



**TUG HILL**  
OPERATING

**Well: Hudson S-15 HU (slot O)**  
**Site: Hudson Alt North**  
**Project: Marshall County, West Virginia NAD83 UTM 17N**  
**Design: rev9**  
**Rig: Nabors X08**

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	V Sect	Annotation
1	10799.00	19.82	43.92	10582.65	1183.05	1169.16	0.00	0.000	-182.51	Survey @ 10799.00 MD 10582.65 TVD
2	11146.96	19.82	43.92	10910.00	1268.03	1251.00	0.00	0.000	-196.97	KOP Begin 6°/100' build/turn
3	11946.10	65.86	66.86	11483.18	1524.04	1707.21	6.00	28.614	-108.48	Begin 8°/100' build/turn
4	12987.76	89.00	150.00	11755.00	1200.75	2560.65	8.00	88.104	680.16	Begin 89.00° lateral
5	30465.16	89.00	150.00	12060.75	-13932.77	11298.09	0.00	0.00017937.92		PBHL/TD 30465.16 MD 12060.75 TVD

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	V Sect	Annotation
178.00	0.44	306.19	178.00	0.40	-0.55	-0.66	MWD surveys
30424.00	88.64	151.64	12004.43	-13906.70	11290.85	17913.11	Survey @ 30424.00 MD 12004.43 TVD
30457.00	88.64	151.64	12005.21	-13935.73	11306.52	17945.53	Survey Proj. to 30457.00 MD 12005.21 TVD



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

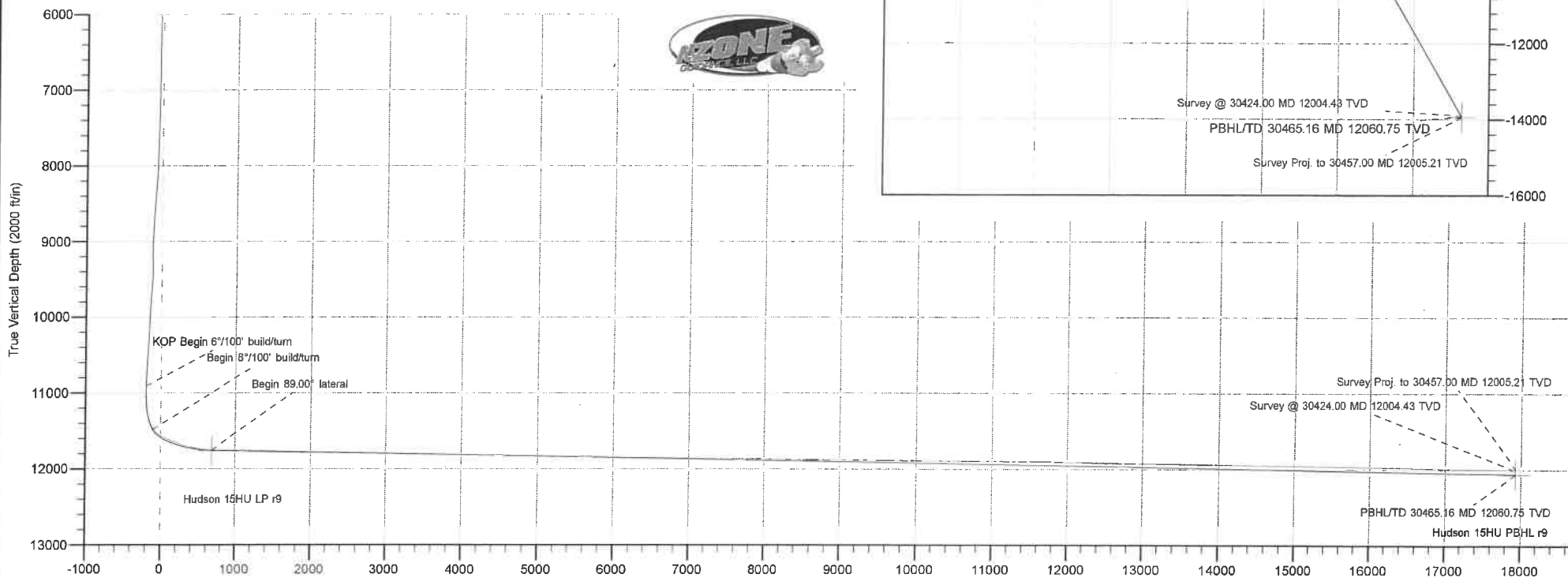
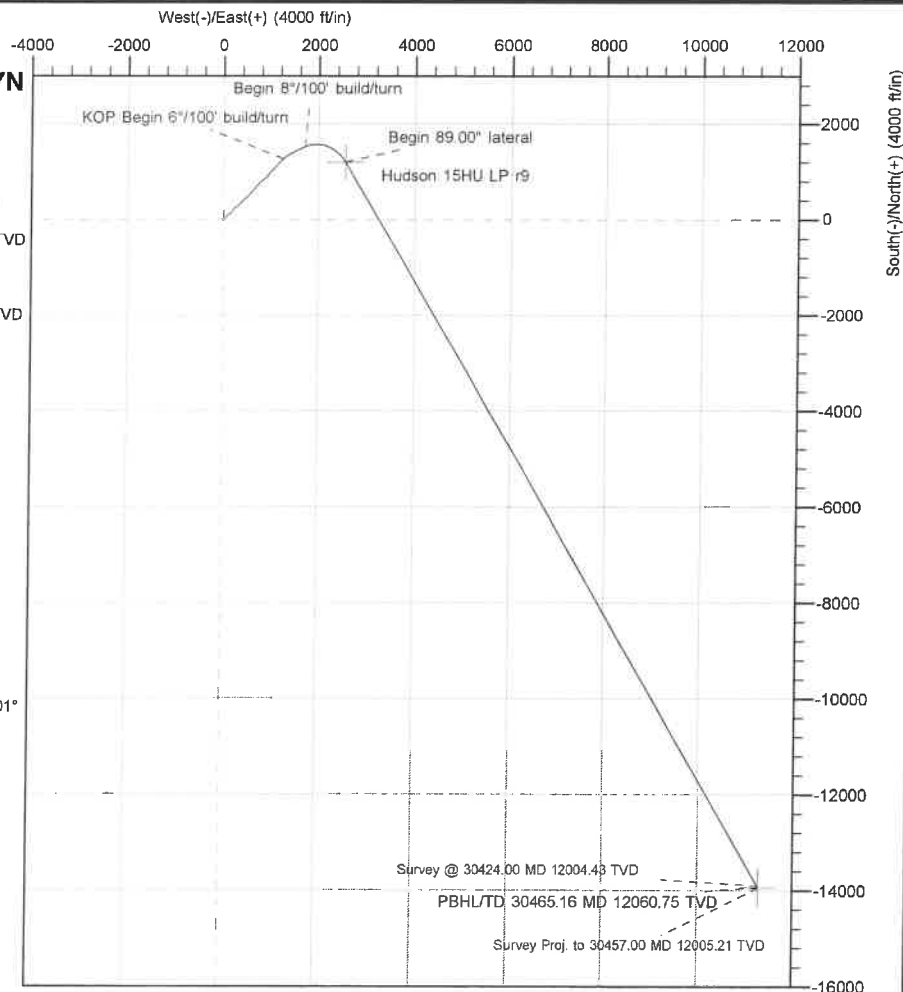
Magnetic Field  
 Strength: 51712.6nT  
 Dip Angle: 66.52°  
 Date: 12/14/2021  
 Model: IGRF2020

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
14464523.491	1732322.915	39.828695000	-80.672640000

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



Vertical Section at 140.96° (2000 ft/in)



Survey Report



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Hudson S-15 HU (slot O)
<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-15 HU (slot O)	<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>	39.82877400
<b>From:</b>	Lat/Long	<b>Easting:</b>	1,732,278.451 usft	<b>Longitude:</b>	-80.67279800
<b>Position Uncertainty:</b>	0.00 ft	<b>Slot Radius:</b>	13-3/16 °		

<b>Well</b>	Hudson S-15 HU (slot O)					
<b>Well Position</b>	+N/-S	0.00 ft	<b>Northing:</b>	14,464,523.491 usft	<b>Latitude:</b>	39.82869500
	+E/-W	0.00 ft	<b>Easting:</b>	1,732,322.915 usft	<b>Longitude:</b>	-80.67264000
<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	12/14/2021	-8.691	66.517	51,712.64481540

<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	140.96	

<b>Survey Program</b>	<b>Date</b>	1/18/2022			
<b>From (ft)</b>	<b>To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
178.00	1,072.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,165.00	2,838.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,965.00	10,799.00	MWD (Original Hole)	MWD	MWD - Standard	
10,930.00	30,424.00	MWD lat (Original Hole)	MWD	MWD - Standard	
30,457.00	30,457.00	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
	178.00	0.44	306.19	178.00	0.40	-0.55	-0.66	0.25	0.25	0.00
	<b>MWD surveys</b>									
	209.00	0.48	342.31	209.00	0.60	-0.69	-0.90	0.93	0.13	116.52
	240.00	0.70	345.47	240.00	0.90	-0.77	-1.19	0.72	0.71	10.19
	270.00	0.88	342.49	269.99	1.30	-0.89	-1.57	0.62	0.60	-9.93



Survey Report



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 Wellbore: Original Hole  
 Design: Surveys Original Hole

Local Co-ordinate Reference: Well Hudson S-15 HU (slot O)  
 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)
301.00	0.48	7.71	300.99	1.66	-0.94	-1.88	1.58	-1.29	81.35
331.00	0.48	17.11	330.99	1.90	-0.89	-2.04	0.26	0.00	31.33
361.00	0.48	41.02	360.99	2.12	-0.77	-2.13	0.66	0.00	79.70
391.00	0.48	56.93	390.99	2.28	-0.58	-2.14	0.44	0.00	53.03
422.00	0.40	51.30	421.99	2.42	-0.39	-2.12	0.29	-0.26	-18.16
453.00	0.31	44.27	452.99	2.55	-0.25	-2.13	0.32	-0.29	-22.68
484.00	0.22	32.76	483.99	2.66	-0.16	-2.16	0.34	-0.29	-37.13
514.00	0.13	102.02	513.99	2.70	-0.09	-2.15	0.71	-0.30	230.87
545.00	0.18	85.67	544.99	2.69	-0.01	-2.10	0.21	0.16	-52.74
575.00	0.18	115.29	574.99	2.68	0.08	-2.03	0.31	0.00	98.73
605.00	0.18	121.88	605.99	2.63	0.17	-1.94	0.07	0.00	21.26
637.00	0.18	167.06	636.99	2.56	0.22	-1.85	0.45	0.00	145.74
668.00	0.18	178.04	667.98	2.46	0.23	-1.77	0.11	0.00	35.42
698.00	0.18	181.47	697.98	2.37	0.23	-1.69	0.04	0.00	11.43
729.00	0.22	184.81	728.98	2.26	0.23	-1.61	0.13	0.13	10.77
761.00	0.13	187.27	760.98	2.16	0.22	-1.54	0.28	-0.28	7.69
792.00	0.18	193.07	791.98	2.08	0.20	-1.49	0.17	0.16	18.71
824.00	0.13	203.09	823.98	2.00	0.18	-1.44	0.18	-0.16	31.31
855.00	0.18	220.23	854.98	1.93	0.13	-1.42	0.22	0.16	55.29
886.00	0.13	226.55	885.98	1.87	0.07	-1.40	0.17	-0.16	20.39
917.00	0.22	239.21	916.98	1.81	0.00	-1.41	0.31	0.29	40.84
948.00	0.22	231.13	947.98	1.74	-0.10	-1.42	0.10	0.00	-26.06
979.00	0.22	252.75	978.98	1.69	-0.20	-1.44	0.27	0.00	69.74
1,010.00	0.26	258.11	1,009.98	1.66	-0.33	-1.50	0.15	0.13	17.29
1,041.00	0.26	261.10	1,040.98	1.63	-0.47	-1.56	0.04	0.00	9.65
1,072.00	0.22	302.76	1,071.98	1.65	-0.59	-1.65	0.56	-0.13	134.39
1,165.00	0.88	341.96	1,164.98	2.43	-0.96	-2.49	0.78	0.71	42.15
1,259.00	1.32	359.01	1,258.96	4.20	-1.20	-4.02	0.58	0.47	18.14
1,353.00	1.27	9.12	1,352.94	6.31	-1.06	-5.56	0.25	-0.05	10.76
1,400.00	1.01	32.67	1,399.93	7.17	-0.75	-6.04	1.13	-0.55	50.11
1,447.00	1.41	40.14	1,446.92	7.96	-0.15	-6.28	0.91	0.85	15.89
1,494.00	1.58	46.21	1,493.90	8.85	0.69	-6.44	0.49	0.36	12.91
1,541.00	1.58	72.05	1,540.88	9.50	1.77	-6.26	1.50	0.00	54.98
1,588.00	2.37	77.76	1,587.86	9.91	3.34	-5.59	1.73	1.68	12.15
1,636.00	2.98	92.44	1,635.80	10.06	5.55	-4.32	1.90	1.27	30.58
1,683.00	3.96	95.25	1,682.72	9.86	8.39	-2.38	2.12	2.09	5.98
1,731.00	4.75	94.55	1,730.58	9.55	12.02	0.15	1.65	1.65	-1.46
1,825.00	4.22	81.54	1,824.29	9.75	19.32	4.60	1.22	-0.56	-13.84
1,919.00	5.41	52.62	1,917.97	12.95	26.27	6.48	2.83	1.27	-30.77
2,012.00	5.71	42.43	2,010.54	19.03	32.87	5.92	1.11	0.32	-10.96
2,107.00	5.71	42.07	2,105.07	26.03	39.23	4.49	0.04	0.00	-0.38
2,202.00	5.63	42.87	2,199.60	32.95	45.56	3.11	0.12	-0.08	0.84
2,296.00	4.83	40.67	2,293.21	39.33	51.28	1.75	0.88	-0.65	-2.34
2,390.00	4.92	36.01	2,386.87	45.59	56.23	0.00	0.43	0.10	-4.96

