



Well: Van Winkle S-21 HU (slot B)
 Site: Van Winkle
 Project: Marshall County, West Virginia NAD83 UTM 17N
 Design: rev8
 Rig: Nabors B28

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	Vsect	Annotation
1	11284.00	72.18	162.120	10979.19	-603.57	-1294.90	0.00	0.00	20.95	Tie in survey @ 11284 MD
2	11310.00	74.48	160.564	10986.65	-627.16	-1286.93	10.54	-33.17	45.74	S/T Begin 3°/100' drop/turn (135R)
3	11340.00	73.84	161.227	10994.83	-654.43	-1277.48	3.00	135.00	74.49	Begin 5°/100' build/turn (90R)
4	11370.00	73.85	162.788	11003.18	-681.84	-1268.58	5.00	90.00	103.14	Begin 10°/100' build
5	11470.00	83.85	162.788	11022.49	-775.44	-1239.59	10.00	0.00	200.41	Begin 10°/100' build/turn
6	11551.89	90.50	158.000	11026.53	-852.42	-1212.15	10.00	-35.87	281.88	Begin 90.50° lateral
7	11651.89	90.50	158.000	11025.66	-945.14	-1174.69	0.00	0.00	381.80	Begin 2°/100' drop/turn
8	12306.18	89.00	145.000	11028.52	-1518.88	-863.18	2.00	-96.58	1032.78	Begin 89.00° lateral
9	12648.18	89.00	145.000	11034.49	-1798.99	-667.05	0.00	0.00	1368.62	Begin 2°/100' turn
10	12907.20	89.00	150.181	11039.02	-2017.56	-528.29	2.00	90.04	1624.83	Begin 89.00° lateral
11	26147.14	89.00	150.181	11270.00	-13502.82	6054.37	0.00	0.00	14798.02	PBHL/TD 26147.14 MD 11270.00 TVD

DESIGN TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
Van Winkle S-21HU LP r5	11017.00	-908.03	-1164.32	14446391.964	1715958.388	39.779051000	-80.731122000
- plan misses target center by 25.16ft at 11621.45ft MD (11025.92 TVD, -916.91 N, -1186.10 E)							
Van Winkle S-21HU PBHL r5	11270.00	-13502.82	6054.37	14433797.198	1723177.060	39.744400000	-80.705576000
- plan hits target center							

ANNOTATIONS SURVEYS ORIGINAL HOLE

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
184.00	0.48	72.650	184.00	0.21	0.68	0.08	MWD surveys
5445.00	12.87	265.461	5398.27	-95.05	-507.76	-121.01	Top of Fish @ 5445.00 MD 5398.27 TVD
6149.00	11.80	267.590	6088.53	-103.78	-645.27	-169.30	Survey @ 6149.00 MD 6088.53 TVD
6224.00	11.80	267.590	6161.95	-104.42	-660.59	-174.98	Survey Proj. to 6224.00 MD 6161.95 TVD OH

ANNOTATIONS SURVEYS SIDETRACK 01

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
5112.00	10.78	269.320	5073.05	-95.79	-436.46	-91.16	Tie into original hole @ 5112 MD
5247.00	12.26	273.120	5205.35	-94.66	-463.29	-103.16	Survey @ 5247.00 MD 5205.35 TVD

ANNOTATIONS SURVEYS SIDETRACK 02

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
4641.00	12.92	269.180	4613.98	-89.69	-331.79	-53.90	Tie into original hole @ 4641 MD
11889.00	87.16	152.010	11016.14	-1142.01	-1027.09	621.85	Survey @ 11889 MD 11016.14 TVD ST2
11953.00	87.16	152.010	11019.31	-1198.46	-997.09	685.63	Top of Fish @ 11953 MD 11019.31 TVD ST2
11982.00	87.16	152.010	11020.74	-1224.03	-983.49	714.53	Survey Proj. to 11982 MD 11020.74 TVD ST2

ANNOTATIONS SURVEYS SIDETRACK 03

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
11237.00	65.45	163.170	10952.21	-561.77	-1307.97	-22.55	Tie into sidetrack 02 @ 11237 MD
26114.00	86.77	147.180	11314.44	-13448.96	6074.63	14757.17	Survey @ 26114.00 MD 11314.44 TVD ST3
26173.00	86.77	147.180	11317.76	-13498.46	6106.56	14815.40	Survey Proj. to 26173.00 MD 11317.76 TVD ST3

Survey @ 5247.00 MD 5205.35 TVD

Top of Fish @ 5445.00 MD 5398.27 TVD

Survey @ 6149.00 MD 6088.53 TVD

Survey Proj. to 6224.00 MD 6161.95 TVD OH

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)

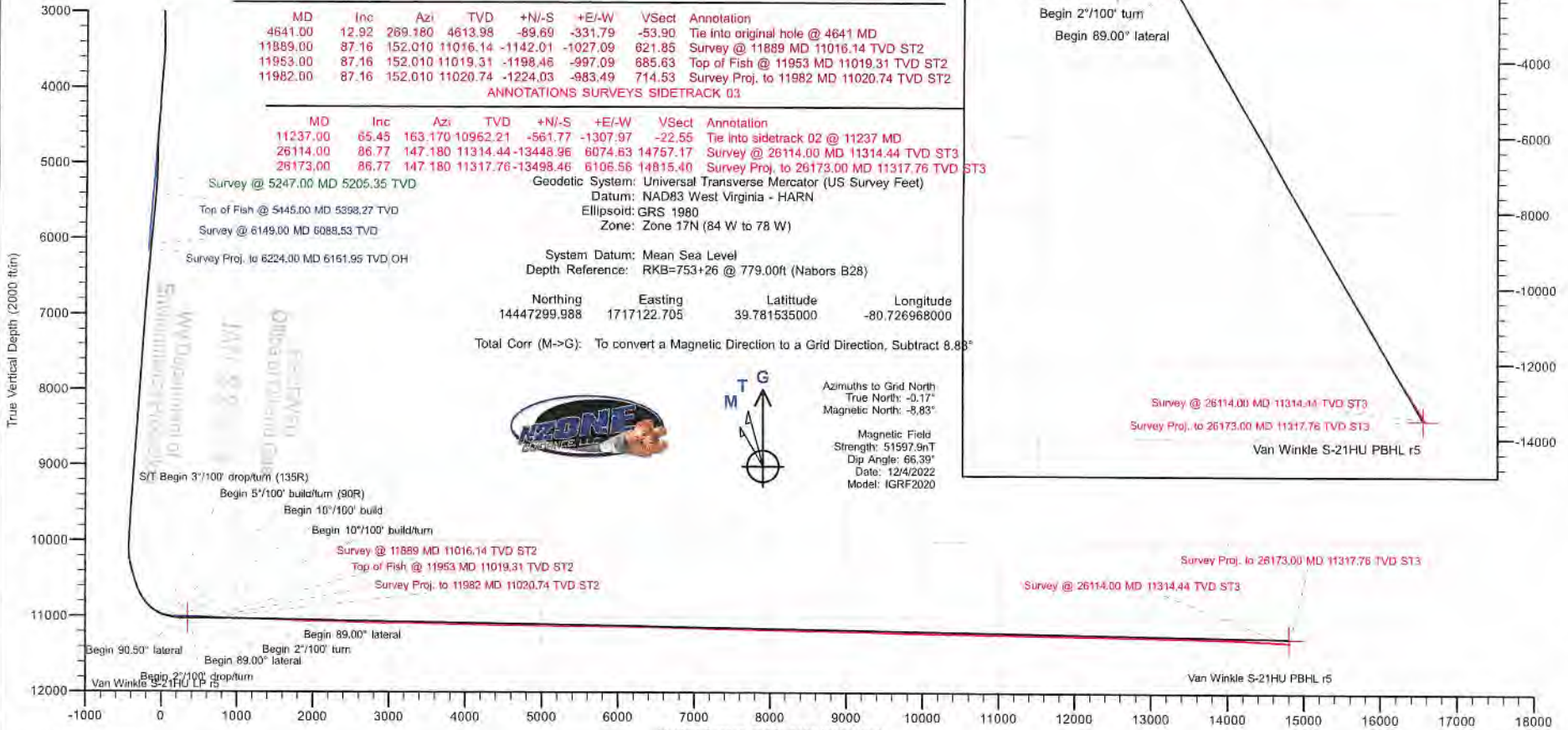
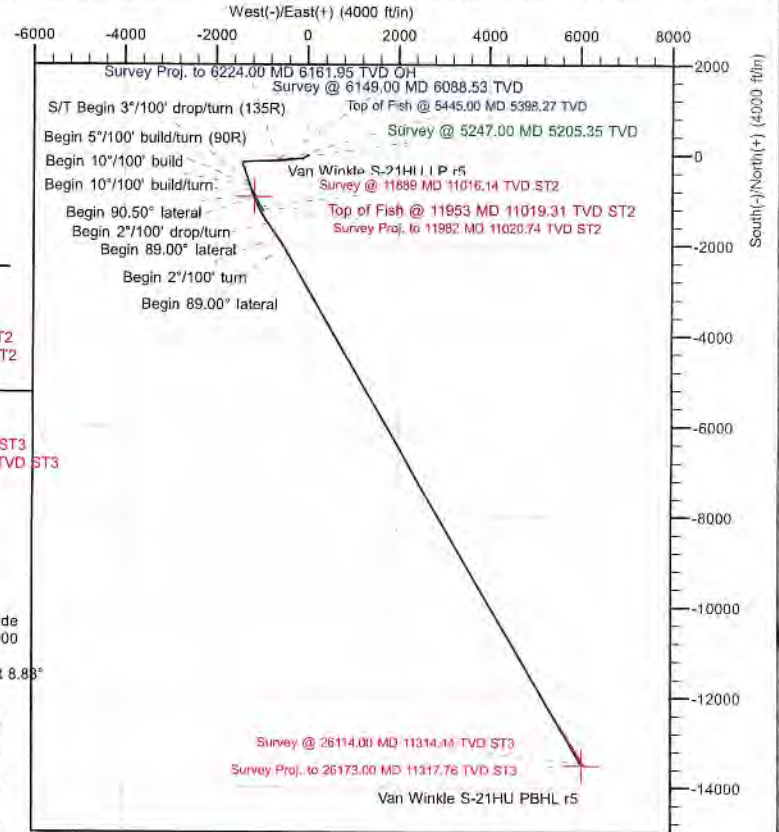
Northing: 14447299.988 Easting: 17117122.705 Latitude: 39.781535000 Longitude: -80.726968000

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.88°



Azimuths to Grid North
 True North: -0.17°
 Magnetic North: -8.83°

Magnetic Field
 Strength: 51597.9nT
 Dip Angle: 66.39°
 Date: 12/4/2022
 Model: IGRF2020





Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	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 S-21 HU (slot B)					
Well Position	+N/-S	0.00 ft	Northing:	14,447,299.987 usft	Latitude:	39.781535000
	+E/-W	0.00 ft	Easting:	1,717,122.706 usft	Longitude:	-80.726968000
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	10/10/2022	-8.65	66.41	51,613.57311444

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	155.850	

Survey Program	Date 10/23/2022				
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
14.00	2,196.00	MWD surf (Original Hole)	MWD	MWD - Standard	
2,260.00	6,149.00	MWD (Original Hole)	MWD	MWD - Standard	
6,219.00	6,224.00	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	
184.00	0.48	72.650	184.00	0.21	0.68	0.08	0.28	0.28	0.00	
MWD surveys										
213.00	0.40	92.950	213.00	0.24	0.90	0.14	0.60	-0.28	70.00	
242.00	0.48	78.190	242.00	0.26	1.12	0.22	0.48	0.28	-50.90	
270.00	0.31	39.870	270.00	0.35	1.28	0.21	1.09	-0.61	-136.86	
299.00	0.48	60.610	299.00	0.46	1.44	0.16	0.76	0.59	71.52	

02/23/2024



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Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-21 HU (slot B)	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)
329.00	0.48	65.970	328.99	0.58	1.66	0.15	0.15	0.00	17.87
361.00	0.22	93.920	360.99	0.63	1.84	0.18	0.95	-0.81	87.34
392.00	0.62	78.270	391.99	0.66	2.07	0.25	1.33	1.29	-50.48
423.00	0.70	96.560	422.99	0.67	2.42	0.38	0.72	0.26	59.00
455.00	0.48	99.720	454.99	0.63	2.75	0.55	0.69	-0.69	9.88
487.00	0.70	133.290	486.99	0.47	3.02	0.81	1.25	0.69	104.91
522.00	0.48	137.340	521.99	0.21	3.28	1.14	0.64	-0.63	11.57
552.00	1.01	206.160	551.98	-0.12	3.24	1.43	3.16	1.77	229.40
583.00	0.88	181.020	582.98	-0.60	3.12	1.82	1.39	-0.42	-81.10
614.00	0.88	179.880	613.98	-1.07	3.12	2.26	0.06	0.00	-3.68
646.00	0.70	147.270	645.97	-1.48	3.22	2.67	1.49	-0.56	-101.91
678.00	0.79	157.730	677.97	-1.85	3.41	3.09	0.51	0.28	32.69
710.00	1.10	147.180	709.97	-2.32	3.66	3.61	1.11	0.97	-32.97
741.00	1.41	168.450	740.96	-2.94	3.90	4.28	1.79	1.00	68.61
773.00	1.41	151.930	772.95	-3.67	4.16	5.05	1.27	0.00	-51.63
805.00	1.41	153.510	804.94	-4.37	4.52	5.84	0.12	0.00	4.94
836.00	1.04	168.440	835.93	-4.99	4.75	6.50	1.57	-1.19	48.16
868.00	0.86	170.840	867.93	-5.51	4.85	7.01	0.58	-0.56	7.50
900.00	1.17	160.400	899.92	-6.06	4.99	7.57	1.12	0.97	-32.63
931.00	0.74	151.890	930.92	-6.53	5.20	8.08	1.46	-1.39	-27.45
963.00	0.74	153.220	962.92	-6.90	5.39	8.50	0.05	0.00	4.16
995.00	0.50	194.200	994.91	-7.22	5.44	8.81	1.53	-0.75	128.06
1,027.00	0.49	151.560	1,026.91	-7.47	5.48	9.06	1.13	-0.03	-133.25
1,058.00	0.29	192.140	1,057.91	-7.67	5.52	9.25	1.06	-0.65	130.90
1,090.00	0.62	147.930	1,089.91	-7.89	5.60	9.49	1.43	1.03	-138.16
1,122.00	0.50	131.170	1,121.91	-8.13	5.79	9.79	0.63	-0.38	-52.38
1,154.00	0.51	159.800	1,153.91	-8.36	5.95	10.06	0.78	0.03	89.47
1,186.00	0.40	208.550	1,185.91	-8.59	5.94	10.27	1.21	-0.34	152.34
1,217.00	0.47	214.890	1,216.91	-8.79	5.82	10.40	0.27	0.23	20.45
1,249.00	0.17	271.540	1,248.91	-8.89	5.70	10.45	1.26	-0.94	177.03
1,281.00	0.52	290.880	1,280.91	-8.84	5.51	10.32	1.14	1.09	60.44
1,312.00	1.09	269.170	1,311.90	-8.79	5.09	10.11	2.05	1.84	-70.03
1,344.00	1.24	292.870	1,343.90	-8.66	4.46	9.73	1.56	0.47	74.06
1,376.00	1.45	287.960	1,375.89	-8.40	3.76	9.21	0.75	0.66	-15.34
1,408.00	1.52	274.670	1,407.88	-8.25	2.95	8.73	1.10	0.22	-41.53
1,440.00	1.86	261.200	1,439.86	-8.29	2.02	8.39	1.63	1.06	-42.09
1,471.00	2.67	262.160	1,470.84	-8.47	0.80	8.05	2.62	2.61	3.10
1,503.00	3.09	254.260	1,502.80	-8.80	-0.77	7.72	1.80	1.31	-24.69
1,534.00	3.18	245.190	1,533.75	-9.39	-2.35	7.61	1.62	0.29	-29.26
1,566.00	3.46	235.710	1,565.70	-10.31	-3.95	7.79	1.92	0.88	-29.63
1,597.00	3.60	234.080	1,596.64	-11.40	-5.51	8.15	0.56	0.45	-5.26
1,629.00	4.09	230.200	1,628.57	-12.72	-7.20	8.66	1.73	1.53	-12.13
1,659.00	4.51	225.560	1,658.48	-14.23	-8.87	9.36	1.82	1.40	-15.47



