



Well: Van Winkle N-16 HU (slot E)

Site: Van Winkle

Project: Marshall County, West Virginia NAD83 UTM 17N

Design: rev6

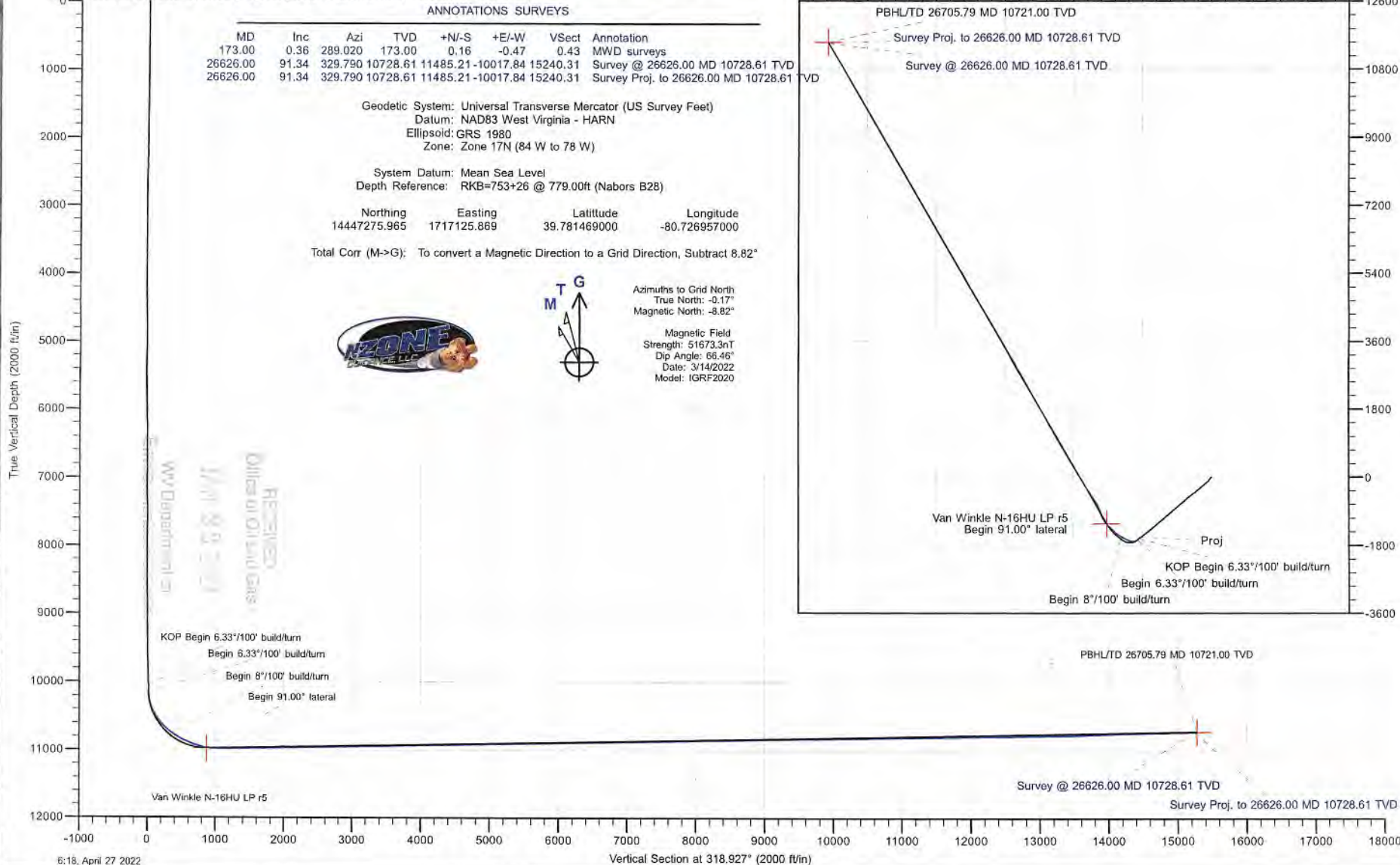
Rig: Nabors B28

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSect	Annotation
1	10347.00	27.56	232.960	9906.21	-1567.69	-1817.87	0.00	0.00	12.52	Survey @ 10347.00 MD 9906.21 TVD
2	10405.00	27.56	232.960	9957.63	-1583.86	-1839.29	0.00	0.00	14.41	Proj
3	10521.00	27.56	232.960	10060.47	-1616.19	-1882.13	0.00	0.00	18.18	KOP Begin 6.33°/100' build/turn
4	10623.51	33.28	226.879	10148.85	-1649.73	-1921.63	6.33	-30.97	18.85	Begin 6.33°/100' build/turn
5	11420.29	50.00	303.127	10779.20	-1631.18	-2365.77	6.33	105.08	324.63	Begin 8°/100' build/turn
6	12018.46	91.00	330.156	10977.90	-1222.55	-2727.75	8.00	37.79	870.51	Begin 91.00° lateral
7	26705.79	91.00	330.156	10721.00	11515.10	-10035.55	0.00		0.0015274.48	PBHL/TD 26705.79 MD 10721.00 TVD

DESIGN TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
Van Winkle N-16HU PBHL r5 - plan hits target center	10721.00	11515.10	-10035.55	1707090.338	1714398.120	39.813171000	-80.762569000
Van Winkle N-16HU LP r5 - plan misses target center by 0.10ft at 12018.47ft MD (10977.90 TVD, -1222.55 N, -2727.75 E)	10978.00	-1222.55	-2727.75	14447275.965	1717125.869	39.781469000	-80.726957000



ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	VSect	Annotation
173.00	0.36	289.020	173.00	0.16	-0.47	0.43	MWD surveys
26626.00	91.34	329.790	10728.61	11485.21	-10017.84	15240.31	Survey @ 26626.00 MD 10728.61 TVD
26626.00	91.34	329.790	10728.61	11485.21	-10017.84	15240.31	Survey Proj. to 26626.00 MD 10728.61 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=753+26 @ 779.00ft (Nabors B28)

Northing	Easting	Latitude	Longitude
14447275.965	1717125.869	39.781469000	-80.726957000

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.82°



Azimuths to Grid North
 True North: -0.17°
 Magnetic North: -8.82°
 Magnetic Field
 Strength: 51573.3nT
 Dip Angle: 66.46°
 Date: 3/14/2022
 Model: IGRF2020





Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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

Site	Van Winkle				
Site Position:		Northing:	14,447,369.493 usft	Latitude:	39.781725330
From:	Lat/Long	Easting:	1,717,188.440 usft	Longitude:	-80.726733270
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "		

Well	Van Winkle N-16 HU (slot E)					
Well Position	+N/-S	0.00 ft	Northing:	14,447,275.965 usft	Latitude:	39.781469000
	+E/-W	0.00 ft	Easting:	1,717,125.869 usft	Longitude:	-80.726957000
Position Uncertainty	0.00 ft		Wellhead Elevation:	ft	Ground Level:	753.00 ft
Grid Convergence:	0.17 °					

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	3/14/2022	-8.65	66.46	51,673.34856595

Design	Surveys Original Hole				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.00	0.00	0.00	318.929	

Survey Program	Date 4/27/2022				
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
14.00	525.00	MWD surf (Original Hole)	MWD	MWD - Standard	
569.00	2,185.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,215.00	4,429.00	MWD 2215-4429 MD (Original Hole)	MWD	MWD - Standard	
4,436.00	26,626.00	MWD (Original Hole)	MWD	MWD - Standard	
26,662.00	26,662.00	Projection (Original Hole)	MWD	MWD - Standard	

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	
0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14.00	0.00	0.000	14.00	0.00	0.00	0.00	0.00	0.00	0.00	
173.00	0.36	289.020	173.00	0.16	-0.47	0.43	0.23	0.23	0.00	
MWD surveys										
201.00	0.34	259.770	201.00	0.18	-0.64	0.55	0.63	-0.07	-104.46	
230.00	0.31	294.490	230.00	0.19	-0.79	0.67	0.68	-0.10	119.72	



Survey Report



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Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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)
259.00	0.34	250.360	259.00	0.20	-0.95	0.77	0.85	0.10	-152.17
288.00	0.19	252.760	288.00	0.15	-1.07	0.82	0.52	-0.52	8.28
318.00	0.34	251.880	318.00	0.11	-1.20	0.88	0.50	0.50	-2.93
350.00	0.42	250.440	350.00	0.04	-1.41	0.96	0.25	0.25	-4.50
381.00	0.56	240.460	381.00	-0.07	-1.64	1.03	0.53	0.45	-32.19
412.00	0.60	232.180	411.99	-0.24	-1.90	1.07	0.30	0.13	-26.71
444.00	0.98	211.450	443.99	-0.58	-2.18	0.99	1.47	1.19	-64.78
475.00	1.38	202.010	474.98	-1.15	-2.46	0.75	1.43	1.29	-30.45
507.00	1.52	207.470	506.97	-1.89	-2.80	0.42	0.61	0.44	17.06
525.00	1.59	212.150	524.97	-2.31	-3.04	0.26	0.81	0.39	26.00
569.00	1.49	211.630	568.95	-3.31	-3.67	-0.09	0.23	-0.23	-1.18
601.00	1.52	208.870	600.94	-4.04	-4.09	-0.36	0.25	0.09	-8.63
633.00	1.64	209.290	632.93	-4.81	-4.52	-0.66	0.38	0.38	1.31
664.00	1.68	205.710	663.91	-5.61	-4.93	-0.99	0.36	0.13	-11.55
696.00	1.66	203.210	695.90	-6.46	-5.32	-1.37	0.24	-0.06	-7.81
728.00	1.53	196.850	727.89	-7.29	-5.62	-1.80	0.69	-0.41	-19.88
760.00	1.46	195.710	759.88	-8.09	-5.86	-2.25	0.24	-0.22	-3.56
791.00	1.54	194.370	790.87	-8.87	-6.07	-2.70	0.28	0.26	-4.32
823.00	1.32	195.700	822.86	-9.65	-6.28	-3.15	0.70	-0.69	4.16
855.00	1.22	202.160	854.85	-10.32	-6.50	-3.50	0.55	-0.31	20.19
887.00	1.09	198.140	886.84	-10.92	-6.73	-3.81	0.48	-0.41	-12.56
918.00	0.89	200.710	917.84	-11.43	-6.90	-4.08	0.66	-0.65	8.29
950.00	0.60	204.170	949.84	-11.81	-7.06	-4.27	0.92	-0.91	10.81
982.00	0.45	197.190	981.83	-12.09	-7.17	-4.40	0.51	-0.47	-21.81
1,013.00	0.44	194.290	1,012.83	-12.32	-7.23	-4.53	0.08	-0.03	-9.35
1,045.00	0.46	187.590	1,044.83	-12.56	-7.28	-4.69	0.18	0.06	-20.94
1,076.00	0.45	176.790	1,075.83	-12.81	-7.29	-4.87	0.28	-0.03	-34.84
1,109.00	0.52	169.470	1,108.83	-13.08	-7.25	-5.10	0.28	0.21	-22.18
1,140.00	0.51	171.010	1,139.83	-13.36	-7.21	-5.34	0.06	-0.03	4.97
1,172.00	0.58	180.570	1,171.83	-13.66	-7.19	-5.58	0.36	0.22	29.88
1,205.00	0.64	200.170	1,204.83	-14.00	-7.25	-5.79	0.65	0.18	59.39
1,237.00	0.81	212.950	1,236.82	-14.36	-7.44	-5.94	0.73	0.53	39.94
1,269.00	1.09	222.880	1,268.82	-14.77	-7.77	-6.03	1.01	0.88	31.03
1,301.00	1.46	224.990	1,300.81	-15.28	-8.26	-6.09	1.17	1.16	6.59
1,333.00	1.91	228.540	1,332.80	-15.92	-8.95	-6.13	1.44	1.41	11.09
1,365.00	2.52	227.700	1,364.77	-16.75	-9.87	-6.14	1.91	1.91	-2.63
1,396.00	3.05	228.990	1,395.74	-17.75	-11.00	-6.16	1.72	1.71	4.16
1,428.00	3.63	227.790	1,427.68	-18.99	-12.39	-6.18	1.83	1.81	-3.75
1,459.00	4.09	226.710	1,458.61	-20.41	-13.92	-6.24	1.50	1.48	-3.48
1,491.00	4.42	224.940	1,490.52	-22.06	-15.62	-6.37	1.11	1.03	-5.53
1,522.00	4.69	224.840	1,521.43	-23.81	-17.36	-6.54	0.87	0.87	-0.32
1,554.00	4.93	223.060	1,553.31	-25.74	-19.22	-6.78	0.88	0.75	-5.56
1,585.00	5.20	222.530	1,584.19	-27.75	-21.08	-7.07	0.88	0.87	-1.71
1,617.00	5.48	221.610	1,616.05	-29.96	-23.07	-7.43	0.91	0.88	-2.88



Survey Report



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Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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)
1,649.00	5.45	221.810	1,647.91	-32.23	-25.10	-7.81	0.11	-0.09	0.63
1,680.00	5.38	221.440	1,678.77	-34.42	-27.05	-8.18	0.25	-0.23	-1.19
1,712.00	5.25	221.080	1,710.63	-36.65	-29.00	-8.58	0.42	-0.41	-1.13
1,744.00	5.28	220.830	1,742.50	-38.87	-30.92	-8.98	0.12	0.09	-0.78
1,775.00	5.49	220.480	1,773.36	-41.07	-32.82	-9.40	0.69	0.68	-1.13
1,807.00	5.82	220.250	1,805.20	-43.48	-34.86	-9.87	1.03	1.03	-0.72
1,838.00	5.37	221.310	1,836.06	-45.77	-36.84	-10.30	1.49	-1.45	3.42
1,870.00	4.36	222.840	1,867.94	-47.78	-38.65	-10.63	3.18	-3.16	4.78
1,901.00	3.84	224.770	1,898.86	-49.38	-40.18	-10.83	1.74	-1.68	6.23
1,932.00	3.53	226.810	1,929.80	-50.77	-41.61	-10.94	1.09	-1.00	6.58
1,963.00	3.56	227.630	1,960.74	-52.08	-43.02	-11.00	0.19	0.10	2.65
1,995.00	3.78	226.830	1,992.67	-53.47	-44.52	-11.06	0.71	0.69	-2.50
2,027.00	3.93	225.280	2,024.60	-54.96	-46.07	-11.17	0.57	0.47	-4.84
2,058.00	4.22	222.170	2,055.52	-56.55	-47.59	-11.37	1.18	0.94	-10.03
2,090.00	4.44	219.590	2,087.43	-58.38	-49.17	-11.71	0.92	0.69	-8.06
2,121.00	4.69	216.600	2,118.33	-60.32	-50.69	-12.17	1.11	0.81	-9.65
2,153.00	4.74	215.060	2,150.22	-62.45	-52.23	-12.77	0.43	0.16	-4.81
2,185.00	4.91	213.800	2,182.11	-64.68	-53.75	-13.45	0.63	0.53	-3.94
2,215.00	4.77	212.800	2,212.00	-66.79	-55.14	-14.13	0.54	-0.47	-3.33
2,247.00	5.10	211.910	2,243.88	-69.12	-56.61	-14.91	1.06	1.03	-2.78
2,278.00	5.30	210.230	2,274.76	-71.52	-58.06	-15.78	0.81	0.65	-5.42
2,310.00	5.35	209.110	2,306.62	-74.10	-59.53	-16.75	0.36	0.16	-3.50
2,341.00	5.51	208.920	2,337.48	-76.67	-60.95	-17.75	0.52	0.52	-0.61
2,373.00	5.61	212.950	2,369.33	-79.33	-62.55	-18.71	1.26	0.31	12.59
2,405.00	5.07	216.810	2,401.19	-81.77	-64.25	-19.44	2.03	-1.69	12.06
2,437.00	5.06	217.980	2,433.06	-84.01	-65.96	-20.00	0.32	-0.03	3.66
2,468.00	5.07	218.550	2,463.94	-86.16	-67.66	-20.51	0.17	0.03	1.84
2,500.00	5.12	218.200	2,495.82	-88.39	-69.42	-21.03	0.18	0.16	-1.09
2,532.00	5.21	218.770	2,527.69	-90.65	-71.21	-21.55	0.32	0.28	1.78
2,563.00	5.38	217.670	2,558.55	-92.89	-72.98	-22.08	0.64	0.55	-3.55
2,594.00	5.65	219.030	2,589.41	-95.23	-74.83	-22.63	0.97	0.87	4.39
2,626.00	5.51	220.490	2,621.26	-97.62	-76.82	-23.13	0.62	-0.44	4.56
2,657.00	4.79	223.620	2,652.13	-99.69	-78.68	-23.46	2.49	-2.32	10.10
2,689.00	4.74	223.870	2,684.02	-101.61	-80.52	-23.70	0.17	-0.16	0.78
2,721.00	4.59	225.140	2,715.92	-103.47	-82.34	-23.91	0.57	-0.47	3.97
2,753.00	4.66	224.970	2,747.81	-105.29	-84.17	-24.08	0.22	0.22	-0.53
2,783.00	4.70	225.000	2,777.71	-107.02	-85.90	-24.25	0.13	0.13	0.10
2,815.00	4.85	225.010	2,809.60	-108.91	-87.78	-24.43	0.47	0.47	0.03
2,847.00	4.93	224.450	2,841.49	-110.84	-89.70	-24.63	0.29	0.25	-1.75
2,878.00	5.10	224.790	2,872.37	-112.77	-91.61	-24.83	0.56	0.55	1.10
2,910.00	5.22	225.030	2,904.24	-114.81	-93.64	-25.04	0.38	0.38	0.75
2,941.00	5.24	225.050	2,935.11	-116.81	-95.64	-25.23	0.06	0.06	0.06
2,972.00	5.34	225.800	2,965.98	-118.81	-97.67	-25.40	0.39	0.32	2.42