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**Local Co-ordinate Reference:** Well Hudson S-15 HU (slot O)  
**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)
2,484.00	5.27	40.84	2,480.50	52.12	61.42	-1.79	0.59	0.37	5.14
2,578.00	5.23	32.85	2,574.10	58.99	66.57	-3.88	0.78	-0.04	-8.50
2,673.00	5.49	36.80	2,668.69	66.26	71.64	-6.34	0.47	0.27	4.16
2,768.00	5.71	42.95	2,763.24	73.36	77.58	-8.11	0.67	0.23	6.47
2,838.00	6.06	44.80	2,832.87	78.53	82.56	-8.99	0.57	0.50	2.64
2,965.00	5.76	34.25	2,959.20	88.56	90.87	-11.55	0.89	-0.24	-8.31
3,059.00	6.55	34.52	3,052.65	96.87	96.56	-14.42	0.84	0.84	0.29
3,154.00	6.50	46.38	3,147.04	105.05	103.53	-16.38	1.42	-0.05	12.48
3,248.00	6.15	62.03	3,240.48	111.08	111.83	-15.84	1.87	-0.37	16.65
3,341.00	6.11	67.39	3,332.95	115.32	120.79	-13.48	0.62	-0.04	5.76
3,435.00	6.20	66.16	3,426.41	119.29	130.06	-10.74	0.17	0.10	-1.31
3,529.00	4.70	60.80	3,519.98	123.22	138.06	-8.75	1.68	-1.60	-5.70
3,623.00	4.13	56.14	3,613.70	126.99	144.23	-7.79	0.72	-0.61	-4.96
3,717.00	4.26	53.41	3,707.45	130.96	149.85	-7.33	0.25	0.14	-2.90
3,811.00	4.61	52.45	3,801.17	135.34	155.65	-7.08	0.38	0.37	-1.02
3,905.00	4.83	53.15	3,894.85	140.01	161.81	-6.83	0.24	0.23	0.74
3,999.00	4.17	51.30	3,988.56	144.52	167.64	-6.66	0.72	-0.70	-1.97
4,094.00	3.87	40.05	4,083.32	149.14	172.40	-7.25	0.89	-0.32	-11.84
4,188.00	3.91	33.72	4,177.11	154.23	176.22	-8.80	0.46	0.04	-6.73
4,282.00	4.09	28.45	4,270.88	159.85	179.60	-11.03	0.44	0.19	-5.61
4,376.00	4.31	28.89	4,364.63	165.89	182.90	-13.64	0.24	0.23	0.47
4,470.00	5.36	31.00	4,458.29	172.74	186.87	-16.47	1.13	1.12	2.24
4,564.00	5.67	36.01	4,551.86	180.26	191.86	-19.17	0.61	0.33	5.33
4,658.00	6.28	40.40	4,645.35	187.93	197.92	-21.31	0.81	0.65	4.67
4,752.00	6.55	32.67	4,738.76	196.36	204.15	-23.93	0.96	0.29	-8.22
4,847.00	6.86	27.22	4,833.11	205.97	209.67	-27.91	0.74	0.33	-5.74
4,941.00	7.21	35.22	4,926.40	215.78	215.64	-31.78	1.11	0.37	8.51
5,034.00	6.72	41.28	5,018.72	224.64	222.59	-34.27	0.95	-0.53	6.52
5,128.00	6.33	48.23	5,112.11	232.22	230.09	-35.44	0.94	-0.41	7.39
5,221.00	6.24	52.89	5,204.55	238.69	237.94	-35.52	0.56	-0.10	5.01
5,315.00	6.64	53.76	5,297.96	244.98	246.40	-35.08	0.44	0.43	0.93
5,409.00	7.12	49.28	5,391.28	251.99	255.20	-34.99	0.77	0.51	-4.77
5,505.00	6.59	53.59	5,486.60	259.15	264.14	-34.91	0.77	-0.55	4.49
5,600.00	5.84	55.61	5,581.04	265.11	272.52	-34.27	0.82	-0.79	2.13
5,694.00	4.79	54.91	5,674.63	270.07	279.67	-33.61	1.12	-1.12	-0.74
5,789.00	5.19	54.29	5,769.27	274.86	286.41	-33.09	0.42	0.42	-0.65
5,882.00	6.64	57.02	5,861.78	280.24	294.33	-32.27	1.59	1.56	2.94
5,976.00	7.21	54.91	5,955.09	286.59	303.72	-31.29	0.66	0.61	-2.24
6,069.00	8.00	43.74	6,047.28	294.62	312.97	-31.70	1.80	0.85	-12.01
6,124.00	8.66	39.61	6,101.70	300.57	318.26	-33.00	1.62	1.20	-7.51
6,156.00	8.09	39.79	6,133.35	304.16	321.23	-33.91	1.78	-1.78	0.56
6,187.00	6.86	39.70	6,164.09	307.26	323.81	-34.69	3.97	-3.97	-0.29
6,219.00	6.46	37.77	6,195.87	310.16	326.14	-35.48	1.43	-1.25	-6.03



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Survey

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6,250.00	5.71	34.96	6,226.70	312.80	328.09	-36.30	2.60	-2.42	-9.06
6,281.00	4.79	32.49	6,257.57	315.15	329.67	-37.14	3.06	-2.97	-7.97
6,313.00	4.09	31.44	6,289.47	317.25	330.98	-37.94	2.20	-2.19	-3.28
6,344.00	4.00	27.05	6,320.40	319.16	332.05	-38.75	1.04	-0.29	-14.16
6,438.00	5.36	52.97	6,414.09	324.72	337.04	-39.92	2.64	1.45	27.57
6,533.00	5.23	63.34	6,508.69	329.34	344.46	-38.84	1.02	-0.14	10.92
6,627.00	3.56	61.94	6,602.41	332.64	350.86	-37.37	1.78	-1.78	-1.49
6,722.00	3.47	38.82	6,697.23	336.26	355.27	-37.41	1.48	-0.09	-24.34
6,816.00	4.57	44.97	6,791.00	341.13	359.70	-38.40	1.26	1.17	6.54
6,910.00	4.75	45.06	6,884.69	346.53	365.10	-39.19	0.19	0.19	0.10
7,004.00	5.76	41.72	6,978.29	352.80	370.99	-40.35	1.12	1.07	-3.55
7,098.00	6.68	36.80	7,071.74	360.70	377.41	-42.44	1.13	0.98	-5.23
7,193.00	7.69	39.70	7,165.99	370.01	384.78	-45.03	1.13	1.06	3.05
7,287.00	8.39	47.61	7,259.07	379.47	393.86	-46.66	1.39	0.74	8.41
7,381.00	9.54	48.14	7,351.92	389.30	404.73	-47.45	1.23	1.22	0.56
7,476.00	10.68	44.54	7,445.45	400.82	416.76	-48.82	1.37	1.20	-3.79
7,571.00	11.67	44.18	7,538.61	414.11	429.75	-50.96	1.25	1.25	-0.38
7,665.00	13.45	45.77	7,630.32	428.67	444.32	-53.09	1.72	1.68	1.69
7,759.00	17.01	46.73	7,721.01	445.72	462.17	-55.09	3.80	3.79	1.02
7,868.00	19.86	47.17	7,824.40	469.24	487.36	-57.49	2.62	2.61	0.40
7,947.00	20.17	46.73	7,898.63	487.70	507.12	-59.38	0.44	0.39	-0.56
8,042.00	19.69	44.27	7,987.94	510.39	530.22	-62.45	1.02	-0.51	-2.59
8,135.00	18.65	41.55	8,075.73	532.85	551.12	-66.74	1.32	-0.90	-2.92
8,230.00	19.47	41.46	8,165.47	556.20	571.78	-71.86	0.65	0.65	-0.09
8,324.00	19.56	41.28	8,254.07	579.76	592.54	-77.09	0.12	0.10	-0.19
8,419.00	20.00	38.56	8,343.47	604.42	613.15	-83.25	1.07	0.46	-2.86
8,513.00	19.86	36.19	8,431.84	629.88	632.60	-90.78	0.87	-0.15	-2.52
8,607.00	19.73	39.61	8,520.29	654.99	652.15	-97.97	1.24	-0.14	3.64
8,701.00	18.76	44.45	8,609.04	678.00	672.85	-102.81	1.99	-1.03	5.15
8,796.00	18.63	42.95	8,699.03	700.01	693.89	-106.65	0.52	-0.14	-1.58
8,890.00	17.71	39.79	8,788.34	721.99	713.27	-111.51	1.43	-0.98	-3.36
8,984.00	18.76	44.71	8,877.63	743.72	733.05	-115.93	1.98	1.12	5.23
9,077.00	18.33	43.04	8,965.80	765.04	753.56	-119.57	0.73	-0.46	-1.80
9,169.00	18.94	44.89	9,052.97	786.19	773.97	-123.15	0.92	0.66	2.01
9,262.00	20.92	52.71	9,140.42	806.95	797.83	-124.23	3.57	2.13	8.41
9,356.00	21.58	55.08	9,228.03	827.01	825.36	-122.48	1.15	0.70	2.52
9,450.00	21.84	53.76	9,315.36	847.24	853.64	-120.38	0.59	0.28	-1.40
9,544.00	21.27	47.96	9,402.79	869.00	880.41	-120.42	2.35	-0.61	-6.17
9,638.00	20.87	43.04	9,490.52	892.66	904.50	-123.62	1.93	-0.43	-5.23
9,732.00	21.01	40.67	9,578.31	917.68	926.91	-128.94	0.91	0.15	-2.52
9,825.00	21.18	37.24	9,665.08	943.70	947.94	-135.90	1.34	0.18	-3.69
9,919.00	18.19	39.79	9,753.58	968.50	967.61	-142.77	3.31	-3.18	2.71
10,013.00	18.19	42.51	9,842.88	990.58	986.92	-147.77	0.90	0.00	2.89

**Company:** Tug Hill Operating LLC  
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**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:** Well Hudson S-15 HU (slot O)  
**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)
10,107.00	18.37	43.13	9,932.14	1,012.21	1,006.96	-151.95	0.28	0.19	0.66
10,201.00	18.24	44.97	10,021.38	1,033.43	1,027.48	-155.50	0.63	-0.14	1.96
10,294.00	18.72	45.24	10,109.59	1,054.23	1,048.36	-158.51	0.52	0.52	0.29
10,388.00	20.26	44.54	10,198.20	1,076.46	1,070.49	-161.83	1.66	1.64	-0.74
10,482.00	21.14	43.83	10,286.13	1,100.29	1,093.65	-165.75	0.97	0.94	-0.76
10,577.00	21.31	41.37	10,374.69	1,125.60	1,118.92	-170.75	0.95	0.18	-2.59
10,670.00	20.61	41.72	10,461.53	1,150.50	1,138.98	-176.20	0.76	-0.75	0.38
10,764.00	19.86	43.39	10,549.73	1,174.45	1,160.96	-180.96	1.01	-0.80	1.78
10,799.00	19.82	43.92	10,582.65	1,183.05	1,169.16	-182.47	0.53	-0.11	1.51
10,930.00	19.40	45.30	10,706.06	1,214.35	1,200.03	-187.34	0.48	-0.32	1.05
11,024.00	18.82	45.70	10,794.88	1,235.92	1,221.98	-190.27	0.63	-0.62	0.43
11,117.00	18.16	46.23	10,883.08	1,256.42	1,243.18	-192.84	0.73	-0.71	0.57
11,164.00	19.71	47.77	10,927.53	1,266.81	1,254.34	-193.88	3.46	3.30	3.28
11,209.00	21.74	49.67	10,969.62	1,277.31	1,266.31	-194.49	4.75	4.51	4.22
11,256.00	24.70	51.12	11,012.81	1,289.11	1,280.59	-194.66	6.41	6.30	3.09
11,302.00	28.28	54.60	11,053.97	1,301.46	1,296.96	-193.94	8.48	7.78	7.57
11,349.00	31.99	56.14	11,094.61	1,314.85	1,316.39	-192.11	8.06	7.89	3.28
11,395.00	36.06	56.72	11,133.56	1,329.38	1,338.30	-189.60	8.69	8.66	1.23
11,443.00	39.33	57.33	11,170.74	1,345.02	1,362.41	-186.55	7.00	6.96	1.30
11,489.00	42.16	56.89	11,205.59	1,361.32	1,387.61	-183.34	6.18	6.15	-0.96
11,536.00	44.94	57.86	11,239.65	1,378.77	1,414.89	-179.72	6.08	5.91	2.06
11,583.00	47.99	58.35	11,272.02	1,396.77	1,443.81	-175.48	6.53	6.49	1.04
11,630.00	50.46	59.93	11,302.72	1,415.02	1,474.37	-170.40	5.84	5.26	3.36
11,677.00	52.72	61.52	11,331.92	1,433.02	1,506.49	-164.15	5.49	4.81	3.38
11,724.00	55.10	62.84	11,359.60	1,450.73	1,540.08	-156.75	5.55	5.06	2.81
11,771.00	57.05	65.13	11,385.83	1,467.83	1,575.13	-147.96	5.79	4.15	4.87
11,818.00	59.17	65.93	11,410.66	1,484.35	1,611.45	-137.92	4.74	4.51	1.70
11,864.00	61.03	67.47	11,433.59	1,500.12	1,648.07	-127.09	4.98	4.04	3.35
11,911.00	63.37	68.00	11,455.51	1,515.87	1,686.55	-115.09	5.08	4.98	1.13
11,958.00	64.74	71.26	11,476.08	1,530.57	1,726.16	-101.56	6.88	2.91	6.94
12,005.00	64.83	76.19	11,496.11	1,542.48	1,766.96	-85.11	9.49	0.19	10.49
12,052.00	65.18	80.25	11,515.98	1,551.18	1,808.65	-65.61	7.86	0.74	8.64
12,099.00	66.95	83.20	11,535.05	1,557.35	1,851.15	-43.63	6.86	3.77	6.28
12,145.00	68.63	86.15	11,552.44	1,561.29	1,893.55	-19.99	6.97	3.85	6.41
12,192.00	70.66	88.80	11,568.79	1,563.23	1,937.57	6.23	6.83	4.32	5.64
12,239.00	71.72	92.01	11,583.94	1,562.91	1,982.05	34.50	6.85	2.26	6.83
12,286.00	72.21	95.89	11,598.50	1,559.83	2,026.62	64.96	7.92	1.04	8.26
12,333.00	72.07	100.21	11,612.92	1,553.57	2,070.90	97.72	8.75	-0.30	9.19
12,380.00	71.94	104.66	11,627.45	1,543.95	2,114.54	132.68	9.01	-0.28	9.47
12,427.00	71.72	109.02	11,642.11	1,531.01	2,157.27	169.64	8.83	-0.47	9.28
12,474.00	72.07	113.08	11,656.72	1,514.97	2,198.95	208.35	8.24	0.74	8.64
12,521.00	73.40	117.44	11,670.68	1,495.82	2,239.53	248.78	9.30	2.83	9.28
12,568.00	74.68	121.28	11,683.60	1,473.68	2,278.90	290.79	8.31	2.72	8.17
12,615.00	76.18	123.74	11,695.43	1,449.22	2,317.25	333.94	5.99	3.19	5.23