Survey Report



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Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-21 HU (slot B)	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)
1,691.00	5.16	222.060	1,690.37	-16.18	-10.73	10.38	2.23	2.03	-10.94
1,722.00	4.88	217.470	1,721.25	-18.26	-12.47	11.57	1.58	-0.90	-14.81
1,753.00	4.98	217.900	1,752.14	-20.37	-14.10	12.82	0.34	0.32	1.39
1,785.00	4.15	226.230	1,784.03	-22.27	-15.79	13.86	3.31	-2.59	26.03
1,816.00	3.82	224.110	1,814.96	-23.79	-17.31	14.62	1.17	-1.06	-6.84
1,848.00	3.32	227.140	1,846.90	-25.18	-18.74	15.31	1.67	-1.56	9.47
1,880.00	3.36	236.280	1,878.84	-26.33	-20.19	15.77	1.67	0.13	28.56
1,911.00	2.92	239.720	1,909.80	-27.24	-21.63	16.00	1.54	-1.42	11.10
1,943.00	2.84	249.310	1,941.76	-27.93	-23.08	16.04	1.52	-0.25	29.97
1,975.00	2.92	266.850	1,973.72	-28.25	-24.63	15.70	2.75	0.25	54.81
2,006.00	3.07	269.470	2,004.67	-28.30	-26.25	15.09	0.65	0.48	8.45
2,038.00	3.70	275.350	2,036.62	-28.22	-28.14	14.23	2.25	1.97	18.38
2,070.00	4.10	272.560	2,068.54	-28.07	-30.31	13.21	1.38	1.25	-8.72
2,101.00	4.04	265.420	2,099.47	-28.11	-32.50	12.35	1.65	-0.19	-23.03
2,133.00	3.59	250.220	2,131.40	-28.53	-34.57	11.89	3.45	-1.41	-47.50
2,164.00	4.16	246.230	2,162.32	-29.32	-36.51	11.81	2.03	1.84	-12.87
2,196.00	4.22	240.260	2,194.24	-30.37	-38.60	11.92	1.38	0.19	-18.66
2,260.00	4.39	220.130	2,258.06	-33.41	-42.22	13.21	2.36	0.27	-31.45
2,292.00	4.61	216.530	2,289.96	-35.38	-43.77	14.37	1.12	0.69	-11.25
2,324.00	4.53	220.140	2,321.86	-37.38	-45.35	15.55	0.93	-0.25	11.28
2,356.00	3.91	225.390	2,353.77	-39.11	-46.95	16.48	2.28	-1.94	16.41
2,388.00	2.91	237.790	2,385.72	-40.31	-48.41	16.98	3.87	-3.13	38.75
2,419.00	2.39	239.880	2,416.68	-41.05	-49.63	17.15	1.71	-1.68	6.74
2,451.00	1.44	246.530	2,448.67	-41.55	-50.58	17.22	3.04	-2.97	20.78
2,481.00	1.45	242.770	2,478.66	-41.87	-51.26	17.23	0.32	0.03	-12.53
2,513.00	1.62	251.740	2,510.65	-42.20	-52.05	17.21	0.92	0.53	28.03
2,545.00	1.31	240.360	2,542.64	-42.52	-52.80	17.20	1.32	-0.97	-35.56
2,576.00	1.18	259.840	2,573.63	-42.75	-53.42	17.15	1.42	-0.42	62.84
2,608.00	1.08	253.690	2,605.62	-42.90	-54.04	17.03	0.49	-0.31	-19.22
2,640.00	1.43	245.610	2,637.61	-43.15	-54.69	16.99	1.22	1.09	-25.25
2,671.00	2.34	243.330	2,668.60	-43.59	-55.61	17.02	2.94	2.94	-7.35
2,703.00	2.84	228.130	2,700.56	-44.41	-56.78	17.29	2.64	1.56	-47.50
2,735.00	2.74	233.380	2,732.53	-45.40	-57.99	17.70	0.86	-0.31	16.41
2,767.00	3.42	233.030	2,764.48	-46.43	-59.36	18.08	2.13	2.13	-1.09
2,798.00	3.03	231.020	2,795.43	-47.50	-60.74	18.49	1.31	-1.26	-6.48
2,830.00	3.41	229.620	2,827.38	-48.65	-62.12	18.97	1.21	1.19	-4.38
2,862.00	3.29	230.490	2,859.33	-49.85	-63.55	19.48	0.41	-0.38	2.72
2,893.00	2.98	222.240	2,890.28	-51.01	-64.78	20.04	1.76	-1.00	-26.61
2,923.00	3.04	220.750	2,920.24	-52.19	-65.83	20.69	0.33	0.20	-4.97
2,955.00	3.02	225.960	2,952.19	-53.42	-66.99	21.34	0.86	-0.06	16.28
2,986.00	2.72	219.030	2,983.15	-54.56	-68.04	21.95	1.48	-0.97	-22.35
3,018.00	3.35	225.270	3,015.11	-55.81	-69.18	22.62	2.22	1.97	19.50
3,049.00	3.66	225.190	3,046.05	-57.14	-70.52	23.29	1.00	1.00	-0.26
3,081.00	4.41	229.080	3,077.97	-58.67	-72.18	24.00	2.49	2.34	12.16



Survey Report



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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)
3,113.00	5.46	230.640	3,109.85	-60.44	-74.28	24.76	3.31	3.28	4.88
3,144.00	6.05	234.790	3,140.70	-62.32	-76.76	25.46	2.33	1.90	13.39
3,175.00	7.07	238.190	3,171.49	-64.26	-79.72	26.02	3.52	3.29	10.97
3,207.00	7.75	236.640	3,203.23	-66.49	-83.19	26.63	2.21	2.13	-4.84
3,238.00	8.19	239.290	3,233.93	-68.76	-86.84	27.22	1.85	1.42	8.55
3,270.00	8.57	239.630	3,265.59	-71.13	-90.85	27.74	1.20	1.19	1.06
3,302.00	8.97	239.360	3,297.21	-73.61	-95.06	28.28	1.26	1.25	-0.84
3,333.00	8.96	240.760	3,327.83	-76.02	-99.24	28.77	0.70	-0.03	4.52
3,365.00	8.64	239.900	3,359.46	-78.44	-103.50	29.24	1.08	-1.00	-2.69
3,397.00	8.57	241.590	3,391.10	-80.78	-107.67	29.66	0.82	-0.22	5.28
3,429.00	7.36	244.640	3,422.79	-82.80	-111.62	29.88	4.00	-3.78	9.53
3,461.00	6.72	252.670	3,454.55	-84.23	-115.26	29.70	3.66	-2.00	25.09
3,493.00	6.79	261.610	3,486.32	-85.07	-118.92	28.97	3.29	0.22	27.94
3,525.00	7.22	267.330	3,518.09	-85.44	-122.80	27.72	2.56	1.34	17.88
3,557.00	8.16	269.870	3,549.80	-85.53	-127.08	26.06	3.12	2.94	7.94
3,588.00	9.54	269.330	3,580.43	-85.57	-131.85	24.14	4.46	4.45	-1.74
3,620.00	10.83	272.020	3,611.92	-85.49	-137.51	21.76	4.30	4.03	8.41
3,652.00	11.24	271.670	3,643.33	-85.30	-143.63	19.07	1.30	1.28	-1.09
3,683.00	11.17	272.750	3,673.74	-85.07	-149.65	16.40	0.71	-0.23	3.48
3,715.00	10.67	273.580	3,705.16	-84.73	-155.70	13.62	1.64	-1.56	2.59
3,747.00	10.14	272.820	3,736.64	-84.41	-161.47	10.96	1.71	-1.66	-2.38
3,779.00	10.43	272.440	3,768.12	-84.15	-167.18	8.39	0.93	0.91	-1.19
3,810.00	10.47	270.940	3,798.61	-83.98	-172.80	5.94	0.89	0.13	-4.84
3,842.00	10.31	272.080	3,830.08	-83.83	-178.57	3.44	0.81	-0.50	3.56
3,874.00	10.90	271.610	3,861.54	-83.64	-184.45	0.86	1.86	1.84	-1.47
3,905.00	11.85	270.040	3,891.93	-83.56	-190.56	-1.72	3.22	3.06	-5.06
3,937.00	12.01	269.370	3,923.23	-83.59	-197.18	-4.40	0.66	0.50	-2.09
3,968.00	12.53	269.200	3,953.53	-83.67	-203.77	-7.02	1.68	1.68	-0.55
4,000.00	12.99	268.380	3,984.74	-83.82	-210.83	-9.77	1.54	1.44	-2.56
4,032.00	12.36	267.240	4,015.96	-84.09	-217.85	-12.40	2.12	-1.97	-3.56
4,063.00	12.12	266.010	4,046.25	-84.48	-224.41	-14.73	1.14	-0.77	-3.97
4,095.00	10.48	261.230	4,077.63	-85.15	-230.64	-16.66	5.90	-5.13	-14.94
4,126.00	10.24	260.110	4,108.13	-86.06	-236.14	-18.09	1.01	-0.77	-3.61
4,158.00	9.71	257.590	4,139.64	-87.12	-241.58	-19.34	2.15	-1.66	-7.88
4,190.00	9.96	256.480	4,171.17	-88.35	-246.90	-20.40	0.98	0.78	-3.47
4,222.00	9.96	258.120	4,202.69	-89.57	-252.30	-21.49	0.89	0.00	5.13
4,254.00	9.92	262.830	4,234.21	-90.48	-257.74	-22.89	2.54	-0.13	14.72
4,286.00	9.69	265.050	4,265.74	-91.06	-263.16	-24.58	1.38	-0.72	6.94
4,317.00	9.95	266.620	4,296.29	-91.44	-268.43	-26.39	1.20	0.84	5.06
4,349.00	9.88	269.140	4,327.81	-91.65	-273.94	-28.45	1.37	-0.22	7.88
4,381.00	10.69	270.160	4,359.30	-91.68	-279.65	-30.76	2.59	2.53	3.19
4,413.00	11.05	273.080	4,390.72	-91.51	-285.68	-33.38	2.06	1.13	9.13
4,452.00	10.75	274.330	4,429.02	-91.03	-293.04	-36.83	0.98	-0.77	3.21



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	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)	
4,546.00	11.85	272.450	4,521.20	-89.96	-311.43	-45.33	1.23	1.17	-2.00	
4,641.00	12.92	269.180	4,613.98	-89.69	-331.79	-53.90	1.35	1.13	-3.44	
4,735.00	13.66	268.580	4,705.47	-90.12	-353.40	-62.35	0.80	0.79	-0.64	
4,829.00	14.21	268.560	4,796.70	-90.68	-376.03	-71.10	0.59	0.59	-0.02	
4,923.00	13.38	264.990	4,887.99	-91.92	-398.40	-79.12	1.26	-0.88	-3.80	
5,018.00	11.31	261.310	4,980.79	-94.29	-418.56	-85.21	2.33	-2.18	-3.87	
5,112.00	10.78	269.320	5,073.05	-95.79	-436.46	-91.16	1.73	-0.56	8.52	
5,207.00	11.56	273.300	5,166.25	-95.34	-454.85	-99.09	1.15	0.82	4.19	
5,301.00	12.91	272.180	5,258.12	-94.40	-474.74	-108.09	1.46	1.44	-1.19	
5,396.00	13.64	267.910	5,350.58	-94.41	-496.54	-117.01	1.29	0.77	-4.49	
5,445.00	12.87	265.461	5,398.27	-95.05	-507.76	-121.01	1.94	-1.57	-5.00	
Top of Fish @ 5445.00 MD 5398.27 TVD										
5,490.00	12.19	262.950	5,442.20	-96.03	-517.47	-124.09	1.94	-1.52	-5.58	
5,583.00	12.48	261.080	5,533.06	-98.79	-537.14	-129.61	0.53	0.31	-2.01	
5,678.00	11.02	262.740	5,626.06	-101.53	-556.29	-134.95	1.58	-1.54	1.75	
5,772.00	9.92	269.420	5,718.50	-102.75	-573.30	-140.80	1.74	-1.17	7.11	
5,866.00	10.23	270.750	5,811.05	-102.72	-589.74	-147.55	0.41	0.33	1.41	
5,961.00	11.04	269.070	5,904.42	-102.76	-607.27	-154.69	0.91	0.85	-1.77	
6,055.00	11.91	268.620	5,996.54	-103.14	-625.97	-161.99	0.93	0.93	-0.48	
6,149.00	11.80	267.590	6,088.53	-103.78	-645.27	-169.30	0.25	-0.12	-1.10	
Survey @ 6149.00 MD 6088.53 TVD										
6,224.00	11.80	267.590	6,161.95	-104.42	-660.59	-174.98	0.00	0.00	0.00	
Survey Proj. to 6224.00 MD 6161.95 TVD OH										

Design Annotations				
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
184.00	184.00	0.21	0.68	MWD surveys
5,445.00	5,398.27	-95.05	-507.76	Top of Fish @ 5445.00 MD 5398.27 TVD
6,149.00	6,088.53	-103.78	-645.27	Survey @ 6149.00 MD 6088.53 TVD
6,224.00	6,161.95	-104.42	-660.59	Survey Proj. to 6224.00 MD 6161.95 TVD OH



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	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 S-21 HU (slot B)					
Well Position	+N/-S	0.00 ft	Northing:	14,447,299.987 usft	Latitude:	39.781535000
	+E/-W	0.00 ft	Easting:	1,717,122.706 usft	Longitude:	-80.726968000
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	10/10/2022	-8.65	66.41	51,613.57311444

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	155.850	

Survey Program	Date 10/23/2022				
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
14.00	2,196.00	MWD surf (Original Hole)	MWD	MWD - Standard	
2,260.00	6,149.00	MWD (Original Hole)	MWD	MWD - Standard	
6,219.00	6,224.00	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	14,447,299.987	1,717,122.706	39.781535000	-80.726968000	
14.00	0.00	0.000	14.00	0.00	0.00	14,447,299.987	1,717,122.706	39.781535000	-80.726968000	
184.00	0.48	72.650	184.00	0.21	0.68	14,447,300.200	1,717,123.385	39.781535578	-80.726965579	
MWD surveys										
213.00	0.40	92.950	213.00	0.24	0.90	14,447,300.231	1,717,123.602	39.781535661	-80.726964806	
242.00	0.48	78.190	242.00	0.26	1.12	14,447,300.251	1,717,123.822	39.781535713	-80.726964022	
270.00	0.31	39.870	270.00	0.35	1.28	14,447,300.333	1,717,123.986	39.781535937	-80.726963440	
299.00	0.48	60.610	299.00	0.46	1.44	14,447,300.452	1,717,124.142	39.781536265	-80.726962883	
329.00	0.48	65.970	328.99	0.58	1.66	14,447,300.565	1,717,124.366	39.781536573	-80.726962084	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	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
361.00	0.22	93.920	360.99	0.63	1.84	14,447,300.616	1,717,124.550	39.781536710	-80.726961429
392.00	0.62	78.270	391.99	0.66	2.07	14,447,300.646	1,717,124.773	39.781536790	-80.726960633
423.00	0.70	96.560	422.99	0.67	2.42	14,447,300.658	1,717,125.126	39.781536822	-80.726959379
455.00	0.48	99.720	454.99	0.63	2.75	14,447,300.613	1,717,125.452	39.781536696	-80.726958218
487.00	0.70	133.290	486.99	0.47	3.02	14,447,300.457	1,717,125.727	39.781536263	-80.726957243
522.00	0.48	137.340	521.99	0.21	3.28	14,447,300.202	1,717,125.981	39.781535562	-80.726956338
552.00	1.01	206.160	551.98	-0.12	3.24	14,447,299.872	1,717,125.950	39.781534657	-80.726956453
583.00	0.88	181.020	582.98	-0.60	3.12	14,447,299.389	1,717,125.825	39.781533331	-80.726956902
614.00	0.88	179.880	613.98	-1.07	3.12	14,447,298.913	1,717,125.822	39.781532023	-80.726956921
646.00	0.70	147.270	645.97	-1.48	3.22	14,447,298.503	1,717,125.928	39.781530896	-80.726956547
678.00	0.79	157.730	677.97	-1.85	3.41	14,447,298.134	1,717,126.117	39.781529882	-80.726955877
710.00	1.10	147.180	709.97	-2.32	3.66	14,447,297.672	1,717,126.367	39.781528611	-80.726954992
741.00	1.41	168.450	740.96	-2.94	3.90	14,447,297.048	1,717,126.605	39.781526896	-80.726954153
773.00	1.41	151.930	772.95	-3.67	4.16	14,447,296.315	1,717,126.869	39.781524880	-80.726953221
805.00	1.41	153.510	804.94	-4.37	4.52	14,447,295.615	1,717,127.230	39.781522955	-80.726951944
836.00	1.04	168.440	835.93	-4.99	4.75	14,447,294.998	1,717,127.456	39.781521259	-80.726951145
868.00	0.86	170.840	867.93	-5.51	4.85	14,447,294.477	1,717,127.553	39.781519826	-80.726950807
900.00	1.17	160.400	899.92	-6.06	4.99	14,447,293.932	1,717,127.701	39.781518328	-80.726950287
931.00	0.74	151.890	930.92	-6.53	5.20	14,447,293.457	1,717,127.901	39.781517023	-80.726949578
963.00	0.74	153.220	962.92	-6.90	5.39	14,447,293.091	1,717,128.092	39.781516014	-80.726948905
995.00	0.50	194.200	994.91	-7.22	5.44	14,447,292.771	1,717,128.150	39.781515135	-80.726948698
1,027.00	0.49	151.560	1,026.91	-7.47	5.48	14,447,292.515	1,717,128.181	39.781514433	-80.726948591
1,058.00	0.29	192.140	1,057.91	-7.67	5.52	14,447,292.322	1,717,128.228	39.781513902	-80.726948427
1,090.00	0.62	147.930	1,089.91	-7.89	5.60	14,447,292.096	1,717,128.303	39.781513281	-80.726948163
1,122.00	0.50	131.170	1,121.91	-8.13	5.79	14,447,291.857	1,717,128.500	39.781512624	-80.726947464
1,154.00	0.51	159.800	1,153.91	-8.36	5.95	14,447,291.632	1,717,128.654	39.781512003	-80.726946918
1,186.00	0.40	208.550	1,185.91	-8.59	5.94	14,447,291.400	1,717,128.650	39.781511366	-80.726946935
1,217.00	0.47	214.890	1,216.91	-8.79	5.82	14,447,291.201	1,717,128.525	39.781510820	-80.726947380
1,249.00	0.17	271.540	1,248.91	-8.89	5.70	14,447,291.094	1,717,128.403	39.781510529	-80.726947818
1,281.00	0.52	290.880	1,280.91	-8.84	5.51	14,447,291.147	1,717,128.220	39.781510676	-80.726948469
1,312.00	1.09	269.170	1,311.90	-8.79	5.09	14,447,291.193	1,717,127.794	39.781510806	-80.726949986
1,344.00	1.24	292.870	1,343.90	-8.66	4.46	14,447,291.323	1,717,127.170	39.781511168	-80.726952203
1,376.00	1.45	287.960	1,375.89	-8.40	3.76	14,447,291.583	1,717,126.466	39.781511887	-80.726954707
1,408.00	1.52	274.670	1,407.88	-8.25	2.95	14,447,291.742	1,717,125.658	39.781512331	-80.726957582
1,440.00	1.86	261.200	1,439.86	-8.29	2.02	14,447,291.697	1,717,124.722	39.781512216	-80.726960914
1,471.00	2.67	262.160	1,470.84	-8.47	0.80	14,447,291.522	1,717,123.509	39.781511744	-80.726965232
1,503.00	3.09	254.260	1,502.80	-8.80	-0.77	14,447,291.186	1,717,121.941	39.781510835	-80.726970819
1,534.00	3.18	245.190	1,533.75	-9.39	-2.35	14,447,290.599	1,717,120.356	39.781509235	-80.726976466
1,566.00	3.46	235.710	1,565.70	-10.31	-3.95	14,447,289.682	1,717,118.753	39.781506732	-80.726982183
1,597.00	3.60	234.080	1,596.64	-11.40	-5.51	14,447,288.584	1,717,117.191	39.781503730	-80.726987751
1,629.00	4.09	230.200	1,628.57	-12.72	-7.20	14,447,287.264	1,717,115.501	39.781500119	-80.726993782
1,659.00	4.51	225.560	1,658.48	-14.23	-8.87	14,447,285.754	1,717,113.837	39.781495984	-80.726999722
1,691.00	5.16	222.060	1,690.37	-16.18	-10.73	14,447,283.804	1,717,111.975	39.781490647	-80.727006372
1,722.00	4.88	217.470	1,721.25	-18.26	-12.47	14,447,281.723	1,717,110.239	39.781484945	-80.727012574
1,753.00	4.98	217.900	1,752.14	-20.37	-14.10	14,447,279.615	1,717,108.610	39.781479169	-80.727018394
1,785.00	4.15	226.230	1,784.03	-22.27	-15.79	14,447,277.718	1,717,106.921	39.781473973	-80.727024427
1,816.00	3.82	224.110	1,814.96	-23.79	-17.31	14,447,276.200	1,717,105.392	39.781469819	-80.727029885
1,848.00	3.32	227.140	1,846.90	-25.18	-18.74	14,447,274.804	1,717,103.971	39.781465998	-80.727034959
1,880.00	3.36	236.280	1,878.84	-26.33	-20.19	14,447,273.654	1,717,102.512	39.781462849	-80.727040165
1,911.00	2.92	239.720	1,909.80	-27.24	-21.63	14,447,272.751	1,717,101.074	39.781460383	-80.727045292
1,943.00	2.84	249.310	1,941.76	-27.93	-23.08	14,447,272.060	1,717,099.629	39.781458497	-80.727050444
1,975.00	2.92	266.850	1,973.72	-28.25	-24.63	14,447,271.735	1,717,098.073	39.781457618	-80.727055985
2,006.00	3.07	269.470	2,004.67	-28.30	-26.25	14,447,271.684	1,717,096.455	39.781457491	-80.727061746
2,038.00	3.70	275.350	2,036.62	-28.22	-28.14	14,447,271.773	1,717,094.570	39.781457750	-80.727068454