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Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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)	
3,004.00	5.36	224.350	2,997.84	-120.92	-99.79	-25.60	0.43	0.06	-4.53	
3,035.00	5.79	224.360	3,028.69	-123.07	-101.89	-25.84	1.39	1.39	0.03	
3,065.00	6.06	222.700	3,058.53	-125.32	-104.02	-26.14	1.07	0.90	-5.53	
3,097.00	6.29	223.660	3,090.34	-127.83	-106.38	-26.48	0.79	0.72	3.00	
3,129.00	6.64	225.650	3,122.14	-130.39	-108.91	-26.75	1.30	1.09	6.22	
3,160.00	6.90	227.950	3,152.93	-132.89	-111.58	-26.88	1.21	0.84	7.42	
3,192.00	7.25	230.650	3,184.68	-135.46	-114.57	-26.85	1.51	1.09	8.44	
3,223.00	7.55	231.670	3,215.42	-137.96	-117.68	-26.70	1.06	0.97	3.29	
3,255.00	8.32	232.890	3,247.12	-140.66	-121.17	-26.44	2.46	2.41	3.81	
3,286.00	8.47	232.940	3,277.78	-143.39	-124.78	-26.12	0.48	0.48	0.16	
3,318.00	8.40	232.320	3,309.44	-146.24	-128.51	-25.82	0.36	-0.22	-1.94	
3,350.00	8.59	232.430	3,341.09	-149.13	-132.26	-25.53	0.60	0.59	0.34	
3,382.00	9.31	232.610	3,372.70	-152.15	-136.21	-25.22	2.25	2.25	0.56	
3,414.00	9.61	233.970	3,404.26	-155.30	-140.42	-24.82	1.17	0.94	4.25	
3,445.00	9.80	232.690	3,434.82	-158.42	-144.61	-24.42	0.93	0.61	-4.13	
3,477.00	9.83	232.550	3,466.35	-161.73	-148.95	-24.07	0.12	0.09	-0.44	
3,509.00	9.68	232.410	3,497.89	-165.03	-153.25	-23.73	0.47	-0.47	-0.44	
3,541.00	9.77	232.620	3,529.43	-168.32	-157.54	-23.40	0.30	0.28	0.66	
3,573.00	10.32	231.790	3,560.94	-171.74	-161.95	-23.08	1.78	1.72	-2.59	
3,604.00	10.42	231.150	3,591.43	-175.22	-166.31	-22.83	0.49	0.32	-2.06	
3,635.00	10.39	230.470	3,621.92	-178.76	-170.65	-22.65	0.41	-0.10	-2.19	
3,667.00	10.06	229.380	3,653.41	-182.41	-175.00	-22.55	1.20	-1.03	-3.41	
3,699.00	9.61	227.390	3,684.94	-186.04	-179.09	-22.60	1.76	-1.41	-6.22	
3,730.00	9.61	227.320	3,715.51	-189.55	-182.89	-22.74	0.04	0.00	-0.23	
3,762.00	9.96	227.550	3,747.04	-193.23	-186.90	-22.88	1.10	1.09	0.72	
3,794.00	9.91	228.000	3,778.56	-196.94	-190.99	-22.99	0.29	-0.16	1.41	
3,826.00	9.78	228.940	3,810.09	-200.56	-195.08	-23.04	0.65	-0.41	2.94	
3,858.00	10.17	231.050	3,841.61	-204.12	-199.33	-22.93	1.67	1.22	6.59	
3,890.00	10.54	231.550	3,873.09	-207.72	-203.82	-22.69	1.19	1.16	1.56	
3,921.00	10.70	232.640	3,903.55	-211.23	-208.33	-22.38	0.83	0.52	3.52	
3,953.00	10.56	232.390	3,935.01	-214.82	-213.01	-22.01	0.46	-0.44	-0.78	
3,985.00	10.50	232.260	3,966.47	-218.40	-217.64	-21.66	0.20	-0.19	-0.41	
4,017.00	10.52	231.740	3,997.93	-221.99	-222.24	-21.35	0.30	0.06	-1.63	
4,048.00	10.62	230.720	4,028.40	-225.55	-226.67	-21.12	0.68	0.32	-3.29	
4,080.00	10.68	229.980	4,059.85	-229.32	-231.23	-20.97	0.47	0.19	-2.31	
4,111.00	11.08	229.240	4,090.30	-233.12	-235.68	-20.91	1.37	1.29	-2.39	
4,143.00	10.93	229.700	4,121.71	-237.09	-240.33	-20.85	0.54	-0.47	1.44	
4,174.00	10.79	228.790	4,152.15	-240.90	-244.75	-20.82	0.71	-0.45	-2.94	
4,206.00	10.74	228.730	4,183.59	-244.84	-249.24	-20.83	0.16	-0.16	-0.19	
4,238.00	10.68	228.470	4,215.03	-248.77	-253.70	-20.87	0.24	-0.19	-0.81	
4,270.00	10.84	230.280	4,246.47	-252.66	-258.24	-20.82	1.17	0.50	5.66	
4,301.00	10.60	229.210	4,276.93	-256.39	-262.64	-20.74	1.01	-0.77	-3.45	
4,333.00	10.37	228.890	4,308.39	-260.20	-267.04	-20.73	0.74	-0.72	-1.00	



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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)
4,365.00	10.54	227.530	4,339.86	-264.07	-271.37	-20.80	0.94	0.53	-4.25
4,397.00	10.55	227.000	4,371.32	-268.05	-275.67	-20.97	0.30	0.03	-1.66
4,429.00	10.31	225.860	4,402.79	-272.04	-279.87	-21.22	0.99	-0.75	-3.56
4,436.00	10.33	226.460	4,409.68	-272.91	-280.77	-21.28	1.56	0.29	8.57
4,534.00	10.06	220.890	4,506.13	-285.43	-292.74	-22.86	1.04	-0.28	-5.68
4,627.00	10.68	226.080	4,597.62	-297.55	-304.27	-24.42	1.20	0.67	5.58
4,720.00	10.81	235.530	4,688.99	-308.46	-317.67	-23.85	1.90	0.14	10.16
4,816.00	11.11	240.840	4,783.25	-318.07	-333.17	-20.90	1.10	0.31	5.53
4,910.00	11.21	230.680	4,875.48	-328.27	-348.14	-18.75	2.09	0.11	-10.81
5,003.00	11.71	228.060	4,966.62	-340.31	-362.16	-18.62	0.78	0.54	-2.82
5,097.00	12.13	225.460	5,058.60	-353.61	-376.29	-19.36	0.73	0.45	-2.77
5,189.00	10.98	226.730	5,148.73	-366.39	-389.56	-20.29	1.28	-1.25	1.38
5,283.00	10.94	226.830	5,241.02	-378.63	-402.59	-20.96	0.05	-0.04	0.11
5,376.00	11.78	224.450	5,332.19	-391.45	-415.67	-22.02	1.03	0.90	-2.56
5,470.00	11.09	228.210	5,424.33	-404.32	-429.13	-22.88	1.08	-0.73	4.00
5,564.00	10.45	237.670	5,516.68	-414.91	-443.08	-21.70	2.00	-0.68	10.06
5,658.00	11.15	239.250	5,609.01	-424.11	-458.09	-18.78	0.81	0.74	1.68
5,752.00	10.90	237.330	5,701.28	-433.56	-473.38	-15.85	0.47	-0.27	-2.04
5,846.00	10.99	233.240	5,793.57	-443.72	-488.04	-13.88	0.83	0.10	-4.35
5,940.00	12.26	231.210	5,885.64	-455.33	-503.00	-12.81	1.42	1.35	-2.16
6,033.00	11.15	233.470	5,976.71	-466.87	-517.92	-11.70	1.29	-1.19	2.43
6,126.00	9.86	233.990	6,068.15	-476.90	-531.59	-10.29	1.39	-1.39	0.56
6,219.00	8.13	232.800	6,160.00	-485.56	-543.27	-9.14	1.87	-1.86	-1.28
6,313.00	8.39	234.810	6,253.02	-493.53	-554.17	-7.99	0.41	0.28	2.14
6,405.00	9.93	233.660	6,343.85	-502.10	-566.05	-6.65	1.69	1.67	-1.25
6,498.00	10.98	232.880	6,435.30	-512.20	-579.57	-5.38	1.14	1.13	-0.84
6,592.00	12.80	229.050	6,527.28	-524.43	-594.57	-4.74	2.11	1.94	-4.07
6,686.00	14.01	226.280	6,618.72	-539.12	-610.66	-5.24	1.46	1.29	-2.95
6,781.00	14.87	226.490	6,710.72	-555.46	-627.81	-6.29	0.91	0.91	0.22
6,874.00	16.12	228.090	6,800.34	-572.30	-646.08	-6.99	1.42	1.34	1.72
6,968.00	16.68	226.480	6,890.51	-590.30	-665.57	-7.76	0.77	0.60	-1.71
7,061.00	17.07	225.540	6,979.51	-609.05	-684.99	-9.14	0.51	0.42	-1.01
7,155.00	17.96	227.570	7,069.15	-628.50	-705.53	-10.29	1.15	0.95	2.16
7,277.00	22.55	230.830	7,183.58	-655.98	-737.57	-9.97	3.87	3.76	2.67
7,343.00	24.13	232.410	7,244.18	-672.20	-758.07	-8.73	2.57	2.39	2.39
7,438.00	27.61	232.430	7,329.64	-697.48	-790.92	-6.20	3.66	3.66	0.02
7,530.00	27.02	230.790	7,411.39	-723.69	-824.01	-4.22	1.04	-0.64	-1.78
7,625.00	28.83	229.010	7,495.32	-752.36	-858.02	-3.49	2.10	1.91	-1.87
7,718.00	28.84	228.550	7,576.79	-781.91	-891.76	-3.61	0.24	0.01	-0.49
7,811.00	28.23	227.200	7,658.50	-811.71	-924.71	-4.42	0.95	-0.66	-1.45
7,904.00	26.69	226.710	7,741.02	-840.97	-956.06	-5.89	1.67	-1.66	-0.53
7,998.00	27.24	228.050	7,824.80	-869.83	-987.42	-7.04	0.87	0.59	1.43
8,091.00	27.15	229.120	7,907.52	-897.94	-1,019.29	-7.29	0.53	-0.10	1.15
8,185.00	25.63	227.630	7,991.72	-925.68	-1,050.53	-7.68	1.76	-1.62	-1.59



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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)	
8,279.00	28.27	227.440	8,075.50	-954.45	-1,081.95	-8.72	2.81	2.81	-0.20	
8,372.00	30.31	230.380	8,156.61	-984.31	-1,116.26	-8.70	2.68	2.19	3.16	
8,465.00	29.91	230.390	8,237.06	-1,014.06	-1,152.20	-7.52	0.43	-0.43	0.01	
8,558.00	29.54	228.430	8,317.83	-1,044.06	-1,187.22	-7.13	1.12	-0.40	-2.11	
8,652.00	30.36	227.600	8,399.28	-1,075.45	-1,222.09	-7.88	0.98	0.87	-0.88	
8,746.00	29.82	229.980	8,480.61	-1,106.50	-1,257.54	-8.00	1.39	-0.57	2.53	
8,839.00	29.83	231.670	8,561.29	-1,135.72	-1,293.39	-6.47	0.90	0.01	1.82	
8,932.00	29.93	230.610	8,641.93	-1,164.78	-1,329.47	-4.68	0.58	0.11	-1.14	
9,026.00	28.72	227.440	8,723.89	-1,194.94	-1,364.23	-4.58	2.09	-1.29	-3.37	
9,119.00	28.48	227.510	8,805.54	-1,225.03	-1,397.04	-5.71	0.26	-0.26	0.08	
9,212.00	28.72	228.110	8,887.20	-1,254.93	-1,430.02	-6.58	0.40	0.26	0.65	
9,304.00	28.26	229.070	8,968.05	-1,283.96	-1,462.93	-6.85	0.71	-0.50	1.04	
9,397.00	27.15	231.770	9,050.39	-1,311.52	-1,496.24	-5.74	1.80	-1.19	2.90	
9,490.00	26.89	231.540	9,133.24	-1,337.73	-1,529.37	-3.73	0.30	-0.28	-0.25	
9,583.00	26.90	229.360	9,216.19	-1,364.51	-1,561.81	-2.61	1.06	0.01	-2.34	
9,677.00	25.67	228.480	9,300.47	-1,391.86	-1,593.19	-2.61	1.37	-1.31	-0.94	
9,770.00	23.96	229.620	9,384.88	-1,417.45	-1,622.66	-2.54	1.91	-1.84	1.23	
9,862.00	22.42	231.470	9,469.44	-1,440.48	-1,650.61	-1.54	1.85	-1.67	2.01	
9,893.00	22.55	231.730	9,498.08	-1,447.84	-1,659.90	-0.99	0.53	0.42	0.84	
9,924.00	22.59	231.820	9,526.71	-1,455.20	-1,669.25	-0.40	0.17	0.13	0.29	
9,955.00	23.03	231.990	9,555.29	-1,462.62	-1,678.71	0.23	1.44	1.42	0.55	
9,986.00	23.74	232.260	9,583.74	-1,470.17	-1,688.42	0.91	2.32	2.29	0.87	
10,017.00	24.40	232.520	9,612.04	-1,477.89	-1,698.44	1.68	2.16	2.13	0.84	
10,049.00	25.36	232.870	9,641.07	-1,486.05	-1,709.15	2.56	3.04	3.00	1.09	
10,082.00	26.24	233.580	9,670.78	-1,494.64	-1,720.65	3.64	2.83	2.67	2.15	
10,111.00	26.77	233.490	9,696.74	-1,502.34	-1,731.06	4.68	1.83	1.83	-0.31	
10,143.00	27.12	233.310	9,725.26	-1,510.98	-1,742.70	5.81	1.12	1.09	-0.56	
10,173.00	26.68	233.580	9,752.02	-1,519.07	-1,753.60	6.88	1.52	-1.47	0.90	
10,204.00	26.64	233.050	9,779.72	-1,527.38	-1,764.76	7.94	0.78	-0.13	-1.71	
10,236.00	27.34	232.700	9,808.23	-1,536.14	-1,776.34	8.94	2.24	2.19	-1.09	
10,267.00	28.18	232.610	9,835.67	-1,544.90	-1,787.82	9.88	2.71	2.71	-0.29	
10,298.00	28.35	232.870	9,862.97	-1,553.79	-1,799.50	10.85	0.68	0.55	0.84	
10,329.00	28.04	232.870	9,890.29	-1,562.63	-1,811.18	11.86	1.00	-1.00	0.00	
10,347.00	27.56	232.960	9,906.21	-1,567.69	-1,817.87	12.44	2.68	-2.67	0.50	
10,381.00	26.51	234.340	9,936.50	-1,576.85	-1,830.32	13.71	3.60	-3.09	4.06	
10,467.00	28.24	234.470	10,012.87	-1,599.87	-1,862.47	17.48	2.01	2.01	0.15	
10,514.00	28.28	231.780	10,054.27	-1,613.22	-1,880.27	19.11	2.71	0.09	-5.72	
10,561.00	29.83	227.110	10,095.35	-1,628.07	-1,897.58	19.29	5.84	3.30	-9.94	
10,608.00	29.08	226.450	10,136.28	-1,643.89	-1,914.43	18.43	1.74	-1.60	-1.40	
10,654.00	24.75	236.450	10,177.31	-1,656.93	-1,930.57	19.21	13.59	-9.41	21.74	
10,686.00	22.63	244.870	10,206.62	-1,663.25	-1,941.73	21.78	12.46	-6.63	26.31	
10,717.00	23.91	248.260	10,235.10	-1,668.11	-1,952.97	25.49	5.97	4.13	10.94	
10,749.00	26.03	250.290	10,264.11	-1,672.88	-1,965.60	30.20	7.14	6.63	6.34	