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**Local Co-ordinate Reference:** Well Hudson S-15 HU (slot O)  
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**North Reference:** Grid  
**Survey Calculation Method:** Minimum Curvature  
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**Survey**

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
12,662.00	77.29	128.21	11,706.22	1,422.99	2,354.73	377.91	5.63	2.36	5.26
12,709.00	77.38	129.52	11,716.52	1,394.85	2,390.93	422.57	6.87	0.19	7.04
12,756.00	78.17	133.48	11,726.48	1,364.42	2,425.32	467.87	8.40	1.68	8.43
12,804.00	79.32	137.14	11,735.85	1,330.96	2,458.42	514.71	7.85	2.40	7.63
12,851.00	80.82	140.22	11,743.96	1,296.19	2,488.98	560.96	7.20	3.19	6.55
12,898.00	82.94	143.04	11,750.80	1,259.71	2,517.86	607.48	7.46	4.51	6.00
12,945.00	85.37	145.29	11,755.38	1,221.81	2,545.23	654.15	7.03	5.17	4.79
12,993.00	87.98	147.36	11,758.17	1,181.94	2,571.79	701.85	6.94	5.44	4.31
13,040.00	88.56	150.36	11,759.59	1,141.74	2,596.08	748.38	6.50	1.23	6.38
13,087.00	88.69	151.46	11,760.71	1,100.68	2,618.93	794.66	2.36	0.28	2.34
13,181.00	89.17	152.21	11,762.47	1,017.82	2,663.29	886.96	0.95	0.51	0.80
13,276.00	88.20	151.51	11,764.65	934.08	2,708.08	980.22	1.26	-1.02	-0.74
13,370.00	88.42	150.93	11,767.42	851.72	2,753.32	1,072.67	0.66	0.23	-0.62
13,464.00	88.51	150.10	11,769.94	769.93	2,799.56	1,165.33	0.89	0.10	-0.88
13,559.00	88.47	150.05	11,772.44	687.62	2,846.94	1,259.10	0.07	-0.04	-0.05
13,653.00	88.33	149.87	11,775.07	606.28	2,893.98	1,351.91	0.24	-0.15	-0.19
13,747.00	88.78	150.27	11,777.44	524.84	2,940.86	1,444.69	0.64	0.48	0.43
13,842.00	88.73	150.01	11,779.50	442.47	2,988.15	1,538.45	0.28	-0.05	-0.27
13,935.00	89.17	149.39	11,781.21	362.19	3,035.06	1,630.36	0.82	0.47	-0.67
14,030.00	89.22	149.70	11,782.54	280.31	3,083.21	1,724.28	0.33	0.05	0.33
14,123.00	89.13	149.83	11,783.88	199.97	3,130.04	1,816.18	0.17	-0.10	0.14
14,216.00	89.44	149.48	11,785.04	119.71	3,177.02	1,908.10	0.50	0.33	-0.38
14,309.00	89.62	149.21	11,785.80	39.71	3,224.43	2,000.10	0.35	0.19	-0.29
14,404.00	89.53	149.13	11,786.51	-41.86	3,273.12	2,094.13	0.13	-0.09	-0.08
14,497.00	89.26	149.08	11,787.49	-121.66	3,320.87	2,186.18	0.30	-0.29	-0.05
14,591.00	88.73	150.01	11,789.14	-202.68	3,368.51	2,279.12	1.14	-0.56	0.99
14,685.00	89.04	149.08	11,790.97	-283.69	3,416.14	2,372.04	1.04	0.33	-0.99
14,780.00	89.13	149.17	11,792.49	-365.22	3,464.89	2,466.07	0.13	0.09	0.09
14,875.00	88.86	149.74	11,794.15	-447.02	3,513.16	2,560.01	0.66	-0.28	0.60
14,968.00	89.44	149.52	11,795.53	-527.25	3,560.17	2,651.94	0.67	0.62	-0.24
15,063.00	89.44	149.57	11,796.46	-609.14	3,608.32	2,745.87	0.05	0.00	0.05
15,157.00	89.35	149.65	11,797.45	-690.22	3,655.87	2,838.79	0.13	-0.10	0.09
15,251.00	89.31	149.57	11,798.55	-771.30	3,703.42	2,931.72	0.10	-0.04	-0.09
15,346.00	89.57	149.65	11,799.48	-853.24	3,751.48	3,025.63	0.29	0.27	0.08
15,440.00	89.17	148.99	11,800.51	-934.08	3,799.44	3,118.63	0.82	-0.43	-0.70
15,534.00	89.13	149.39	11,801.91	-1,014.80	3,847.58	3,211.65	0.43	-0.04	0.43
15,628.00	89.57	150.05	11,802.97	-1,095.97	3,894.97	3,304.55	0.84	0.47	0.70
15,722.00	89.31	150.36	11,803.89	-1,177.54	3,941.68	3,397.32	0.43	-0.28	0.33
15,817.00	88.91	150.54	11,805.37	-1,260.18	3,988.52	3,491.01	0.46	-0.42	0.19
15,911.00	89.00	150.54	11,807.08	-1,342.01	4,034.75	3,583.68	0.10	0.10	0.00
16,006.00	89.31	149.87	11,808.48	-1,424.44	4,081.95	3,677.44	0.78	0.33	-0.71
16,100.00	89.09	150.23	11,809.80	-1,505.88	4,128.87	3,770.25	0.45	-0.23	0.38
16,195.00	89.13	149.87	11,811.27	-1,588.18	4,176.29	3,864.04	0.38	0.04	-0.38



Survey Report



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Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
16,289.00	88.82	150.27	11,812.95	-1,669.63	4,223.19	3,956.84	0.54	-0.33	0.43
16,383.00	89.22	149.83	11,814.56	-1,751.07	4,270.11	4,049.65	0.63	0.43	-0.47
16,477.00	89.17	150.14	11,815.88	-1,832.45	4,317.13	4,142.48	0.33	-0.05	0.33
16,570.00	89.09	150.54	11,817.29	-1,913.26	4,363.14	4,234.22	0.44	-0.09	0.43
16,664.00	88.60	150.23	11,819.19	-1,994.96	4,409.58	4,326.93	0.62	-0.52	-0.33
16,758.00	88.78	150.18	11,821.34	-2,076.52	4,456.28	4,419.69	0.20	0.19	-0.05
16,852.00	88.86	149.83	11,823.27	-2,157.91	4,503.26	4,512.50	0.38	0.09	-0.37
16,946.00	88.78	150.49	11,825.21	-2,239.43	4,550.03	4,605.27	0.71	-0.09	0.70
17,040.00	89.31	150.40	11,826.78	-2,321.19	4,596.38	4,697.97	0.57	0.56	-0.10
17,134.00	89.62	149.43	11,827.65	-2,402.52	4,643.50	4,790.82	1.08	0.33	-1.03
17,229.00	89.40	149.43	11,828.47	-2,484.31	4,691.82	4,884.78	0.23	-0.23	0.00
17,323.00	89.31	149.52	11,829.52	-2,565.28	4,739.56	4,977.74	0.14	-0.10	0.10
17,417.00	89.09	150.05	11,830.84	-2,646.50	4,786.86	5,070.62	0.61	-0.23	0.56
17,511.00	89.79	149.74	11,831.76	-2,727.81	4,834.00	5,163.47	0.81	0.74	-0.33
17,605.00	89.13	150.10	11,832.64	-2,809.15	4,881.12	5,256.32	0.80	-0.70	0.38
17,699.00	89.22	149.65	11,834.00	-2,890.45	4,928.29	5,349.17	0.49	0.10	-0.48
17,793.00	89.13	150.05	11,835.35	-2,971.72	4,975.50	5,442.03	0.44	-0.10	0.43
17,887.00	89.09	150.27	11,836.81	-3,053.25	5,022.26	5,534.81	0.24	-0.04	0.23
17,981.00	88.86	149.65	11,838.49	-3,134.61	5,069.31	5,627.64	0.70	-0.24	-0.66
18,076.00	89.04	149.83	11,840.23	-3,216.65	5,117.18	5,721.51	0.27	0.19	0.19
18,170.00	89.26	149.52	11,841.63	-3,297.78	5,164.63	5,814.42	0.40	0.23	-0.33
18,263.00	89.00	150.01	11,843.04	-3,378.12	5,211.46	5,906.31	0.60	-0.28	0.53
18,356.00	89.13	149.48	11,844.56	-3,458.44	5,258.31	5,998.21	0.59	0.14	-0.57
18,450.00	88.82	150.01	11,846.24	-3,539.62	5,305.66	6,091.09	0.65	-0.33	0.56
18,544.00	89.44	149.79	11,847.66	-3,620.94	5,352.80	6,183.94	0.70	0.66	-0.23
18,638.00	89.31	149.70	11,848.69	-3,702.13	5,400.16	6,276.83	0.17	-0.14	-0.10
18,733.00	89.62	149.52	11,849.58	-3,784.07	5,448.22	6,370.74	0.38	0.33	-0.19
18,827.00	89.35	150.27	11,850.42	-3,865.39	5,495.36	6,463.60	0.85	-0.29	0.80
18,922.00	89.57	150.54	11,851.32	-3,947.99	5,542.28	6,557.30	0.37	0.23	0.28
19,016.00	89.66	149.79	11,851.95	-4,029.53	5,589.04	6,650.09	0.80	0.10	-0.80
19,111.00	89.44	150.05	11,852.69	-4,111.73	5,636.65	6,743.93	0.36	-0.23	0.27
19,204.00	89.57	149.92	11,853.50	-4,192.26	5,683.17	6,835.77	0.20	0.14	-0.14
19,299.00	89.44	149.13	11,854.32	-4,274.13	5,731.35	6,929.71	0.84	-0.14	-0.83
19,391.00	89.17	149.83	11,855.43	-4,353.38	5,778.07	7,020.69	0.82	-0.29	0.76
19,486.00	89.35	149.43	11,856.66	-4,435.34	5,826.10	7,114.59	0.46	0.19	-0.42
19,585.00	89.26	150.18	11,857.86	-4,520.90	5,875.88	7,212.41	0.76	-0.09	0.76
19,679.00	89.22	150.89	11,859.11	-4,602.73	5,922.12	7,305.09	0.76	-0.04	0.76
19,772.00	89.31	151.51	11,860.30	-4,684.22	5,966.92	7,396.60	0.67	0.10	0.67
19,866.00	89.35	151.46	11,861.40	-4,766.81	6,011.79	7,489.01	0.07	0.04	-0.05
19,960.00	89.35	150.71	11,862.47	-4,849.09	6,057.23	7,581.54	0.80	0.00	-0.80
20,055.00	89.22	151.20	11,863.65	-4,932.13	6,103.35	7,675.09	0.53	-0.14	0.52
20,149.00	89.48	150.32	11,864.72	-5,014.15	6,149.26	7,767.72	0.98	0.28	-0.94
20,243.00	89.35	150.49	11,865.68	-5,095.88	6,195.69	7,860.44	0.23	-0.14	0.18