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	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
2,070.00	4.10	272.560	2,068.54	-28.07	-30.31	14,447,271.920	1,717,092.399	39.781458173	-80.727076180
2,101.00	4.04	265.420	2,099.47	-28.11	-32.50	14,447,271.882	1,717,090.203	39.781458088	-80.727083995
2,133.00	3.59	250.220	2,131.40	-28.53	-34.57	14,447,271.453	1,717,088.137	39.781456927	-80.727091355
2,164.00	4.16	246.230	2,162.32	-29.32	-36.51	14,447,270.671	1,717,086.194	39.781454796	-80.727098277
2,196.00	4.22	240.260	2,194.24	-30.37	-38.60	14,447,269.620	1,717,084.110	39.781451925	-80.727105708
2,260.00	4.39	220.130	2,258.06	-33.41	-42.22	14,447,266.578	1,717,080.486	39.781443603	-80.727118639
2,292.00	4.61	216.530	2,289.96	-35.38	-43.77	14,447,264.609	1,717,078.932	39.781438207	-80.727124195
2,324.00	4.53	220.140	2,321.86	-37.38	-45.35	14,447,262.609	1,717,077.351	39.781432729	-80.727129841
2,356.00	3.91	225.390	2,353.77	-39.11	-46.95	14,447,260.877	1,717,075.760	39.781427985	-80.727135524
2,388.00	2.91	237.790	2,385.72	-40.31	-48.41	14,447,259.678	1,717,074.296	39.781424704	-80.727140748
2,419.00	2.39	239.880	2,416.68	-41.05	-49.63	14,447,258.934	1,717,073.071	39.781422672	-80.727145116
2,451.00	1.44	246.530	2,448.67	-41.55	-50.58	14,447,258.439	1,717,072.125	39.781421321	-80.727148488
2,481.00	1.45	242.770	2,478.66	-41.87	-51.26	14,447,258.115	1,717,071.442	39.781420437	-80.727150924
2,513.00	1.62	251.740	2,510.65	-42.20	-52.05	14,447,257.788	1,717,070.652	39.781419546	-80.727153738
2,545.00	1.31	240.360	2,542.64	-42.52	-52.80	14,447,257.466	1,717,069.905	39.781418666	-80.727156402
2,576.00	1.18	259.840	2,573.63	-42.75	-53.42	14,447,257.234	1,717,069.283	39.781418035	-80.727158619
2,608.00	1.08	253.690	2,605.62	-42.90	-54.04	14,447,257.091	1,717,068.669	39.781417648	-80.727160805
2,640.00	1.43	245.610	2,637.61	-43.15	-54.69	14,447,256.842	1,717,068.016	39.781416968	-80.727163132
2,671.00	2.34	243.330	2,668.60	-43.59	-55.61	14,447,256.398	1,717,067.098	39.781415757	-80.727166404
2,703.00	2.84	228.130	2,700.56	-44.41	-56.78	14,447,255.576	1,717,065.924	39.781413508	-80.727170592
2,735.00	2.74	233.380	2,732.53	-45.40	-57.99	14,447,254.590	1,717,064.720	39.781410812	-80.727174889
2,767.00	3.42	233.030	2,764.48	-46.43	-59.36	14,447,253.560	1,717,063.343	39.781407995	-80.727179800
2,798.00	3.03	231.020	2,795.43	-47.50	-60.74	14,447,252.488	1,717,061.967	39.781405064	-80.727184708
2,830.00	3.41	229.620	2,827.38	-48.65	-62.12	14,447,251.340	1,717,060.585	39.781401921	-80.727189641
2,862.00	3.29	230.490	2,859.33	-49.85	-63.55	14,447,250.139	1,717,059.152	39.781398635	-80.727194756
2,893.00	2.98	222.240	2,890.28	-51.01	-64.78	14,447,248.977	1,717,057.924	39.781395453	-80.727199140
2,923.00	3.04	220.750	2,920.24	-52.19	-65.83	14,447,247.797	1,717,056.880	39.781392221	-80.727202867
2,955.00	3.02	225.960	2,952.19	-53.42	-66.99	14,447,246.568	1,717,055.720	39.781388856	-80.727207008
2,986.00	2.72	219.030	2,983.15	-54.56	-68.04	14,447,245.429	1,717,054.670	39.781385737	-80.727210759
3,018.00	3.35	225.270	3,015.11	-55.81	-69.18	14,447,244.181	1,717,053.528	39.781382320	-80.727214839
3,049.00	3.66	225.190	3,046.05	-57.14	-70.52	14,447,242.846	1,717,052.182	39.781378665	-80.727219642
3,081.00	4.41	229.080	3,077.97	-58.67	-72.18	14,447,241.321	1,717,050.528	39.781374489	-80.727225547
3,113.00	5.46	230.640	3,109.85	-60.44	-74.28	14,447,239.549	1,717,048.421	39.781369642	-80.727230365
3,144.00	6.05	234.790	3,140.70	-62.32	-76.76	14,447,237.672	1,717,045.946	39.781364507	-80.727234189
3,175.00	7.07	238.190	3,171.49	-64.26	-79.72	14,447,235.724	1,717,042.990	39.781359183	-80.727252438
3,207.00	7.75	236.640	3,203.23	-66.49	-83.19	14,447,233.500	1,717,039.514	39.781353103	-80.727264834
3,238.00	8.19	239.290	3,233.93	-68.76	-86.84	14,447,231.223	1,717,035.870	39.781346881	-80.727277830
3,270.00	8.57	239.630	3,265.59	-71.13	-90.85	14,447,228.853	1,717,031.853	39.781340407	-80.727292153
3,302.00	8.97	239.360	3,297.21	-73.61	-95.06	14,447,226.376	1,717,027.650	39.781333640	-80.727307142
3,333.00	8.96	240.760	3,327.83	-76.02	-99.24	14,447,223.966	1,717,023.464	39.781327054	-80.727322067
3,365.00	8.64	239.900	3,359.46	-78.44	-103.50	14,447,221.543	1,717,019.210	39.781320436	-80.727337234
3,397.00	8.57	241.590	3,391.10	-80.78	-107.67	14,447,219.203	1,717,015.034	39.781314046	-80.727352126
3,429.00	7.36	244.640	3,422.79	-82.80	-111.62	14,447,217.191	1,717,011.084	39.781308552	-80.727366205
3,461.00	6.72	252.670	3,454.55	-84.23	-115.26	14,447,215.755	1,717,007.445	39.781304640	-80.727379175
3,493.00	6.79	261.610	3,486.32	-85.07	-118.92	14,447,214.921	1,717,003.786	39.781302381	-80.727392208
3,525.00	7.22	267.330	3,518.09	-85.44	-122.80	14,447,214.552	1,716,999.906	39.781301398	-80.727406023
3,557.00	8.16	269.870	3,549.80	-85.53	-127.08	14,447,214.453	1,716,995.626	39.781301162	-80.727421257
3,588.00	9.54	269.330	3,580.43	-85.57	-131.85	14,447,214.418	1,716,990.857	39.781301106	-80.727438233
3,620.00	10.83	272.020	3,611.92	-85.49	-137.51	14,447,214.493	1,716,985.201	39.781301359	-80.727458365
3,652.00	11.24	271.670	3,643.33	-85.30	-143.63	14,447,214.690	1,716,979.079	39.781301951	-80.727480153
3,683.00	11.17	272.750	3,673.74	-85.07	-149.65	14,447,214.922	1,716,973.060	39.781302639	-80.727501575
3,715.00	10.67	273.580	3,705.16	-84.73	-155.70	14,447,215.255	1,716,967.007	39.781303606	-80.727523115
3,747.00	10.14	272.820	3,736.64	-84.41	-161.47	14,447,215.579	1,716,961.237	39.781304543	-80.727543650
3,779.00	10.43	272.440	3,768.12	-84.15	-167.18	14,447,215.841	1,716,955.529	39.781305310	-80.727563962

02/23/2024



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	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	
3,810.00	10.47	270.940	3,798.61	-83.98	-172.80	14,447,216.007	1,716,949.910	39.781305811	-80.727583964	
3,842.00	10.31	272.080	3,830.08	-83.83	-178.57	14,447,216.158	1,716,944.141	39.781306276	-80.727604496	
3,874.00	10.90	271.610	3,861.54	-83.64	-184.45	14,447,216.347	1,716,938.255	39.781306844	-80.727625444	
3,905.00	11.85	270.040	3,891.93	-83.56	-190.56	14,447,216.432	1,716,932.142	39.781307127	-80.727647202	
3,937.00	12.01	269.370	3,923.23	-83.59	-197.18	14,447,216.397	1,716,925.527	39.781307088	-80.727670747	
3,968.00	12.53	269.200	3,953.53	-83.67	-203.77	14,447,216.315	1,716,918.940	39.781306917	-80.727694195	
4,000.00	12.99	268.380	3,984.74	-83.82	-210.83	14,447,216.165	1,716,911.874	39.781306564	-80.727719348	
4,032.00	12.36	267.240	4,015.96	-84.09	-217.85	14,447,215.898	1,716,904.858	39.781305890	-80.727744323	
4,063.00	12.12	266.010	4,046.25	-84.48	-224.41	14,447,215.512	1,716,898.297	39.781304884	-80.727767679	
4,095.00	10.48	261.230	4,077.63	-85.15	-230.64	14,447,214.835	1,716,892.069	39.781303076	-80.727789854	
4,126.00	10.24	260.110	4,108.13	-86.06	-236.14	14,447,213.931	1,716,886.568	39.781300641	-80.727809444	
4,158.00	9.71	257.590	4,139.64	-87.12	-241.58	14,447,212.863	1,716,881.131	39.781297752	-80.727828810	
4,190.00	9.96	256.480	4,171.17	-88.35	-246.90	14,447,211.636	1,716,875.804	39.781294427	-80.727847782	
4,222.00	9.96	258.120	4,202.69	-89.57	-252.30	14,447,210.419	1,716,870.406	39.781291131	-80.727867011	
4,254.00	9.92	262.830	4,234.21	-90.48	-257.74	14,447,209.506	1,716,864.963	39.781288667	-80.727886395	
4,286.00	9.69	265.050	4,265.74	-91.06	-263.16	14,447,208.929	1,716,859.545	39.781287130	-80.727905686	
4,317.00	9.95	266.620	4,296.29	-91.44	-268.43	14,447,208.546	1,716,854.272	39.781286122	-80.727924458	
4,349.00	9.88	269.140	4,327.81	-91.65	-273.94	14,447,208.342	1,716,848.767	39.781285607	-80.727944054	
4,381.00	10.69	270.160	4,359.30	-91.68	-279.65	14,447,208.309	1,716,843.054	39.781285564	-80.727964390	
4,413.00	11.05	273.080	4,390.72	-91.51	-285.68	14,447,208.482	1,716,837.024	39.781286090	-80.727985852	
4,452.00	10.75	274.330	4,429.02	-91.03	-293.04	14,447,208.958	1,716,829.665	39.781287457	-80.728012040	
4,546.00	11.85	272.450	4,521.20	-89.96	-311.43	14,447,210.032	1,716,811.280	39.781290561	-80.728077467	
4,641.00	12.92	269.180	4,613.98	-89.69	-331.79	14,447,210.297	1,716,790.915	39.781291458	-80.728149954	
4,735.00	13.66	268.580	4,705.47	-90.12	-353.40	14,447,209.872	1,716,769.311	39.781290470	-80.728226856	
4,829.00	14.21	268.560	4,796.70	-90.68	-376.03	14,447,209.307	1,716,746.681	39.781289107	-80.728307411	
4,923.00	13.38	264.990	4,887.99	-91.92	-398.40	14,447,208.067	1,716,724.311	39.781285889	-80.728387046	
5,018.00	11.31	261.310	4,980.79	-94.29	-418.56	14,447,205.699	1,716,704.150	39.781279554	-80.728458832	
5,112.00	10.78	269.320	5,073.05	-95.79	-436.46	14,447,204.202	1,716,686.247	39.781275592	-80.728522573	
5,207.00	11.56	273.300	5,166.25	-95.34	-454.85	14,447,204.644	1,716,667.860	39.781276960	-80.728588015	
5,301.00	12.91	272.180	5,258.12	-94.40	-474.74	14,447,205.586	1,716,647.963	39.781279712	-80.728658827	
5,396.00	13.64	267.910	5,350.58	-94.41	-496.54	14,447,205.581	1,716,626.164	39.781279880	-80.728736420	
5,445.00	12.87	265.461	5,398.27	-95.05	-507.76	14,447,204.939	1,716,614.949	39.781278209	-80.728776346	
Top of Fish @ 5445.00 MD 5398.27 TVD										
5,490.00	12.19	262.950	5,442.20	-96.03	-517.47	14,447,203.959	1,716,605.237	39.781275599	-80.728810926	
5,583.00	12.48	261.080	5,533.06	-98.79	-537.14	14,447,201.196	1,716,585.565	39.781268174	-80.728880975	
5,678.00	11.02	262.740	5,626.06	-101.53	-556.29	14,447,198.457	1,716,566.416	39.781260810	-80.728949162	
5,772.00	9.92	269.420	5,718.50	-102.75	-573.30	14,447,197.239	1,716,549.407	39.781257609	-80.729009719	
5,866.00	10.23	270.750	5,811.05	-102.72	-589.74	14,447,197.266	1,716,532.964	39.781257820	-80.729068246	
5,961.00	11.04	269.070	5,904.42	-102.76	-607.27	14,447,197.229	1,716,515.434	39.781257864	-80.729130644	
6,055.00	11.91	268.620	5,996.54	-103.14	-625.97	14,447,196.850	1,716,496.737	39.781256976	-80.729197196	
6,149.00	11.80	267.590	6,088.53	-103.78	-645.27	14,447,196.212	1,716,477.438	39.781255385	-80.729265898	
Survey @ 6149.00 MD 6088.53 TVD										
6,224.00	11.80	267.590	6,161.95	-104.42	-660.59	14,447,195.567	1,716,462.114	39.781253741	-80.729320448	
Survey Proj. to 6224.00 MD 6161.95 TVD OH										



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Feb2822

Design Annotations				
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
184.00	184.00	0.21	0.68	MWD surveys
5,445.00	5,398.27	-95.05	-507.76	Top of Fish @ 5445.00 MD 5398.27 TVD
6,149.00	6,088.53	-103.78	-645.27	Survey @ 6149.00 MD 6088.53 TVD
6,224.00	6,161.95	-104.42	-660.59	Survey Proj. to 6224.00 MD 6161.95 TVD OH

Checked By: _____ Approved By: _____ Date: _____



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

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
From:	Lat/Long	Easting:	1,717,188.440 usft
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "
		Latitude:	39.781725330
		Longitude:	-80.726733270

Well	Van Winkle S-21 HU (slot B)		
Well Position	+N/-S	0.00 ft	Northing: 14,447,299.987 usft
	+E/-W	0.00 ft	Easting: 1,717,122.706 usft
Position Uncertainty	0.00 ft	Wellhead Elevation:	ft
Grid Convergence:	0.17 °	Ground Level:	753.00 ft
		Latitude:	39.781535000
		Longitude:	-80.726968000

Wellbore	Sidetrack 01				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	10/23/2022	-8.65	66.40	51,609.87161052

Design	Surveys Sidetrack 01				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	5,112.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.00	0.00	0.00	155.850	

Survey Program	Date	10/29/2022			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
14.00	2,196.00	MWD surf (Original Hole)	MWD	MWD - Standard	
2,260.00	5,112.00	MWD (Original Hole)	MWD	MWD - Standard	
5,185.00	5,247.00	MWD ST1 (Sidetrack 01)	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	
184.00	0.48	72.650	184.00	0.21	0.68	0.08	0.28	0.28	0.00	
213.00	0.40	92.950	213.00	0.24	0.90	0.14	0.60	-0.28	70.00	
242.00	0.48	78.190	242.00	0.26	1.12	0.22	0.48	0.28	-50.90	
270.00	0.31	39.870	270.00	0.35	1.28	0.21	1.09	-0.61	-136.86	
299.00	0.48	60.610	299.00	0.46	1.44	0.16	0.76	0.59	71.52	
329.00	0.48	65.970	328.99	0.58	1.66	0.15	0.15	0.00	17.87	



