.75	149.74	11,920.72	-8,659.90	5,401.43	14,455,853.329	1,737,702.469	39.804829091	-80.653598496
22,564.00	87.38	150.89	11,923.89	-8,741.52	5,447.95	14,455,771.715	1,737,748.993	39.804604466	-80.653433969
22,658.00	88.22	150.89	11,927.50	-8,823.58	5,493.64	14,455,689.650	1,737,794.689	39.804378610	-80.653272398
22,753.00	88.84	150.97	11,929.94	-8,906.59	5,539.79	14,455,606.846	1,737,840.831	39.804150169	-80.653109248
22,847.00	88.31	150.36	11,932.28	-8,988.51	5,585.83	14,455,524.725	1,737,886.869	39.803924706	-80.652946461
22,940.00	88.48	149.48	11,934.88	-9,068.95	5,632.42	14,455,444.283	1,737,933.462	39.803703295	-80.652781673
23,034.00	89.67	149.04	11,936.40	-9,149.73	5,680.46	14,455,363.502	1,737,981.502	39.803480942	-80.652611741
23,129.00	88.75	149.22	11,937.71	-9,231.27	5,729.20	14,455,281.970	1,738,030.241	39.803256513	-80.652439334
23,223.00	89.36	149.22	11,939.26	-9,312.01	5,777.29	14,455,201.222	1,738,078.338	39.803034249	-80.652269201
23,317.00	88.26	149.39	11,941.21	-9,392.82	5,825.27	14,455,120.411	1,738,126.311	39.802811809	-80.652099512
23,411.00	88.44	148.60	11,943.92	-9,473.36	5,873.67	14,455,039.875	1,738,174.711	39.802590124	-80.651928299
23,505.00	89.49	147.28	11,945.62	-9,553.01	5,923.55	14,454,960.227	1,738,224.597	39.802370858	-80.651751784
23,566.00	90.24	146.84	11,945.76	-9,604.20	5,956.72	14,454,909.034	1,738,257.766	39.802229916	-80.651634397
<b>Survey @ 23566.00 MD 11945.76 TVD</b>									
23,630.00	90.24	146.84	11,945.49	-9,657.78	5,991.73	14,454,855.458	1,738,292.772	39.802082407	-80.651510501
<b>Survey Proj. to 23630.00 MD 11945.49 TVD</b>									

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
180.00	180.00	-0.11	0.09	MWD surveys
23,566.00	11,945.76	-9,604.20	5,956.72	Survey @ 23566.00 MD 11945.76 TVD
23,630.00	11,945.49	-9,657.78	5,991.73	Survey Proj. to 23630.00 MD 11945.49 TVD