**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia NAD83 UTM 17N  
**Site:** Hudson Alt North  
**Well:** Hudson S-15 HU (slot O)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:** Well Hudson S-15 HU (slot O)  
**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)
20,338.00	89.22	150.45	11,866.87	-5,178.53	6,242.51	7,954.12	0.14	-0.14	-0.04
20,432.00	89.22	150.32	11,868.14	-5,260.25	6,288.95	8,046.85	0.14	0.00	-0.14
20,526.00	89.48	149.61	11,869.21	-5,341.62	6,336.00	8,139.68	0.80	0.28	-0.76
20,621.00	89.40	149.79	11,870.14	-5,423.64	6,383.93	8,233.57	0.21	-0.08	0.19
20,716.00	89.26	149.74	11,871.25	-5,505.71	6,431.76	8,327.45	0.16	-0.15	-0.05
20,809.00	89.13	150.58	11,872.56	-5,586.37	6,478.03	8,419.24	0.91	-0.14	0.90
20,904.00	89.13	150.18	11,874.00	-5,668.95	6,524.98	8,512.95	0.42	0.00	-0.42
20,998.00	89.40	149.87	11,875.21	-5,750.37	6,571.94	8,605.77	0.44	0.29	-0.33
21,091.00	89.17	150.45	11,876.37	-5,831.03	6,618.21	8,697.56	0.67	-0.25	0.62
21,186.00	89.22	150.76	11,877.70	-5,913.79	6,664.83	8,791.21	0.33	0.05	0.33
21,280.00	89.17	151.02	11,879.02	-5,995.91	6,710.56	8,883.79	0.28	-0.05	0.28
21,374.00	89.26	150.98	11,880.31	-6,078.12	6,756.13	8,976.34	0.10	0.10	-0.04
21,468.00	90.23	150.98	11,880.73	-6,160.31	6,801.73	9,068.91	1.03	1.03	0.00
21,562.00	89.53	149.87	11,880.92	-6,242.06	6,848.12	9,161.63	1.40	-0.74	-1.18
21,655.00	89.48	150.05	11,881.73	-6,322.57	6,894.68	9,253.48	0.20	-0.05	0.19
21,750.00	89.17	150.62	11,882.85	-6,405.11	6,941.69	9,347.20	0.68	-0.33	0.60
21,843.00	89.35	150.62	11,884.05	-6,486.14	6,987.31	9,438.88	0.19	0.19	0.00
21,938.00	89.57	149.30	11,884.94	-6,568.38	7,034.87	9,532.70	1.41	0.23	-1.39
22,033.00	89.57	149.39	11,885.66	-6,650.10	7,083.30	9,626.68	0.09	0.00	0.09
22,127.00	89.35	148.42	11,886.54	-6,730.59	7,131.85	9,719.77	1.06	-0.23	-1.03
22,221.00	89.22	147.23	11,887.72	-6,810.14	7,181.90	9,813.09	1.27	-0.14	-1.27
22,316.00	89.09	146.61	11,889.12	-6,889.74	7,233.74	9,907.57	0.67	-0.14	-0.65
22,410.00	89.40	147.01	11,890.36	-6,968.39	7,285.20	10,001.07	0.54	0.33	0.43
22,504.00	89.53	147.98	11,891.23	-7,047.66	7,335.71	10,094.45	1.04	0.14	1.03
22,598.00	89.35	148.99	11,892.15	-7,127.79	7,384.84	10,187.64	1.09	-0.19	1.07
22,691.00	89.31	150.40	11,893.24	-7,208.08	7,431.76	10,279.55	1.52	-0.04	1.52
22,785.00	89.35	151.55	11,894.34	-7,290.26	7,477.37	10,372.11	1.22	0.04	1.22
22,879.00	89.48	153.36	11,895.30	-7,373.60	7,520.83	10,464.22	1.93	0.14	1.93
22,972.00	89.44	154.28	11,896.17	-7,457.06	7,561.86	10,554.88	0.99	-0.04	0.99
23,065.00	89.88	149.96	11,896.73	-7,539.24	7,605.34	10,646.10	4.67	0.47	-4.65
23,160.00	89.48	149.39	11,897.26	-7,621.24	7,653.30	10,740.00	0.73	-0.42	-0.60
23,255.00	89.09	149.21	11,898.44	-7,702.92	7,701.80	10,833.99	0.45	-0.41	-0.19
23,348.00	89.22	149.65	11,899.81	-7,782.98	7,749.10	10,925.96	0.49	0.14	0.47
23,443.00	89.35	149.92	11,901.00	-7,865.07	7,796.90	11,019.83	0.32	0.14	0.28
23,537.00	89.57	149.65	11,901.89	-7,946.30	7,844.20	11,112.71	0.37	0.23	-0.29
23,631.00	89.62	149.79	11,902.55	-8,027.47	7,891.60	11,205.61	0.16	0.05	0.15
23,725.00	89.75	148.38	11,903.07	-8,108.11	7,939.89	11,298.67	1.51	0.14	-1.50
23,818.00	90.46	148.99	11,902.90	-8,187.56	7,988.23	11,390.82	1.01	0.76	0.66
23,912.00	91.65	148.24	11,901.17	-8,267.80	8,037.17	11,483.96	1.50	1.27	-0.80
24,005.00	89.40	149.39	11,900.31	-8,347.35	8,085.32	11,576.08	2.72	-2.42	1.24
24,100.00	89.17	150.14	11,901.50	-8,429.42	8,133.15	11,669.95	0.83	-0.24	0.79
24,194.00	88.56	150.89	11,903.36	-8,511.23	8,179.41	11,762.63	1.03	-0.65	0.80
24,287.00	88.64	150.32	11,905.63	-8,592.23	8,225.04	11,854.29	0.62	0.09	-0.61
24,381.00	88.51	150.49	11,907.97	-8,673.94	8,271.45	11,946.98	0.23	-0.14	0.18

**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia NAD83 UTM 17N  
**Site:** Hudson Alt North  
**Well:** Hudson S-15 HU (slot O)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:** Well Hudson S-15 HU (slot O)  
**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)
24,476.00	88.56	150.54	11,910.40	-8,756.61	8,318.20	12,040.64	0.07	0.05	0.05
24,570.00	88.56	150.36	11,912.76	-8,838.36	8,364.54	12,133.32	0.19	0.00	-0.19
24,664.00	88.51	150.36	11,915.17	-8,920.03	8,411.01	12,226.03	0.05	-0.05	0.00
24,758.00	88.60	150.14	11,917.54	-9,001.61	8,457.64	12,318.77	0.25	0.10	-0.23
24,852.00	89.17	149.48	11,919.37	-9,082.85	8,504.90	12,411.63	0.93	0.61	-0.70
24,946.00	89.04	150.36	11,920.83	-9,164.18	8,552.01	12,504.47	0.95	-0.14	0.94
25,040.00	88.91	150.27	11,922.51	-9,245.83	8,598.55	12,597.20	0.17	-0.14	-0.10
25,135.00	89.13	150.18	11,924.14	-9,328.27	8,645.72	12,690.95	0.25	0.23	-0.09
25,229.00	88.86	150.49	11,925.79	-9,409.94	8,692.24	12,783.68	0.44	-0.29	0.33
25,324.00	88.91	150.27	11,927.64	-9,492.51	8,739.18	12,877.38	0.24	0.05	-0.23
25,419.00	89.44	150.01	11,929.00	-9,574.89	8,786.48	12,971.15	0.62	0.56	-0.27
25,513.00	89.35	149.96	11,930.00	-9,656.28	8,833.50	13,063.99	0.11	-0.10	-0.05
25,608.00	89.57	149.65	11,930.89	-9,738.39	8,881.27	13,157.85	0.40	0.23	-0.33
25,703.00	89.26	149.79	11,931.86	-9,820.42	8,929.17	13,251.74	0.36	-0.33	0.15
25,796.00	89.75	149.26	11,932.67	-9,900.57	8,976.34	13,343.70	0.78	0.53	-0.57
25,890.00	89.35	149.79	11,933.40	-9,981.58	9,024.01	13,436.65	0.71	-0.43	0.56
25,985.00	89.44	149.21	11,934.41	-10,063.43	9,072.22	13,530.59	0.62	0.09	-0.61
26,079.00	89.44	148.91	11,935.33	-10,144.05	9,120.55	13,623.64	0.32	0.00	-0.32
26,173.00	88.95	149.48	11,936.65	-10,224.78	9,168.68	13,716.67	0.80	-0.52	0.61
26,268.00	89.00	149.96	11,938.35	-10,306.81	9,216.58	13,810.54	0.51	0.05	0.51
26,362.00	89.17	149.30	11,939.85	-10,387.90	9,264.09	13,903.45	0.72	0.18	-0.70
26,456.00	88.86	151.77	11,941.46	-10,469.72	9,310.32	13,996.12	2.65	-0.33	2.63
26,551.00	89.13	151.77	11,943.13	-10,553.41	9,355.25	14,089.42	0.28	0.28	0.00
26,645.00	88.91	152.08	11,944.74	-10,636.33	9,399.48	14,181.69	0.40	-0.23	0.33
26,740.00	89.70	150.93	11,945.89	-10,719.82	9,444.80	14,275.08	1.47	0.83	-1.21
26,834.00	89.31	151.51	11,946.70	-10,802.20	9,490.06	14,367.57	0.74	-0.41	0.62
26,928.00	89.17	151.73	11,947.95	-10,884.90	9,534.73	14,459.94	0.28	-0.15	0.23
27,022.00	89.13	151.15	11,949.34	-10,967.45	9,579.67	14,552.36	0.62	-0.04	-0.62
27,117.00	89.22	151.99	11,950.71	-11,050.98	9,624.89	14,645.73	0.89	0.09	0.88
27,211.00	89.40	152.08	11,951.84	-11,134.00	9,668.97	14,737.97	0.21	0.19	0.10
27,305.00	89.00	149.92	11,953.16	-11,216.20	9,714.53	14,830.52	2.34	-0.43	-2.30
27,398.00	89.35	148.95	11,954.50	-11,298.27	9,761.82	14,922.49	1.11	0.38	-1.04
27,492.00	89.48	148.60	11,955.45	-11,376.65	9,810.54	15,015.61	0.40	0.14	-0.37
27,587.00	89.40	148.55	11,956.38	-11,457.71	9,860.07	15,109.77	0.10	-0.08	-0.05
27,681.00	89.40	149.13	11,957.37	-11,538.15	9,908.71	15,202.88	0.62	0.00	0.62
27,775.00	89.44	149.92	11,958.32	-11,619.15	9,956.38	15,295.82	0.84	0.04	0.84
27,869.00	89.35	149.48	11,959.31	-11,700.31	10,003.80	15,388.73	0.48	-0.10	-0.47
27,963.00	89.48	149.79	11,960.27	-11,781.41	10,051.32	15,481.65	0.36	0.14	0.33
28,058.00	89.57	149.48	11,961.06	-11,863.38	10,099.34	15,575.56	0.34	0.09	-0.33
28,152.00	89.17	149.08	11,962.09	-11,944.18	10,147.35	15,668.56	0.60	-0.43	-0.43
28,247.00	88.60	149.70	11,963.94	-12,025.93	10,195.72	15,762.52	0.89	-0.60	0.65
28,341.00	88.47	150.10	11,966.34	-12,107.22	10,242.84	15,855.34	0.45	-0.14	0.43
28,436.00	88.29	149.87	11,969.03	-12,189.45	10,290.35	15,949.13	0.31	-0.19	-0.24



Survey Report



**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia NAD83 UTM 17N  
**Site:** Hudson Alt North  
**Well:** Hudson S-15 HU (slot O)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:** Well Hudson S-15 HU (slot O)  
**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)	
28,530.00	89.04	149.52	11,971.22	-12,270.58	10,337.77	16,042.01	0.89	0.80	-0.37	
28,625.00	88.95	149.13	11,972.89	-12,352.28	10,366.22	16,135.99	0.42	-0.09	-0.41	
28,718.00	89.40	149.21	11,974.23	-12,432.13	10,433.88	16,228.03	0.49	0.48	0.09	
28,812.00	89.40	149.39	11,975.21	-12,512.95	10,481.87	16,321.03	0.19	0.00	0.19	
28,906.00	88.91	149.74	11,976.60	-12,593.99	10,529.48	16,413.96	0.64	-0.52	0.37	
29,000.00	88.51	149.39	11,978.71	-12,675.01	10,577.09	16,506.88	0.57	-0.43	-0.37	
29,095.00	88.64	149.52	11,981.07	-12,756.80	10,625.35	16,600.81	0.19	0.14	0.14	
29,189.00	88.73	148.91	11,983.23	-12,837.54	10,673.45	16,693.81	0.66	0.10	-0.65	
29,284.00	88.56	149.26	11,985.48	-12,919.02	10,722.24	16,787.83	0.41	-0.18	0.37	
29,379.00	88.38	149.61	11,988.02	-13,000.79	10,770.54	16,881.75	0.41	-0.19	0.37	
29,473.00	89.22	148.60	11,989.98	-13,081.43	10,818.79	16,974.78	1.40	0.89	-1.07	
29,568.00	89.40	151.51	11,991.13	-13,163.73	10,868.20	17,068.57	3.07	0.19	3.06	
29,663.00	89.57	151.55	11,991.98	-13,247.24	10,911.49	17,161.96	0.18	0.18	0.04	
29,758.00	89.44	150.80	11,992.80	-13,330.47	10,957.29	17,255.45	0.80	-0.14	-0.79	
29,853.00	89.00	151.28	11,994.10	-13,413.58	11,003.28	17,348.97	0.69	-0.46	0.51	
29,946.00	89.48	149.08	11,995.33	-13,494.25	11,049.52	17,440.76	2.42	0.52	-2.37	
30,040.00	89.31	148.86	11,996.32	-13,574.80	11,097.97	17,533.83	0.30	-0.18	-0.23	
30,134.00	88.82	149.30	11,997.85	-13,655.43	11,146.27	17,626.88	0.70	-0.52	0.47	
30,228.00	88.78	149.21	11,999.82	-13,736.20	11,194.31	17,719.87	0.10	-0.04	-0.10	
30,322.00	88.60	150.49	12,001.97	-13,817.46	11,241.51	17,812.72	1.37	-0.19	1.36	
30,424.00	88.64	151.64	12,004.43	-13,906.70	11,290.85	17,913.11	1.13	0.04	1.13	
<b>Survey @ 30424.00 MD 12004.43 TVD</b>										
30,457.00	88.64	151.64	12,005.21	-13,935.73	11,306.52	17,945.53	0.00	0.00	0.00	
<b>Survey Proj. to 30457.00 MD 12005.21 TVD</b>										

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
178.00	178.00	0.40	-0.55	MWD surveys
30,424.00	12,004.43	-13,906.70	11,290.85	Survey @ 30424.00 MD 12004.43 TVD

Checked By: \_\_\_\_\_ Approved By: \_\_\_\_\_ Date: \_\_\_\_\_



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Hudson S-15 HU (slot O)
<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-15 HU (slot O)	<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-15 HU (slot O)					
<b>Well Position</b>	+N-S	0.00 ft	<b>Northing:</b>	14,464,523.491 usft	<b>Latitude:</b>	39.828695000
	+E-W	0.00 ft	<b>Easting:</b>	1,732,322.915 usft	<b>Longitude:</b>	-80.672640000
<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	12/14/2021	-8.691	66.517	51,712.64481540

<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	140.96

<b>Survey Program</b>	Date 1/18/2022			
<b>From (ft)</b>	<b>To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>
178.00	1,072.00	MWD surf (Original Hole)	MWD	MWD - Standard
1,165.00	2,838.00	MWD int (Original Hole)	MWD	MWD - Standard
2,965.00	10,799.00	MWD (Original Hole)	MWD	MWD - Standard
10,930.00	30,424.00	MWD lat (Original Hole)	MWD	MWD - Standard
30,457.00	30,457.00	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	14,464,523.491	1,732,322.915	39.828695000	-80.672640000	
178.00	0.44	306.19	178.00	0.40	-0.55	14,464,523.895	1,732,322.364	39.828696114	-80.672641959	
<b>MWD surveys</b>										
209.00	0.48	342.31	209.00	0.60	-0.69	14,464,524.089	1,732,322.228	39.828696648	-80.672642439	
240.00	0.70	345.47	240.00	0.90	-0.77	14,464,524.396	1,732,322.141	39.828697492	-80.672642745	
270.00	0.88	342.49	269.99	1.30	-0.89	14,464,524.793	1,732,322.026	39.828698584	-80.672643150	
301.00	0.48	7.71	300.99	1.66	-0.94	14,464,525.149	1,732,321.972	39.828699561	-80.672643339	