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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)
10,780.00	28.55	252.100	10,291.65	-1,677.45	-1,979.06	35.59	8.56	8.13	5.84
10,812.00	30.76	254.040	10,319.46	-1,682.05	-1,994.20	42.07	7.53	6.91	6.06
10,843.00	31.68	258.000	10,345.97	-1,685.92	-2,009.79	49.39	7.25	2.97	12.77
10,874.00	32.35	264.130	10,372.27	-1,688.46	-2,026.01	58.13	10.70	2.16	19.77
10,906.00	33.36	269.240	10,399.15	-1,689.46	-2,043.33	68.76	9.22	3.16	15.97
10,937.00	34.38	274.000	10,424.90	-1,688.96	-2,060.58	80.48	9.17	3.29	15.35
10,969.00	35.48	279.070	10,451.14	-1,686.86	-2,078.77	94.00	9.70	3.44	15.84
11,000.00	36.41	283.120	10,476.24	-1,683.36	-2,096.62	108.37	8.23	3.00	13.06
11,031.00	37.61	285.900	10,500.99	-1,678.68	-2,114.68	123.77	6.64	3.87	8.97
11,062.00	38.98	288.320	10,525.32	-1,673.02	-2,133.03	140.09	6.55	4.42	7.81
11,094.00	40.21	289.380	10,549.98	-1,666.43	-2,152.33	157.74	4.39	3.84	3.31
11,126.00	41.14	290.830	10,574.25	-1,659.26	-2,171.92	176.01	4.14	2.91	4.53
11,157.00	42.20	292.240	10,597.41	-1,651.69	-2,191.09	194.31	4.56	3.42	4.55
11,189.00	43.53	293.520	10,620.86	-1,643.22	-2,211.14	213.87	4.97	4.16	4.00
11,220.00	45.03	294.840	10,643.06	-1,634.36	-2,230.88	233.52	5.68	4.84	4.26
11,252.00	46.66	295.590	10,665.35	-1,624.57	-2,251.65	254.54	5.36	5.09	2.34
11,283.00	48.65	296.960	10,686.23	-1,614.43	-2,272.19	275.69	7.20	6.42	4.42
11,314.00	50.51	298.100	10,706.33	-1,603.52	-2,293.12	297.66	6.62	6.00	3.68
11,346.00	52.36	298.760	10,726.28	-1,591.61	-2,315.12	321.10	6.00	5.78	2.06
11,377.00	54.22	300.840	10,744.81	-1,579.25	-2,336.68	344.57	8.06	6.00	6.71
11,409.00	55.99	302.070	10,763.11	-1,565.55	-2,359.06	369.61	6.37	5.53	3.84
11,439.00	58.06	303.880	10,779.44	-1,551.85	-2,380.17	393.81	8.56	6.90	6.03
11,472.00	59.88	305.460	10,796.45	-1,535.77	-2,403.42	421.21	6.87	5.52	4.79
11,503.00	61.03	306.960	10,811.74	-1,519.83	-2,425.18	447.52	5.61	3.71	4.84
11,535.00	62.70	308.590	10,826.83	-1,502.55	-2,447.48	475.20	6.89	5.22	5.09
11,566.00	63.99	309.250	10,840.74	-1,485.14	-2,469.04	502.48	4.58	4.16	2.13
11,598.00	63.81	308.900	10,854.81	-1,467.03	-2,491.35	530.80	1.13	-0.56	-1.09
11,629.00	63.77	308.900	10,868.50	-1,449.56	-2,512.99	558.18	0.13	-0.13	0.00
11,661.00	65.05	309.910	10,882.33	-1,431.24	-2,535.29	586.65	4.91	4.00	3.16
11,693.00	66.86	311.010	10,895.36	-1,412.28	-2,557.52	615.55	6.47	5.66	3.44
11,724.00	69.33	313.000	10,906.93	-1,393.03	-2,578.89	644.10	9.95	7.97	6.42
11,755.00	71.06	313.970	10,917.43	-1,372.96	-2,600.05	673.13	6.31	5.58	3.13
11,788.00	70.75	313.260	10,928.23	-1,351.45	-2,622.62	704.18	2.24	-0.94	-2.15
11,834.00	72.16	314.890	10,942.86	-1,321.11	-2,653.95	747.63	4.55	3.07	3.54
11,850.00	73.35	315.990	10,947.60	-1,310.22	-2,664.67	762.89	9.92	7.44	6.88
11,881.00	75.52	317.710	10,955.92	-1,288.44	-2,685.09	792.73	8.81	7.00	5.55
11,929.00	79.67	319.610	10,966.23	-1,253.24	-2,716.05	839.59	9.47	8.65	3.96
11,976.00	83.25	321.860	10,973.21	-1,217.27	-2,745.45	886.04	8.97	7.62	4.79
12,024.00	85.51	323.180	10,977.91	-1,179.36	-2,774.52	933.71	5.45	4.71	2.75
12,069.00	87.41	326.660	10,980.69	-1,142.61	-2,800.32	978.37	8.80	4.22	7.73
12,164.00	90.32	336.620	10,982.58	-1,059.14	-2,845.37	1,070.89	10.92	3.06	10.48
12,259.00	89.48	343.270	10,982.74	-969.95	-2,877.93	1,159.52	7.06	-0.88	7.00
12,354.00	89.53	344.590	10,983.56	-878.67	-2,904.23	1,245.62	1.39	0.05	1.39



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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)
12,448.00	91.60	337.980	10,982.64	-789.70	-2,934.37	1,332.50	7.37	2.20	-7.03
12,542.00	92.62	328.380	10,979.17	-705.97	-2,976.70	1,423.43	10.26	1.09	-10.21
12,574.00	93.06	325.380	10,977.58	-679.20	-2,994.16	1,455.08	9.46	1.38	-9.38
12,606.00	92.27	322.820	10,976.09	-653.31	-3,012.90	1,486.91	8.36	-2.47	-8.00
12,636.00	90.63	322.600	10,975.33	-629.45	-3,031.07	1,516.84	5.52	-5.47	-0.73
12,731.00	89.57	325.200	10,975.17	-552.70	-3,087.04	1,611.47	2.96	-1.12	2.74
12,826.00	90.28	325.340	10,975.29	-474.63	-3,141.16	1,705.89	0.76	0.75	0.15
12,920.00	90.85	325.290	10,974.37	-397.33	-3,194.65	1,799.30	0.61	0.61	-0.05
13,015.00	90.94	329.300	10,972.88	-317.42	-3,245.96	1,893.26	4.22	0.09	4.22
13,109.00	90.77	328.990	10,971.48	-236.73	-3,294.17	1,985.76	0.38	-0.18	-0.33
13,203.00	91.07	329.480	10,969.97	-155.97	-3,342.24	2,078.23	0.61	0.32	0.52
13,298.00	90.99	329.520	10,968.26	-74.13	-3,390.45	2,171.60	0.09	-0.08	0.04
13,393.00	90.81	329.130	10,966.77	7.57	-3,438.91	2,265.03	0.45	-0.19	-0.41
13,488.00	90.81	329.210	10,965.43	89.13	-3,487.59	2,358.51	0.08	0.00	0.08
13,582.00	90.94	329.130	10,963.99	169.84	-3,535.76	2,451.00	0.16	0.14	-0.09
13,677.00	91.47	329.130	10,961.99	251.36	-3,584.50	2,544.48	0.56	0.56	0.00
13,770.00	91.60	329.260	10,959.50	331.21	-3,632.11	2,635.96	0.20	0.14	0.14
13,865.00	91.43	329.430	10,956.99	412.91	-3,680.53	2,729.36	0.25	-0.18	0.18
13,959.00	91.65	329.350	10,954.46	493.78	-3,728.37	2,821.76	0.25	0.23	-0.09
14,054.00	91.78	329.570	10,951.62	575.57	-3,776.62	2,915.12	0.27	0.14	0.23
14,148.00	91.52	329.260	10,948.91	656.45	-3,824.43	3,007.51	0.43	-0.28	-0.33
14,243.00	90.90	330.100	10,946.91	738.44	-3,872.38	3,100.82	1.10	-0.65	0.88
14,337.00	90.81	330.320	10,945.50	820.01	-3,919.08	3,193.00	0.25	-0.10	0.23
14,432.00	90.90	329.790	10,944.09	902.32	-3,966.49	3,286.20	0.57	0.09	-0.56
14,527.00	91.21	330.540	10,942.34	984.71	-4,013.75	3,379.36	0.85	0.33	0.79
14,621.00	91.21	330.620	10,940.35	1,066.57	-4,059.91	3,471.41	0.09	0.00	0.09
14,714.00	90.90	330.010	10,938.64	1,147.35	-4,105.96	3,562.56	0.74	-0.33	-0.66
14,809.00	90.94	330.620	10,937.12	1,229.87	-4,153.00	3,655.68	0.64	0.04	0.64
14,903.00	91.16	332.340	10,935.39	1,312.45	-4,197.87	3,747.41	1.84	0.23	1.83
14,997.00	90.94	330.930	10,933.67	1,395.15	-4,242.52	3,839.09	1.52	-0.23	-1.50
15,092.00	91.12	331.290	10,931.96	1,478.31	-4,288.41	3,931.94	0.42	0.19	0.38
15,187.00	91.30	332.120	10,929.96	1,561.94	-4,333.43	4,024.57	0.89	0.19	0.87
15,281.00	90.06	330.710	10,928.84	1,644.47	-4,378.40	4,116.33	2.00	-1.32	-1.50
15,375.00	90.32	331.590	10,928.53	1,726.81	-4,423.76	4,208.20	0.98	0.28	0.94
15,469.00	90.77	331.070	10,927.63	1,809.28	-4,468.85	4,300.00	0.73	0.48	-0.55
15,564.00	90.90	331.020	10,926.25	1,892.39	-4,514.84	4,392.88	0.15	0.14	-0.05
15,658.00	90.90	330.760	10,924.77	1,974.51	-4,560.56	4,484.83	0.28	0.00	-0.28
15,753.00	90.94	331.200	10,923.25	2,057.57	-4,606.64	4,577.72	0.47	0.04	0.46
15,848.00	90.99	332.170	10,921.65	2,141.19	-4,651.70	4,670.36	1.02	0.05	1.02
15,943.00	90.72	331.730	10,920.23	2,225.02	-4,696.37	4,762.91	0.54	-0.28	-0.46
16,037.00	90.99	332.030	10,918.83	2,307.92	-4,740.66	4,854.51	0.43	0.29	0.32
16,132.00	91.21	331.590	10,917.00	2,391.64	-4,785.53	4,947.10	0.52	0.23	-0.46
16,227.00	90.94	331.290	10,915.22	2,475.06	-4,830.94	5,039.83	0.42	-0.28	-0.32
16,322.00	90.68	330.980	10,913.88	2,558.25	-4,876.80	5,132.67	0.43	-0.27	-0.33