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

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)
361.00	0.22	93.920	360.99	0.63	1.84	0.18	0.95	-0.81	87.34
392.00	0.62	78.270	391.99	0.66	2.07	0.25	1.33	1.29	-50.48
423.00	0.70	96.560	422.99	0.67	2.42	0.38	0.72	0.26	59.00
455.00	0.48	99.720	454.99	0.63	2.75	0.55	0.69	-0.69	9.88
487.00	0.70	133.290	486.99	0.47	3.02	0.81	1.25	0.69	104.91
522.00	0.48	137.340	521.99	0.21	3.28	1.14	0.64	-0.63	11.57
552.00	1.01	206.160	551.98	-0.12	3.24	1.43	3.16	1.77	229.40
583.00	0.88	181.020	582.98	-0.60	3.12	1.82	1.39	-0.42	-81.10
614.00	0.88	179.880	613.98	-1.07	3.12	2.26	0.06	0.00	-3.68
646.00	0.70	147.270	645.97	-1.48	3.22	2.67	1.49	-0.56	-101.91
678.00	0.79	157.730	677.97	-1.85	3.41	3.09	0.51	0.28	32.69
710.00	1.10	147.180	709.97	-2.32	3.66	3.61	1.11	0.97	-32.97
741.00	1.41	168.450	740.96	-2.94	3.90	4.28	1.79	1.00	68.61
773.00	1.41	151.930	772.95	-3.67	4.16	5.05	1.27	0.00	-51.63
805.00	1.41	153.510	804.94	-4.37	4.52	5.84	0.12	0.00	4.94
836.00	1.04	168.440	835.93	-4.99	4.75	6.50	1.57	-1.19	48.16
868.00	0.86	170.840	867.93	-5.51	4.85	7.01	0.58	-0.56	7.50
900.00	1.17	160.400	899.92	-6.06	4.99	7.57	1.12	0.97	-32.63
931.00	0.74	151.890	930.92	-6.53	5.20	8.08	1.46	-1.39	-27.45
963.00	0.74	153.220	962.92	-6.90	5.39	8.50	0.05	0.00	4.16
995.00	0.50	194.200	994.91	-7.22	5.44	8.81	1.53	-0.75	128.06
1,027.00	0.49	151.560	1,026.91	-7.47	5.48	9.06	1.13	-0.03	-133.25
1,058.00	0.29	192.140	1,057.91	-7.67	5.52	9.25	1.06	-0.65	130.90
1,090.00	0.62	147.930	1,089.91	-7.89	5.60	9.49	1.43	1.03	-138.16
1,122.00	0.50	131.170	1,121.91	-8.13	5.79	9.79	0.63	-0.38	-52.38
1,154.00	0.51	159.800	1,153.91	-8.36	5.95	10.06	0.78	0.03	89.47
1,186.00	0.40	208.550	1,185.91	-8.59	5.94	10.27	1.21	-0.34	152.34
1,217.00	0.47	214.890	1,216.91	-8.79	5.82	10.40	0.27	0.23	20.45
1,249.00	0.17	271.540	1,248.91	-8.89	5.70	10.45	1.26	-0.94	177.03
1,281.00	0.52	290.880	1,280.91	-8.84	5.51	10.32	1.14	1.09	60.44
1,312.00	1.09	269.170	1,311.90	-8.79	5.09	10.11	2.05	1.84	-70.03
1,344.00	1.24	292.870	1,343.90	-8.66	4.46	9.73	1.56	0.47	74.06
1,376.00	1.45	287.960	1,375.89	-8.40	3.76	9.21	0.75	0.66	-15.34
1,408.00	1.52	274.670	1,407.88	-8.25	2.95	8.73	1.10	0.22	-41.53
1,440.00	1.86	261.200	1,439.86	-8.29	2.02	8.39	1.63	1.06	-42.09
1,471.00	2.67	262.160	1,470.84	-8.47	0.80	8.05	2.62	2.61	3.10
1,503.00	3.09	254.260	1,502.80	-8.80	-0.77	7.72	1.80	1.31	-24.69
1,534.00	3.18	245.190	1,533.75	-9.39	-2.35	7.61	1.62	0.29	-29.26
1,566.00	3.46	235.710	1,565.70	-10.31	-3.95	7.79	1.92	0.88	-29.63
1,597.00	3.60	234.080	1,596.64	-11.40	-5.51	8.15	0.56	0.45	-5.26
1,629.00	4.09	230.200	1,628.57	-12.72	-7.20	8.66	1.73	1.53	-12.13
1,659.00	4.51	225.560	1,658.48	-14.23	-8.87	9.36	1.82	1.40	-15.47
1,691.00	5.16	222.060	1,690.37	-16.18	-10.73	10.38	2.23	2.03	-10.94



Company: Tug Hill Operating LLC
Project: Marshall County, West Virginia NAD83 UTM 17N
Site: Van Winkle
Well: Van Winkle S-21 HU (slot B)
Wellbore: Sidetrack 01
Design: Surveys Sidetrack 01

Local Co-ordinate Reference: Well Van Winkle S-21 HU (slot B)
TVD Reference: RKB=753+26 @ 779.00ft (Nabors B28)
MD Reference: RKB=753+26 @ 779.00ft (Nabors B28)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: DB_Decv0422v16

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)
1,722.00	4.88	217.470	1,721.25	-18.26	-12.47	11.57	1.58	-0.90	-14.81
1,753.00	4.98	217.900	1,752.14	-20.37	-14.10	12.82	0.34	0.32	1.39
1,785.00	4.15	226.230	1,784.03	-22.27	-15.79	13.86	3.31	-2.59	26.03
1,816.00	3.82	224.110	1,814.96	-23.79	-17.31	14.62	1.17	-1.06	-6.84
1,848.00	3.32	227.140	1,846.90	-25.18	-18.74	15.31	1.67	-1.56	9.47
1,880.00	3.36	236.280	1,878.84	-26.33	-20.19	15.77	1.67	0.13	28.56
1,911.00	2.92	239.720	1,909.80	-27.24	-21.63	16.00	1.54	-1.42	11.10
1,943.00	2.84	249.310	1,941.76	-27.93	-23.08	16.04	1.52	-0.25	29.97
1,975.00	2.92	266.850	1,973.72	-28.25	-24.63	15.70	2.75	0.25	54.81
2,006.00	3.07	269.470	2,004.67	-28.30	-26.25	15.09	0.65	0.48	8.45
2,038.00	3.70	275.350	2,036.62	-28.22	-28.14	14.23	2.25	1.97	18.38
2,070.00	4.10	272.560	2,068.54	-28.07	-30.31	13.21	1.38	1.25	-8.72
2,101.00	4.04	265.420	2,099.47	-28.11	-32.50	12.35	1.65	-0.19	-23.03
2,133.00	3.59	250.220	2,131.40	-28.53	-34.57	11.89	3.45	-1.41	-47.50
2,164.00	4.16	246.230	2,162.32	-29.32	-36.51	11.81	2.03	1.84	-12.87
2,196.00	4.22	240.260	2,194.24	-30.37	-38.60	11.92	1.38	0.19	-18.66
2,260.00	4.39	220.130	2,258.06	-33.41	-42.22	13.21	2.36	0.27	-31.45
2,292.00	4.61	216.530	2,289.96	-35.38	-43.77	14.37	1.12	0.69	-11.25
2,324.00	4.53	220.140	2,321.86	-37.38	-45.35	15.55	0.93	-0.25	11.28
2,356.00	3.91	225.390	2,353.77	-39.11	-46.95	16.48	2.28	-1.94	16.41
2,388.00	2.91	237.790	2,385.72	-40.31	-48.41	16.98	3.87	-3.13	38.75
2,419.00	2.39	239.880	2,416.68	-41.05	-49.63	17.15	1.71	-1.68	6.74
2,451.00	1.44	246.530	2,448.67	-41.55	-50.58	17.22	3.04	-2.97	20.78
2,481.00	1.45	242.770	2,478.66	-41.87	-51.26	17.23	0.32	0.03	-12.53
2,513.00	1.62	251.740	2,510.65	-42.20	-52.05	17.21	0.92	0.53	28.03
2,545.00	1.31	240.360	2,542.64	-42.52	-52.80	17.20	1.32	-0.97	-35.56
2,576.00	1.18	259.840	2,573.63	-42.75	-53.42	17.15	1.42	-0.42	62.84
2,608.00	1.08	253.690	2,605.62	-42.90	-54.04	17.03	0.49	-0.31	-19.22
2,640.00	1.43	245.610	2,637.61	-43.15	-54.69	16.99	1.22	1.09	-25.25
2,671.00	2.34	243.330	2,668.60	-43.59	-55.61	17.02	2.94	2.94	-7.35
2,703.00	2.84	228.130	2,700.56	-44.41	-56.78	17.29	2.64	1.56	-47.50
2,735.00	2.74	233.380	2,732.53	-45.40	-57.99	17.70	0.86	-0.31	16.41
2,767.00	3.42	233.030	2,764.48	-46.43	-59.36	18.08	2.13	2.13	-1.09
2,798.00	3.03	231.020	2,795.43	-47.50	-60.74	18.49	1.31	-1.26	-6.48
2,830.00	3.41	229.620	2,827.38	-48.65	-62.12	18.97	1.21	1.19	-4.38
2,862.00	3.29	230.490	2,859.33	-49.85	-63.55	19.48	0.41	-0.38	2.72
2,893.00	2.98	222.240	2,890.28	-51.01	-64.78	20.04	1.76	-1.00	-26.61
2,923.00	3.04	220.750	2,920.24	-52.19	-65.83	20.69	0.33	0.20	-4.97
2,955.00	3.02	225.960	2,952.19	-53.42	-66.99	21.34	0.86	-0.06	16.28
2,986.00	2.72	219.030	2,983.15	-54.56	-68.04	21.95	1.48	-0.97	-22.35
3,018.00	3.35	225.270	3,015.11	-55.81	-69.18	22.62	2.22	1.97	19.50
3,049.00	3.66	225.190	3,046.05	-57.14	-70.52	23.29	1.00	1.00	-0.26
3,081.00	4.41	229.080	3,077.97	-58.67	-72.18	24.00	2.49	2.34	12.16
3,113.00	5.46	230.640	3,109.85	-60.44	-74.28	24.76	3.31	3.28	4.88



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

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)
3,144.00	6.05	234.790	3,140.70	-62.32	-76.76	25.46	2.33	1.90	13.39
3,175.00	7.07	238.190	3,171.49	-64.26	-79.72	26.02	3.52	3.29	10.97
3,207.00	7.75	236.640	3,203.23	-66.49	-83.19	26.63	2.21	2.13	-4.84
3,238.00	8.19	239.290	3,233.93	-68.76	-86.84	27.22	1.85	1.42	8.55
3,270.00	8.57	239.630	3,265.59	-71.13	-90.85	27.74	1.20	1.19	1.06
3,302.00	8.97	239.360	3,297.21	-73.61	-95.06	28.28	1.26	1.25	-0.84
3,333.00	8.96	240.760	3,327.83	-76.02	-99.24	28.77	0.70	-0.03	4.52
3,365.00	8.64	239.900	3,359.46	-78.44	-103.50	29.24	1.08	-1.00	-2.69
3,397.00	8.57	241.590	3,391.10	-80.78	-107.67	29.66	0.82	-0.22	5.28
3,429.00	7.36	244.640	3,422.79	-82.80	-111.62	29.88	4.00	-3.78	9.53
3,461.00	6.72	252.670	3,454.55	-84.23	-115.26	29.70	3.66	-2.00	25.09
3,493.00	6.79	261.610	3,486.32	-85.07	-118.92	28.97	3.29	0.22	27.94
3,525.00	7.22	267.330	3,518.09	-85.44	-122.80	27.72	2.56	1.34	17.88
3,557.00	8.16	269.870	3,549.80	-85.53	-127.08	26.06	3.12	2.94	7.94
3,588.00	9.54	269.330	3,580.43	-85.57	-131.85	24.14	4.46	4.45	-1.74
3,620.00	10.83	272.020	3,611.92	-85.49	-137.51	21.76	4.30	4.03	8.41
3,652.00	11.24	271.670	3,643.33	-85.30	-143.63	19.07	1.30	1.28	-1.09
3,683.00	11.17	272.750	3,673.74	-85.07	-149.65	16.40	0.71	-0.23	3.48
3,715.00	10.67	273.580	3,705.16	-84.73	-155.70	13.62	1.64	-1.56	2.59
3,747.00	10.14	272.820	3,736.64	-84.41	-161.47	10.96	1.71	-1.66	-2.38
3,779.00	10.43	272.440	3,768.12	-84.15	-167.18	8.39	0.93	0.91	-1.19
3,810.00	10.47	270.940	3,798.61	-83.98	-172.80	5.94	0.89	0.13	-4.84
3,842.00	10.31	272.080	3,830.08	-83.83	-178.57	3.44	0.81	-0.50	3.56
3,874.00	10.90	271.610	3,861.54	-83.64	-184.45	0.86	1.86	1.84	-1.47
3,905.00	11.85	270.040	3,891.93	-83.56	-190.56	-1.72	3.22	3.06	-5.06
3,937.00	12.01	269.370	3,923.23	-83.59	-197.18	-4.40	0.66	0.50	-2.09
3,968.00	12.53	269.200	3,953.53	-83.67	-203.77	-7.02	1.68	1.68	-0.55
4,000.00	12.99	268.380	3,984.74	-83.82	-210.83	-9.77	1.54	1.44	-2.56
4,032.00	12.36	267.240	4,015.96	-84.09	-217.85	-12.40	2.12	-1.97	-3.56
4,063.00	12.12	266.010	4,046.25	-84.48	-224.41	-14.73	1.14	-0.77	-3.97
4,095.00	10.48	261.230	4,077.63	-85.15	-230.64	-16.66	5.90	-5.13	-14.94
4,126.00	10.24	260.110	4,108.13	-86.06	-236.14	-18.09	1.01	-0.77	-3.61
4,158.00	9.71	257.590	4,139.64	-87.12	-241.58	-19.34	2.15	-1.66	-7.88
4,190.00	9.96	256.480	4,171.17	-88.35	-246.90	-20.40	0.98	0.78	-3.47
4,222.00	9.96	258.120	4,202.69	-89.57	-252.30	-21.49	0.89	0.00	5.13
4,254.00	9.92	262.830	4,234.21	-90.48	-257.74	-22.89	2.54	-0.13	14.72
4,286.00	9.69	265.050	4,265.74	-91.06	-263.16	-24.58	1.38	-0.72	6.94
4,317.00	9.95	266.620	4,296.29	-91.44	-268.43	-26.39	1.20	0.84	5.06
4,349.00	9.88	269.140	4,327.81	-91.65	-273.94	-28.45	1.37	-0.22	7.88
4,381.00	10.69	270.160	4,359.30	-91.68	-279.65	-30.76	2.59	2.53	3.19
4,413.00	11.05	273.080	4,390.72	-91.51	-285.68	-33.38	2.06	1.13	9.13
4,452.00	10.75	274.330	4,429.02	-91.03	-293.04	-36.83	0.98	-0.77	3.21
4,546.00	11.85	272.450	4,521.20	-89.96	-311.43	-45.33	1.23	1.17	-2.00



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

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)	
4,641.00	12.92	269.180	4,613.98	-89.69	-331.79	-53.90	1.35	1.13	-3.44	
4,735.00	13.66	268.580	4,705.47	-90.12	-353.40	-62.35	0.80	0.79	-0.64	
4,829.00	14.21	268.560	4,796.70	-90.68	-376.03	-71.10	0.59	0.59	-0.02	
4,923.00	13.38	264.990	4,887.99	-91.92	-398.40	-79.12	1.26	-0.88	-3.80	
5,018.00	11.31	261.310	4,980.79	-94.29	-418.56	-85.21	2.33	-2.18	-3.87	
5,112.00	10.78	269.320	5,073.05	-95.79	-436.46	-91.16	1.73	-0.56	8.52	
Tie into original hole @ 5112 MD										
5,185.00	11.43	273.470	5,144.69	-95.43	-450.51	-97.24	1.41	0.89	5.68	
5,200.00	11.78	273.650	5,159.38	-95.24	-453.52	-98.64	2.35	2.33	1.20	
5,247.00	12.26	273.120	5,205.35	-94.66	-463.29	-103.16	1.05	1.02	-1.13	
Survey @ 5247.00 MD 5205.35 TVD										

Design Annotations					
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment	
		+N/-S (ft)	+E/-W (ft)		
5,112.00	5,073.05	-95.79	-436.46	Tie into original hole @ 5112 MD	
5,247.00	5,205.35	-94.66	-463.29	Survey @ 5247.00 MD 5205.35 TVD	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

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 S-21 HU (slot B)					
Well Position	+N/-S	0.00 ft	Northing:	14,447,299.987 usft	Latitude:	39.781535000
	+E/-W	0.00 ft	Easting:	1,717,122.706 usft	Longitude:	-80.726968000
Position Uncertainty		0.00 ft	Wellhead Elevation:	ft	Ground Level:	753.00 ft

Wellbore	Sidetrack 01				
Magnetics	Model Name	Sample Date	Declination	Dip Angle	Field Strength
	IGRF2020	10/23/2022	(°)	(°)	(nT)
			-8.65	66.40	51,609.87161052

Design	Surveys Sidetrack 01				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	5,112.00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W	Direction	
	(ft)	(ft)	(ft)	(°)	
	0.00	0.00	0.00		155.850

Survey Program	Date 10/29/2022				
From	To	Survey (Wellbore)	Tool Name	Description	
(ft)	(ft)				
14.00	2,196.00	MWD surf (Original Hole)	MWD	MWD - Standard	
2,260.00	5,112.00	MWD (Original Hole)	MWD	MWD - Standard	
5,185.00	5,247.00	MWD ST1 (Sidetrack 01)	MWD	MWD - Standard	