Survey Report - Geographic



<b>Company:</b> Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b> Well Hudson S-15 HU (slot O)
<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-15 HU (slot O)	<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
331.00	0.48	17.11	330.99	1.90	-0.89	14,464,525.393	1,732,322.025	39.828700233	-80.672643144
361.00	0.48	41.02	360.99	2.12	-0.77	14,464,525.808	1,732,322.145	39.828700822	-80.672642716
391.00	0.48	56.93	390.99	2.28	-0.58	14,464,525.772	1,732,322.333	39.828701268	-80.672642045
422.00	0.40	51.30	421.99	2.42	-0.39	14,464,525.910	1,732,322.526	39.828701647	-80.672641355
453.00	0.31	44.27	452.99	2.55	-0.25	14,464,526.038	1,732,322.669	39.828701996	-80.672640844
484.00	0.22	32.76	483.99	2.86	-0.16	14,464,526.148	1,732,322.760	39.828702298	-80.672640519
514.00	0.13	102.02	513.99	2.70	-0.09	14,464,526.189	1,732,322.824	39.828702411	-80.672640289
545.00	0.18	85.67	544.99	2.69	-0.01	14,464,526.186	1,732,322.907	39.828702400	-80.672639993
575.00	0.18	115.29	574.99	2.88	0.08	14,464,526.169	1,732,322.997	39.828702353	-80.672639674
606.00	0.18	121.88	605.99	2.63	0.17	14,464,526.123	1,732,323.082	39.828702225	-80.672639371
637.00	0.18	167.06	636.99	2.56	0.22	14,464,526.049	1,732,323.134	39.828702023	-80.672639186
668.00	0.18	178.04	667.98	2.46	0.23	14,464,525.953	1,732,323.147	39.828701759	-80.672639142
698.00	0.18	181.47	697.98	2.37	0.23	14,464,525.859	1,732,323.147	39.828701500	-80.672639142
729.00	0.22	184.81	728.98	2.28	0.23	14,464,525.751	1,732,323.141	39.828701204	-80.672639166
761.00	0.13	187.27	760.98	2.16	0.22	14,464,525.654	1,732,323.131	39.828700937	-80.672639202
792.00	0.18	193.07	791.98	2.08	0.20	14,464,525.572	1,732,323.116	39.828700711	-80.672639258
824.00	0.13	203.09	823.98	2.00	0.18	14,464,525.489	1,732,323.090	39.828700485	-80.672639350
855.00	0.18	220.23	854.98	1.93	0.13	14,464,525.420	1,732,323.045	39.828700295	-80.672639512
886.00	0.13	226.55	885.98	1.87	0.07	14,464,525.358	1,732,322.988	39.828700127	-80.672639716
917.00	0.22	239.21	916.98	1.81	0.00	14,464,525.304	1,732,322.911	39.828699977	-80.672639990
948.00	0.22	231.13	947.98	1.74	-0.10	14,464,525.236	1,732,322.814	39.828699792	-80.672640338
979.00	0.22	252.75	978.98	1.69	-0.20	14,464,525.181	1,732,322.711	39.828699642	-80.672640706
1,010.00	0.26	258.11	1,009.98	1.66	-0.33	14,464,525.149	1,732,322.585	39.828699555	-80.672641154
1,041.00	0.26	261.10	1,040.98	1.63	-0.47	14,464,525.123	1,732,322.447	39.828699487	-80.672641647
1,072.00	0.22	302.76	1,071.98	1.65	-0.59	14,464,525.145	1,732,322.327	39.828699547	-80.672642072
1,165.00	0.88	341.96	1,164.98	2.43	-0.96	14,464,525.920	1,732,321.956	39.828701681	-80.672643385
1,259.00	1.32	359.01	1,258.96	4.20	-1.20	14,464,527.689	1,732,321.714	39.828700541	-80.672644225
1,353.00	1.27	9.12	1,352.94	6.31	-1.06	14,464,529.800	1,732,321.860	39.828712337	-80.672643676
1,400.00	1.01	32.67	1,399.93	7.17	-0.75	14,464,530.663	1,732,322.166	39.828714704	-80.672642574
1,447.00	1.41	40.14	1,446.92	7.96	-0.15	14,464,531.454	1,732,322.763	39.828716969	-80.672640439
1,494.00	1.58	46.21	1,493.90	8.85	0.69	14,464,532.345	1,732,323.603	39.828719306	-80.672637434
1,541.00	1.58	72.05	1,540.88	9.50	1.77	14,464,532.993	1,732,324.687	39.828721075	-80.672633564
1,588.00	2.37	77.76	1,587.86	9.91	3.34	14,464,533.398	1,732,326.253	39.828722174	-80.672627980
1,636.00	2.98	92.44	1,635.80	10.06	5.55	14,464,533.556	1,732,328.470	39.828722583	-80.672620083
1,683.00	3.96	95.25	1,682.72	9.86	8.39	14,464,533.355	1,732,331.307	39.828722004	-80.672609982
1,731.00	4.75	94.55	1,730.58	9.55	12.02	14,464,533.046	1,732,334.938	39.828721118	-80.672597051
1,825.00	4.22	81.54	1,824.29	9.75	19.32	14,464,533.246	1,732,342.239	39.828721594	-80.672571043
1,919.00	5.41	52.62	1,917.97	12.95	26.27	14,464,536.448	1,732,349.183	39.828730311	-80.672546271
2,012.00	5.71	42.43	2,010.54	19.03	32.87	14,464,542.522	1,732,355.788	39.828746932	-80.672522664
2,107.00	5.71	42.07	2,105.07	26.03	39.23	14,464,549.518	1,732,362.143	39.828766082	-80.672499937
2,202.00	5.63	42.87	2,199.60	32.95	45.56	14,464,556.442	1,732,368.480	39.828785032	-80.672477276
2,296.00	4.83	40.67	2,293.21	39.33	51.28	14,464,562.823	1,732,374.196	39.828802498	-80.672456833
2,390.00	4.92	36.01	2,386.87	45.59	56.23	14,464,569.085	1,732,379.145	39.828819646	-80.672439124
2,484.00	5.27	40.84	2,480.50	52.12	61.42	14,464,575.612	1,732,384.338	39.828837517	-80.672420542
2,578.00	5.23	32.85	2,574.10	58.99	66.57	14,464,582.477	1,732,389.485	39.828856319	-80.672402120
2,673.00	5.49	36.80	2,668.69	66.26	71.64	14,464,589.753	1,732,394.556	39.828876250	-80.672383963
2,768.00	5.71	42.95	2,763.24	73.36	77.58	14,464,596.851	1,732,400.498	39.828895684	-80.672362705
2,838.00	6.06	44.80	2,832.87	78.53	82.56	14,464,602.022	1,732,405.474	39.828909833	-80.672344913
2,965.00	5.76	34.25	2,959.20	88.56	90.87	14,464,612.047	1,732,413.785	39.828937280	-80.672315181
3,059.00	6.55	34.52	3,052.65	96.87	96.56	14,464,620.363	1,732,419.478	39.828960062	-80.672294794
3,154.00	6.50	46.38	3,147.04	105.05	103.53	14,464,628.538	1,732,426.442	39.828982440	-80.672269885
3,248.00	6.15	62.03	3,240.48	111.08	111.83	14,464,634.570	1,732,434.741	39.828998923	-80.672240245
3,341.00	6.11	67.39	3,332.95	115.32	120.79	14,464,638.809	1,732,443.710	39.829010475	-80.672208244
3,435.00	6.20	68.16	3,426.41	119.29	130.06	14,464,642.784	1,732,452.971	39.829021298	-80.672175206



Survey Report - Geographic



**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia NAD83 UTM 17N  
**Site:** Hudson Alt North  
**Well:** Hudson S-15 HU (slot O)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole

**Local Co-ordinate Reference:** Well Hudson S-15 HU (slot O)  
**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
3,529.00	4.70	60.80	3,519.98	123.22	138.06	14,464,646.715	1,732,460.976	39.829032012	-80.672146642
3,623.00	4.13	56.14	3,613.70	126.99	144.23	14,464,650.480	1,732,467.148	39.829042289	-80.672124607
3,717.00	4.26	53.41	3,707.45	130.96	149.85	14,464,654.447	1,732,472.762	39.829053127	-80.672104558
3,811.00	4.61	52.45	3,801.17	135.34	155.65	14,464,658.830	1,732,478.561	39.829065106	-80.672083849
3,905.00	4.83	53.15	3,894.85	140.01	161.81	14,464,663.506	1,732,484.722	39.829077894	-80.672061841
3,999.00	4.17	51.30	3,988.56	144.52	167.64	14,464,668.016	1,732,490.556	39.829090212	-80.672041002
4,094.00	3.87	40.05	4,083.32	149.14	172.40	14,464,672.630	1,732,495.315	39.829102834	-80.672023993
4,188.00	3.91	33.72	4,177.11	154.23	176.22	14,464,677.724	1,732,499.135	39.829116785	-80.672010319
4,282.00	4.09	28.45	4,270.88	159.85	179.60	14,464,683.337	1,732,502.511	39.829132166	-80.671998220
4,376.00	4.31	26.89	4,364.63	165.89	182.90	14,464,689.377	1,732,505.815	39.829148719	-80.671986375
4,470.00	5.36	31.00	4,458.29	172.74	186.87	14,464,696.233	1,732,509.783	39.829167508	-80.671972153
4,564.00	5.67	36.01	4,551.86	180.26	191.86	14,464,703.752	1,732,514.774	39.829188108	-80.671954276
4,658.00	6.28	40.40	4,645.35	187.93	197.92	14,464,711.424	1,732,520.836	39.829209115	-80.671932583
4,752.00	6.55	32.67	4,738.76	196.36	204.15	14,464,719.852	1,732,527.062	39.829232199	-80.671910296
4,847.00	6.86	27.22	4,833.11	205.97	209.67	14,464,729.459	1,732,532.582	39.829258525	-80.671890505
4,941.00	7.21	35.22	4,926.40	215.78	215.64	14,464,739.270	1,732,538.552	39.829285409	-80.671869116
5,034.00	6.72	41.28	5,018.72	224.64	222.59	14,464,748.127	1,732,545.508	39.829309662	-80.671844225
5,128.00	6.33	48.23	5,112.11	232.22	230.09	14,464,755.712	1,732,553.001	39.829330417	-80.671817436
5,221.00	6.24	52.89	5,204.55	238.69	237.94	14,464,762.177	1,732,560.856	39.829348092	-80.671789375
5,315.00	6.64	53.76	5,297.96	244.98	246.40	14,464,768.472	1,732,569.313	39.829365294	-80.671759169
5,409.00	7.12	49.28	5,391.28	251.99	255.20	14,464,775.485	1,732,578.112	39.829384466	-80.671727737
5,505.00	6.59	53.59	5,486.60	259.15	264.14	14,464,782.636	1,732,587.054	39.829404014	-80.671695792
5,600.00	5.84	55.61	5,581.04	265.11	272.52	14,464,788.602	1,732,595.430	39.829420312	-80.671665881
5,694.00	4.79	54.91	5,674.63	270.07	279.67	14,464,793.560	1,732,602.588	39.829433854	-80.671640320
5,789.00	5.19	54.29	5,769.27	274.86	286.41	14,464,798.348	1,732,609.322	39.829446936	-80.671616270
5,882.00	6.64	57.02	5,861.78	280.24	294.33	14,464,803.730	1,732,617.249	39.829461637	-80.671587967
5,976.00	7.21	54.91	5,955.09	286.59	303.72	14,464,810.079	1,732,626.634	39.829478979	-80.671554454
6,069.00	8.00	43.74	6,047.28	294.62	312.97	14,464,818.110	1,732,635.885	39.829500941	-80.671521200
6,124.00	8.66	39.61	6,101.70	300.57	318.26	14,464,824.066	1,732,641.171	39.829517242	-80.671502494
6,156.00	8.09	39.79	6,133.35	304.16	321.23	14,464,827.652	1,732,644.148	39.829527061	-80.671491843
6,187.00	6.86	39.70	6,164.09	307.26	323.81	14,464,830.752	1,732,646.727	39.829535550	-80.671482618
6,219.00	6.46	37.77	6,195.87	310.16	326.14	14,464,833.646	1,732,649.050	39.829543472	-80.671474304
6,250.00	5.71	34.96	6,226.70	312.80	328.09	14,464,836.288	1,732,651.002	39.829550709	-80.671467318
6,281.00	4.79	32.49	6,257.57	315.15	329.67	14,464,838.644	1,732,652.581	39.829557162	-80.671461663
6,313.00	4.09	31.44	6,289.47	317.25	330.98	14,464,840.745	1,732,653.894	39.829562918	-80.671456599
6,344.00	4.00	27.05	6,320.40	319.16	332.05	14,464,842.651	1,732,654.962	39.829568142	-80.671453129
6,438.00	5.36	52.97	6,414.09	324.72	337.04	14,464,848.216	1,732,659.959	39.829583374	-80.671435258
6,533.00	5.23	63.34	6,508.69	329.34	344.46	14,464,852.831	1,732,667.370	39.829595973	-80.671408797
6,627.00	3.56	61.94	6,602.41	332.64	350.88	14,464,856.126	1,732,673.775	39.829604958	-80.671385942
6,722.00	3.47	38.82	6,697.23	336.26	355.27	14,464,859.753	1,732,678.180	39.829614676	-80.671370204
6,816.00	4.57	44.97	6,791.00	341.13	359.70	14,464,864.619	1,732,682.610	39.829628194	-80.671354361
6,910.00	4.75	45.06	6,884.69	346.53	365.10	14,464,870.018	1,732,688.012	39.829642965	-80.671335050
7,004.00	5.76	41.72	6,978.29	352.80	370.99	14,464,876.288	1,732,693.906	39.829660125	-80.671313974
7,098.00	6.68	36.80	7,071.74	360.70	377.41	14,464,884.187	1,732,700.320	39.829681752	-80.671291023
7,193.00	7.69	39.70	7,165.99	370.01	384.78	14,464,893.502	1,732,707.690	39.829707259	-80.671264650
7,287.00	8.39	47.61	7,259.07	379.47	393.86	14,464,902.964	1,732,716.773	39.829733154	-80.671232174
7,381.00	9.54	48.14	7,351.92	389.30	404.73	14,464,912.786	1,732,727.640	39.829760017	-80.671193339
7,476.00	10.68	44.54	7,445.45	400.82	416.76	14,464,924.314	1,732,739.678	39.829791554	-80.671150310
7,571.00	11.87	44.18	7,538.61	414.11	429.75	14,464,937.596	1,732,752.662	39.829827898	-80.671103889
7,665.00	13.45	45.77	7,630.32	428.67	444.32	14,464,952.156	1,732,767.234	39.829867735	-80.671051795
7,759.00	17.01	46.73	7,721.01	445.72	462.17	14,464,969.211	1,732,785.084	39.829914392	-80.670987991
7,868.00	19.66	47.17	7,824.40	469.24	487.36	14,464,992.731	1,732,810.276	39.829978729	-80.670897950
7,947.00	20.17	46.73	7,898.63	487.70	507.12	14,465,011.189	1,732,830.035	39.830029219	-80.670827331
8,042.00	19.69	44.27	7,987.94	510.39	530.22	14,465,033.876	1,732,853.132	39.830091289	-80.670744762