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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)	
16,416.00	90.63	329.960	10,912.80	2,640.03	-4,923.13	5,224.76	1.09	-0.05	-1.09	
16,511.00	91.03	329.210	10,911.43	2,721.95	-4,971.22	5,318.11	0.89	0.42	-0.79	
16,610.00	91.16	330.100	10,909.54	2,807.37	-5,021.22	5,415.36	0.91	0.13	0.90	
16,704.00	91.69	330.140	10,907.20	2,888.85	-5,068.04	5,507.55	0.57	0.56	0.04	
16,798.00	91.65	330.270	10,904.46	2,970.39	-5,114.72	5,599.70	0.14	-0.04	0.14	
16,892.00	91.83	329.790	10,901.61	3,051.78	-5,161.66	5,691.89	0.55	0.19	-0.51	
16,985.00	91.07	329.350	10,899.25	3,131.94	-5,208.75	5,783.26	0.94	-0.82	-0.47	
17,079.00	91.12	329.740	10,897.46	3,212.96	-5,256.38	5,875.64	0.42	0.05	0.41	
17,173.00	91.12	329.790	10,895.62	3,294.16	-5,303.71	5,967.94	0.05	0.00	0.05	
17,267.00	90.94	329.830	10,893.93	3,375.39	-5,350.97	6,060.24	0.20	-0.19	0.04	
17,362.00	90.99	329.570	10,892.33	3,457.40	-5,398.89	6,153.55	0.28	0.05	-0.27	
17,456.00	90.99	330.010	10,890.70	3,538.63	-5,446.18	6,245.86	0.47	0.00	0.47	
17,550.00	91.03	330.140	10,889.05	3,620.08	-5,493.07	6,338.07	0.14	0.04	0.14	
17,643.00	90.99	330.320	10,887.41	3,700.79	-5,539.24	6,429.25	0.20	-0.04	0.19	
17,738.00	90.90	330.270	10,885.84	3,783.30	-5,586.31	6,522.37	0.11	-0.09	-0.05	
17,832.00	91.16	330.400	10,884.15	3,864.97	-5,632.82	6,614.50	0.31	0.28	0.14	
17,926.00	90.94	329.260	10,882.43	3,946.22	-5,680.06	6,706.79	1.23	-0.23	-1.21	
18,020.00	91.03	329.080	10,880.81	4,026.92	-5,728.22	6,799.28	0.21	0.10	-0.19	
18,114.00	91.21	329.300	10,878.98	4,107.64	-5,776.36	6,891.76	0.30	0.19	0.23	
18,208.00	91.07	329.390	10,877.11	4,188.49	-5,824.28	6,984.19	0.18	-0.15	0.10	
18,302.00	91.07	329.430	10,875.35	4,269.39	-5,872.11	7,076.61	0.04	0.00	0.04	
18,396.00	91.16	329.570	10,873.52	4,350.37	-5,919.81	7,168.99	0.18	0.10	0.15	
18,489.00	91.03	329.480	10,871.74	4,430.51	-5,966.96	7,260.39	0.17	-0.14	-0.10	
18,584.00	90.63	329.430	10,870.37	4,512.32	-6,015.24	7,353.78	0.42	-0.42	-0.05	
18,678.00	90.77	329.300	10,869.22	4,593.19	-6,063.13	7,446.22	0.20	0.15	-0.14	
18,772.00	90.85	329.570	10,867.89	4,674.12	-6,110.93	7,538.64	0.30	0.09	0.29	
18,866.00	90.85	329.700	10,866.50	4,755.22	-6,158.44	7,630.99	0.14	0.00	0.14	
18,959.00	90.90	329.700	10,865.08	4,835.50	-6,205.36	7,722.34	0.05	0.05	0.00	
19,052.00	91.03	329.520	10,863.51	4,915.71	-6,252.40	7,813.72	0.24	0.14	-0.19	
19,145.00	90.90	329.210	10,861.94	4,995.72	-6,299.78	7,905.16	0.36	-0.14	-0.33	
19,239.00	90.72	329.390	10,860.61	5,076.54	-6,347.77	7,997.62	0.27	-0.19	0.19	
19,333.00	90.85	329.610	10,859.33	5,157.53	-6,395.47	8,090.02	0.27	0.14	0.23	
19,427.00	91.38	329.610	10,857.50	5,238.60	-6,443.02	8,182.37	0.56	0.56	0.00	
19,520.00	91.47	329.610	10,855.18	5,318.79	-6,490.05	8,273.73	0.10	0.10	0.00	
19,614.00	91.12	329.830	10,853.06	5,399.95	-6,537.43	8,366.04	0.44	-0.37	0.23	
19,708.00	91.16	330.010	10,851.19	5,481.27	-6,584.54	8,458.30	0.20	0.04	0.19	
19,802.00	91.12	330.180	10,849.32	5,562.74	-6,631.39	8,550.50	0.19	-0.04	0.18	
19,896.00	90.90	328.640	10,847.66	5,643.64	-6,679.22	8,642.92	1.65	-0.23	-1.64	
19,989.00	90.99	329.210	10,846.13	5,723.29	-6,727.22	8,734.49	0.62	0.10	0.61	
20,082.00	90.99	329.610	10,844.52	5,803.33	-6,774.54	8,825.93	0.43	0.00	0.43	
20,176.00	90.81	330.140	10,843.05	5,884.62	-6,821.71	8,918.21	0.60	-0.19	0.56	
20,269.00	90.81	329.660	10,841.73	5,965.08	-6,868.34	9,009.50	0.52	0.00	-0.52	
20,363.00	90.99	330.100	10,840.25	6,046.37	-6,915.51	9,101.77	0.51	0.19	0.47	



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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)	
20,456.00	91.03	330.540	10,838.62	6,127.16	-6,961.55	9,192.93	0.47	0.04	0.47	
20,549.00	91.12	330.890	10,836.87	6,208.26	-7,007.03	9,283.95	0.39	0.10	0.38	
20,643.00	90.85	330.360	10,835.25	6,290.16	-7,053.14	9,375.99	0.63	-0.29	-0.56	
20,737.00	91.52	331.330	10,833.31	6,372.23	-7,098.92	9,467.94	1.25	0.71	1.03	
20,829.00	91.74	331.590	10,830.69	6,453.02	-7,142.86	9,557.71	0.37	0.24	0.28	
20,922.00	91.25	331.730	10,828.27	6,534.85	-7,186.99	9,648.39	0.55	-0.53	0.15	
21,016.00	91.07	331.680	10,826.36	6,617.60	-7,231.54	9,740.05	0.20	-0.19	-0.05	
21,110.00	91.38	332.170	10,824.35	6,700.52	-7,275.77	9,831.62	0.62	0.33	0.52	
21,203.00	90.68	330.270	10,822.68	6,782.01	-7,320.53	9,922.47	2.18	-0.75	-2.04	
21,297.00	90.23	330.400	10,821.94	6,863.69	-7,367.05	10,014.61	0.50	-0.48	0.14	
21,391.00	90.63	331.020	10,821.23	6,945.67	-7,413.04	10,106.63	0.78	0.43	0.66	
21,486.00	90.06	330.710	10,820.66	7,028.65	-7,459.29	10,199.57	0.68	-0.60	-0.33	
21,580.00	90.41	330.800	10,820.27	7,110.66	-7,505.21	10,291.57	0.38	0.37	0.10	
21,672.00	89.93	329.740	10,820.00	7,190.55	-7,550.84	10,381.78	1.26	-0.52	-1.15	
21,766.00	91.12	331.640	10,819.14	7,272.51	-7,596.85	10,473.79	2.38	1.27	2.02	
21,859.00	91.16	330.710	10,817.29	7,353.97	-7,641.68	10,564.66	1.00	0.04	-1.00	
21,952.00	90.81	329.960	10,815.69	7,434.77	-7,687.70	10,655.81	0.89	-0.38	-0.81	
22,045.00	90.59	329.880	10,814.55	7,515.24	-7,734.31	10,747.09	0.25	-0.24	-0.09	
22,138.00	90.68	330.050	10,813.52	7,595.74	-7,780.85	10,838.37	0.21	0.10	0.18	
22,232.00	90.85	329.960	10,812.27	7,677.15	-7,827.84	10,930.61	0.20	0.18	-0.10	
22,326.00	90.85	330.230	10,810.87	7,758.62	-7,874.70	11,022.82	0.29	0.00	0.29	
22,420.00	90.85	330.230	10,809.48	7,840.21	-7,921.37	11,114.99	0.00	0.00	0.00	
22,514.00	90.90	330.230	10,808.04	7,921.79	-7,968.04	11,207.15	0.05	0.05	0.00	
22,607.00	90.59	330.400	10,806.83	8,002.58	-8,014.09	11,298.32	0.38	-0.33	0.18	
22,701.00	90.54	330.800	10,805.91	8,084.47	-8,060.23	11,390.37	0.43	-0.05	0.43	
22,795.00	90.50	330.490	10,805.05	8,166.40	-8,106.31	11,482.41	0.33	-0.04	-0.33	
22,889.00	90.46	330.050	10,804.27	8,248.02	-8,152.92	11,574.57	0.47	-0.04	-0.47	
22,983.00	90.19	330.010	10,803.73	8,329.45	-8,199.88	11,666.81	0.29	-0.29	-0.04	
23,078.00	90.59	330.270	10,803.09	8,411.84	-8,247.18	11,759.99	0.50	0.42	0.27	
23,170.00	90.59	330.710	10,802.14	8,491.90	-8,292.49	11,850.12	0.48	0.00	0.48	
23,264.00	90.50	330.450	10,801.25	8,573.77	-8,338.66	11,942.18	0.29	-0.10	-0.28	
23,358.00	90.54	329.740	10,800.39	8,655.25	-8,385.53	12,034.40	0.76	0.04	-0.76	
23,451.00	90.46	329.880	10,799.58	8,735.64	-8,432.29	12,125.72	0.17	-0.09	0.15	
23,544.00	90.81	330.230	10,798.55	8,816.22	-8,478.71	12,216.97	0.53	0.38	0.38	
23,638.00	91.07	329.880	10,797.01	8,897.66	-8,525.63	12,309.19	0.46	0.28	-0.37	
23,731.00	91.30	330.850	10,795.08	8,978.47	-8,571.60	12,400.32	1.07	0.25	1.04	
23,824.00	91.21	330.890	10,793.05	9,059.69	-8,616.86	12,491.29	0.11	-0.10	0.04	
23,919.00	90.94	330.400	10,791.27	9,142.48	-8,663.43	12,584.29	0.59	-0.28	-0.52	
24,012.00	91.16	329.520	10,789.56	9,222.97	-8,709.97	12,675.56	0.98	0.24	-0.95	
24,105.00	91.34	329.700	10,787.53	9,303.17	-8,757.01	12,766.92	0.27	0.19	0.19	
24,198.00	90.81	329.300	10,785.79	9,383.29	-8,804.20	12,858.33	0.71	-0.57	-0.43	
24,292.00	90.94	329.740	10,784.35	9,464.29	-8,851.88	12,950.72	0.49	0.14	0.47	
24,385.00	90.54	329.700	10,783.15	9,544.60	-8,898.77	13,042.06	0.43	-0.43	-0.04	



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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)
24,479.00	90.54	329.520	10,782.26	9,625.68	-8,946.32	13,134.43	0.19	0.00	-0.19
24,572.00	90.28	329.300	10,781.60	9,705.73	-8,993.64	13,225.88	0.37	-0.28	-0.24
24,667.00	90.23	329.350	10,781.18	9,787.44	-9,042.11	13,319.32	0.07	-0.05	0.05
24,758.00	92.09	330.930	10,779.33	9,866.33	-9,087.40	13,408.56	2.68	2.04	1.74
24,851.00	91.65	329.830	10,776.30	9,947.14	-9,133.34	13,499.65	1.27	-0.47	-1.18
24,944.00	91.78	330.400	10,773.52	10,027.73	-9,179.66	13,590.85	0.63	0.14	0.61
25,036.00	92.67	330.450	10,769.94	10,107.69	-9,225.03	13,680.93	0.97	0.97	0.05
25,129.00	92.31	330.230	10,765.90	10,188.42	-9,271.01	13,772.01	0.45	-0.39	-0.24
25,221.00	92.58	330.270	10,761.98	10,268.23	-9,316.62	13,862.14	0.30	0.29	0.04
25,315.00	92.58	330.360	10,757.75	10,349.81	-9,363.13	13,954.19	0.10	0.00	0.10
25,408.00	91.38	329.740	10,754.53	10,430.34	-9,409.53	14,045.39	1.45	-1.29	-0.67
25,502.00	91.52	330.010	10,752.16	10,511.62	-9,456.69	14,137.65	0.32	0.15	0.29
25,594.00	91.30	329.920	10,749.89	10,591.24	-9,502.72	14,227.92	0.26	-0.24	-0.10
25,688.00	91.30	329.880	10,747.76	10,672.54	-9,549.85	14,320.18	0.04	0.00	-0.04
25,782.00	91.30	330.140	10,745.63	10,753.93	-9,596.83	14,412.40	0.28	0.00	0.28
25,875.00	91.47	330.490	10,743.38	10,834.71	-9,642.87	14,503.55	0.42	0.18	0.38
25,969.00	91.07	330.180	10,741.30	10,916.36	-9,689.38	14,595.67	0.54	-0.43	-0.33
26,063.00	91.25	330.180	10,739.39	10,997.90	-9,736.12	14,687.84	0.19	0.19	0.00
26,157.00	90.85	329.660	10,737.67	11,079.23	-9,783.22	14,780.10	0.70	-0.43	-0.55
26,251.00	90.90	329.830	10,736.23	11,160.42	-9,830.58	14,872.42	0.19	0.05	0.18
26,269.00	91.03	330.100	10,735.93	11,176.00	-9,839.59	14,890.08	1.66	0.72	1.50
26,345.00	91.03	330.360	10,734.57	11,241.96	-9,877.32	14,964.60	0.34	0.00	0.34
26,438.00	91.69	330.320	10,732.36	11,322.75	-9,923.32	15,055.74	0.71	0.71	-0.04
26,531.00	90.77	329.570	10,730.36	11,403.22	-9,969.89	15,147.00	1.28	-0.99	-0.81
26,626.00	91.34	329.790	10,728.61	11,485.21	-10,017.84	15,240.32	0.64	0.60	0.23
Survey @ 26626.00 MD 10728.61 TVD - Survey Proj. to 26626.00 MD 10728.61 TVD									
26,662.00	91.34	329.790	10,727.77	11,516.32	-10,035.95	15,275.66	0.00	0.00	0.00

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
173.00	173.00	0.16	-0.47	MWD surveys
26,626.00	10,728.61	11,485.21	-10,017.84	Survey @ 26626.00 MD 10728.61 TVD
26,626.00	10,728.61	11,485.21	-10,017.84	Survey Proj. to 26626.00 MD 10728.61 TVD



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

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

Site	Van Winkle				
Site Position:		Northing:	14,447,369.493 usft	Latitude:	39.781725330
From:	Lat/Long	Easting:	1,717,188.440 usft	Longitude:	-80.726733270
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "	Grid Convergence:	0.17 °

Well	Van Winkle N-16 HU (slot E)					
Well Position	+N/-S	0.00 ft	Northing:	14,447,275.965 usft	Latitude:	39.781469000
	+E/-W	0.00 ft	Easting:	1,717,125.869 usft	Longitude:	-80.726957000
Position Uncertainty		0.00 ft	Wellhead Elevation:	ft	Ground Level:	753.00 ft

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	3/14/2022	-8.65	66.46	51,673.34856595

Design	Surveys Original Hole				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.00	0.00	0.00	318.929	

Survey Program	Date 4/27/2022				
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
14.00	525.00	MWD surf (Original Hole)	MWD	MWD - Standard	
569.00	2,185.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,215.00	4,429.00	MWD 2215-4429 MD (Original Hole)	MWD	MWD - Standard	
4,436.00	26,626.00	MWD (Original Hole)	MWD	MWD - Standard	
26,662.00	26,662.00	Projection (Original Hole)	MWD	MWD - Standard	