Survey										
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Map	Map	Latitude	Longitude	
Depth	(°)	(°)	Depth	(ft)	(ft)	Northing	Easting			
(ft)			(ft)	(ft)	(ft)	(usft)	(usft)			
0.00	0.00	0.000	0.00	0.00	0.00	14,447,299.987	1,717,122.706	39.781535000	-80.726968000	
14.00	0.00	0.000	14.00	0.00	0.00	14,447,299.987	1,717,122.706	39.781535000	-80.726968000	
184.00	0.48	72.650	184.00	0.21	0.68	14,447,300.200	1,717,123.385	39.781535578	-80.726965579	
213.00	0.40	92.950	213.00	0.24	0.90	14,447,300.231	1,717,123.602	39.781535661	-80.726964806	
242.00	0.48	78.190	242.00	0.26	1.12	14,447,300.251	1,717,123.822	39.781535713	-80.726964022	
270.00	0.31	39.870	270.00	0.35	1.28	14,447,300.333	1,717,123.986	39.781535937	-80.726963440	
299.00	0.48	60.610	299.00	0.46	1.44	14,447,300.452	1,717,124.142	39.781536265	-80.726962883	
329.00	0.48	65.970	328.99	0.58	1.66	14,447,300.565	1,717,124.366	39.781536573	-80.726962084	
361.00	0.22	93.920	360.99	0.63	1.84	14,447,300.616	1,717,124.550	39.781536710	-80.726961429	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
Project:	Marshall County, West Virginia NAD83 UTM 17N	TVD Reference:	RKB=753+26 @ 779.00ft (Nabors B26)
Site:	Van Winkle	MD Reference:	RKB=753+26 @ 779.00ft (Nabors B28)
Well:	Van Winkle S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422y16

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
392.00	0.62	78.270	391.99	0.66	2.07	14,447,300.648	1,717,124.773	39.781536790	-80.726960633	
423.00	0.70	96.560	422.99	0.67	2.42	14,447,300.658	1,717,125.126	39.781536822	-80.726959379	
455.00	0.48	99.720	454.99	0.63	2.75	14,447,300.613	1,717,125.452	39.781536696	-80.726958218	
487.00	0.70	133.290	486.99	0.47	3.02	14,447,300.457	1,717,125.727	39.781536263	-80.726957243	
522.00	0.48	137.340	521.99	0.21	3.28	14,447,300.202	1,717,125.981	39.781535562	-80.726956338	
552.00	1.01	206.160	551.98	-0.12	3.24	14,447,299.872	1,717,125.950	39.781534657	-80.726956453	
583.00	0.88	181.020	582.98	-0.60	3.12	14,447,299.389	1,717,125.825	39.781533331	-80.726956902	
614.00	0.88	179.880	613.98	-1.07	3.12	14,447,298.913	1,717,125.822	39.781532023	-80.726956921	
646.00	0.70	147.270	645.97	-1.48	3.22	14,447,298.503	1,717,125.928	39.781530896	-80.726956547	
678.00	0.79	157.730	677.97	-1.85	3.41	14,447,298.134	1,717,126.117	39.781529882	-80.726955877	
710.00	1.10	147.180	709.97	-2.32	3.66	14,447,297.672	1,717,126.367	39.781528611	-80.726954992	
741.00	1.41	168.450	740.96	-2.94	3.90	14,447,297.048	1,717,126.605	39.781526896	-80.726954153	
773.00	1.41	151.930	772.95	-3.67	4.16	14,447,296.315	1,717,126.869	39.781524880	-80.726953221	
805.00	1.41	153.510	804.94	-4.37	4.52	14,447,295.615	1,717,127.230	39.781522955	-80.726951944	
836.00	1.04	168.440	835.93	-4.99	4.75	14,447,294.998	1,717,127.456	39.781521259	-80.726951145	
868.00	0.86	170.840	867.93	-5.51	4.85	14,447,294.477	1,717,127.553	39.781519826	-80.726950807	
900.00	1.17	160.400	899.92	-6.06	4.99	14,447,293.932	1,717,127.701	39.781518328	-80.726950287	
931.00	0.74	151.890	930.92	-6.53	5.20	14,447,293.457	1,717,127.901	39.781517023	-80.726949578	
963.00	0.74	153.220	962.92	-6.90	5.39	14,447,293.091	1,717,128.092	39.781516014	-80.726948905	
995.00	0.50	194.200	994.91	-7.22	5.44	14,447,292.771	1,717,128.150	39.781515135	-80.726948698	
1,027.00	0.49	151.560	1,026.91	-7.47	5.48	14,447,292.515	1,717,128.181	39.781514433	-80.726948591	
1,058.00	0.29	192.140	1,057.91	-7.67	5.52	14,447,292.322	1,717,128.228	39.781513902	-80.726948427	
1,090.00	0.62	147.930	1,089.91	-7.89	5.60	14,447,292.096	1,717,128.303	39.781513281	-80.726948163	
1,122.00	0.50	131.170	1,121.91	-8.13	5.79	14,447,291.857	1,717,128.500	39.781512624	-80.726947464	
1,154.00	0.51	159.800	1,153.91	-8.36	5.95	14,447,291.632	1,717,128.654	39.781512003	-80.726946918	
1,186.00	0.40	208.550	1,185.91	-8.59	5.94	14,447,291.400	1,717,128.650	39.781511366	-80.726946935	
1,217.00	0.47	214.890	1,216.91	-8.79	5.82	14,447,291.201	1,717,128.525	39.781510820	-80.726947380	
1,249.00	0.17	271.540	1,248.91	-8.89	5.70	14,447,291.094	1,717,128.403	39.781510529	-80.726947818	
1,281.00	0.52	290.880	1,280.91	-8.84	5.51	14,447,291.147	1,717,128.220	39.781510676	-80.726948469	
1,312.00	1.09	269.170	1,311.90	-8.79	5.09	14,447,291.193	1,717,127.794	39.781510806	-80.726949986	
1,344.00	1.24	292.870	1,343.90	-8.66	4.46	14,447,291.323	1,717,127.170	39.781511168	-80.726952203	
1,376.00	1.45	287.960	1,375.89	-8.40	3.76	14,447,291.583	1,717,126.466	39.781511887	-80.726954707	
1,408.00	1.52	274.670	1,407.88	-8.25	2.95	14,447,291.742	1,717,125.658	39.781512331	-80.726957582	
1,440.00	1.86	261.200	1,439.86	-8.29	2.02	14,447,291.697	1,717,124.722	39.781512216	-80.726960914	
1,471.00	2.67	262.160	1,470.84	-8.47	0.80	14,447,291.522	1,717,123.509	39.781511744	-80.726965232	
1,503.00	3.09	254.260	1,502.80	-8.80	-0.77	14,447,291.186	1,717,121.941	39.781510835	-80.726970819	
1,534.00	3.18	245.190	1,533.75	-9.39	-2.35	14,447,290.599	1,717,120.356	39.781509235	-80.726976466	
1,566.00	3.46	235.710	1,565.70	-10.31	-3.95	14,447,289.682	1,717,118.753	39.781506732	-80.726982183	
1,597.00	3.60	234.080	1,596.64	-11.40	-5.51	14,447,288.584	1,717,117.191	39.781503730	-80.726987751	
1,629.00	4.09	230.200	1,628.57	-12.72	-7.20	14,447,287.264	1,717,115.501	39.781500119	-80.726993782	
1,659.00	4.51	225.560	1,658.48	-14.23	-8.87	14,447,285.754	1,717,113.837	39.781495984	-80.726999722	
1,691.00	5.16	222.060	1,690.37	-16.18	-10.73	14,447,283.804	1,717,111.975	39.781490647	-80.727006372	
1,722.00	4.88	217.470	1,721.25	-18.26	-12.47	14,447,281.723	1,717,110.239	39.781484945	-80.727012574	
1,753.00	4.98	217.900	1,752.14	-20.37	-14.10	14,447,279.615	1,717,108.610	39.781479169	-80.727018394	
1,785.00	4.15	226.230	1,784.03	-22.27	-15.79	14,447,277.718	1,717,106.921	39.781473973	-80.727024427	
1,816.00	3.82	224.110	1,814.96	-23.79	-17.31	14,447,276.200	1,717,105.392	39.781469819	-80.727029885	
1,848.00	3.32	227.140	1,846.90	-25.18	-18.74	14,447,274.804	1,717,103.971	39.781465998	-80.727034959	
1,880.00	3.36	236.280	1,878.84	-26.33	-20.19	14,447,273.654	1,717,102.512	39.781462849	-80.727040165	
1,911.00	2.92	239.720	1,909.80	-27.24	-21.63	14,447,272.751	1,717,101.074	39.781460383	-80.727045292	
1,943.00	2.84	249.310	1,941.76	-27.93	-23.08	14,447,272.060	1,717,099.629	39.781458497	-80.727050444	
1,975.00	2.92	266.850	1,973.72	-28.25	-24.63	14,447,271.735	1,717,098.073	39.781457618	-80.727055985	
2,006.00	3.07	269.470	2,004.67	-28.30	-26.25	14,447,271.684	1,717,096.455	39.781457491	-80.727061746	
2,038.00	3.70	275.350	2,036.62	-28.22	-28.14	14,447,271.773	1,717,094.570	39.781457750	-80.727068454	
2,070.00	4.10	272.560	2,068.54	-28.07	-30.31	14,447,271.920	1,717,092.399	39.781458173	-80.727076180	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
2,101.00	4.04	265.420	2,099.47	-28.11	-32.50	14,447,271.882	1,717,090.203	39.781458088	-80.727083995	
2,133.00	3.59	250.220	2,131.40	-28.53	-34.57	14,447,271.453	1,717,088.137	39.781456927	-80.727091355	
2,164.00	4.16	246.230	2,162.32	-29.32	-36.51	14,447,270.671	1,717,086.194	39.781454796	-80.727098277	
2,196.00	4.22	240.260	2,194.24	-30.37	-38.60	14,447,269.620	1,717,084.110	39.781451925	-80.727105708	
2,260.00	4.39	220.130	2,258.06	-33.41	-42.22	14,447,266.578	1,717,080.486	39.781443603	-80.727118639	
2,292.00	4.61	216.530	2,289.96	-35.38	-43.77	14,447,264.609	1,717,078.932	39.781438207	-80.727124195	
2,324.00	4.53	220.140	2,321.86	-37.38	-45.35	14,447,262.609	1,717,077.351	39.781432729	-80.727129841	
2,356.00	3.91	225.390	2,353.77	-39.11	-46.95	14,447,260.877	1,717,075.760	39.781427985	-80.727135524	
2,388.00	2.91	237.790	2,385.72	-40.31	-48.41	14,447,259.678	1,717,074.296	39.781424704	-80.727153738	
2,419.00	2.39	239.880	2,416.68	-41.05	-49.63	14,447,258.934	1,717,073.071	39.781422672	-80.727145116	
2,451.00	1.44	246.530	2,448.67	-41.55	-50.58	14,447,258.439	1,717,072.125	39.781421321	-80.727148488	
2,481.00	1.45	242.770	2,478.66	-41.87	-51.26	14,447,258.115	1,717,071.442	39.781420437	-80.727150924	
2,513.00	1.62	251.740	2,510.65	-42.20	-52.05	14,447,257.788	1,717,070.652	39.781419546	-80.727153738	
2,545.00	1.31	240.360	2,542.64	-42.52	-52.80	14,447,257.466	1,717,069.905	39.781418666	-80.727156402	
2,576.00	1.18	259.840	2,573.63	-42.75	-53.42	14,447,257.234	1,717,069.283	39.781418035	-80.727158619	
2,608.00	1.08	253.690	2,605.62	-42.90	-54.04	14,447,257.091	1,717,068.669	39.781417648	-80.727160805	
2,640.00	1.43	245.610	2,637.61	-43.15	-54.69	14,447,256.842	1,717,068.016	39.781416968	-80.727163132	
2,671.00	2.34	243.330	2,668.60	-43.59	-55.61	14,447,256.398	1,717,067.098	39.781415757	-80.727166404	
2,703.00	2.84	228.130	2,700.56	-44.41	-56.78	14,447,255.576	1,717,065.924	39.781413508	-80.727170592	
2,735.00	2.74	233.380	2,732.53	-45.40	-57.99	14,447,254.590	1,717,064.720	39.781410812	-80.727174889	
2,767.00	3.42	233.030	2,764.48	-46.43	-59.36	14,447,253.560	1,717,063.343	39.781407995	-80.727179800	
2,798.00	3.03	231.020	2,795.43	-47.50	-60.74	14,447,252.488	1,717,061.967	39.781405064	-80.727184708	
2,830.00	3.41	229.620	2,827.38	-48.65	-62.12	14,447,251.340	1,717,060.585	39.781401921	-80.727189641	
2,862.00	3.29	230.490	2,859.33	-49.85	-63.55	14,447,250.139	1,717,059.152	39.781398635	-80.727194756	
2,893.00	2.98	222.240	2,890.28	-51.01	-64.78	14,447,248.977	1,717,057.924	39.781395453	-80.727199140	
2,923.00	3.04	220.750	2,920.24	-52.19	-65.83	14,447,247.797	1,717,056.880	39.781392221	-80.727202867	
2,955.00	3.02	225.960	2,952.19	-53.42	-66.99	14,447,246.568	1,717,055.720	39.781388856	-80.727207008	
2,986.00	2.72	219.030	2,983.15	-54.56	-68.04	14,447,245.429	1,717,054.670	39.781385737	-80.727210759	
3,018.00	3.35	225.270	3,015.11	-55.81	-69.18	14,447,244.181	1,717,053.528	39.781382320	-80.727214839	
3,049.00	3.66	225.190	3,046.05	-57.14	-70.52	14,447,242.846	1,717,052.182	39.781378665	-80.727219642	
3,081.00	4.41	229.080	3,077.97	-58.67	-72.18	14,447,241.321	1,717,050.528	39.781374489	-80.727225547	
3,113.00	5.46	230.640	3,109.85	-60.44	-74.28	14,447,239.549	1,717,048.421	39.781369642	-80.727230365	
3,144.00	6.05	234.790	3,140.70	-62.32	-76.76	14,447,237.672	1,717,045.946	39.781364507	-80.727241895	
3,175.00	7.07	238.190	3,171.49	-64.26	-79.72	14,447,235.724	1,717,042.990	39.781359183	-80.727252438	
3,207.00	7.75	236.640	3,203.23	-66.49	-83.19	14,447,233.500	1,717,039.514	39.781353103	-80.727264834	
3,238.00	8.19	239.290	3,233.93	-68.76	-86.84	14,447,231.223	1,717,035.870	39.781346881	-80.727277830	
3,270.00	8.57	239.630	3,265.59	-71.13	-90.85	14,447,228.853	1,717,031.853	39.781340407	-80.727292153	
3,302.00	8.97	239.360	3,297.21	-73.61	-95.06	14,447,226.376	1,717,027.650	39.781333640	-80.727307142	
3,333.00	8.96	240.760	3,327.83	-76.02	-99.24	14,447,223.966	1,717,023.464	39.781327054	-80.727322067	
3,365.00	8.64	239.900	3,359.46	-78.44	-103.50	14,447,221.543	1,717,019.210	39.781320436	-80.727337234	
3,397.00	8.57	241.590	3,391.10	-80.78	-107.67	14,447,219.203	1,717,015.034	39.781314046	-80.727352126	
3,429.00	7.36	244.640	3,422.79	-82.80	-111.62	14,447,217.191	1,717,011.084	39.781308552	-80.727366205	
3,461.00	6.72	252.670	3,454.55	-84.23	-115.26	14,447,215.755	1,717,007.445	39.781304640	-80.727379175	
3,493.00	6.79	261.610	3,486.32	-85.07	-118.92	14,447,214.921	1,717,003.786	39.781302381	-80.727392208	
3,525.00	7.22	267.330	3,518.09	-85.44	-122.80	14,447,214.552	1,716,999.906	39.781301398	-80.727406023	
3,557.00	8.16	269.870	3,549.80	-85.53	-127.08	14,447,214.453	1,716,995.626	39.781301162	-80.727421257	
3,588.00	9.54	269.330	3,580.43	-85.57	-131.85	14,447,214.418	1,716,990.857	39.781301106	-80.727438233	
3,620.00	10.83	272.020	3,611.92	-85.49	-137.51	14,447,214.493	1,716,985.201	39.781301359	-80.727458365	
3,652.00	11.24	271.670	3,643.33	-85.30	-143.63	14,447,214.690	1,716,979.079	39.781301951	-80.727480153	
3,683.00	11.17	272.750	3,673.74	-85.07	-149.65	14,447,214.922	1,716,973.060	39.781302639	-80.727501575	
3,715.00	10.67	273.580	3,705.16	-84.73	-155.70	14,447,215.255	1,716,967.007	39.781303606	-80.727523115	
3,747.00	10.14	272.820	3,736.64	-84.41	-161.47	14,447,215.579	1,716,961.237	39.781304543	-80.727543650	
3,779.00	10.43	272.440	3,768.12	-84.15	-167.18	14,447,215.841	1,716,955.529	39.781305310	-80.727563962	
3,810.00	10.47	270.940	3,798.61	-83.98	-172.80	14,447,216.007	1,716,949.910	39.781305811	-80.727583964	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Decv0422v16