Survey Report - Geographic



**Company:** Tug Hill Operating LLC  
**Project:** Marshall County, West Virginia NAD83 UTM 17N  
**Site:** Hudson Alt North  
**Well:** Hudson S-15 HU (slot O)  
**Wellbore:** Original Hole  
**Design:** Surveys Original Hole  
**Local Co-ordinate Reference:** Well Hudson S-15 HU (slot O)  
**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
8,135.00	18.85	41.55	8,075.73	532.85	551.12	14,465,056.339	1,732,874.034	39.830152766	-80.670670016
8,230.00	19.47	41.46	8,165.47	556.20	571.78	14,465,079.689	1,732,894.696	39.830216683	-80.670596114
8,324.00	19.56	41.28	8,254.07	579.76	592.54	14,465,103.254	1,732,915.450	39.830281188	-80.670521883
8,419.00	20.00	38.56	8,343.47	604.42	613.15	14,465,127.909	1,732,936.069	39.830348688	-80.670448117
8,513.00	19.86	36.19	8,431.84	629.88	632.60	14,465,153.366	1,732,955.517	39.830418401	-80.670378510
8,607.00	19.73	39.61	8,520.29	654.99	652.15	14,465,178.477	1,732,975.061	39.830487163	-80.670308564
8,701.00	18.76	44.45	8,609.04	678.00	672.85	14,465,201.493	1,732,995.764	39.830550161	-80.670234520
8,796.00	18.63	42.95	8,699.03	700.01	693.89	14,465,223.505	1,733,016.801	39.830610398	-80.670159299
8,890.00	17.71	39.79	8,788.34	721.99	713.27	14,465,245.482	1,733,036.182	39.830670555	-80.670089976
8,984.00	18.76	44.71	8,877.63	743.72	733.05	14,465,267.212	1,733,055.968	39.830730030	-80.670019215
9,077.00	18.33	43.04	8,965.80	765.04	753.56	14,465,288.528	1,733,076.470	39.830788362	-80.669945809
9,169.00	18.94	44.89	9,052.97	786.19	773.97	14,465,309.679	1,733,096.881	39.830846241	-80.669872928
9,262.00	20.92	52.71	9,140.42	806.95	797.83	14,465,330.437	1,733,120.748	39.830903005	-80.669787640
9,356.00	21.58	55.08	9,228.03	827.01	825.36	14,465,350.500	1,733,148.275	39.830957824	-80.669689328
9,450.00	21.84	53.76	9,315.36	847.24	853.64	14,465,370.732	1,733,176.551	39.831013099	-80.669588342
9,544.00	21.27	47.96	9,402.79	869.00	880.41	14,465,392.489	1,733,203.320	39.831072576	-80.669492709
9,638.00	20.87	43.04	9,490.52	892.66	904.50	14,465,416.146	1,733,227.412	39.831137298	-80.669406582
9,732.00	21.01	40.67	9,578.31	917.68	926.91	14,465,441.165	1,733,249.822	39.831205778	-80.669326429
9,825.00	21.18	37.24	9,665.08	943.70	947.94	14,465,467.186	1,733,270.854	39.831277024	-80.669251169
9,919.00	18.19	39.79	9,753.58	968.50	967.61	14,465,491.984	1,733,290.525	39.831344927	-80.669180776
10,013.00	18.19	42.51	9,842.88	990.58	986.92	14,465,514.074	1,733,309.829	39.831405394	-80.669111725
10,107.00	18.37	43.13	9,932.14	1,012.21	1,006.96	14,465,535.700	1,733,329.870	39.831464580	-80.669040056
10,201.00	18.24	44.97	10,021.38	1,033.43	1,027.48	14,465,556.918	1,733,350.393	39.831522640	-80.668966673
10,294.00	18.72	45.24	10,109.59	1,054.23	1,048.36	14,465,577.723	1,733,371.276	39.831579564	-80.668892013
10,388.00	20.26	44.54	10,198.20	1,076.46	1,070.49	14,465,599.946	1,733,393.404	39.831640369	-80.668812902
10,482.00	21.14	43.83	10,286.13	1,100.29	1,093.65	14,465,623.775	1,733,416.558	39.831705573	-80.668730111
10,577.00	21.31	41.37	10,374.69	1,125.60	1,116.92	14,465,649.088	1,733,439.831	39.831774851	-80.668646880
10,670.00	20.61	41.72	10,461.53	1,150.50	1,138.98	14,465,673.987	1,733,461.893	39.831843006	-80.668567967
10,764.00	19.86	43.39	10,549.73	1,174.45	1,160.96	14,465,697.940	1,733,483.872	39.831908561	-80.668489361
10,799.00	19.82	43.92	10,582.65	1,183.05	1,169.16	14,465,706.534	1,733,492.072	39.831932080	-80.668460039
10,930.00	19.40	45.30	10,706.06	1,214.35	1,200.03	14,465,737.835	1,733,522.942	39.832017725	-80.668349667
11,024.00	18.82	45.70	10,794.88	1,235.92	1,221.98	14,465,759.406	1,733,544.890	39.832076739	-80.668271202
11,117.00	18.16	46.23	10,883.08	1,256.42	1,243.18	14,465,779.908	1,733,566.092	39.832132828	-80.668195411
11,164.00	19.71	47.77	10,927.53	1,266.81	1,254.34	14,465,790.302	1,733,577.250	39.832161259	-80.668155528
11,209.00	21.74	49.67	10,969.62	1,277.31	1,266.31	14,465,800.797	1,733,589.223	39.832189959	-80.668112740
11,256.00	24.70	51.12	11,012.81	1,289.11	1,280.59	14,465,812.597	1,733,603.507	39.832222128	-80.668061707
11,302.00	28.28	54.60	11,053.97	1,301.46	1,296.96	14,465,824.947	1,733,619.877	39.832255967	-80.668003231
11,349.00	31.99	56.14	11,094.61	1,314.85	1,316.39	14,465,838.338	1,733,639.298	39.832292544	-80.667933877
11,396.00	36.06	56.72	11,133.56	1,329.38	1,338.30	14,465,852.871	1,733,661.210	39.832332232	-80.667855635
11,443.00	39.33	57.33	11,170.74	1,345.02	1,362.41	14,465,868.506	1,733,685.318	39.832374922	-80.667769554
11,489.00	42.16	56.89	11,205.59	1,361.32	1,387.61	14,465,884.811	1,733,710.525	39.832419441	-80.667679550
11,536.00	44.94	57.86	11,239.65	1,378.77	1,414.89	14,465,902.261	1,733,737.798	39.832467086	-80.667582170
11,583.00	47.99	58.35	11,272.02	1,396.77	1,443.81	14,465,920.259	1,733,766.725	39.832516216	-80.667478894
11,630.00	50.46	59.93	11,302.72	1,415.02	1,474.37	14,465,938.505	1,733,797.279	39.832566013	-80.667369820
11,677.00	52.72	61.52	11,331.92	1,433.02	1,506.49	14,465,956.505	1,733,829.403	39.832615117	-80.667255151
11,724.00	55.10	62.84	11,359.60	1,450.73	1,540.08	14,465,974.222	1,733,862.993	39.832663430	-80.667135268
11,771.00	57.05	65.13	11,385.83	1,467.83	1,575.13	14,465,991.317	1,733,898.039	39.832710017	-80.667010206
11,818.00	59.17	65.93	11,410.66	1,484.35	1,611.45	14,466,007.843	1,733,934.360	39.832755029	-80.666880612
11,864.00	61.03	67.47	11,433.59	1,500.12	1,648.07	14,466,023.610	1,733,970.983	39.832797954	-80.666749948
11,911.00	63.37	68.00	11,455.51	1,515.87	1,686.55	14,466,039.359	1,734,009.457	39.832840812	-80.666612695
11,958.00	64.74	71.26	11,476.08	1,530.57	1,726.16	14,466,054.060	1,734,049.071	39.832880779	-80.666471392
12,005.00	64.83	76.19	11,496.11	1,542.48	1,766.96	14,466,065.971	1,734,089.872	39.832913072	-80.666325900
12,052.00	65.18	80.25	11,515.98	1,551.18	1,808.65	14,466,074.663	1,734,131.561	39.832936515	-80.666177284
12,099.00	66.95	83.20	11,535.05	1,557.35	1,851.15	14,466,080.837	1,734,174.065	39.832953034	-80.666025800

<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Hudson S-15 HU (slot O)
<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-15 HU (slot O)	<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
12,145.00	68.63	86.15	11,552.44	1,561.29	1,893.55	14,466,084.783	1,734,216.461	39.832963434	-80.665974730
12,192.00	70.66	88.80	11,568.79	1,563.23	1,937.57	14,466,086.717	1,734,260.477	39.832968294	-80.665717920
12,239.00	71.72	92.01	11,583.94	1,562.91	1,982.05	14,466,086.398	1,734,304.958	39.832966963	-80.665559480
12,286.00	72.21	95.89	11,598.50	1,559.83	2,026.62	14,466,083.318	1,734,349.532	39.832958047	-80.665400746
12,333.00	72.07	100.21	11,612.92	1,553.57	2,070.90	14,466,077.056	1,734,393.814	39.832940395	-80.665243095
12,380.00	71.94	104.66	11,627.45	1,543.95	2,114.54	14,466,067.434	1,734,437.453	39.832913522	-80.665087778
12,427.00	71.72	109.02	11,642.11	1,531.01	2,157.27	14,466,054.502	1,734,480.182	39.832877568	-80.664935747
12,474.00	72.07	113.08	11,656.72	1,514.97	2,198.95	14,466,038.459	1,734,521.863	39.832833081	-80.664787493
12,521.00	73.40	117.44	11,670.68	1,495.82	2,239.53	14,466,019.307	1,734,562.438	39.832780067	-80.664643216
12,568.00	74.68	121.28	11,683.60	1,473.66	2,278.90	14,465,997.152	1,734,601.811	39.832718820	-80.664503266
12,615.00	76.18	123.74	11,695.43	1,449.22	2,317.25	14,465,972.705	1,734,640.165	39.832651286	-80.664366974
12,662.00	77.29	126.21	11,706.22	1,422.99	2,354.73	14,465,946.483	1,734,677.644	39.832578889	-80.664233822
12,709.00	77.38	129.52	11,716.52	1,394.85	2,390.93	14,465,918.340	1,734,713.840	39.832501230	-80.664105267
12,756.00	78.17	133.48	11,726.48	1,364.42	2,425.32	14,465,887.909	1,734,748.233	39.832417303	-80.663983164
12,804.00	79.32	137.14	11,735.85	1,330.96	2,458.42	14,465,854.445	1,734,781.332	39.832325063	-80.663865713
12,851.00	80.82	140.22	11,743.96	1,296.19	2,488.98	14,465,819.679	1,734,811.893	39.832229272	-80.663757321
12,898.00	82.94	143.04	11,750.60	1,259.71	2,517.86	14,465,783.204	1,734,840.768	39.832128805	-80.663654956
12,945.00	85.37	145.29	11,755.38	1,221.81	2,545.23	14,465,745.303	1,734,868.136	39.832024438	-80.663557980
12,993.00	87.98	147.36	11,758.17	1,181.94	2,571.79	14,465,705.430	1,734,894.701	39.831914863	-80.663463888
13,040.00	88.56	150.36	11,759.59	1,141.74	2,596.08	14,465,665.225	1,734,918.992	39.831804001	-80.663377902
13,087.00	88.69	151.46	11,760.71	1,100.68	2,618.93	14,465,624.167	1,734,941.836	39.831691008	-80.663297084
13,181.00	89.17	152.21	11,762.47	1,017.82	2,663.29	14,465,541.312	1,734,986.197	39.831463013	-80.663140183
13,276.00	88.20	151.51	11,764.65	934.08	2,708.08	14,465,457.565	1,735,030.988	39.831232561	-80.662981759
13,370.00	88.42	150.93	11,767.42	851.72	2,753.32	14,465,375.213	1,735,076.225	39.831005936	-80.662821736
13,464.00	88.51	150.10	11,769.94	769.93	2,799.56	14,465,293.418	1,735,122.474	39.830780829	-80.662658097
13,559.00	88.47	150.05	11,772.44	687.62	2,846.94	14,465,211.112	1,735,169.850	39.830554308	-80.662490453
13,653.00	88.33	149.87	11,775.07	606.28	2,893.98	14,465,129.770	1,735,216.888	39.830330438	-80.662324000
13,747.00	88.78	150.27	11,777.44	524.84	2,940.86	14,465,048.333	1,735,263.773	39.830106307	-80.662158094
13,842.00	88.73	150.01	11,779.50	442.47	2,988.15	14,464,965.965	1,735,311.061	39.829879613	-80.661960769
13,935.00	89.17	149.39	11,781.21	362.19	3,035.06	14,464,885.683	1,735,357.973	39.829658655	-80.661824752
14,030.00	89.22	149.70	11,782.54	280.31	3,083.21	14,464,803.799	1,735,406.120	39.829433282	-80.661654361
14,123.00	89.13	149.83	11,783.88	199.97	3,130.04	14,464,723.458	1,735,452.945	39.829212163	-80.661488660
14,216.00	89.44	149.48	11,785.04	119.71	3,177.02	14,464,643.206	1,735,499.926	39.828991284	-80.661322405
14,309.00	89.62	149.21	11,785.80	39.71	3,224.43	14,464,563.206	1,735,547.342	39.828771091	-80.661154596
14,404.00	89.53	149.13	11,786.51	-41.86	3,273.12	14,464,481.632	1,735,596.027	39.828546565	-80.660982288
14,497.00	89.26	149.08	11,787.49	-121.66	3,320.87	14,464,401.833	1,735,643.776	39.828326921	-80.660813290
14,591.00	88.73	150.01	11,789.14	-202.68	3,368.51	14,464,320.816	1,735,691.413	39.828103934	-80.660644711
14,685.00	89.04	149.08	11,790.97	-283.69	3,416.14	14,464,239.802	1,735,739.049	39.827880955	-80.660476139
14,780.00	89.13	149.17	11,792.49	-365.22	3,464.89	14,464,158.275	1,735,787.793	39.827656555	-80.660303624
14,875.00	88.86	149.74	11,794.15	-447.02	3,513.16	14,464,076.471	1,735,836.066	39.827431400	-80.660132794
14,968.00	89.44	149.52	11,795.53	-527.25	3,560.17	14,463,996.242	1,735,883.079	39.827210583	-80.659966429
15,063.00	89.44	149.57	11,796.46	-609.14	3,608.32	14,463,914.354	1,735,931.229	39.826985195	-80.659796042
15,157.00	89.35	149.65	11,797.45	-690.22	3,655.87	14,463,833.274	1,735,978.779	39.826762035	-80.659627778
15,251.00	89.31	149.57	11,798.55	-771.30	3,703.42	14,463,752.195	1,736,026.329	39.826538877	-80.659459519
15,346.00	89.57	149.65	11,799.48	-853.24	3,751.48	14,463,670.252	1,736,074.385	39.826313340	-80.659289467
15,440.00	89.17	148.99	11,800.51	-934.08	3,799.44	14,463,589.415	1,736,122.345	39.826090841	-80.659119746
15,534.00	89.13	149.39	11,801.91	-1,014.80	3,847.58	14,463,508.690	1,736,170.485	39.825868649	-80.658949380
15,628.00	89.57	150.05	11,802.97	-1,095.97	3,894.97	14,463,427.520	1,736,217.879	39.825645242	-80.658781681
15,722.00	89.31	150.36	11,803.89	-1,177.54	3,941.88	14,463,345.951	1,736,264.585	39.825420744	-80.658616438
15,817.00	88.91	150.54	11,805.37	-1,260.18	3,988.52	14,463,263.318	1,736,311.432	39.825193325	-80.658450710
15,911.00	89.00	150.54	11,807.08	-1,342.01	4,034.75	14,463,181.486	1,736,357.655	39.824968111	-80.658287194
16,006.00	89.31	149.87	11,808.48	-1,424.44	4,081.95	14,463,099.054	1,736,404.854	39.824741238	-80.658120207
16,100.00	89.09	150.23	11,809.80	-1,505.88	4,128.87	14,463,017.615	1,736,451.778	39.824517095	-80.657954190
16,195.00	89.13	149.87	11,811.27	-1,588.18	4,176.29	14,462,935.311	1,736,499.201	39.824290573	-80.657786411