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
0.00	0.00	0.000	0.00	0.00	0.00	14,447,275.965	1,717,125.869	39.781469000	-80.726957000	
14.00	0.00	0.000	14.00	0.00	0.00	14,447,275.965	1,717,125.869	39.781469000	-80.726957000	
173.00	0.36	289.020	173.00	0.16	-0.47	14,447,276.127	1,717,125.397	39.781469451	-80.726958679	
MWD surveys										
201.00	0.34	259.770	201.00	0.18	-0.64	14,447,276.141	1,717,125.232	39.781469491	-80.726959266	
230.00	0.31	294.490	230.00	0.19	-0.79	14,447,276.158	1,717,125.076	39.781469539	-80.726959821	
259.00	0.34	250.360	259.00	0.20	-0.95	14,447,276.162	1,717,124.924	39.781469551	-80.726960364	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
288.00	0.19	252.760	288.00	0.15	-1.07	14,447,276.119	1,717,124.797	39.781469433	-80.726960816	
318.00	0.34	251.880	318.00	0.11	-1.20	14,447,276.076	1,717,124.665	39.781469318	-80.726961287	
350.00	0.42	250.440	350.00	0.04	-1.41	14,447,276.008	1,717,124.464	39.781469130	-80.726962002	
381.00	0.56	240.460	381.00	-0.07	-1.64	14,447,275.895	1,717,124.225	39.781468823	-80.726962854	
412.00	0.60	232.180	411.99	-0.24	-1.90	14,447,275.721	1,717,123.965	39.781468347	-80.726963781	
444.00	0.98	211.450	443.99	-0.58	-2.18	14,447,275.385	1,717,123.690	39.781467426	-80.726964764	
475.00	1.38	202.010	474.98	-1.15	-2.46	14,447,274.812	1,717,123.412	39.781465856	-80.726965761	
507.00	1.52	207.470	506.97	-1.89	-2.80	14,447,274.078	1,717,123.071	39.781463844	-80.726966979	
525.00	1.59	212.150	524.97	-2.31	-3.04	14,447,273.655	1,717,122.828	39.781462684	-80.726967849	
569.00	1.49	211.630	568.95	-3.31	-3.67	14,447,272.651	1,717,122.204	39.781459932	-80.726970084	
601.00	1.52	208.870	600.94	-4.04	-4.09	14,447,271.925	1,717,121.780	39.781457942	-80.726971598	
633.00	1.64	209.290	632.93	-4.81	-4.52	14,447,271.154	1,717,121.352	39.781455828	-80.726973133	
664.00	1.68	205.710	663.91	-5.61	-4.93	14,447,270.358	1,717,120.937	39.781453645	-80.726974616	
696.00	1.66	203.210	695.90	-6.46	-5.32	14,447,269.509	1,717,120.551	39.781451317	-80.726976000	
728.00	1.53	196.850	727.89	-7.29	-5.62	14,447,268.675	1,717,120.245	39.781449027	-80.726977100	
760.00	1.46	195.710	759.88	-8.09	-5.86	14,447,267.873	1,717,120.011	39.781446829	-80.726977942	
791.00	1.54	194.370	790.87	-8.87	-6.07	14,447,267.090	1,717,119.800	39.781444678	-80.726978699	
823.00	1.32	195.700	822.86	-9.65	-6.28	14,447,266.318	1,717,119.594	39.781442561	-80.726979442	
855.00	1.22	202.160	854.85	-10.32	-6.50	14,447,265.648	1,717,119.366	39.781440722	-80.726980262	
887.00	1.09	198.140	886.84	-10.92	-6.73	14,447,265.043	1,717,119.142	39.781439063	-80.726981063	
918.00	0.89	200.710	917.84	-11.43	-6.90	14,447,264.538	1,717,118.965	39.781437677	-80.726981698	
950.00	0.60	204.170	949.84	-11.81	-7.06	14,447,264.152	1,717,118.809	39.781436620	-80.726982260	
982.00	0.45	197.190	981.83	-12.09	-7.17	14,447,263.880	1,717,118.703	39.781435871	-80.726982639	
1,013.00	0.44	194.290	1,012.83	-12.32	-7.23	14,447,263.648	1,717,118.638	39.781435236	-80.726982874	
1,045.00	0.46	187.590	1,044.83	-12.56	-7.28	14,447,263.401	1,717,118.590	39.781434560	-80.726983045	
1,076.00	0.45	176.790	1,075.83	-12.81	-7.29	14,447,263.157	1,717,118.581	39.781433887	-80.726983082	
1,109.00	0.52	169.470	1,108.83	-13.08	-7.25	14,447,262.880	1,717,118.615	39.781433127	-80.726982962	
1,140.00	0.51	171.010	1,139.83	-13.36	-7.21	14,447,262.605	1,717,118.663	39.781432373	-80.726982797	
1,172.00	0.58	180.570	1,171.83	-13.66	-7.19	14,447,262.303	1,717,118.683	39.781431542	-80.726982726	
1,205.00	0.64	200.170	1,204.83	-14.00	-7.25	14,447,261.963	1,717,118.618	39.781430608	-80.726982962	
1,237.00	0.81	212.950	1,236.82	-14.36	-7.44	14,447,261.605	1,717,118.433	39.781429628	-80.726983623	
1,269.00	1.09	222.880	1,268.82	-14.77	-7.77	14,447,261.192	1,717,118.103	39.781428497	-80.726984803	
1,301.00	1.46	224.990	1,300.81	-15.28	-8.26	14,447,260.681	1,717,117.608	39.781427097	-80.726986571	
1,333.00	1.91	228.540	1,332.80	-15.92	-8.95	14,447,260.040	1,717,116.920	39.781425341	-80.726989027	
1,365.00	2.52	227.700	1,364.77	-16.75	-9.87	14,447,259.213	1,717,116.000	39.781423079	-80.726992310	
1,396.00	3.05	228.990	1,395.74	-17.75	-11.00	14,447,258.213	1,717,114.874	39.781420342	-80.726996330	
1,428.00	3.63	227.790	1,427.68	-18.99	-12.39	14,447,256.974	1,717,113.481	39.781416951	-80.727001301	
1,459.00	4.09	226.710	1,458.61	-20.41	-13.92	14,447,255.557	1,717,111.949	39.781413071	-80.727006768	
1,491.00	4.42	224.940	1,490.52	-22.06	-15.62	14,447,253.901	1,717,110.248	39.781408540	-80.727012843	
1,522.00	4.69	224.840	1,521.43	-23.81	-17.36	14,447,252.157	1,717,108.510	39.781403764	-80.727019046	
1,554.00	4.93	223.060	1,553.31	-25.74	-19.22	14,447,250.225	1,717,106.649	39.781398473	-80.727025692	
1,585.00	5.20	222.530	1,584.19	-27.75	-21.08	14,447,248.216	1,717,104.790	39.781392973	-80.727032331	
1,617.00	5.48	221.610	1,616.05	-29.96	-23.07	14,447,246.005	1,717,102.795	39.781386917	-80.727039456	
1,649.00	5.45	221.810	1,647.91	-32.23	-25.10	14,447,243.730	1,717,100.767	39.781380686	-80.727046698	
1,680.00	5.38	221.440	1,678.77	-34.42	-27.05	14,447,241.543	1,717,098.824	39.781374697	-80.727053639	
1,712.00	5.25	221.080	1,710.63	-36.65	-29.00	14,447,239.315	1,717,096.869	39.781368594	-80.727060621	
1,744.00	5.28	220.830	1,742.50	-38.87	-30.92	14,447,237.098	1,717,094.945	39.781362520	-80.727067496	
1,775.00	5.49	220.480	1,773.36	-41.07	-32.82	14,447,234.890	1,717,093.049	39.781356475	-80.727074266	
1,807.00	5.82	220.250	1,805.20	-43.48	-34.86	14,447,232.488	1,717,091.007	39.781349893	-80.727081561	
1,838.00	5.37	221.310	1,836.06	-45.77	-36.84	14,447,230.199	1,717,089.034	39.781343623	-80.727088609	
1,870.00	4.36	222.840	1,867.94	-47.78	-38.65	14,447,228.182	1,717,087.218	39.781338100	-80.727095093	
1,901.00	3.84	224.770	1,898.86	-49.38	-40.18	14,447,226.581	1,717,085.686	39.781333716	-80.727100564	
1,932.00	3.53	226.810	1,929.80	-50.77	-41.61	14,447,225.191	1,717,084.259	39.781329910	-80.727105658	
1,963.00	3.56	227.630	1,960.74	-52.08	-43.02	14,447,223.889	1,717,082.852	39.781326347	-80.727110680	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
1,995.00	3.78	226.830	1,992.67	-53.47	-44.52	14,447,222.498	1,717,081.349	39.781322539	-80.727116046	
2,027.00	3.93	225.280	2,024.60	-54.96	-46.07	14,447,221.004	1,717,079.801	39.781318451	-80.727121574	
2,058.00	4.22	222.170	2,055.52	-56.55	-47.59	14,447,219.412	1,717,078.280	39.781314089	-80.727127003	
2,090.00	4.44	219.590	2,087.43	-58.38	-49.17	14,447,217.584	1,717,076.700	39.781309084	-80.727132646	
2,121.00	4.69	216.600	2,118.33	-60.32	-50.69	14,447,215.642	1,717,075.180	39.781303764	-80.727138079	
2,153.00	4.74	215.060	2,150.22	-62.45	-52.23	14,447,213.510	1,717,073.641	39.781297920	-80.727143582	
2,185.00	4.91	213.800	2,182.11	-64.68	-53.75	14,447,211.290	1,717,072.119	39.781291835	-80.727149021	
2,215.00	4.77	212.800	2,212.00	-66.79	-55.14	14,447,209.174	1,717,070.729	39.781286038	-80.727153991	
2,247.00	5.10	211.910	2,243.88	-69.12	-56.61	14,447,206.848	1,717,069.257	39.781279663	-80.727159258	
2,278.00	5.30	210.230	2,274.76	-71.52	-58.06	14,447,204.442	1,717,067.808	39.781273066	-80.727164442	
2,310.00	5.35	209.110	2,306.62	-74.10	-59.53	14,447,201.861	1,717,066.338	39.781265992	-80.727169702	
2,341.00	5.51	208.920	2,337.48	-76.67	-60.95	14,447,199.296	1,717,064.915	39.781258958	-80.727174794	
2,373.00	5.61	212.950	2,369.33	-79.33	-62.55	14,447,196.639	1,717,063.321	39.781251674	-80.727180495	
2,405.00	5.07	216.810	2,401.19	-81.77	-64.25	14,447,194.194	1,717,061.623	39.781244975	-80.727186565	
2,437.00	5.06	217.980	2,433.06	-84.01	-65.96	14,447,191.950	1,717,059.908	39.781238826	-80.727192696	
2,468.00	5.07	218.550	2,463.94	-86.16	-67.66	14,447,189.801	1,717,058.213	39.781232939	-80.727198752	
2,500.00	5.12	218.200	2,495.82	-88.39	-69.42	14,447,187.573	1,717,056.449	39.781226835	-80.727205056	
2,532.00	5.21	218.770	2,527.69	-90.65	-71.21	14,447,185.318	1,717,054.656	39.781220657	-80.727211462	
2,563.00	5.38	217.670	2,558.55	-92.89	-72.98	14,447,183.070	1,717,052.886	39.781214499	-80.727217784	
2,594.00	5.65	219.030	2,589.41	-95.23	-74.83	14,447,180.735	1,717,051.037	39.781208100	-80.727223991	
2,626.00	5.51	220.490	2,621.26	-97.62	-76.82	14,447,178.343	1,717,049.048	39.781201548	-80.727230199	
2,657.00	4.79	223.620	2,652.13	-99.69	-78.68	14,447,176.274	1,717,047.188	39.781195881	-80.727238139	
2,689.00	4.74	223.870	2,684.02	-101.61	-80.52	14,447,174.353	1,717,045.350	39.781190623	-80.727244702	
2,721.00	4.59	225.140	2,715.92	-103.47	-82.34	14,447,172.497	1,717,043.527	39.781185540	-80.727251214	
2,753.00	4.66	224.970	2,747.81	-105.29	-84.17	14,447,170.674	1,717,041.700	39.781180550	-80.727257734	
2,783.00	4.70	225.000	2,777.71	-107.02	-85.90	14,447,168.943	1,717,039.970	39.781175810	-80.727263912	
2,815.00	4.85	225.010	2,809.60	-108.91	-87.78	14,447,167.060	1,717,038.086	39.781170653	-80.727270638	
2,847.00	4.93	224.450	2,841.49	-110.84	-89.70	14,447,165.122	1,717,036.167	39.781165347	-80.727277491	
2,878.00	5.10	224.790	2,872.37	-112.77	-91.61	14,447,163.193	1,717,034.263	39.781160066	-80.727284288	
2,910.00	5.22	225.030	2,904.24	-114.81	-93.64	14,447,161.155	1,717,032.231	39.781154486	-80.727291542	
2,941.00	5.24	225.050	2,935.11	-116.81	-95.64	14,447,159.158	1,717,030.232	39.781149019	-80.727298681	
2,972.00	5.34	225.800	2,965.98	-118.81	-97.67	14,447,157.152	1,717,028.196	39.781143527	-80.727305949	
3,004.00	5.36	224.350	2,997.84	-120.92	-99.79	14,447,155.045	1,717,026.083	39.781137759	-80.727313491	
3,035.00	5.79	224.360	3,028.69	-123.07	-101.89	14,447,152.892	1,717,023.978	39.781131863	-80.727321008	
3,065.00	6.06	222.700	3,058.53	-125.32	-104.02	14,447,150.646	1,717,021.846	39.781125714	-80.727328621	
3,097.00	6.29	223.660	3,090.34	-127.83	-106.38	14,447,148.137	1,717,019.490	39.781118841	-80.727337033	
3,129.00	6.64	225.650	3,122.14	-130.39	-108.91	14,447,145.575	1,717,016.957	39.781111828	-80.727346077	
3,160.00	6.90	227.950	3,152.93	-132.89	-111.58	14,447,143.075	1,717,014.293	39.781104985	-80.727355588	
3,192.00	7.25	230.650	3,184.68	-135.46	-114.57	14,447,140.508	1,717,011.304	39.781097958	-80.727366254	
3,223.00	7.55	231.670	3,215.42	-137.96	-117.68	14,447,138.004	1,717,008.194	39.781091109	-80.727377352	
3,255.00	8.32	232.890	3,247.12	-140.66	-121.17	14,447,135.303	1,717,004.698	39.781083721	-80.727389823	
3,286.00	8.47	232.940	3,277.78	-143.39	-124.78	14,447,132.574	1,717,001.088	39.781076257	-80.727402704	
3,318.00	8.40	232.320	3,309.44	-146.24	-128.51	14,447,129.725	1,716,997.357	39.781068464	-80.727416013	
3,350.00	8.59	232.430	3,341.09	-149.13	-132.26	14,447,126.840	1,716,993.613	39.781060570	-80.727429370	
3,382.00	9.31	232.610	3,372.70	-152.15	-136.21	14,447,123.811	1,716,989.663	39.781052285	-80.727443466	
3,414.00	9.61	233.970	3,404.26	-155.30	-140.42	14,447,120.668	1,716,985.446	39.781043689	-80.727458508	
3,445.00	9.80	232.690	3,434.82	-158.42	-144.61	14,447,117.547	1,716,981.255	39.781035152	-80.727473460	
3,477.00	9.83	232.550	3,466.35	-161.73	-148.95	14,447,114.235	1,716,976.920	39.781026094	-80.727488924	
3,509.00	9.68	232.410	3,497.89	-165.03	-153.25	14,447,110.933	1,716,972.620	39.781017061	-80.727504267	
3,541.00	9.77	232.620	3,529.43	-168.32	-157.54	14,447,107.643	1,716,968.331	39.781008063	-80.727519570	
3,573.00	10.32	231.790	3,560.94	-171.74	-161.95	14,447,104.222	1,716,963.921	39.780998704	-80.727535303	
3,604.00	10.42	231.150	3,591.43	-175.22	-166.31	14,447,100.746	1,716,959.556	39.780989195	-80.727550877	
3,635.00	10.39	230.470	3,621.92	-178.76	-170.65	14,447,097.208	1,716,955.216	39.780979515	-80.727566361	
3,667.00	10.06	229.380	3,653.41	-182.41	-175.00	14,447,093.552	1,716,950.869	39.780969511	-80.727581873	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
3,699.00	9.61	227.390	3,684.94	-186.04	-179.09	14,447,089.924	1,716,946.782	39.780959582	-80.727596461
3,730.00	9.61	227.320	3,715.51	-189.55	-182.89	14,447,086.418	1,716,942.975	39.780949985	-80.727610048
3,762.00	9.96	227.550	3,747.04	-193.23	-186.90	14,447,082.740	1,716,938.970	39.780939917	-80.727624345
3,794.00	9.91	228.000	3,778.56	-196.94	-190.99	14,447,079.029	1,716,934.882	39.780929761	-80.727638937
3,826.00	9.78	228.940	3,810.09	-200.56	-195.08	14,447,075.402	1,716,930.786	39.780919833	-80.727653555
3,858.00	10.17	231.050	3,841.61	-204.12	-199.33	14,447,071.840	1,716,926.540	39.780910088	-80.727668708
3,890.00	10.54	231.550	3,873.09	-207.72	-203.82	14,447,068.244	1,716,922.050	39.780900250	-80.727684725
3,921.00	10.70	232.640	3,903.55	-211.23	-208.33	14,447,064.735	1,716,917.543	39.780890650	-80.727700809
3,953.00	10.56	232.390	3,935.01	-214.82	-213.01	14,447,061.143	1,716,912.858	39.780880824	-80.727717520
3,985.00	10.50	232.260	3,966.47	-218.40	-217.64	14,447,057.569	1,716,908.230	39.780871047	-80.727734034
4,017.00	10.52	231.740	3,997.93	-221.99	-222.24	14,447,053.975	1,716,903.630	39.780861216	-80.727750444
4,048.00	10.62	230.720	4,028.40	-225.55	-226.67	14,447,050.414	1,716,899.197	39.780851474	-80.727766263
4,080.00	10.68	229.980	4,059.85	-229.32	-231.23	14,447,046.641	1,716,894.644	39.780841149	-80.727782510
4,111.00	11.08	229.240	4,090.30	-233.12	-235.68	14,447,042.849	1,716,890.188	39.780830772	-80.727798412
4,143.00	10.93	229.700	4,121.71	-237.09	-240.33	14,447,038.879	1,716,885.545	39.780819909	-80.727814981
4,174.00	10.79	228.790	4,152.15	-240.90	-244.75	14,447,035.066	1,716,881.120	39.780809475	-80.727830770
4,206.00	10.74	228.730	4,183.59	-244.84	-249.24	14,447,031.126	1,716,876.626	39.780798692	-80.727846810
4,238.00	10.68	228.470	4,215.03	-248.77	-253.70	14,447,027.193	1,716,872.165	39.780787929	-80.727862730
4,270.00	10.84	230.280	4,246.47	-252.66	-258.24	14,447,023.305	1,716,867.631	39.780777287	-80.727883912
4,301.00	10.60	229.210	4,276.93	-256.39	-262.64	14,447,019.579	1,716,863.230	39.780767093	-80.727894616
4,333.00	10.37	228.890	4,308.39	-260.20	-267.04	14,447,015.763	1,716,858.832	39.780756649	-80.727910313
4,365.00	10.54	227.530	4,339.86	-264.07	-271.37	14,447,011.893	1,716,854.503	39.780746057	-80.727925763
4,397.00	10.55	227.000	4,371.32	-268.05	-275.67	14,447,007.919	1,716,850.201	39.780735179	-80.727941116
4,429.00	10.31	225.860	4,402.79	-272.04	-279.87	14,447,003.927	1,716,846.004	39.780724251	-80.727956100
4,436.00	10.33	226.460	4,409.68	-272.91	-280.77	14,447,003.058	1,716,845.099	39.780721873	-80.727959329
4,534.00	10.06	220.890	4,506.13	-285.43	-292.74	14,446,990.534	1,716,833.127	39.780687580	-80.727925763
4,627.00	10.68	226.080	4,597.62	-297.55	-304.27	14,446,978.416	1,716,821.602	39.780654396	-80.728043231
4,720.00	10.81	235.530	4,688.99	-308.46	-317.67	14,446,967.502	1,716,808.204	39.780624534	-80.728091038
4,816.00	11.11	240.840	4,783.25	-318.07	-333.17	14,446,957.900	1,716,792.704	39.780598293	-80.728146310
4,910.00	11.21	230.680	4,875.48	-328.27	-348.14	14,446,947.696	1,716,777.726	39.780570396	-80.728199736
5,003.00	11.71	228.060	4,966.62	-340.31	-362.16	14,446,935.660	1,716,763.712	39.780537459	-80.728249745
5,097.00	12.13	225.460	5,058.60	-353.61	-376.29	14,446,922.357	1,716,749.577	39.780501044	-80.728300201
5,189.00	10.98	226.730	5,148.73	-366.39	-389.56	14,446,909.572	1,716,736.308	39.780466042	-80.728347570
5,283.00	10.94	226.830	5,241.02	-378.63	-402.59	14,446,897.333	1,716,723.284	39.780432540	-80.728394058
5,376.00	11.78	224.450	5,332.19	-391.45	-415.67	14,446,884.519	1,716,710.200	39.780397456	-80.728440768
5,470.00	11.09	228.210	5,424.33	-404.32	-429.13	14,446,871.644	1,716,696.739	39.780362211	-80.728488817
5,564.00	10.45	237.670	5,516.68	-414.91	-443.08	14,446,861.059	1,716,682.794	39.780333260	-80.728538566
5,658.00	11.15	239.250	5,609.01	-424.11	-458.09	14,446,851.853	1,716,667.780	39.780308102	-80.728592107
5,752.00	10.90	237.330	5,701.28	-433.56	-473.38	14,446,842.409	1,716,652.488	39.780282292	-80.728646640
5,846.00	10.99	233.240	5,793.57	-443.72	-488.04	14,446,832.249	1,716,637.828	39.780254513	-80.728698930
5,940.00	12.26	231.210	5,885.64	-455.33	-503.00	14,446,820.634	1,716,622.870	39.780222739	-80.728752296
6,033.00	11.15	233.470	5,976.71	-466.87	-517.92	14,446,809.095	1,716,607.947	39.780191175	-80.728805535
6,126.00	9.86	233.990	6,068.15	-476.90	-531.59	14,446,799.061	1,716,594.280	39.780163731	-80.728854290
6,219.00	8.13	232.800	6,160.00	-485.56	-543.27	14,446,790.403	1,716,582.600	39.780140051	-80.728895956
6,313.00	8.39	234.810	6,253.02	-493.53	-554.17	14,446,782.432	1,716,571.701	39.780118252	-80.728934835
6,405.00	9.93	233.660	6,343.85	-502.10	-566.05	14,446,773.863	1,716,559.825	39.780094818	-80.728977197
6,498.00	10.98	232.880	6,435.30	-512.20	-579.57	14,446,763.766	1,716,546.304	39.780072022	-80.729025434
6,592.00	12.80	229.050	6,527.28	-524.43	-594.57	14,446,751.538	1,716,531.300	39.780033745	-80.729078970
6,686.00	14.01	226.280	6,618.72	-539.12	-610.66	14,446,736.849	1,716,515.211	39.779993538	-80.729136394
6,781.00	14.87	226.490	6,710.72	-555.46	-627.81	14,446,720.509	1,716,498.059	39.779948806	-80.729197619
6,874.00	16.12	228.090	6,800.34	-572.30	-646.08	14,446,703.668	1,716,479.796	39.779902709	-80.729262806
6,968.00	16.68	226.480	6,890.51	-590.30	-665.57	14,446,685.862	1,716,460.302	39.779853421	-80.729332385
7,061.00	17.07	225.540	6,979.51	-609.05	-684.99	14,446,666.911	1,716,440.881	39.779802087	-80.729401710
7,155.00	17.96	227.570	7,069.15	-628.50	-705.53	14,446,647.469	1,716,420.337	39.779748865	-80.729475044