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
3,842.00	10.31	272.080	3,830.08	-83.83	-178.57	14,447,216.158	1,716,944.141	39.781306276	-80.727604496	
3,874.00	10.90	271.610	3,861.54	-83.64	-184.45	14,447,216.347	1,716,938.255	39.781306844	-80.727625444	
3,905.00	11.85	270.040	3,891.93	-83.56	-190.56	14,447,216.432	1,716,932.142	39.781307127	-80.727647202	
3,937.00	12.01	269.370	3,923.23	-83.59	-197.18	14,447,216.397	1,716,925.527	39.781307088	-80.727670747	
3,968.00	12.53	269.200	3,953.53	-83.67	-203.77	14,447,216.315	1,716,918.940	39.781306917	-80.727694195	
4,000.00	12.99	268.380	3,984.74	-83.82	-210.83	14,447,216.165	1,716,911.874	39.781306564	-80.727719348	
4,032.00	12.36	267.240	4,015.96	-84.09	-217.85	14,447,215.898	1,716,904.858	39.781305890	-80.727744323	
4,063.00	12.12	266.010	4,046.25	-84.48	-224.41	14,447,215.512	1,716,898.297	39.781304884	-80.727767679	
4,095.00	10.48	266.120	4,077.63	-85.15	-230.64	14,447,214.835	1,716,892.069	39.781303076	-80.727789854	
4,126.00	10.24	260.110	4,108.13	-86.06	-236.14	14,447,213.931	1,716,886.568	39.781300641	-80.727809444	
4,158.00	9.71	257.590	4,139.64	-87.12	-241.58	14,447,212.863	1,716,881.131	39.781297752	-80.727828810	
4,190.00	9.96	256.480	4,171.17	-88.35	-246.90	14,447,211.636	1,716,875.804	39.781294427	-80.727847782	
4,222.00	9.96	258.120	4,202.69	-89.57	-252.30	14,447,210.419	1,716,870.406	39.781291131	-80.727867011	
4,254.00	9.92	262.830	4,234.21	-90.48	-257.74	14,447,209.506	1,716,864.963	39.781288667	-80.727886395	
4,286.00	9.69	265.050	4,265.74	-91.06	-263.16	14,447,208.929	1,716,859.545	39.781287130	-80.727905686	
4,317.00	9.95	266.620	4,296.29	-91.44	-268.43	14,447,208.546	1,716,854.272	39.781286122	-80.727924458	
4,349.00	9.88	269.140	4,327.81	-91.65	-273.94	14,447,208.342	1,716,848.767	39.781285607	-80.727944054	
4,381.00	10.69	270.160	4,359.30	-91.68	-279.65	14,447,208.309	1,716,843.054	39.781285564	-80.727964390	
4,413.00	11.05	273.080	4,390.72	-91.51	-285.68	14,447,208.482	1,716,837.024	39.781286090	-80.727985852	
4,452.00	10.75	274.330	4,429.02	-91.03	-293.04	14,447,208.958	1,716,829.665	39.781287457	-80.728012040	
4,546.00	11.85	272.450	4,521.20	-89.96	-311.43	14,447,210.032	1,716,811.280	39.781290561	-80.728077467	
4,641.00	12.92	269.180	4,613.98	-89.69	-331.79	14,447,210.297	1,716,790.915	39.781291458	-80.728149954	
4,735.00	13.66	268.580	4,705.47	-90.12	-353.40	14,447,209.872	1,716,769.311	39.781290470	-80.728226856	
4,829.00	14.21	268.560	4,796.70	-90.68	-376.03	14,447,209.307	1,716,746.681	39.781289107	-80.728307411	
4,923.00	13.38	264.990	4,887.99	-91.92	-398.40	14,447,208.067	1,716,724.311	39.781285889	-80.728387046	
5,018.00	11.31	261.310	4,980.79	-94.29	-418.56	14,447,205.699	1,716,704.150	39.781279554	-80.728458832	
5,112.00	10.78	269.320	5,073.05	-95.79	-436.46	14,447,204.202	1,716,686.247	39.781275592	-80.728522573	
Tie into original hole @ 5112 MD										
5,185.00	11.43	273.470	5,144.69	-95.43	-450.51	14,447,204.559	1,716,672.201	39.781276689	-80.728572567	
5,200.00	11.78	273.650	5,159.38	-95.24	-453.52	14,447,204.746	1,716,669.189	39.781277229	-80.728583285	
5,247.00	12.26	273.120	5,205.35	-94.66	-463.29	14,447,205.323	1,716,659.418	39.781278895	-80.728618056	
Survey @ 5247.00 MD 5205.35 TVD										

Design Annotations					
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment	
		+N/-S (ft)	+E/-W (ft)		
5,112.00	5,073.05	-95.79	-436.46	Tie into original hole @ 5112 MD	
5,247.00	5,205.35	-94.66	-463.29	Survey @ 5247.00 MD 5205.35 TVD	

Checked By: _____ Approved By: _____ Date: _____



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

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 S-21 HU (slot B)					
Well Position	+N/-S	0.00 ft	Northing:	14,447,299.987 usft	Latitude:	39.781535000
	+E/-W	0.00 ft	Easting:	1,717,122.706 usft	Longitude:	-80.726968000
Position Uncertainty	0.00 ft	Wellhead Elevation:	ft	Ground Level:	753.00 ft	
Grid Convergence:	0.17 °					

Wellbore	Sidetrack 02				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	11/4/2022	-8.65	66.40	51,606.45874343

Design	Surveys Sidetrack 02				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	4,641.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.00	0.00	0.00	155.850	

Survey Program	Date	12/5/2022			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
14.00	2,196.00	MWD surf (Original Hole)	MWD	MWD - Standard	
2,260.00	4,641.00	MWD (Original Hole)	MWD	MWD - Standard	
4,718.00	11,889.00	MWD ST2 (Sidetrack 02)	MWD	MWD - Standard	
11,953.00	11,982.00	Projection (Sidetrack 02)	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	0.00
14.00	0.00	0.000	14.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
184.00	0.48	72.650	184.00	0.21	0.68	0.08	0.28	0.28	0.00	0.00
213.00	0.40	92.950	213.00	0.24	0.90	0.14	0.60	-0.28	70.00	0.00
242.00	0.48	78.190	242.00	0.26	1.12	0.22	0.48	0.28	-50.90	0.00
270.00	0.31	39.870	270.00	0.35	1.28	0.21	1.09	-0.61	-136.86	0.00
299.00	0.48	60.610	299.00	0.46	1.44	0.16	0.76	0.59	71.52	0.00



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

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)	
329.00	0.48	65.970	328.99	0.58	1.66	0.15	0.15	0.00	17.87	
361.00	0.22	93.920	360.99	0.63	1.84	0.18	0.95	-0.81	87.34	
392.00	0.62	78.270	391.99	0.66	2.07	0.25	1.33	1.29	-50.48	
423.00	0.70	96.560	422.99	0.67	2.42	0.38	0.72	0.26	59.00	
455.00	0.48	99.720	454.99	0.63	2.75	0.55	0.69	-0.69	9.88	
487.00	0.70	133.290	486.99	0.47	3.02	0.81	1.25	0.69	104.91	
522.00	0.48	137.340	521.99	0.21	3.28	1.14	0.64	-0.63	11.57	
552.00	1.01	206.160	551.98	-0.12	3.24	1.43	3.16	1.77	229.40	
583.00	0.88	181.020	582.98	-0.60	3.12	1.82	1.39	-0.42	-81.10	
614.00	0.88	179.880	613.98	-1.07	3.12	2.26	0.06	0.00	-3.68	
646.00	0.70	147.270	645.97	-1.48	3.22	2.67	1.49	-0.56	-101.91	
678.00	0.79	157.730	677.97	-1.85	3.41	3.09	0.51	0.28	32.69	
710.00	1.10	147.180	709.97	-2.32	3.66	3.61	1.11	0.97	-32.97	
741.00	1.41	168.450	740.96	-2.94	3.90	4.28	1.79	1.00	68.61	
773.00	1.41	151.930	772.95	-3.67	4.16	5.05	1.27	0.00	-51.63	
805.00	1.41	153.510	804.94	-4.37	4.52	5.84	0.12	0.00	4.94	
836.00	1.04	168.440	835.93	-4.99	4.75	6.50	1.57	-1.19	48.16	
868.00	0.86	170.840	867.93	-5.51	4.85	7.01	0.58	-0.56	7.50	
900.00	1.17	160.400	899.92	-6.06	4.99	7.57	1.12	0.97	-32.63	
931.00	0.74	151.890	930.92	-6.53	5.20	8.08	1.46	-1.39	-27.45	
963.00	0.74	153.220	962.92	-6.90	5.39	8.50	0.05	0.00	4.16	
995.00	0.50	194.200	994.91	-7.22	5.44	8.81	1.53	-0.75	128.06	
1,027.00	0.49	151.560	1,026.91	-7.47	5.48	9.06	1.13	-0.03	-133.25	
1,058.00	0.29	192.140	1,057.91	-7.67	5.52	9.25	1.06	-0.65	130.90	
1,090.00	0.62	147.930	1,089.91	-7.89	5.60	9.49	1.43	1.03	-138.16	
1,122.00	0.50	131.170	1,121.91	-8.13	5.79	9.79	0.63	-0.38	-52.38	
1,154.00	0.51	159.800	1,153.91	-8.36	5.95	10.06	0.78	0.03	89.47	
1,186.00	0.40	208.550	1,185.91	-8.59	5.94	10.27	1.21	-0.34	152.34	
1,217.00	0.47	214.890	1,216.91	-8.79	5.82	10.40	0.27	0.23	20.45	
1,249.00	0.17	271.540	1,248.91	-8.89	5.70	10.45	1.26	-0.94	177.03	
1,281.00	0.52	290.880	1,280.91	-8.84	5.51	10.32	1.14	1.09	60.44	
1,312.00	1.09	269.170	1,311.90	-8.79	5.09	10.11	2.05	1.84	-70.03	
1,344.00	1.24	292.870	1,343.90	-8.66	4.46	9.73	1.56	0.47	74.06	
1,376.00	1.45	287.960	1,375.89	-8.40	3.76	9.21	0.75	0.66	-15.34	
1,408.00	1.52	274.670	1,407.88	-8.25	2.95	8.73	1.10	0.22	-41.53	
1,440.00	1.86	261.200	1,439.88	-8.29	2.02	8.39	1.63	1.06	-42.09	
1,471.00	2.67	262.160	1,470.84	-8.47	0.80	8.05	2.62	2.61	3.10	
1,503.00	3.09	254.260	1,502.80	-8.80	-0.77	7.72	1.80	1.31	-24.69	
1,534.00	3.18	245.190	1,533.75	-9.39	-2.35	7.61	1.62	0.29	-29.26	
1,566.00	3.46	235.710	1,565.70	-10.31	-3.95	7.79	1.92	0.88	-29.63	
1,597.00	3.60	234.080	1,596.64	-11.40	-5.51	8.15	0.56	0.45	-5.26	
1,629.00	4.09	230.200	1,628.57	-12.72	-7.20	8.66	1.73	1.53	-12.13	
1,659.00	4.51	225.560	1,658.48	-14.23	-8.87	9.36	1.82	1.40	-15.47	



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

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)
1,691.00	5.16	222.060	1,690.37	-16.18	-10.73	10.38	2.23	2.03	-10.94
1,722.00	4.88	217.470	1,721.25	-18.26	-12.47	11.57	1.58	-0.90	-14.81
1,753.00	4.98	217.900	1,752.14	-20.37	-14.10	12.82	0.34	0.32	1.39
1,785.00	4.15	226.230	1,784.03	-22.27	-15.79	13.86	3.31	-2.59	26.03
1,816.00	3.82	224.110	1,814.96	-23.79	-17.31	14.62	1.17	-1.06	-6.84
1,848.00	3.32	227.140	1,846.90	-25.18	-18.74	15.31	1.67	-1.56	9.47
1,880.00	3.36	236.280	1,878.84	-26.33	-20.19	15.77	1.67	0.13	28.56
1,911.00	2.92	239.720	1,909.80	-27.24	-21.63	16.00	1.54	-1.42	11.10
1,943.00	2.84	249.310	1,941.76	-27.93	-23.08	16.04	1.52	-0.25	29.97
1,975.00	2.92	266.850	1,973.72	-28.25	-24.63	15.70	2.75	0.25	54.81
2,006.00	3.07	269.470	2,004.67	-28.30	-26.25	15.09	0.65	0.48	8.45
2,038.00	3.70	275.350	2,036.62	-28.22	-28.14	14.23	2.25	1.97	18.38
2,070.00	4.10	272.560	2,068.54	-28.07	-30.31	13.21	1.38	1.25	-8.72
2,101.00	4.04	265.420	2,099.47	-28.11	-32.50	12.35	1.65	-0.19	-23.03
2,133.00	3.59	250.220	2,131.40	-28.53	-34.57	11.89	3.45	-1.41	-47.50
2,164.00	4.16	246.230	2,162.32	-29.32	-36.51	11.81	2.03	1.84	-12.87
2,196.00	4.22	240.260	2,194.24	-30.37	-38.60	11.92	1.38	0.19	-18.66
2,260.00	4.39	220.130	2,258.06	-33.41	-42.22	13.21	2.36	0.27	-31.45
2,292.00	4.61	216.530	2,289.96	-35.38	-43.77	14.37	1.12	0.69	-11.25
2,324.00	4.53	220.140	2,321.86	-37.38	-45.35	15.55	0.93	-0.25	11.28
2,356.00	3.91	225.390	2,353.77	-39.11	-46.95	16.48	2.28	-1.94	16.41
2,388.00	2.91	237.790	2,385.72	-40.31	-48.41	16.98	3.87	-3.13	38.75
2,419.00	2.39	239.880	2,416.68	-41.05	-49.63	17.15	1.71	-1.68	6.74
2,451.00	1.44	246.530	2,448.67	-41.55	-50.58	17.22	3.04	-2.97	20.78
2,481.00	1.45	242.770	2,478.66	-41.87	-51.26	17.23	0.32	0.03	-12.53
2,513.00	1.62	251.740	2,510.65	-42.20	-52.05	17.21	0.92	0.53	28.03
2,545.00	1.31	240.360	2,542.64	-42.52	-52.80	17.20	1.32	-0.97	-35.56
2,576.00	1.18	259.840	2,573.63	-42.75	-53.42	17.15	1.42	-0.42	62.84
2,608.00	1.08	253.690	2,605.62	-42.90	-54.04	17.03	0.49	-0.31	-19.22
2,640.00	1.43	245.610	2,637.61	-43.15	-54.69	16.99	1.22	1.09	-25.25
2,671.00	2.34	243.330	2,668.60	-43.59	-55.61	17.02	2.94	2.94	-7.35
2,703.00	2.84	228.130	2,700.56	-44.41	-56.78	17.29	2.64	1.56	-47.50
2,735.00	2.74	233.380	2,732.53	-45.40	-57.99	17.70	0.86	-0.31	16.41
2,767.00	3.42	233.030	2,764.48	-46.43	-59.36	18.08	2.13	2.13	-1.09
2,798.00	3.03	231.020	2,795.43	-47.50	-60.74	18.49	1.31	-1.26	-6.48
2,830.00	3.41	229.620	2,827.38	-48.65	-62.12	18.97	1.21	1.19	-4.38
2,862.00	3.29	230.490	2,859.33	-49.85	-63.55	19.48	0.41	-0.38	2.72
2,893.00	2.98	222.240	2,890.28	-51.01	-64.78	20.04	1.76	-1.00	-26.61
2,923.00	3.04	220.750	2,920.24	-52.19	-65.83	20.69	0.33	0.20	-4.97
2,955.00	3.02	225.960	2,952.19	-53.42	-66.99	21.34	0.86	-0.06	16.28
2,986.00	2.72	219.030	2,983.15	-54.56	-68.04	21.95	1.48	-0.97	-22.35
3,018.00	3.35	225.270	3,015.11	-55.81	-69.18	22.62	2.22	1.97	19.50
3,049.00	3.66	225.190	3,046.05	-57.14	-70.52	23.29	1.00	1.00	-0.26
3,081.00	4.41	229.080	3,077.97	-58.67	-72.18	24.00	2.49	2.34	12.16



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

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)
3,113.00	5.46	230.640	3,109.85	-60.44	-74.28	24.76	3.31	3.28	4.88
3,144.00	6.05	234.790	3,140.70	-62.32	-76.76	25.46	2.33	1.90	13.39
3,175.00	7.07	238.190	3,171.49	-64.26	-79.72	26.02	3.52	3.29	10.97
3,207.00	7.75	236.640	3,203.23	-66.49	-83.19	26.63	2.21	2.13	-4.84
3,238.00	8.19	239.290	3,233.93	-68.76	-86.84	27.22	1.85	1.42	8.55
3,270.00	8.57	239.630	3,265.59	-71.13	-90.85	27.74	1.20	1.19	1.06
3,302.00	8.97	239.360	3,297.21	-73.61	-95.06	28.28	1.26	1.25	-0.84
3,333.00	8.96	240.760	3,327.83	-76.02	-99.24	28.77	0.70	-0.03	4.52
3,365.00	8.64	239.900	3,359.46	-78.44	-103.50	29.24	1.08	-1.00	-2.69
3,397.00	8.57	241.590	3,391.10	-80.78	-107.67	29.66	0.82	-0.22	5.28
3,429.00	7.36	244.640	3,422.79	-82.80	-111.62	29.88	4.00	-3.78	9.53
3,461.00	6.72	252.670	3,454.55	-84.23	-115.26	29.70	3.66	-2.00	25.09
3,493.00	6.79	261.610	3,486.32	-85.07	-118.92	28.97	3.29	0.22	27.94
3,525.00	7.22	267.330	3,518.09	-85.44	-122.80	27.72	2.56	1.34	17.88
3,557.00	8.16	269.870	3,549.80	-85.53	-127.08	26.06	3.12	2.94	7.94
3,588.00	9.54	269.330	3,580.43	-85.57	-131.85	24.14	4.46	4.45	-1.74
3,620.00	10.83	272.020	3,611.92	-85.49	-137.51	21.76	4.30	4.03	8.41
3,652.00	11.24	271.670	3,643.33	-85.30	-143.63	19.07	1.30	1.28	-1.09
3,683.00	11.17	272.750	3,673.74	-85.07	-149.65	16.40	0.71	-0.23	3.48
3,715.00	10.67	273.580	3,705.16	-84.73	-155.70	13.62	1.64	-1.56	2.59
3,747.00	10.14	272.820	3,736.64	-84.41	-161.47	10.96	1.71	-1.66	-2.38
3,779.00	10.43	272.440	3,768.12	-84.15	-167.18	8.39	0.93	0.91	-1.19
3,810.00	10.47	270.940	3,798.61	-83.98	-172.80	5.94	0.89	0.13	-4.84
3,842.00	10.31	272.080	3,830.08	-83.83	-178.57	3.44	0.81	-0.50	3.56
3,874.00	10.90	271.610	3,861.54	-83.64	-184.45	0.86	1.86	1.84	-1.47
3,905.00	11.85	270.040	3,891.93	-83.56	-190.56	-1.72	3.22	3.06	-5.06
3,937.00	12.01	269.370	3,923.23	-83.59	-197.18	-4.40	0.66	0.50	-2.09
3,968.00	12.53	269.200	3,953.53	-83.67	-203.77	-7.02	1.68	1.68	-0.55
4,000.00	12.99	268.380	3,984.74	-83.82	-210.83	-9.77	1.54	1.44	-2.56
4,032.00	12.36	267.240	4,015.96	-84.09	-217.85	-12.40	2.12	-1.97	-3.56
4,063.00	12.12	266.010	4,046.25	-84.48	-224.41	-14.73	1.14	-0.77	-3.97
4,095.00	10.48	261.230	4,077.63	-85.15	-230.64	-16.66	5.90	-5.13	-14.94
4,126.00	10.24	260.110	4,108.13	-86.06	-236.14	-18.09	1.01	-0.77	-3.61
4,158.00	9.71	257.590	4,139.64	-87.12	-241.58	-19.34	2.15	-1.66	-7.88
4,190.00	9.96	256.480	4,171.17	-88.35	-246.90	-20.40	0.98	0.78	-3.47
4,222.00	9.96	258.120	4,202.69	-89.57	-252.30	-21.49	0.89	0.00	5.13
4,254.00	9.92	262.830	4,234.21	-90.48	-257.74	-22.89	2.54	-0.13	14.72
4,286.00	9.69	265.050	4,265.74	-91.06	-263.16	-24.58	1.38	-0.72	6.94
4,317.00	9.95	266.620	4,296.29	-91.44	-268.43	-26.39	1.20	0.84	5.06
4,349.00	9.88	269.140	4,327.81	-91.65	-273.94	-28.45	1.37	-0.22	7.88
4,381.00	10.69	270.160	4,359.30	-91.68	-279.65	-30.76	2.59	2.53	3.19
4,413.00	11.05	273.080	4,390.72	-91.51	-285.68	-33.38	2.06	1.13	9.13
4,452.00	10.75	274.330	4,429.02	-91.03	-293.04	-36.83	0.98	-0.77	3.21