Survey Report - Geographic



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Hudson S-15 HU (slot O)
<b>Project:</b>	Marshall County, West Virginia NAD83 UTM 17N	<b>TVD Reference:</b>	RKB=1346+33 @ 1379.00ft (Nabors XD8)
<b>Site:</b>	Hudson Alt North	<b>MD Reference:</b>	RKB=1346+33 @ 1379.00ft (Nabors X08)
<b>Well:</b>	Hudson S-15 HU (slot O)	<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

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
16,289.00	88.82	150.27	11,812.95	-1,669.63	4,223.19	14,462,853.861	1,736,546.094	39.824066359	-80.657620508
16,383.00	89.22	149.83	11,814.56	-1,751.07	4,270.11	14,462,772.426	1,736,593.015	39.823842267	-80.657454502
16,477.00	89.17	150.14	11,815.88	-1,832.45	4,317.13	14,462,691.040	1,736,640.032	39.823618269	-80.657288160
16,570.00	89.09	150.54	11,817.29	-1,913.26	4,363.14	14,462,610.235	1,736,686.048	39.823395875	-80.657125374
16,664.00	88.60	150.23	11,819.19	-1,994.96	4,409.58	14,462,528.532	1,736,732.490	39.823171010	-80.656961084
16,758.00	88.78	150.18	11,821.34	-2,076.52	4,456.28	14,462,446.979	1,736,779.186	39.822946556	-80.656795887
16,852.00	88.86	149.83	11,823.27	-2,157.91	4,503.26	14,462,365.586	1,736,826.169	39.822722538	-80.656629689
16,946.00	88.78	150.49	11,825.21	-2,239.43	4,550.03	14,462,284.067	1,736,872.931	39.822498174	-80.656464240
17,040.00	89.31	150.40	11,826.78	-2,321.19	4,596.38	14,462,202.310	1,736,919.291	39.822273161	-80.656300248
17,134.00	89.62	149.43	11,827.65	-2,402.52	4,643.50	14,462,120.978	1,736,966.409	39.822049308	-80.656133551
17,229.00	89.40	149.43	11,828.47	-2,484.31	4,691.82	14,462,039.186	1,737,014.724	39.821824177	-80.655962600
17,323.00	89.31	149.52	11,829.52	-2,565.28	4,739.56	14,461,958.219	1,737,062.465	39.821601319	-80.655793682
17,417.00	89.09	150.05	11,830.84	-2,646.50	4,786.86	14,461,876.998	1,737,109.765	39.821377767	-80.655628337
17,511.00	89.79	149.74	11,831.76	-2,727.81	4,834.00	14,461,795.682	1,737,156.911	39.821153958	-80.655459543
17,605.00	89.13	150.10	11,832.64	-2,809.15	4,881.12	14,461,714.346	1,737,204.022	39.820930092	-80.655292876
17,699.00	89.22	149.65	11,834.00	-2,890.45	4,928.29	14,461,633.051	1,737,251.195	39.820706338	-80.655125991
17,793.00	89.13	150.05	11,835.35	-2,971.72	4,975.50	14,461,551.777	1,737,298.403	39.820482640	-80.654958980
17,887.00	89.09	150.27	11,836.81	-3,053.25	5,022.26	14,461,470.249	1,737,345.169	39.820258253	-80.654793545
17,981.00	88.86	149.65	11,838.49	-3,134.61	5,069.31	14,461,388.889	1,737,392.218	39.820034321	-80.654627104
18,076.00	89.04	149.83	11,840.23	-3,216.65	5,117.18	14,461,306.847	1,737,440.083	39.819808507	-80.654457768
18,170.00	89.26	149.52	11,841.63	-3,297.78	5,164.63	14,461,225.718	1,737,487.538	39.819585204	-80.654289877
18,263.00	89.00	150.01	11,843.04	-3,378.12	5,211.46	14,461,145.379	1,737,534.363	39.819364077	-80.654124225
18,356.00	89.13	149.48	11,844.56	-3,458.44	5,258.31	14,461,065.058	1,737,581.214	39.819142999	-80.653958477
18,450.00	88.82	150.01	11,846.24	-3,539.62	5,305.66	14,460,983.875	1,737,628.568	39.818919549	-80.653790952
18,544.00	89.44	149.79	11,847.66	-3,620.94	5,352.80	14,460,902.560	1,737,675.704	39.818695740	-80.653624206
18,638.00	89.31	149.70	11,848.69	-3,702.13	5,400.16	14,460,821.369	1,737,723.063	39.818472267	-80.653456666
18,733.00	89.62	149.52	11,849.58	-3,784.07	5,448.22	14,460,739.426	1,737,771.120	39.818248720	-80.653286653
18,827.00	89.35	150.27	11,850.42	-3,865.39	5,495.36	14,460,658.110	1,737,818.267	39.818022906	-80.653119872
18,922.00	89.57	150.54	11,851.32	-3,947.99	5,542.28	14,460,575.508	1,737,865.182	39.817795562	-80.652953936
19,016.00	89.66	149.79	11,851.95	-4,029.53	5,589.04	14,460,493.969	1,737,911.946	39.817571139	-80.652788524
19,111.00	89.44	150.05	11,852.69	-4,111.73	5,636.65	14,460,411.766	1,737,959.559	39.817344883	-80.652620098
19,204.00	89.57	149.92	11,853.50	-4,192.26	5,683.17	14,460,331.241	1,738,006.078	39.817123247	-80.652455546
19,299.00	89.44	149.13	11,854.32	-4,274.13	5,731.35	14,460,249.369	1,738,054.256	39.816897894	-80.652285105
19,391.00	89.17	149.83	11,855.43	-4,353.38	5,778.07	14,460,170.122	1,738,100.973	39.816679764	-80.652119832
19,486.00	89.35	149.43	11,856.66	-4,435.34	5,826.10	14,460,088.165	1,738,149.000	39.816454179	-80.651949939
19,585.00	89.26	150.18	11,857.86	-4,520.90	5,875.88	14,460,002.605	1,738,198.787	39.816218679	-80.651773819
19,679.00	89.22	150.89	11,859.11	-4,602.73	5,922.12	14,459,920.771	1,738,245.020	39.815993450	-80.651610308
19,772.00	89.31	151.51	11,860.30	-4,684.22	5,966.92	14,459,839.281	1,738,289.819	39.815769183	-80.651451902
19,866.00	89.35	151.46	11,861.40	-4,766.81	6,011.79	14,459,756.690	1,738,334.691	39.815541888	-80.651293253
19,960.00	89.35	150.71	11,862.47	-4,849.09	6,057.23	14,459,674.415	1,738,380.138	39.815315453	-80.651132553
20,055.00	89.22	151.20	11,863.65	-4,932.13	6,103.35	14,459,591.369	1,738,426.256	39.815086867	-80.650969473
20,149.00	89.48	150.32	11,864.72	-5,014.15	6,149.26	14,459,509.352	1,738,472.168	39.814861169	-80.650807112
20,243.00	89.35	150.49	11,865.68	-5,095.88	6,195.69	14,459,427.620	1,738,518.589	39.814636216	-80.650642939
20,338.00	89.22	150.45	11,866.87	-5,178.53	6,242.51	14,459,344.968	1,738,565.409	39.814408731	-80.650477359
20,432.00	89.22	150.32	11,868.14	-5,260.25	6,288.95	14,459,263.255	1,738,611.857	39.814183831	-80.650313092
20,526.00	89.48	149.61	11,869.21	-5,341.62	6,336.00	14,459,181.883	1,738,658.903	39.813959861	-80.650146689
20,621.00	89.40	149.79	11,870.14	-5,423.64	6,383.93	14,459,099.865	1,738,706.831	39.813734104	-80.649977158
20,716.00	89.26	149.74	11,871.25	-5,505.71	6,431.76	14,459,017.794	1,738,754.664	39.813508204	-80.649807964
20,809.00	89.13	150.58	11,872.56	-5,586.37	6,478.03	14,458,937.133	1,738,800.934	39.813286193	-80.649644319
20,904.00	89.13	150.18	11,874.00	-5,668.95	6,524.98	14,458,854.557	1,738,847.882	39.813058916	-80.649478289
20,998.00	89.40	149.87	11,875.21	-5,750.37	6,571.94	14,458,773.137	1,738,894.842	39.812834813	-80.649312198
21,091.00	89.17	150.45	11,876.37	-5,831.03	6,618.21	14,458,692.474	1,738,941.113	39.812612795	-80.649148553
21,186.00	89.22	150.76	11,877.70	-5,913.79	6,664.83	14,458,609.713	1,738,987.737	39.812395013	-80.648983681
21,280.00	89.17	151.02	11,879.02	-5,995.91	6,710.56	14,458,527.595	1,739,033.462	39.812159004	-80.648822002