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
7,277.00	22.55	230.830	7,183.58	-655.98	-737.57	14,446,619.988	1,716,388.299	39.779673659	-80.729589371	
7,343.00	24.13	232.410	7,244.18	-672.20	-758.07	14,446,603.764	1,716,367.797	39.779629274	-80.729662521	
7,438.00	27.61	232.430	7,329.64	-697.48	-790.92	14,446,578.488	1,716,334.951	39.779560133	-80.729779701	
7,530.00	27.02	230.790	7,411.39	-723.69	-824.01	14,446,552.278	1,716,301.861	39.779488427	-80.729897762	
7,625.00	28.83	229.010	7,495.32	-752.36	-858.02	14,446,523.609	1,716,267.848	39.779409977	-80.730019133	
7,718.00	28.84	228.550	7,576.79	-781.91	-891.76	14,446,494.054	1,716,234.110	39.779329089	-80.730139531	
7,811.00	28.23	227.200	7,658.50	-811.71	-924.71	14,446,464.261	1,716,201.159	39.779247542	-80.730257134	
7,904.00	26.69	226.710	7,741.02	-840.97	-956.06	14,446,434.994	1,716,169.816	39.779167425	-80.730369007	
7,998.00	27.24	228.050	7,824.80	-869.83	-987.42	14,446,406.137	1,716,138.450	39.779088436	-80.730480959	
8,091.00	27.15	229.120	7,907.52	-897.94	-1,019.29	14,446,378.021	1,716,106.577	39.779011487	-80.730594705	
8,185.00	25.63	227.630	7,991.72	-925.68	-1,050.53	14,446,350.282	1,716,075.339	39.778935566	-80.730706187	
8,279.00	28.27	227.440	8,075.50	-954.45	-1,081.95	14,446,321.520	1,716,043.917	39.778856837	-80.730818335	
8,372.00	30.31	230.380	8,156.61	-984.31	-1,116.26	14,446,291.654	1,716,009.613	39.778775101	-80.730940752	
8,465.00	29.91	230.390	8,237.06	-1,014.06	-1,152.20	14,446,261.906	1,715,973.673	39.778693701	-80.731068991	
8,558.00	29.54	228.430	8,317.83	-1,044.06	-1,187.22	14,446,231.911	1,715,938.657	39.778611613	-80.731193943	
8,652.00	30.36	227.600	8,399.28	-1,075.45	-1,222.09	14,446,200.516	1,715,903.777	39.778525683	-80.731318423	
8,746.00	29.82	229.980	8,480.61	-1,106.50	-1,257.54	14,446,169.467	1,715,868.334	39.778440706	-80.731444903	
8,839.00	29.83	231.670	8,561.29	-1,135.72	-1,293.39	14,446,140.252	1,715,832.480	39.778360768	-80.731572827	
8,932.00	29.93	230.610	8,641.93	-1,164.78	-1,329.47	14,446,111.183	1,715,796.405	39.778281235	-80.731701539	
9,026.00	28.72	227.440	8,723.89	-1,194.94	-1,364.23	14,446,081.023	1,715,761.643	39.778198694	-80.731825588	
9,119.00	28.48	227.510	8,805.54	-1,225.03	-1,397.04	14,446,050.933	1,715,728.834	39.778116327	-80.731942684	
9,212.00	28.72	228.110	8,887.20	-1,254.93	-1,430.02	14,446,021.036	1,715,695.849	39.778034493	-80.732060403	
9,304.00	28.26	229.070	8,968.05	-1,283.96	-1,462.93	14,445,992.008	1,715,662.939	39.777955044	-80.732177848	
9,397.00	27.15	231.770	9,050.39	-1,311.52	-1,496.24	14,445,964.451	1,715,629.635	39.777879640	-80.732296679	
9,490.00	26.89	231.540	9,133.24	-1,337.73	-1,529.37	14,445,938.240	1,715,596.498	39.777807929	-80.732414898	
9,583.00	26.90	229.360	9,216.19	-1,364.51	-1,561.81	14,445,911.456	1,715,564.065	39.777734640	-80.732530619	
9,677.00	25.67	228.480	9,300.47	-1,391.86	-1,593.19	14,445,884.110	1,715,532.684	39.777659796	-80.732642601	
9,770.00	23.96	229.620	9,384.88	-1,417.45	-1,622.66	14,445,858.521	1,715,503.215	39.777589765	-80.732747760	
9,862.00	22.42	231.470	9,469.44	-1,440.48	-1,650.61	14,445,835.489	1,715,475.259	39.777526740	-80.732847508	
9,893.00	22.55	231.730	9,498.08	-1,447.84	-1,659.90	14,445,828.125	1,715,465.968	39.777506593	-80.732880655	
9,924.00	22.59	231.820	9,526.71	-1,455.20	-1,669.25	14,445,820.763	1,715,456.621	39.777486451	-80.732914002	
9,955.00	23.03	231.990	9,555.29	-1,462.62	-1,678.71	14,445,813.348	1,715,447.162	39.777466167	-80.732947744	
9,986.00	23.74	232.260	9,583.74	-1,470.17	-1,688.42	14,445,805.794	1,715,437.450	39.777445502	-80.732982392	
10,017.00	24.40	232.520	9,612.04	-1,477.89	-1,698.44	14,445,798.079	1,715,427.434	39.777424394	-80.733018124	
10,049.00	25.36	232.870	9,641.07	-1,486.05	-1,709.15	14,445,789.920	1,715,416.725	39.777402076	-80.733056326	
10,082.00	26.24	233.580	9,670.78	-1,494.64	-1,720.65	14,445,781.323	1,715,405.220	39.777378560	-80.733097365	
10,111.00	26.77	233.490	9,696.74	-1,502.34	-1,731.06	14,445,773.631	1,715,394.812	39.777357522	-80.733134491	
10,143.00	27.12	233.310	9,725.26	-1,510.98	-1,742.70	14,445,764.986	1,715,383.171	39.777333874	-80.733176016	
10,173.00	26.68	233.580	9,752.02	-1,519.07	-1,753.60	14,445,756.901	1,715,372.268	39.777311762	-80.733214907	
10,204.00	26.64	233.050	9,779.72	-1,527.38	-1,764.76	14,445,748.592	1,715,361.114	39.777289033	-80.733254696	
10,236.00	27.34	232.700	9,808.23	-1,536.14	-1,776.34	14,445,739.826	1,715,349.535	39.777265055	-80.733296000	
10,267.00	28.18	232.610	9,835.67	-1,544.90	-1,787.82	14,445,731.067	1,715,338.056	39.777241094	-80.733336948	
10,298.00	28.35	232.870	9,862.97	-1,553.79	-1,799.50	14,445,722.180	1,715,326.373	39.777216782	-80.733378627	
10,329.00	28.04	232.870	9,890.29	-1,562.63	-1,811.18	14,445,713.339	1,715,314.695	39.777192598	-80.733420282	
10,347.00	27.56	232.960	9,906.21	-1,567.69	-1,817.87	14,445,708.276	1,715,307.998	39.777178750	-80.733444172	
10,381.00	26.51	234.340	9,936.50	-1,576.85	-1,830.32	14,445,699.115	1,715,295.554	39.777153691	-80.733488559	
10,467.00	28.24	234.470	10,012.87	-1,599.87	-1,862.47	14,445,676.100	1,715,263.400	39.777090749	-80.733603248	
10,514.00	28.28	231.780	10,054.27	-1,613.22	-1,880.27	14,445,662.749	1,715,245.603	39.777054230	-80.733666732	
10,561.00	29.83	227.110	10,095.35	-1,628.07	-1,897.58	14,445,647.902	1,715,228.288	39.777013598	-80.733728516	
10,608.00	29.08	226.450	10,136.28	-1,643.89	-1,914.43	14,445,632.077	1,715,211.445	39.776970274	-80.733788631	
10,654.00	24.75	236.450	10,177.31	-1,656.93	-1,930.57	14,445,619.040	1,715,195.302	39.776934604	-80.733846225	
10,686.00	22.63	244.870	10,206.62	-1,663.25	-1,941.73	14,445,612.721	1,715,184.141	39.776917341	-80.733886015	
10,717.00	23.91	248.260	10,235.10	-1,668.11	-1,952.97	14,445,607.861	1,715,172.905	39.776904086	-80.733926057	
10,749.00	26.03	250.290	10,264.11	-1,672.88	-1,965.60	14,445,603.090	1,715,160.270	39.776891087	-80.733971079	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
10,780.00	28.55	252.100	10,291.65	-1,677.45	-1,979.06	14,445,598.519	1,715,146.815	39.776878642	-80.734019017	
10,812.00	30.76	254.040	10,319.46	-1,682.05	-1,994.20	14,445,593.918	1,715,131.668	39.776866130	-80.734072974	
10,843.00	31.68	258.000	10,345.97	-1,685.92	-2,009.79	14,445,590.045	1,715,116.082	39.776855622	-80.734128489	
10,874.00	32.35	264.130	10,372.27	-1,688.46	-2,026.01	14,445,587.504	1,715,099.865	39.776848774	-80.734186236	
10,906.00	33.36	269.240	10,399.15	-1,689.46	-2,043.33	14,445,586.511	1,715,082.547	39.776846190	-80.734247884	
10,937.00	34.38	274.000	10,424.90	-1,688.96	-2,060.58	14,445,587.009	1,715,065.290	39.776847697	-80.734309301	
10,969.00	35.48	279.070	10,451.14	-1,686.86	-2,078.77	14,445,589.103	1,715,047.102	39.776853598	-80.734374013	
11,000.00	36.41	283.120	10,476.24	-1,683.36	-2,096.62	14,445,592.611	1,715,029.255	39.776863375	-80.734437496	
11,031.00	37.61	285.900	10,500.99	-1,678.68	-2,114.68	14,445,624.278	1,715,011.195	39.776876375	-80.734501724	
11,062.00	38.98	288.320	10,525.32	-1,673.02	-2,133.03	14,445,602.948	1,714,992.840	39.776892060	-80.734566994	
11,094.00	40.21	289.380	10,549.98	-1,666.43	-2,152.33	14,445,609.539	1,714,973.540	39.776910319	-80.734635616	
11,126.00	41.14	290.830	10,574.25	-1,659.26	-2,171.92	14,445,616.710	1,714,953.957	39.776930172	-80.734705242	
11,157.00	42.20	292.240	10,597.41	-1,651.69	-2,191.09	14,445,624.278	1,714,934.788	39.776951110	-80.734773388	
11,189.00	43.53	293.520	10,620.86	-1,643.22	-2,211.14	14,445,632.744	1,714,914.734	39.776974523	-80.734844673	
11,220.00	45.03	294.840	10,643.06	-1,634.36	-2,230.88	14,445,641.611	1,714,894.993	39.776999036	-80.734914843	
11,252.00	46.66	295.590	10,665.35	-1,624.57	-2,251.65	14,445,651.393	1,714,874.224	39.777026069	-80.734988661	
11,283.00	48.65	296.960	10,686.23	-1,614.43	-2,272.19	14,445,661.539	1,714,853.683	39.777054099	-80.735061663	
11,314.00	50.51	298.100	10,706.33	-1,603.52	-2,293.12	14,445,672.449	1,714,832.758	39.777084232	-80.735136025	
11,346.00	52.36	298.760	10,726.28	-1,591.61	-2,315.12	14,445,684.362	1,714,810.756	39.777117127	-80.735214207	
11,377.00	54.22	300.840	10,744.81	-1,579.25	-2,336.68	14,445,696.716	1,714,789.197	39.777151229	-80.735290812	
11,409.00	55.99	302.070	10,763.11	-1,565.55	-2,359.06	14,445,710.414	1,714,766.810	39.777189028	-80.735370345	
11,439.00	58.06	303.880	10,779.44	-1,551.85	-2,380.17	14,445,724.114	1,714,745.702	39.777226824	-80.735445328	
11,472.00	59.88	305.460	10,796.45	-1,535.77	-2,403.42	14,445,740.201	1,714,722.450	39.777271192	-80.735527919	
11,503.00	61.03	306.960	10,811.74	-1,519.83	-2,425.18	14,445,756.134	1,714,700.692	39.777315124	-80.735605192	
11,535.00	62.70	308.590	10,826.83	-1,502.55	-2,447.48	14,445,773.421	1,714,678.391	39.777362779	-80.735684384	
11,566.00	63.99	309.250	10,840.74	-1,485.14	-2,469.04	14,445,790.826	1,714,656.837	39.777410754	-80.735760917	
11,598.00	63.81	308.900	10,854.81	-1,467.03	-2,491.35	14,445,808.940	1,714,634.528	39.777460680	-80.735840129	
11,629.00	63.77	308.900	10,868.50	-1,449.56	-2,512.99	14,445,826.405	1,714,612.883	39.777508820	-80.735916985	
11,661.00	65.05	309.910	10,882.33	-1,431.24	-2,535.29	14,445,844.727	1,714,590.585	39.777559316	-80.735996158	
11,693.00	66.86	311.010	10,895.36	-1,412.28	-2,557.52	14,445,863.690	1,714,568.353	39.777611575	-80.736075088	
11,724.00	69.33	313.000	10,906.93	-1,393.03	-2,578.89	14,445,882.938	1,714,546.986	39.777664608	-80.736150935	
11,755.00	71.06	313.970	10,917.43	-1,372.96	-2,600.05	14,445,903.009	1,714,525.826	39.777719900	-80.736226036	
11,788.00	70.75	313.260	10,928.23	-1,351.45	-2,622.62	14,445,924.520	1,714,503.250	39.777779158	-80.736306167	
11,834.00	72.16	314.890	10,942.86	-1,321.11	-2,653.95	14,445,954.856	1,714,471.922	39.777862721	-80.736417352	
11,850.00	73.35	315.990	10,947.60	-1,310.22	-2,664.67	14,445,965.744	1,714,461.201	39.777892709	-80.736455397	
11,881.00	75.52	317.710	10,955.92	-1,288.44	-2,685.09	14,445,987.530	1,714,440.781	39.777952705	-80.736527848	
11,929.00	79.67	319.610	10,966.23	-1,253.24	-2,716.05	14,446,022.722	1,714,409.829	39.778049601	-80.736637645	
11,976.00	83.25	321.860	10,973.21	-1,217.27	-2,745.45	14,446,058.702	1,714,380.422	39.778148648	-80.736741934	
12,024.00	85.51	323.180	10,977.91	-1,179.36	-2,774.52	14,446,096.607	1,714,351.359	39.778252981	-80.736844982	
12,069.00	87.41	326.660	10,980.69	-1,142.61	-2,800.32	14,446,133.356	1,714,325.552	39.778354112	-80.736936450	
12,164.00	90.32	336.620	10,982.58	-1,059.14	-2,845.37	14,446,216.825	1,714,280.500	39.778583704	-80.737095928	
12,259.00	89.48	343.270	10,982.74	-969.95	-2,877.93	14,446,306.014	1,714,247.941	39.778828902	-80.737210883	
12,354.00	89.53	344.590	10,983.56	-878.67	-2,904.23	14,446,397.296	1,714,221.646	39.779079799	-80.737303523	
12,448.00	91.60	337.980	10,982.64	-789.70	-2,934.37	14,446,486.267	1,714,191.506	39.779324382	-80.737409872	
12,542.00	92.62	328.380	10,979.17	-705.97	-2,976.70	14,446,570.000	1,714,149.175	39.779554676	-80.737559665	
12,574.00	93.06	325.380	10,977.58	-679.20	-2,994.16	14,446,596.765	1,714,131.714	39.779628320	-80.737621535	
12,606.00	92.27	322.820	10,976.09	-653.31	-3,012.90	14,446,622.656	1,714,112.972	39.779699574	-80.737687974	
12,636.00	90.63	322.600	10,975.33	-629.45	-3,031.07	14,446,646.515	1,714,094.803	39.779765243	-80.737752395	
12,731.00	89.57	325.200	10,975.17	-552.70	-3,087.04	14,446,723.266	1,714,038.835	39.779976472	-80.737950804	
12,826.00	90.28	325.340	10,975.29	-474.63	-3,141.16	14,446,801.340	1,713,984.714	39.780191320	-80.738142630	
12,920.00	90.85	325.290	10,974.37	-397.33	-3,194.65	14,446,878.632	1,713,931.224	39.780404013	-80.738332213	
13,015.00	90.94	329.300	10,972.88	-317.42	-3,245.96	14,446,958.544	1,713,879.911	39.780623886	-80.738514024	
13,109.00	90.77	328.990	10,971.48	-236.73	-3,294.17	14,447,039.231	1,713,831.708	39.780845860	-80.738684762	
13,203.00	91.07	329.480	10,969.97	-155.97	-3,342.24	14,447,119.992	1,713,783.631	39.781068036	-80.738855046	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-18 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
13,298.00	90.99	329.520	10,968.26	-74.13	-3,390.45	14,447,201.833	1,713,735.423	39.781293180	-80.739025789
13,393.00	90.81	329.130	10,966.77	7.57	-3,438.91	14,447,283.530	1,713,686.963	39.781517929	-80.739197430
13,488.00	90.81	329.210	10,965.43	89.13	-3,487.59	14,447,365.097	1,713,638.281	39.781742324	-80.739369864
13,582.00	90.94	329.130	10,963.99	169.84	-3,535.76	14,447,445.805	1,713,590.113	39.781964354	-80.739540482
13,677.00	91.47	329.130	10,961.99	251.36	-3,584.50	14,447,527.328	1,713,541.380	39.782188627	-80.739713100
13,770.00	91.60	329.260	10,959.50	331.21	-3,632.11	14,447,607.178	1,713,493.770	39.782408297	-80.739881739
13,865.00	91.43	329.430	10,956.99	412.91	-3,680.53	14,447,688.873	1,713,445.350	39.782633041	-80.740053245
13,959.00	91.65	329.350	10,954.46	493.78	-3,728.37	14,447,769.745	1,713,397.504	39.782855518	-80.740222719
14,054.00	91.78	329.570	10,951.62	575.57	-3,776.62	14,447,851.530	1,713,349.252	39.783080504	-80.740393626
14,148.00	91.52	329.260	10,948.91	656.45	-3,824.43	14,447,932.418	1,713,301.443	39.783303026	-80.740562967
14,243.00	90.90	330.100	10,946.91	738.44	-3,872.38	14,448,014.404	1,713,253.496	39.783528563	-80.740732790
14,337.00	90.81	330.320	10,945.50	820.01	-3,919.08	14,448,095.973	1,713,206.800	39.783752944	-80.740898166
14,432.00	90.90	329.790	10,944.09	902.32	-3,966.49	14,448,178.281	1,713,159.385	39.783979362	-80.741066096
14,527.00	91.21	330.540	10,942.34	984.71	-4,013.75	14,448,260.675	1,713,112.130	39.784206013	-80.741233452
14,621.00	91.21	330.620	10,940.35	1,066.57	-4,059.91	14,448,342.535	1,713,065.967	39.784431188	-80.741396932
14,714.00	90.90	330.010	10,938.64	1,147.35	-4,105.96	14,448,423.315	1,713,019.919	39.784653397	-80.741560014
14,809.00	90.94	330.620	10,937.12	1,229.87	-4,153.00	14,448,505.836	1,712,972.878	39.784880395	-80.741726612
14,903.00	91.16	332.340	10,935.39	1,312.45	-4,197.87	14,448,588.412	1,712,928.006	39.785107526	-80.741885492
14,997.00	90.94	330.930	10,933.67	1,395.15	-4,242.52	14,448,671.110	1,712,883.356	39.785334991	-80.742043579
15,092.00	91.12	331.290	10,931.96	1,478.31	-4,288.41	14,448,754.274	1,712,837.467	39.785563742	-80.742206077
15,187.00	91.30	332.120	10,929.96	1,561.94	-4,333.43	14,448,837.904	1,712,792.446	39.785793768	-80.742365477
15,281.00	90.06	330.710	10,928.84	1,644.47	-4,378.40	14,448,920.436	1,712,747.476	39.786020779	-80.742524710
15,375.00	90.32	331.590	10,928.53	1,726.81	-4,423.76	14,449,002.768	1,712,702.120	39.786247242	-80.742685319
15,469.00	90.77	331.070	10,927.63	1,809.28	-4,468.85	14,449,085.239	1,712,657.024	39.786474086	-80.742845001
15,564.00	90.90	331.020	10,926.25	1,892.39	-4,514.84	14,449,168.355	1,712,611.038	39.786702707	-80.743007849
15,658.00	90.90	330.760	10,924.77	1,974.51	-4,560.56	14,449,250.471	1,712,565.314	39.786928580	-80.743169774
15,753.00	90.94	331.200	10,923.25	2,057.57	-4,606.64	14,449,333.533	1,712,519.234	39.787157053	-80.743332957
15,848.00	90.99	332.170	10,921.65	2,141.19	-4,651.70	14,449,417.153	1,712,474.181	39.787387052	-80.743492481
15,943.00	90.72	331.730	10,920.23	2,225.02	-4,696.37	14,449,500.984	1,712,429.513	39.787617626	-80.743650632
16,037.00	90.99	332.030	10,918.83	2,307.92	-4,740.66	14,449,583.879	1,712,385.214	39.787845626	-80.743807480
16,132.00	91.21	331.590	10,917.00	2,391.64	-4,785.53	14,449,667.595	1,712,340.345	39.788075884	-80.743966351
16,227.00	90.94	331.290	10,915.22	2,475.06	-4,830.94	14,449,751.020	1,712,294.935	39.788305348	-80.744127149
16,322.00	90.68	330.980	10,913.88	2,558.25	-4,876.80	14,449,834.209	1,712,249.079	39.788534166	-80.744289541
16,416.00	90.63	329.960	10,912.80	2,640.03	-4,923.13	14,449,915.991	1,712,202.752	39.788759126	-80.744453624
16,511.00	91.03	329.210	10,911.43	2,721.95	-4,971.22	14,449,997.908	1,712,154.663	39.788984468	-80.744623979
16,610.00	91.16	330.100	10,909.54	2,807.37	-5,021.22	14,450,083.328	1,712,104.658	39.789219446	-80.744801123
16,704.00	91.69	330.140	10,907.20	2,888.85	-5,068.04	14,450,164.807	1,712,057.843	39.789443576	-80.744969949
16,798.00	91.65	330.270	10,904.46	2,970.39	-5,114.72	14,450,246.346	1,712,011.154	39.789667869	-80.745133236
16,892.00	91.83	329.790	10,901.61	3,051.78	-5,161.66	14,450,327.739	1,711,964.219	39.789891763	-80.745298584
16,985.00	91.07	329.350	10,899.25	3,131.94	-5,208.75	14,450,407.902	1,711,917.131	39.790112278	-80.745465398
17,079.00	91.12	329.740	10,897.46	3,212.96	-5,256.38	14,450,488.917	1,711,869.495	39.790335140	-80.745634157
17,173.00	91.12	329.790	10,895.62	3,294.16	-5,303.71	14,450,570.115	1,711,822.171	39.790558498	-80.745801805
17,267.00	90.94	329.830	10,893.93	3,375.39	-5,350.97	14,450,651.351	1,711,774.909	39.790781964	-80.745969232
17,362.00	90.99	329.570	10,892.33	3,457.40	-5,398.89	14,450,733.362	1,711,726.986	39.791007561	-80.746139006
17,456.00	90.99	330.010	10,890.70	3,538.63	-5,446.18	14,450,814.583	1,711,679.695	39.791230984	-80.746306538
17,550.00	91.03	330.140	10,889.05	3,620.08	-5,493.07	14,450,896.038	1,711,632.809	39.791455046	-80.746474267
17,643.00	90.99	330.320	10,887.41	3,700.79	-5,539.24	14,450,976.752	1,711,586.640	39.791677066	-80.746636173
17,738.00	90.90	330.270	10,885.84	3,783.30	-5,586.31	14,451,059.256	1,711,539.571	39.791904011	-80.746802907
17,832.00	91.16	330.400	10,884.15	3,864.97	-5,632.82	14,451,140.923	1,711,493.055	39.792126649	-80.746967678
17,926.00	90.94	329.260	10,882.43	3,946.22	-5,680.06	14,451,222.174	1,711,445.823	39.792352153	-80.747135008
18,020.00	91.03	329.080	10,880.81	4,026.92	-5,728.22	14,451,302.879	1,711,397.656	39.792574164	-80.747305671
18,114.00	91.21	329.300	10,878.98	4,107.84	-5,776.36	14,451,383.597	1,711,349.519	39.792796211	-80.747476227
18,208.00	91.07	329.390	10,877.11	4,188.49	-5,824.28	14,451,464.445	1,711,301.601	39.793018611	-80.747646004
18,302.00	91.07	329.430	10,875.35	4,269.39	-5,872.11	14,451,545.348	1,711,253.774	39.793241164	-80.747815459