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

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)	
4,546.00	11.85	272.450	4,521.20	-89.96	-311.43	-45.33	1.23	1.17	-2.00	
4,641.00	12.92	269.180	4,613.98	-89.69	-331.79	-53.90	1.35	1.13	-3.44	
Tie into original hole @ 4641 MD										
4,718.00	12.84	266.970	4,689.05	-90.27	-348.94	-60.40	0.65	-0.10	-2.87	
4,746.00	12.53	261.700	4,716.36	-90.87	-355.06	-62.35	4.28	-1.11	-18.82	
4,777.00	11.74	256.160	4,746.67	-92.11	-361.45	-63.83	4.54	-2.55	-17.87	
4,808.00	9.49	250.270	4,777.14	-93.73	-366.91	-64.59	8.05	-7.26	-19.00	
4,839.00	8.00	246.580	4,807.78	-95.45	-371.30	-64.82	5.13	-4.81	-11.90	
4,870.00	7.30	243.860	4,838.50	-97.17	-375.05	-64.77	2.54	-2.26	-8.77	
4,963.00	8.57	253.170	4,930.62	-101.78	-386.98	-65.45	1.94	1.37	10.01	
5,056.00	9.23	249.390	5,022.50	-106.41	-400.60	-66.80	0.95	0.71	-4.06	
5,149.00	10.37	255.460	5,114.14	-111.14	-415.68	-68.65	1.65	1.23	6.53	
5,242.00	11.43	257.570	5,205.46	-115.23	-432.78	-71.92	1.22	1.14	2.27	
5,336.00	12.57	254.490	5,297.41	-119.97	-451.74	-75.35	1.39	1.21	-3.28	
5,429.00	11.30	261.610	5,388.40	-124.00	-470.50	-79.35	2.09	-1.37	7.66	
5,522.00	10.95	269.520	5,479.66	-125.41	-488.35	-85.37	1.68	-0.38	8.51	
5,615.00	12.00	270.840	5,570.80	-125.34	-506.85	-93.00	1.16	1.13	1.42	
5,707.00	12.62	266.360	5,660.68	-125.84	-526.45	-100.56	1.24	0.67	-4.87	
5,801.00	12.84	271.630	5,752.38	-126.19	-547.13	-108.70	1.26	0.23	5.61	
5,893.00	13.10	270.840	5,842.03	-125.75	-567.78	-117.55	0.34	0.28	-0.86	
5,986.00	12.31	272.600	5,932.75	-125.14	-588.22	-126.47	0.95	-0.85	1.89	
6,079.00	12.48	270.310	6,023.58	-124.64	-608.17	-135.09	0.56	0.18	-2.46	
6,172.00	12.92	269.520	6,114.31	-124.67	-628.62	-143.43	0.51	0.47	-0.85	
6,266.00	13.63	267.760	6,205.80	-125.19	-650.19	-151.78	0.87	0.76	-1.87	
6,358.00	13.19	268.200	6,295.29	-125.95	-671.52	-159.81	0.49	-0.48	0.48	
6,451.00	13.19	267.670	6,385.83	-126.71	-692.72	-167.79	0.13	0.00	-0.57	
6,543.00	13.58	266.440	6,475.34	-127.81	-713.99	-175.49	0.52	0.42	-1.34	
6,636.00	14.07	268.290	6,565.64	-128.82	-736.19	-183.65	0.71	0.53	1.99	
6,729.00	12.97	267.410	6,656.06	-129.63	-757.91	-191.80	1.20	-1.18	-0.95	
6,823.00	11.56	269.870	6,747.92	-130.13	-777.87	-199.51	1.60	-1.50	2.62	
6,916.00	10.64	270.840	6,839.18	-130.02	-795.78	-206.93	1.01	-0.99	1.04	
7,009.00	10.68	271.800	6,930.57	-129.63	-812.97	-214.33	0.20	0.04	1.03	
7,102.00	10.86	268.900	7,021.93	-129.53	-830.35	-221.53	0.61	0.19	-3.12	
7,196.00	10.73	268.110	7,114.27	-129.98	-847.95	-228.31	0.21	-0.14	-0.84	
7,290.00	9.85	268.900	7,206.76	-130.43	-864.73	-234.77	0.95	-0.94	0.84	
7,383.00	9.54	268.550	7,298.43	-130.78	-880.39	-240.86	0.34	-0.33	-0.38	
7,477.00	9.49	268.990	7,391.14	-131.11	-895.92	-246.91	0.09	-0.05	0.47	
7,570.00	9.36	270.050	7,482.88	-131.24	-911.15	-253.03	0.23	-0.14	1.14	
7,663.00	9.23	270.570	7,574.66	-131.16	-926.17	-259.24	0.17	-0.14	0.56	
7,757.00	9.80	271.450	7,667.37	-130.88	-941.71	-265.85	0.63	0.61	0.94	
7,851.00	10.07	267.940	7,759.96	-130.97	-957.92	-272.40	0.71	0.29	-3.73	
7,945.00	10.07	264.510	7,852.51	-132.05	-974.31	-278.12	0.64	0.00	-3.65	
8,038.00	11.03	265.740	7,943.94	-133.49	-991.28	-283.75	1.06	1.03	1.32	
8,131.00	11.43	266.360	8,035.16	-134.74	-1,009.34	-290.00	0.45	0.43	0.67	



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

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)
8,225.00	11.56	267.230	8,127.27	-135.78	-1,028.05	-296.70	0.23	0.14	0.93
8,318.00	11.78	268.030	8,218.35	-136.56	-1,046.84	-303.68	0.29	0.24	0.86
8,412.00	11.87	269.780	8,310.35	-136.93	-1,066.10	-311.23	0.39	0.10	1.86
8,505.00	10.95	268.200	8,401.51	-137.24	-1,084.49	-318.46	1.04	-0.99	-1.70
8,599.00	10.11	270.570	8,493.93	-137.44	-1,101.67	-325.31	1.01	-0.89	2.52
8,692.00	9.85	270.050	8,585.52	-137.35	-1,117.78	-331.98	0.30	-0.28	-0.56
8,786.00	10.02	266.440	8,678.11	-137.85	-1,133.99	-338.16	0.69	0.18	-3.84
8,879.00	11.08	265.920	8,769.54	-138.99	-1,150.98	-344.07	1.14	1.14	-0.56
8,974.00	10.77	264.950	8,862.82	-140.42	-1,168.92	-350.11	0.38	-0.33	-1.02
9,067.00	11.21	266.440	8,954.11	-141.75	-1,186.60	-356.13	0.56	0.47	1.60
9,160.00	11.78	267.060	9,045.25	-142.80	-1,205.10	-362.74	0.63	0.61	0.67
9,254.00	12.00	265.650	9,137.23	-144.03	-1,224.43	-369.52	0.39	0.23	-1.50
9,347.00	12.13	266.090	9,228.18	-145.43	-1,243.82	-376.18	0.17	0.14	0.47
9,440.00	11.96	266.530	9,319.13	-146.68	-1,263.19	-382.96	0.21	-0.18	0.47
9,534.00	11.69	266.180	9,411.13	-147.90	-1,282.41	-389.71	0.30	-0.29	-0.37
9,627.00	11.43	268.290	9,502.25	-148.81	-1,301.02	-396.50	0.53	-0.28	2.27
9,721.00	10.81	264.770	9,594.48	-149.89	-1,319.11	-402.91	0.98	-0.66	-3.74
9,815.00	10.46	265.210	9,686.87	-151.40	-1,336.39	-408.60	0.38	-0.37	0.47
9,909.00	10.37	265.650	9,779.32	-152.76	-1,353.33	-414.30	0.13	-0.10	0.47
10,002.00	9.36	263.460	9,870.95	-154.25	-1,369.19	-419.42	1.16	-1.09	-2.35
10,016.00	9.10	263.540	9,884.76	-154.51	-1,371.42	-420.10	1.86	-1.86	0.57
10,055.00	8.48	261.300	9,923.31	-155.29	-1,377.33	-421.80	1.82	-1.59	-5.74
10,102.00	9.41	261.350	9,969.73	-156.39	-1,384.55	-423.75	1.98	1.98	0.11
10,149.00	10.16	269.900	10,016.05	-156.98	-1,392.50	-426.47	3.47	1.60	18.19
10,196.00	9.85	268.570	10,062.34	-157.09	-1,400.66	-429.71	0.82	-0.66	-2.83
10,242.00	10.12	242.130	10,107.66	-159.07	-1,408.17	-430.97	9.90	0.59	-57.48
10,289.00	10.52	219.000	10,153.92	-164.34	-1,414.52	-428.76	8.80	0.85	-49.21
10,334.00	10.83	211.150	10,198.15	-171.15	-1,419.30	-424.50	3.30	0.69	-17.44
10,381.00	11.22	207.760	10,244.28	-178.98	-1,423.71	-419.17	1.61	0.83	-7.21
10,427.00	12.90	196.830	10,289.27	-187.85	-1,427.28	-412.53	6.15	3.65	-23.76
10,474.00	14.63	186.610	10,334.92	-198.77	-1,429.48	-403.46	6.34	3.68	-21.74
10,520.00	15.91	176.210	10,379.31	-210.84	-1,429.74	-392.56	6.56	2.78	-22.61
10,567.00	17.32	168.320	10,424.35	-224.12	-1,427.89	-379.69	5.65	3.00	-16.79
10,614.00	17.99	157.130	10,469.15	-237.66	-1,423.66	-365.59	7.35	1.43	-23.81
10,661.00	17.10	142.140	10,513.99	-249.81	-1,416.59	-351.62	9.77	-1.89	-31.89
10,707.00	17.23	136.810	10,557.94	-260.12	-1,407.78	-338.61	3.43	0.28	-11.59
10,738.00	19.22	145.490	10,587.39	-267.67	-1,401.74	-329.24	10.84	6.42	28.00
10,769.00	21.08	151.800	10,616.49	-276.79	-1,396.21	-318.66	9.22	6.00	20.35
10,800.00	22.63	157.570	10,645.27	-287.22	-1,391.30	-307.14	8.54	5.00	18.61
10,831.00	24.70	163.340	10,673.66	-298.94	-1,387.17	-294.75	10.01	6.68	18.61
10,862.00	27.57	165.460	10,701.49	-312.09	-1,383.51	-281.25	9.73	9.26	6.84
10,893.00	30.18	165.240	10,728.63	-326.58	-1,379.72	-266.49	8.43	8.42	-0.71
10,923.00	33.27	164.580	10,754.15	-341.80	-1,375.61	-250.91	10.36	10.30	-2.20



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

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)
10,954.00	36.10	164.220	10,779.64	-358.79	-1,370.87	-233.47	9.15	9.13	-1.16
10,986.00	38.67	164.090	10,805.06	-377.48	-1,365.56	-214.24	8.04	8.03	-0.41
11,016.00	41.71	163.080	10,827.98	-396.05	-1,360.09	-195.06	10.36	10.13	-3.37
11,048.00	44.72	163.390	10,851.30	-417.03	-1,353.77	-173.34	9.43	9.41	0.97
11,079.00	47.50	162.640	10,872.79	-438.39	-1,347.24	-151.17	9.14	8.97	-2.42
11,110.00	50.24	162.370	10,893.17	-460.66	-1,340.22	-127.98	8.86	8.84	-0.87
11,141.00	52.85	162.110	10,912.45	-483.77	-1,332.82	-103.86	8.44	8.42	-0.84
11,175.00	56.35	162.120	10,932.14	-510.15	-1,324.31	-76.31	10.29	10.29	0.03
11,206.00	61.01	162.210	10,948.25	-535.35	-1,316.20	-50.00	15.03	15.03	0.29
11,237.00	65.45	163.170	10,962.21	-561.77	-1,307.97	-22.53	14.59	14.32	3.10
11,284.00	72.18	162.120	10,979.19	-603.57	-1,294.90	20.96	14.47	14.32	-2.23
11,330.00	76.26	159.390	10,991.70	-645.34	-1,280.30	65.06	10.55	8.87	-5.93
11,377.00	81.98	156.140	11,000.57	-688.04	-1,262.83	111.16	13.93	12.17	-6.91
11,424.00	89.19	151.480	11,004.19	-730.04	-1,242.16	157.95	18.25	15.34	-9.91
11,517.00	90.51	152.270	11,004.43	-812.06	-1,198.32	250.72	1.65	1.42	0.85
11,610.00	89.32	152.630	11,004.57	-894.51	-1,155.31	343.55	1.34	-1.28	0.39
11,703.00	87.16	152.630	11,007.42	-977.06	-1,112.58	436.36	2.32	-2.32	0.00
11,795.00	87.47	152.890	11,011.73	-1,058.76	-1,070.51	528.12	0.44	0.34	0.28
11,889.00	87.16	152.010	11,016.14	-1,142.01	-1,027.09	621.85	0.99	-0.33	-0.94
Survey @ 11889 MD 11016.14 TVD ST2									
11,953.00	87.16	152.010	11,019.31	-1,198.46	-997.09	685.63	0.00	0.00	0.00
Top of Fish @ 11953 MD 11019.31 TVD ST2									
11,982.00	87.16	152.010	11,020.74	-1,224.03	-983.49	714.53	0.00	0.00	0.00
Survey Proj. to 11982 MD 11020.74 TVD ST2									

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
4,641.00	4,613.98	-89.69	-331.79	Tie into original hole @ 4641 MD
11,889.00	11,016.14	-1,142.01	-1,027.09	Survey @ 11889 MD 11016.14 TVD ST2
11,953.00	11,019.31	-1,198.46	-997.09	Top of Fish @ 11953 MD 11019.31 TVD ST2
11,982.00	11,020.74	-1,224.03	-983.49	Survey Proj. to 11982 MD 11020.74 TVD ST2



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

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 S-21 HU (slot B)					
Well Position	+N/-S	0.00 ft	Northing:	14,447,299.987 usft	Latitude:	39.781535000
	+E/-W	0.00 ft	Easting:	1,717,122.706 usft	Longitude:	-80.726968000
Position Uncertainty		0.00 ft	Wellhead Elevation:	ft	Ground Level:	753.00 ft

Wellbore	Sidetrack 02				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	11/4/2022	-8.65	66.40	51,606.45874343

Design	Surveys Sidetrack 02				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	4,641.00
Vertical Section:		Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)
		0.00	0.00	0.00	155.850

Survey Program	Date 12/5/2022				
	From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description
	14.00	2,196.00	MWD surf (Original Hole)	MWD	MWD - Standard
	2,260.00	4,641.00	MWD (Original Hole)	MWD	MWD - Standard
	4,718.00	11,889.00	MWD ST2 (Sidetrack 02)	MWD	MWD - Standard
	11,953.00	11,982.00	Projection (Sidetrack 02)	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	14,447,299.987	1,717,122.706	39.781535000	-80.726968000
	14.00	0.00	0.000	14.00	0.00	0.00	14,447,299.987	1,717,122.706	39.781535000	-80.726968000
	184.00	0.48	72.650	184.00	0.21	0.68	14,447,300.200	1,717,123.385	39.781535578	-80.726965579
	213.00	0.40	92.950	213.00	0.24	0.90	14,447,300.231	1,717,123.602	39.781535661	-80.726964806
	242.00	0.48	78.190	242.00	0.26	1.12	14,447,300.251	1,717,123.822	39.781535713	-80.726964022
	270.00	0.31	39.870	270.00	0.35	1.28	14,447,300.333	1,717,123.986	39.781535937	-80.726963440
	299.00	0.48	60.610	299.00	0.46	1.44	14,447,300.452	1,717,124.142	39.781536265	-80.726962883
	329.00	0.48	65.970	328.99	0.58	1.66	14,447,300.565	1,717,124.366	39.781536573	-80.726962084