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Hudson S-15 HU (slot O)
<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-15 HU (slot O)	<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
21,374.00	89.26	150.98	11,880.31	-6,078.12	6,756.13	14,458,445.389	1,739,079.030	39.811932755	-80.648660886
21,468.00	90.23	150.98	11,880.73	-6,160.31	6,801.73	14,458,363.192	1,739,124.630	39.811706533	-80.648499657
21,562.00	89.53	149.87	11,880.92	-6,242.05	6,848.12	14,458,281.442	1,739,171.023	39.811481527	-80.648335596
21,655.00	89.48	150.05	11,881.73	-6,322.57	6,894.68	14,458,200.937	1,739,217.578	39.811259940	-80.648170945
21,750.00	89.17	150.62	11,882.85	-6,405.11	6,941.69	14,458,118.395	1,739,264.592	39.811032751	-80.648004686
21,843.00	89.35	150.62	11,884.05	-6,486.14	6,987.31	14,458,037.363	1,739,310.214	39.810809726	-80.647843366
21,938.00	89.57	149.30	11,884.94	-6,568.38	7,034.87	14,457,955.129	1,739,357.788	39.810583380	-80.647675183
22,033.00	89.57	149.39	11,885.66	-6,650.10	7,083.30	14,457,873.408	1,739,406.204	39.810358430	-80.647503854
22,127.00	89.35	148.42	11,886.54	-6,730.59	7,131.85	14,457,792.919	1,739,454.748	39.810136864	-80.647332124
22,221.00	89.22	147.23	11,887.72	-6,810.14	7,181.90	14,457,713.363	1,739,504.799	39.809917842	-80.647155017
22,316.00	89.09	146.61	11,889.12	-6,889.74	7,233.74	14,457,633.771	1,739,556.645	39.809698702	-80.646971519
22,410.00	89.40	147.01	11,890.36	-6,968.39	7,285.20	14,457,555.113	1,739,608.098	39.809482133	-80.646789410
22,504.00	89.53	147.98	11,891.23	-7,047.66	7,335.71	14,457,475.843	1,739,658.608	39.809263892	-80.646610866
22,598.00	89.35	148.99	11,892.15	-7,127.79	7,384.84	14,457,395.713	1,739,707.740	39.809043303	-80.646436841
22,691.00	89.31	150.40	11,893.24	-7,208.08	7,431.76	14,457,315.429	1,739,754.664	39.808822315	-80.646270884
22,785.00	89.35	151.55	11,894.34	-7,290.26	7,477.37	14,457,233.242	1,739,800.268	39.808596115	-80.646109655
22,879.00	89.48	153.36	11,895.30	-7,373.60	7,520.83	14,457,149.905	1,739,843.734	39.808366780	-80.645958057
22,972.00	89.44	154.28	11,896.17	-7,457.06	7,561.86	14,457,066.450	1,739,884.762	39.808137149	-80.645811139
23,065.00	89.88	149.96	11,896.73	-7,539.24	7,605.34	14,456,984.266	1,739,928.240	39.807910979	-80.645657485
23,160.00	89.48	149.39	11,897.26	-7,621.24	7,653.30	14,456,902.267	1,739,976.205	39.807685268	-80.645487851
23,255.00	89.09	149.21	11,898.44	-7,702.92	7,701.80	14,456,820.587	1,740,024.702	39.807460430	-80.645316316
23,348.00	89.22	149.65	11,899.81	-7,782.98	7,749.10	14,456,740.523	1,740,071.996	39.807240039	-80.645149047
23,443.00	89.35	149.92	11,901.00	-7,865.07	7,796.90	14,456,658.436	1,740,119.800	39.807014088	-80.644979988
23,537.00	89.57	149.65	11,901.89	-7,946.30	7,844.20	14,456,577.210	1,740,167.103	39.806790508	-80.644812704
23,631.00	89.62	149.79	11,902.55	-8,027.47	7,891.60	14,456,496.037	1,740,214.499	39.806567070	-80.644645089
23,725.00	89.75	148.38	11,903.07	-8,108.11	7,939.89	14,456,415.395	1,740,262.791	39.806345082	-80.644474277
23,818.00	90.46	148.99	11,902.90	-8,187.56	7,988.23	14,456,335.944	1,740,311.126	39.806126364	-80.644303295
23,912.00	91.65	148.24	11,901.17	-8,267.80	8,037.17	14,456,255.713	1,740,360.071	39.805905497	-80.644130158
24,005.00	89.40	149.39	11,900.31	-8,347.35	8,085.32	14,456,176.161	1,740,408.220	39.805685504	-80.643959841
24,100.00	89.17	150.14	11,901.50	-8,429.42	8,133.15	14,456,094.092	1,740,456.053	39.805460599	-80.643790689
24,194.00	88.56	150.89	11,903.36	-8,511.23	8,179.41	14,456,012.283	1,740,502.310	39.805235428	-80.643627146
24,287.00	88.64	150.32	11,905.63	-8,592.23	8,225.04	14,455,931.282	1,740,547.942	39.805012481	-80.643465815
24,381.00	88.51	150.49	11,907.97	-8,673.94	8,271.45	14,455,849.570	1,740,594.352	39.804787573	-80.643301729
24,476.00	88.56	150.54	11,910.40	-8,756.61	8,318.20	14,455,766.901	1,740,641.095	39.804560033	-80.643136469
24,570.00	88.56	150.36	11,912.76	-8,838.36	8,364.54	14,455,685.154	1,740,687.439	39.804335029	-80.642972617
24,664.00	88.51	150.36	11,915.17	-8,920.03	8,411.01	14,455,603.481	1,740,733.912	39.804110226	-80.642808310
24,758.00	88.60	150.14	11,917.54	-9,001.61	8,457.64	14,455,521.896	1,740,780.541	39.803885665	-80.642643443
24,852.00	89.17	149.48	11,919.37	-9,082.85	8,504.90	14,455,440.663	1,740,827.801	39.803662060	-80.642476326
24,946.00	89.04	150.36	11,920.83	-9,164.18	8,552.01	14,455,359.333	1,740,874.909	39.803438193	-80.642309756
25,040.00	88.91	150.27	11,922.51	-9,245.83	8,598.55	14,455,277.683	1,740,921.453	39.803213451	-80.642145197
25,135.00	89.13	150.18	11,924.14	-9,328.27	8,645.72	14,455,195.237	1,740,968.622	39.802986517	-80.641978424
25,229.00	88.86	150.49	11,925.79	-9,409.94	8,692.24	14,455,113.570	1,741,015.138	39.802761729	-80.641813968
25,324.00	88.91	150.27	11,927.64	-9,492.51	8,739.18	14,455,031.000	1,741,062.082	39.802534457	-80.641648000
25,419.00	89.44	150.01	11,929.00	-9,574.89	8,786.48	14,454,948.621	1,741,109.376	39.802307705	-80.641480787
25,513.00	89.35	149.96	11,930.00	-9,656.28	8,833.50	14,454,867.231	1,741,156.395	39.802083673	-80.641314541
25,608.00	89.57	149.65	11,930.89	-9,738.39	8,881.27	14,454,785.125	1,741,204.172	39.801857664	-80.641145604
25,703.00	89.26	149.79	11,931.86	-9,820.42	8,929.17	14,454,703.090	1,741,252.071	39.801631850	-80.640976234
25,796.00	89.75	149.26	11,932.67	-9,900.57	8,976.34	14,454,622.942	1,741,299.235	39.801411224	-80.640809456
25,890.00	89.35	149.79	11,933.40	-9,981.58	9,024.01	14,454,541.931	1,741,346.906	39.801186224	-80.640640884
25,985.00	89.44	149.21	11,934.41	-10,063.43	9,072.22	14,454,460.081	1,741,395.119	39.800962914	-80.640470396
26,079.00	89.44	148.91	11,935.33	-10,144.05	9,120.55	14,454,379.461	1,741,443.446	39.800740979	-80.640299487
26,173.00	88.95	149.48	11,936.65	-10,224.78	9,168.68	14,454,298.732	1,741,491.580	39.800518746	-80.640129268
26,268.00	89.00	149.96	11,938.35	-10,306.81	9,216.58	14,454,216.706	1,741,539.474	39.800292955	-80.639959924
26,362.00	89.17	149.30	11,939.85	-10,387.90	9,264.09	14,454,135.616	1,741,586.992	39.800069737	-80.639791904



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Hudson S-15 HU (slot O)
<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-15 HU (slot O)	<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
26,456.00	88.86	151.77	11,941.46	-10,469.72	9,310.32	14,454,053.793	1,741,633.219	39.799844521	-80.639628491
26,551.00	89.13	151.77	11,943.13	-10,553.41	9,355.25	14,453,970.106	1,741,678.148	39.799614200	-80.639469729
26,645.00	88.91	152.08	11,944.74	-10,636.33	9,399.48	14,453,887.179	1,741,722.381	39.799385974	-80.639313437
26,740.00	89.70	150.93	11,945.89	-10,719.82	9,444.80	14,453,803.696	1,741,767.699	39.799156208	-80.639153288
26,834.00	89.31	151.51	11,946.70	-10,802.20	9,490.06	14,453,721.311	1,741,812.953	39.798929459	-80.638993353
26,928.00	89.17	151.73	11,947.95	-10,884.90	9,534.73	14,453,638.616	1,741,857.629	39.798701864	-80.638835482
27,022.00	89.13	151.15	11,949.34	-10,967.45	9,579.67	14,453,556.064	1,741,902.563	39.798474658	-80.638676691
27,117.00	89.22	151.99	11,950.71	-11,050.98	9,624.89	14,453,472.530	1,741,947.786	39.798244754	-80.638516867
27,211.00	89.40	152.08	11,951.84	-11,134.00	9,668.97	14,453,389.512	1,741,991.862	39.798016279	-80.638361158
27,305.00	89.00	149.92	11,953.16	-11,216.20	9,714.53	14,453,307.311	1,742,037.427	39.797790030	-80.638200120
27,398.00	89.35	148.95	11,954.50	-11,296.27	9,761.82	14,453,227.242	1,742,084.713	39.797569619	-80.638032922
27,492.00	89.48	148.60	11,955.45	-11,376.65	9,810.54	14,453,146.864	1,742,133.440	39.797348339	-80.637860602
27,587.00	89.40	148.55	11,956.38	-11,457.71	9,860.07	14,453,065.802	1,742,182.969	39.797125174	-80.637685437
27,681.00	89.40	149.13	11,957.37	-11,538.15	9,908.71	14,452,985.369	1,742,231.604	39.796903745	-80.637513445
27,775.00	89.44	149.92	11,958.32	-11,619.15	9,956.38	14,452,904.360	1,742,279.275	39.796680745	-80.637344898
27,869.00	89.35	149.48	11,959.31	-11,700.31	10,003.80	14,452,823.205	1,742,326.697	39.796467348	-80.637177236
27,963.00	89.48	149.79	11,960.27	-11,781.41	10,051.32	14,452,742.105	1,742,374.212	39.796234097	-80.637009246
28,058.00	89.57	149.48	11,961.06	-11,863.38	10,099.34	14,452,660.140	1,742,422.234	39.796008467	-80.636839467
28,152.00	89.17	149.08	11,962.09	-11,944.18	10,147.35	14,452,579.336	1,742,470.250	39.795786025	-80.636669691
28,247.00	88.60	149.70	11,963.94	-12,025.93	10,195.72	14,452,497.590	1,742,518.613	39.795560994	-80.636498693
28,341.00	88.47	150.10	11,966.34	-12,107.22	10,242.84	14,452,416.293	1,742,565.740	39.795337207	-80.636332093
28,436.00	88.29	149.87	11,969.03	-12,189.45	10,290.35	14,452,334.066	1,742,613.242	39.795110863	-80.636164170
28,530.00	89.04	149.52	11,971.22	-12,270.58	10,337.77	14,452,252.934	1,742,660.661	39.794887526	-80.635996527
28,625.00	88.95	149.13	11,972.89	-12,352.28	10,386.22	14,452,171.238	1,742,709.120	39.794662633	-80.635825195
28,718.00	89.40	149.21	11,974.23	-12,432.13	10,433.88	14,452,091.390	1,742,756.776	39.794442814	-80.635656691
28,812.00	89.40	149.39	11,975.21	-12,512.95	10,481.87	14,452,010.568	1,742,804.765	39.794220323	-80.635487022
28,906.00	88.91	149.74	11,976.60	-12,593.99	10,529.48	14,451,929.530	1,742,852.376	39.793997241	-80.635318699
29,000.00	88.51	149.39	11,978.71	-12,675.01	10,577.09	14,451,848.504	1,742,899.980	39.793774191	-80.635150402
29,095.00	88.64	149.52	11,981.07	-12,756.80	10,625.35	14,451,766.713	1,742,948.245	39.793549033	-80.634979763
29,189.00	88.73	148.91	11,983.23	-12,837.54	10,673.45	14,451,685.980	1,742,996.343	39.793326782	-80.634809707
29,284.00	88.56	149.26	11,985.48	-12,919.02	10,722.24	14,451,604.500	1,743,045.137	39.793102471	-80.634637185
29,379.00	88.38	149.61	11,988.02	-13,000.79	10,770.54	14,451,522.729	1,743,093.429	39.792877369	-80.634466457
29,473.00	89.22	148.60	11,989.98	-13,081.43	10,818.79	14,451,442.086	1,743,141.683	39.792655364	-80.634295846
29,568.00	89.40	151.51	11,991.13	-13,163.73	10,866.20	14,451,359.783	1,743,189.095	39.792428808	-80.634128257
29,663.00	89.57	151.55	11,991.98	-13,247.24	10,911.49	14,451,276.276	1,743,234.380	39.792198968	-80.633968263
29,758.00	89.44	150.80	11,992.80	-13,330.47	10,957.29	14,451,193.050	1,743,280.181	39.791968897	-80.633806427
29,853.00	89.00	151.28	11,994.10	-13,413.58	11,003.28	14,451,109.938	1,743,326.175	39.791741134	-80.633634391
29,946.00	89.48	149.03	11,995.33	-13,494.25	11,049.52	14,451,029.264	1,743,372.415	39.791519065	-80.633460468
30,040.00	89.31	148.86	11,996.32	-13,574.80	11,097.97	14,450,948.721	1,743,420.868	39.791297328	-80.633291554
30,134.00	88.82	148.30	11,997.86	-13,655.43	11,146.27	14,450,868.091	1,743,469.162	39.791075356	-80.633138408
30,228.00	88.78	149.21	11,999.82	-13,736.20	11,194.31	14,450,787.320	1,743,517.206	39.790853011	-80.632968557
30,322.00	88.60	150.49	12,001.97	-13,817.46	11,241.51	14,450,706.060	1,743,564.405	39.790629310	-80.632801719
30,424.00	88.64	151.64	12,004.43	-13,906.70	11,290.85	14,450,616.821	1,743,613.739	39.790383681	-80.632627400
<b>Survey @ 30424.00 MD 12004.43 TVD</b>									
30,457.00	88.64	151.64	12,005.21	-13,935.73	11,306.52	14,450,587.789	1,743,629.410	39.790303778	-80.632572038
<b>Survey Proj. to 30457.00 MD 12005.21 TVD</b>									



Survey Report - Geographic



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Hudson S-15 HU (slot O)
<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 All North	<b>MD Reference:</b>	RKB=1346+33 @ 1379.00ft (Nabors X08)
<b>Well:</b>	Hudson S-15 HU (slot O)	<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

Design Annotations				
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
178.00	178.00	0.40	-0.55	MWD surveys
30,424.00	12,004.43	-13,906.70	11,290.85	Survey @ 30424.00 MD 12004.43 TVD
30,457.00	12,005.21	-13,935.73	11,306.52	Survey Proj. to 30457.00 MD 12005.21 TVD