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
18,396.00	91.16	329.570	10,873.52	4,350.37	-5,919.81	14,451,626.326	1,711,206.074	39.793463919	-80.747984459
18,489.00	91.03	329.480	10,871.74	4,430.51	-5,966.96	14,451,706.463	1,711,158.917	39.793684362	-80.748151538
18,584.00	90.63	329.430	10,870.37	4,512.32	-6,015.24	14,451,788.271	1,711,110.642	39.793909401	-80.748322582
18,678.00	90.77	329.300	10,869.22	4,593.19	-6,063.13	14,451,869.145	1,711,062.746	39.794131873	-80.748492284
18,772.00	90.85	329.570	10,867.89	4,674.12	-6,110.93	14,451,950.076	1,711,014.950	39.794354498	-80.748661631
18,866.00	90.85	329.700	10,866.50	4,755.22	-6,158.44	14,452,031.172	1,710,967.438	39.794577576	-80.748829969
18,959.00	90.90	329.700	10,865.08	4,835.50	-6,205.36	14,452,111.459	1,710,920.523	39.794798425	-80.748996192
19,052.00	91.03	329.520	10,863.51	4,915.71	-6,252.40	14,452,191.669	1,710,873.482	39.795019066	-80.749162860
19,145.00	90.90	329.210	10,861.94	4,995.72	-6,299.78	14,452,271.677	1,710,826.099	39.795239155	-80.749330751
19,239.00	90.72	329.390	10,860.61	5,076.54	-6,347.77	14,452,352.495	1,710,778.113	39.795461471	-80.749500783
19,333.00	90.85	329.610	10,859.33	5,157.53	-6,395.47	14,452,433.481	1,710,730.409	39.795684244	-80.749669810
19,427.00	91.38	329.610	10,857.50	5,238.60	-6,443.02	14,452,514.549	1,710,682.866	39.795907244	-80.749838267
19,520.00	91.47	329.610	10,855.18	5,318.79	-6,490.05	14,452,594.746	1,710,635.833	39.796127847	-80.750004913
19,614.00	91.12	329.830	10,853.06	5,399.95	-6,537.43	14,452,675.901	1,710,588.448	39.796351083	-80.750172805
19,708.00	91.16	330.010	10,851.19	5,481.27	-6,584.54	14,452,757.225	1,710,541.344	39.796574782	-80.750339698
19,802.00	91.12	330.180	10,849.32	5,562.74	-6,631.39	14,452,838.693	1,710,494.488	39.796798873	-80.750505705
19,896.00	90.90	328.640	10,847.66	5,643.64	-6,679.22	14,452,919.596	1,710,446.662	39.797021420	-80.750675176
19,989.00	90.99	329.210	10,846.13	5,723.29	-6,727.22	14,452,999.239	1,710,398.666	39.797240506	-80.750845264
20,082.00	90.99	329.610	10,844.52	5,803.33	-6,774.54	14,453,079.284	1,710,351.346	39.797460692	-80.751012940
20,176.00	90.81	330.140	10,843.05	5,884.62	-6,821.71	14,453,160.577	1,710,304.175	39.797684305	-80.751180077
20,269.00	90.81	329.660	10,841.73	5,965.08	-6,868.34	14,453,241.027	1,710,257.539	39.797905599	-80.751345317
20,363.00	90.99	330.100	10,840.25	6,046.37	-6,915.51	14,453,322.325	1,710,210.375	39.798129223	-80.751512431
20,456.00	91.03	330.540	10,838.62	6,127.16	-6,961.55	14,453,403.111	1,710,164.333	39.798351433	-80.751675556
20,549.00	91.12	330.890	10,836.87	6,208.26	-7,007.03	14,453,484.211	1,710,118.849	39.798574501	-80.751836689
20,643.00	90.85	330.360	10,835.25	6,290.16	-7,053.14	14,453,566.113	1,710,072.747	39.798799775	-80.752000019
20,737.00	91.52	331.330	10,833.31	6,372.23	-7,098.92	14,453,648.184	1,710,026.964	39.799025513	-80.752162215
20,829.00	91.74	331.590	10,830.69	6,453.02	-7,142.86	14,453,728.972	1,709,983.026	39.799247711	-80.752317849
20,922.00	91.25	331.730	10,828.27	6,534.85	-7,186.99	14,453,810.797	1,709,938.894	39.799472760	-80.752474169
21,016.00	91.07	331.680	10,826.36	6,617.60	-7,231.54	14,453,893.549	1,709,894.347	39.799700356	-80.752631961
21,110.00	91.38	332.170	10,824.35	6,700.52	-7,275.77	14,453,976.469	1,709,850.118	39.799928411	-80.752786615
21,203.00	90.68	330.270	10,822.68	6,782.01	-7,320.53	14,454,057.963	1,709,805.353	39.800152556	-80.752947195
21,297.00	90.23	330.400	10,821.94	6,863.69	-7,367.05	14,454,139.640	1,709,758.831	39.800377214	-80.753112028
21,391.00	90.63	331.020	10,821.23	6,945.67	-7,413.04	14,454,221.619	1,709,712.845	39.800602700	-80.753274951
21,486.00	90.06	330.710	10,820.66	7,028.65	-7,459.29	14,454,304.597	1,709,666.594	39.800830929	-80.753438812
21,580.00	90.41	330.800	10,820.27	7,110.66	-7,505.21	14,454,386.615	1,709,620.671	39.801056518	-80.753601512
21,672.00	89.93	329.740	10,820.00	7,190.55	-7,550.84	14,454,466.503	1,709,575.048	39.801276258	-80.753763167
21,766.00	91.12	331.640	10,819.14	7,272.51	-7,596.85	14,454,548.461	1,709,529.037	39.801501682	-80.753926186
21,859.00	91.16	330.710	10,817.29	7,353.97	-7,641.68	14,454,629.921	1,709,484.208	39.801725730	-80.754085002
21,952.00	90.81	329.960	10,815.69	7,434.77	-7,687.70	14,454,710.719	1,709,438.187	39.801947970	-80.754248068
22,045.00	90.59	329.880	10,814.55	7,515.24	-7,734.31	14,454,791.188	1,709,391.578	39.802169311	-80.754413232
22,138.00	90.68	330.050	10,813.52	7,595.74	-7,780.85	14,454,871.695	1,709,345.032	39.802390754	-80.754578173
22,232.00	90.85	329.960	10,812.27	7,677.15	-7,827.84	14,454,953.098	1,709,298.043	39.802614662	-80.754744682
22,326.00	90.85	330.230	10,810.87	7,758.62	-7,874.70	14,455,034.573	1,709,251.183	39.802838766	-80.754910732
22,420.00	90.85	330.230	10,809.48	7,840.21	-7,921.37	14,455,116.158	1,709,204.516	39.803063171	-80.755076099
22,514.00	90.90	330.230	10,808.04	7,921.79	-7,968.04	14,455,197.743	1,709,157.849	39.803287575	-80.755241465
22,607.00	90.59	330.400	10,806.83	8,002.58	-8,014.09	14,455,278.530	1,709,111.796	39.803509785	-80.755404651
22,701.00	90.54	330.800	10,805.91	8,084.47	-8,060.23	14,455,360.420	1,709,065.654	39.803735022	-80.755568148
22,795.00	90.50	330.490	10,805.05	8,166.40	-8,106.31	14,455,442.347	1,709,019.575	39.803960359	-80.755731418
22,889.00	90.46	330.050	10,804.27	8,248.02	-8,152.92	14,455,523.970	1,708,972.961	39.804184869	-80.755896599
22,983.00	90.19	330.010	10,803.73	8,329.45	-8,199.88	14,455,605.400	1,708,926.005	39.804408847	-80.756063001
23,078.00	90.59	330.270	10,803.09	8,411.84	-8,247.18	14,455,687.786	1,708,878.707	39.804635454	-80.756230610
23,170.00	90.59	330.710	10,802.14	8,491.90	-8,292.49	14,455,767.846	1,708,833.393	39.804855659	-80.756391182
23,264.00	90.50	330.450	10,801.25	8,573.77	-8,338.66	14,455,849.720	1,708,787.221	39.805080852	-80.756554788
23,358.00	90.54	329.740	10,800.39	8,655.25	-8,385.53	14,455,931.200	1,708,740.359	39.805304968	-80.756720860



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle N-16 HU (slot E)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle N-16 HU (slot E)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
23,451.00	90.46	329.880	10,799.58	8,735.64	-8,432.29	14,456,011.583	1,708,693.594	39.805526068	-80.756886596
23,544.00	90.81	330.230	10,798.55	8,816.22	-8,478.71	14,456,092.162	1,708,647.174	39.805747707	-80.757051102
23,638.00	91.07	329.880	10,797.01	8,897.66	-8,525.63	14,456,173.602	1,708,600.259	39.805971712	-80.757217366
23,731.00	91.30	330.850	10,795.08	8,978.47	-8,571.60	14,456,254.419	1,708,554.283	39.806193998	-80.757380290
23,824.00	91.21	330.890	10,793.05	9,059.69	-8,616.86	14,456,335.636	1,708,509.023	39.806417379	-80.757540667
23,919.00	90.94	330.400	10,791.27	9,142.48	-8,663.43	14,456,418.423	1,708,462.460	39.806645079	-80.757705664
24,012.00	91.16	329.520	10,789.56	9,222.97	-8,709.97	14,456,498.917	1,708,415.912	39.806866481	-80.757870632
24,105.00	91.34	329.700	10,787.53	9,303.17	-8,757.01	14,456,579.119	1,708,368.877	39.807087088	-80.758037342
24,198.00	90.81	329.300	10,785.79	9,383.29	-8,804.20	14,456,659.236	1,708,321.684	39.807307460	-80.758204612
24,292.00	90.94	329.740	10,784.35	9,464.29	-8,851.88	14,456,740.236	1,708,274.010	39.807530260	-80.758373591
24,385.00	90.54	329.700	10,783.15	9,544.60	-8,898.77	14,456,820.541	1,708,227.121	39.807751147	-80.758539780
24,479.00	90.54	329.520	10,782.26	9,625.68	-8,946.32	14,456,901.622	1,708,179.570	39.807974168	-80.758708320
24,572.00	90.28	329.300	10,781.60	9,705.73	-8,993.64	14,456,981.677	1,708,132.244	39.808194370	-80.758876068
24,667.00	90.23	329.350	10,781.18	9,787.44	-9,042.11	14,457,063.383	1,708,083.779	39.808419115	-80.759047860
24,758.00	92.09	330.930	10,779.33	9,866.33	-9,087.40	14,457,142.280	1,708,038.484	39.808636120	-80.759208391
24,851.00	91.65	329.830	10,776.30	9,947.14	-9,133.34	14,457,223.082	1,707,992.545	39.808858364	-80.759371200
24,944.00	91.78	330.400	10,773.52	10,027.73	-9,179.66	14,457,303.679	1,707,946.228	39.809080046	-80.759535357
25,036.00	92.67	330.450	10,769.94	10,107.69	-9,225.03	14,457,383.631	1,707,900.855	39.809299950	-80.759696159
25,129.00	92.31	330.230	10,765.90	10,188.42	-9,271.01	14,457,464.369	1,707,854.877	39.809522017	-80.759859107
25,221.00	92.58	330.270	10,761.98	10,268.23	-9,316.62	14,457,544.170	1,707,809.267	39.809741508	-80.760020758
25,315.00	92.58	330.360	10,757.75	10,349.81	-9,363.13	14,457,625.751	1,707,762.762	39.809965892	-80.760185576
25,408.00	91.38	329.740	10,754.53	10,430.34	-9,409.53	14,457,706.282	1,707,716.361	39.810187391	-80.760350037
25,502.00	91.52	330.010	10,752.16	10,511.62	-9,456.69	14,457,787.559	1,707,669.199	39.810410947	-80.760517203
25,594.00	91.30	329.920	10,749.89	10,591.24	-9,502.72	14,457,867.181	1,707,623.164	39.810629947	-80.760680370
25,688.00	91.30	329.880	10,747.76	10,672.54	-9,549.85	14,457,948.484	1,707,576.035	39.810853573	-80.760847423
25,782.00	91.30	330.140	10,745.63	10,753.93	-9,596.83	14,458,029.877	1,707,529.061	39.811077445	-80.761013919
25,875.00	91.47	330.490	10,743.38	10,834.71	-9,642.87	14,458,110.648	1,707,483.018	39.811299600	-80.761177108
25,969.00	91.07	330.180	10,741.30	10,916.36	-9,689.38	14,458,192.308	1,707,436.507	39.811524199	-80.761341958
26,063.00	91.25	330.180	10,739.39	10,997.90	-9,736.12	14,458,273.844	1,707,389.772	39.811748462	-80.761507604
26,157.00	90.85	329.660	10,737.67	11,079.23	-9,783.22	14,458,355.171	1,707,342.667	39.811972150	-80.761674575
26,251.00	90.90	329.830	10,736.23	11,160.42	-9,830.58	14,458,436.358	1,707,295.311	39.812195456	-80.761842441
26,269.00	91.03	330.100	10,735.93	11,176.00	-9,839.59	14,458,451.938	1,707,286.303	39.812238310	-80.761874371
26,345.00	91.03	330.360	10,734.57	11,241.96	-9,877.32	14,458,517.897	1,707,248.573	39.812419727	-80.762008101
26,438.00	91.69	330.320	10,732.36	11,322.75	-9,923.32	14,458,598.689	1,707,202.565	39.812641937	-80.762171172
26,531.00	90.77	329.570	10,730.36	11,403.22	-9,969.89	14,458,679.164	1,707,156.000	39.812863283	-80.762336233
26,626.00	91.34	329.790	10,728.61	11,485.21	-10,017.84	14,458,761.156	1,707,108.049	39.813088862	-80.762506211
Survey @ 26626.00 MD 10728.61 TVD - Survey Proj. to 26626.00 MD 10728.61 TVD									
26,662.00	91.34	329.790	10,727.77	11,516.32	-10,035.95	14,458,792.258	1,707,089.940	39.813174349	-80.762570405

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
173.00	173.00	0.16	-0.47	MWD surveys
26,626.00	10,728.61	11,485.21	-10,017.84	Survey @ 26626.00 MD 10728.61 TVD
26,626.00	10,728.61	11,485.21	-10,017.84	Survey Proj. to 26626.00 MD 10728.61 TVD