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
361.00	0.22	93.920	360.99	0.63	1.84	14,447,300.616	1,717,124.550	39.781536710	-80.726961429
392.00	0.62	78.270	391.99	0.66	2.07	14,447,300.646	1,717,124.773	39.781536790	-80.726960633
423.00	0.70	96.560	422.99	0.67	2.42	14,447,300.658	1,717,125.126	39.781536822	-80.726959379
455.00	0.48	99.720	454.99	0.63	2.75	14,447,300.613	1,717,125.452	39.781536696	-80.726958218
487.00	0.70	133.290	486.99	0.47	3.02	14,447,300.457	1,717,125.727	39.781536263	-80.726957243
522.00	0.48	137.340	521.99	0.21	3.28	14,447,300.202	1,717,125.981	39.781535562	-80.726956338
552.00	1.01	206.160	551.98	-0.12	3.24	14,447,299.872	1,717,125.950	39.781534657	-80.726956453
583.00	0.88	181.020	582.98	-0.80	3.12	14,447,299.389	1,717,125.825	39.781533331	-80.726956902
614.00	0.88	179.880	613.98	-1.07	3.12	14,447,298.913	1,717,125.822	39.781532023	-80.726956921
646.00	0.70	147.270	645.97	-1.48	3.22	14,447,298.503	1,717,125.928	39.781530896	-80.726956547
678.00	0.79	157.730	677.97	-1.85	3.41	14,447,298.134	1,717,126.117	39.781529882	-80.726955877
710.00	1.10	147.180	709.97	-2.32	3.66	14,447,297.672	1,717,126.367	39.781528611	-80.726954992
741.00	1.41	168.450	740.96	-2.94	3.90	14,447,297.048	1,717,126.605	39.781526896	-80.726954153
773.00	1.41	151.930	772.95	-3.67	4.16	14,447,296.315	1,717,126.869	39.781524880	-80.726953221
805.00	1.41	153.510	804.94	-4.37	4.52	14,447,295.615	1,717,127.230	39.781522955	-80.726951944
836.00	1.04	168.440	835.93	-4.99	4.75	14,447,294.998	1,717,127.456	39.781521259	-80.726951145
868.00	0.86	170.840	867.93	-5.51	4.85	14,447,294.477	1,717,127.553	39.781519826	-80.726950807
900.00	1.17	160.400	899.92	-6.06	4.99	14,447,293.932	1,717,127.701	39.781518328	-80.726950287
931.00	0.74	151.890	930.92	-6.53	5.20	14,447,293.457	1,717,127.901	39.781517023	-80.726949578
963.00	0.74	153.220	962.92	-6.90	5.39	14,447,293.091	1,717,128.092	39.781516014	-80.726948905
995.00	0.50	194.200	994.91	-7.22	5.44	14,447,292.771	1,717,128.150	39.781515135	-80.726948698
1,027.00	0.49	151.560	1,026.91	-7.47	5.48	14,447,292.515	1,717,128.181	39.781514433	-80.726948591
1,058.00	0.29	192.140	1,057.91	-7.67	5.52	14,447,292.322	1,717,128.228	39.781513902	-80.726948427
1,090.00	0.62	147.930	1,089.91	-7.89	5.60	14,447,292.096	1,717,128.303	39.781513281	-80.726948163
1,122.00	0.50	131.170	1,121.91	-8.13	5.79	14,447,291.857	1,717,128.500	39.781512624	-80.726947464
1,154.00	0.51	159.800	1,153.91	-8.36	5.95	14,447,291.632	1,717,128.654	39.781512003	-80.726946918
1,186.00	0.40	208.550	1,185.91	-8.59	5.94	14,447,291.400	1,717,128.650	39.781511366	-80.726946935
1,217.00	0.47	214.890	1,216.91	-8.79	5.82	14,447,291.201	1,717,128.525	39.781510820	-80.726947380
1,249.00	0.17	271.540	1,248.91	-8.89	5.70	14,447,291.094	1,717,128.403	39.781510529	-80.726947818
1,281.00	0.52	290.880	1,280.91	-8.84	5.51	14,447,291.147	1,717,128.220	39.781510676	-80.726948469
1,312.00	1.09	269.170	1,311.90	-8.79	5.09	14,447,291.193	1,717,127.794	39.781510806	-80.726949986
1,344.00	1.24	292.870	1,343.90	-8.66	4.46	14,447,291.323	1,717,127.170	39.781511168	-80.726952203
1,376.00	1.45	287.960	1,375.89	-8.40	3.76	14,447,291.583	1,717,126.466	39.781511887	-80.726954707
1,408.00	1.52	274.670	1,407.88	-8.25	2.95	14,447,291.742	1,717,125.658	39.781512331	-80.726957582
1,440.00	1.86	261.200	1,439.86	-8.29	2.02	14,447,291.697	1,717,124.722	39.781512216	-80.726960914
1,471.00	2.67	262.160	1,470.84	-8.47	0.80	14,447,291.522	1,717,123.509	39.781511744	-80.726965232
1,503.00	3.09	254.260	1,502.80	-8.80	-0.77	14,447,291.186	1,717,121.941	39.781510835	-80.726970819
1,534.00	3.18	245.190	1,533.75	-9.39	-2.35	14,447,290.599	1,717,120.356	39.781509235	-80.726976466
1,566.00	3.46	235.710	1,565.70	-10.31	-3.95	14,447,289.682	1,717,118.753	39.781506732	-80.726982183
1,597.00	3.60	234.080	1,596.64	-11.40	-5.51	14,447,288.584	1,717,117.191	39.781503730	-80.726987751
1,629.00	4.09	230.200	1,628.57	-12.72	-7.20	14,447,287.264	1,717,115.501	39.781500119	-80.726993782
1,659.00	4.51	225.560	1,658.48	-14.23	-8.87	14,447,285.754	1,717,113.837	39.781495984	-80.726997222
1,691.00	5.16	222.060	1,690.37	-16.18	-10.73	14,447,283.804	1,717,111.975	39.781490647	-80.727006372
1,722.00	4.88	217.470	1,721.25	-18.26	-12.47	14,447,281.723	1,717,110.239	39.781484945	-80.727012574
1,753.00	4.98	217.900	1,752.14	-20.37	-14.10	14,447,279.615	1,717,108.610	39.781479169	-80.727018394
1,785.00	4.15	226.230	1,784.03	-22.27	-15.79	14,447,277.718	1,717,106.921	39.781473973	-80.727024427
1,816.00	3.82	224.110	1,814.96	-23.79	-17.31	14,447,276.200	1,717,105.392	39.781469819	-80.727029885
1,848.00	3.32	227.140	1,846.90	-25.18	-18.74	14,447,274.804	1,717,103.971	39.781465998	-80.727034959
1,880.00	3.36	236.280	1,878.84	-26.33	-20.19	14,447,273.654	1,717,102.512	39.781462849	-80.727040165
1,911.00	2.92	239.720	1,909.80	-27.24	-21.63	14,447,272.751	1,717,101.074	39.781460383	-80.727045292
1,943.00	2.84	249.310	1,941.76	-27.93	-23.08	14,447,272.060	1,717,099.629	39.781458497	-80.727050444
1,975.00	2.92	266.850	1,973.72	-28.25	-24.63	14,447,271.735	1,717,098.073	39.781457618	-80.727055985
2,006.00	3.07	269.470	2,004.67	-28.30	-26.25	14,447,271.684	1,717,096.455	39.781457491	-80.727061746
2,038.00	3.70	275.350	2,036.62	-28.22	-28.14	14,447,271.773	1,717,094.570	39.781457750	-80.727068454



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
2,070.00	4.10	272.560	2,068.54	-28.07	-30.31	14,447,271.920	1,717,092.399	39.781458173	-80.727076180	
2,101.00	4.04	265.420	2,099.47	-28.11	-32.50	14,447,271.882	1,717,090.203	39.781458088	-80.727083995	
2,133.00	3.59	250.220	2,131.40	-28.53	-34.57	14,447,271.453	1,717,088.137	39.781456927	-80.727091355	
2,164.00	4.16	246.230	2,162.32	-29.32	-36.51	14,447,270.671	1,717,086.194	39.781454796	-80.727098277	
2,196.00	4.22	240.260	2,194.24	-30.37	-38.60	14,447,269.620	1,717,084.110	39.781451925	-80.727105708	
2,260.00	4.39	220.130	2,258.06	-33.41	-42.22	14,447,266.578	1,717,080.486	39.781443603	-80.727118639	
2,292.00	4.61	216.530	2,289.96	-35.38	-43.77	14,447,264.609	1,717,078.932	39.781438207	-80.727124195	
2,324.00	4.53	220.140	2,321.86	-37.38	-45.35	14,447,262.609	1,717,077.351	39.781432729	-80.727129841	
2,356.00	3.91	225.390	2,353.77	-39.11	-46.95	14,447,260.877	1,717,075.760	39.781427985	-80.727135524	
2,388.00	2.91	237.790	2,385.72	-40.31	-48.41	14,447,259.678	1,717,074.296	39.781424704	-80.727140748	
2,419.00	2.39	239.880	2,416.68	-41.05	-49.63	14,447,258.934	1,717,073.071	39.781422672	-80.727145116	
2,451.00	1.44	246.530	2,448.67	-41.55	-50.58	14,447,258.439	1,717,072.125	39.781421321	-80.727148488	
2,481.00	1.45	242.770	2,478.66	-41.87	-51.26	14,447,258.115	1,717,071.442	39.781420437	-80.727150924	
2,513.00	1.62	251.740	2,510.65	-42.20	-52.05	14,447,257.788	1,717,070.652	39.781419546	-80.727153738	
2,545.00	1.31	240.360	2,542.64	-42.52	-52.80	14,447,257.466	1,717,069.905	39.781418666	-80.727156402	
2,576.00	1.18	259.840	2,573.63	-42.75	-53.42	14,447,257.234	1,717,069.283	39.781418035	-80.727158619	
2,608.00	1.08	253.690	2,605.62	-42.90	-54.04	14,447,257.091	1,717,068.669	39.781417648	-80.727160805	
2,640.00	1.43	245.610	2,637.61	-43.15	-54.69	14,447,256.842	1,717,068.016	39.781416968	-80.727163132	
2,671.00	2.34	243.330	2,668.60	-43.59	-55.61	14,447,256.398	1,717,067.098	39.781415757	-80.727166404	
2,703.00	2.84	228.130	2,700.56	-44.41	-56.78	14,447,255.576	1,717,065.924	39.781413508	-80.727170592	
2,735.00	2.74	233.380	2,732.53	-45.40	-57.99	14,447,254.590	1,717,064.720	39.781410812	-80.727174889	
2,767.00	3.42	233.030	2,764.48	-46.43	-59.36	14,447,253.560	1,717,063.343	39.781407995	-80.727179800	
2,798.00	3.03	231.020	2,795.43	-47.50	-60.74	14,447,252.488	1,717,061.967	39.781405064	-80.727184708	
2,830.00	3.41	229.620	2,827.38	-48.65	-62.12	14,447,251.340	1,717,060.585	39.781401921	-80.727189641	
2,862.00	3.29	230.490	2,859.33	-49.85	-63.55	14,447,250.139	1,717,059.152	39.781398635	-80.727194756	
2,893.00	2.98	222.240	2,890.28	-51.01	-64.78	14,447,248.977	1,717,057.924	39.781395453	-80.727199140	
2,923.00	3.04	220.750	2,920.24	-52.19	-65.83	14,447,247.797	1,717,056.880	39.781392221	-80.727202867	
2,955.00	3.02	225.960	2,952.19	-53.42	-66.99	14,447,246.568	1,717,055.720	39.781388856	-80.727207008	
2,986.00	2.72	219.030	2,983.15	-54.56	-68.04	14,447,245.429	1,717,054.670	39.781385737	-80.727210759	
3,018.00	3.35	225.270	3,015.11	-55.81	-69.18	14,447,244.181	1,717,053.528	39.781382320	-80.727214839	
3,049.00	3.66	225.190	3,046.05	-57.14	-70.52	14,447,242.846	1,717,052.182	39.781378665	-80.727219642	
3,081.00	4.41	229.080	3,077.97	-58.67	-72.18	14,447,241.321	1,717,050.528	39.781374489	-80.727225547	
3,113.00	5.46	230.640	3,109.85	-60.44	-74.28	14,447,239.549	1,717,048.421	39.781369642	-80.727233065	
3,144.00	6.05	234.790	3,140.70	-62.32	-76.76	14,447,237.672	1,717,045.946	39.781364507	-80.727241895	
3,175.00	7.07	238.190	3,171.49	-64.26	-79.72	14,447,235.724	1,717,042.990	39.781359183	-80.727252438	
3,207.00	7.75	236.640	3,203.23	-66.49	-83.19	14,447,233.500	1,717,039.514	39.781353103	-80.727264834	
3,238.00	8.19	239.290	3,233.93	-68.76	-86.84	14,447,231.223	1,717,035.870	39.781346881	-80.727277830	
3,270.00	8.57	239.630	3,265.59	-71.13	-90.85	14,447,228.853	1,717,031.853	39.781340407	-80.727292153	
3,302.00	8.97	239.360	3,297.21	-73.61	-95.06	14,447,226.376	1,717,027.650	39.781333640	-80.727307142	
3,333.00	8.96	240.760	3,327.83	-76.02	-99.24	14,447,223.966	1,717,023.464	39.781327054	-80.727322067	
3,365.00	8.64	239.900	3,359.46	-78.44	-103.50	14,447,221.543	1,717,019.210	39.781320436	-80.727337234	
3,397.00	8.57	241.590	3,391.10	-80.78	-107.67	14,447,219.203	1,717,015.034	39.781314046	-80.727352126	
3,429.00	7.36	244.640	3,422.79	-82.80	-111.62	14,447,217.191	1,717,011.084	39.781308552	-80.727366205	
3,461.00	6.72	252.670	3,454.55	-84.23	-115.26	14,447,215.755	1,717,007.445	39.781304640	-80.727379175	
3,493.00	6.79	261.610	3,486.32	-85.07	-118.92	14,447,214.921	1,717,003.786	39.781302381	-80.727392208	
3,525.00	7.22	267.330	3,518.09	-85.44	-122.80	14,447,214.552	1,716,999.906	39.781301398	-80.727406023	
3,557.00	8.16	269.870	3,549.80	-85.53	-127.08	14,447,214.453	1,716,995.626	39.781301162	-80.727421257	
3,588.00	9.54	269.330	3,580.43	-85.57	-131.85	14,447,214.418	1,716,990.857	39.781301106	-80.727438233	
3,620.00	10.83	272.020	3,611.92	-85.49	-137.51	14,447,214.493	1,716,985.201	39.781301359	-80.727458365	
3,652.00	11.24	271.670	3,643.33	-85.30	-143.63	14,447,214.690	1,716,979.079	39.781301951	-80.727480153	
3,683.00	11.17	272.750	3,673.74	-85.07	-149.65	14,447,214.922	1,716,973.060	39.781302639	-80.727501575	
3,715.00	10.67	273.580	3,705.16	-84.73	-155.70	14,447,215.255	1,716,967.007	39.781303606	-80.727523115	
3,747.00	10.14	272.820	3,736.64	-84.41	-161.47	14,447,215.579	1,716,961.237	39.781304543	-80.727543650	
3,779.00	10.43	272.440	3,768.12	-84.15	-167.18	14,447,215.841	1,716,955.529	39.781305310	-80.727563962	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
3,810.00	10.47	270.940	3,798.61	-83.98	-172.80	14,447,216.007	1,716,949.910	39.781305811	-80.727583964
3,842.00	10.31	272.080	3,830.08	-83.83	-178.57	14,447,216.158	1,716,944.141	39.781306276	-80.727604496
3,874.00	10.90	271.610	3,861.54	-83.64	-184.45	14,447,216.347	1,716,938.255	39.781306844	-80.727625444
3,905.00	11.85	270.040	3,891.93	-83.56	-190.56	14,447,216.432	1,716,932.142	39.781307127	-80.727647202
3,937.00	12.01	269.370	3,923.23	-83.59	-197.18	14,447,216.397	1,716,925.527	39.781307088	-80.727670747
3,968.00	12.53	269.200	3,953.53	-83.67	-203.77	14,447,216.315	1,716,918.940	39.781306917	-80.727694195
4,000.00	12.99	268.380	3,984.74	-83.82	-210.83	14,447,216.165	1,716,911.874	39.781306564	-80.727719348
4,032.00	12.36	267.240	4,015.96	-84.09	-217.85	14,447,215.898	1,716,904.858	39.781305890	-80.727744323
4,063.00	12.12	266.010	4,046.25	-84.48	-224.41	14,447,215.512	1,716,898.297	39.781304884	-80.727767679
4,095.00	10.48	261.230	4,077.63	-85.15	-230.64	14,447,214.835	1,716,892.069	39.781303076	-80.727789854
4,126.00	10.24	260.110	4,108.13	-86.06	-236.14	14,447,213.931	1,716,886.568	39.781300641	-80.727809444
4,158.00	9.71	257.590	4,139.64	-87.12	-241.58	14,447,212.863	1,716,881.131	39.781297752	-80.727828810
4,190.00	9.96	256.480	4,171.17	-88.35	-246.90	14,447,211.636	1,716,875.804	39.781294427	-80.727767782
4,222.00	9.96	258.120	4,202.69	-89.57	-252.30	14,447,210.419	1,716,870.406	39.781291131	-80.727867011
4,254.00	9.92	262.830	4,234.21	-90.48	-257.74	14,447,209.506	1,716,864.963	39.781288667	-80.727886395
4,286.00	9.69	265.050	4,265.74	-91.06	-263.16	14,447,208.929	1,716,859.545	39.781287130	-80.727905686
4,317.00	9.95	266.620	4,296.29	-91.44	-268.43	14,447,208.546	1,716,854.272	39.781286122	-80.727924458
4,349.00	9.88	269.140	4,327.81	-91.65	-273.94	14,447,208.342	1,716,848.767	39.781285607	-80.727944054
4,381.00	10.69	270.160	4,359.30	-91.68	-279.65	14,447,208.309	1,716,843.054	39.781285564	-80.727964390
4,413.00	11.05	273.080	4,390.72	-91.51	-285.68	14,447,208.482	1,716,837.024	39.781286090	-80.727985852
4,452.00	10.75	274.330	4,429.02	-91.03	-293.04	14,447,208.958	1,716,829.665	39.781287457	-80.728012040
4,546.00	11.85	272.450	4,521.20	-89.96	-311.43	14,447,210.032	1,716,811.280	39.781290561	-80.728077467
4,641.00	12.92	269.180	4,613.98	-89.69	-331.79	14,447,210.297	1,716,790.915	39.781291458	-80.728149954
Tie into original hole @ 4641 MD									
4,718.00	12.84	266.970	4,689.05	-90.27	-348.94	14,447,209.722	1,716,773.763	39.781290021	-80.728211008
4,746.00	12.53	261.700	4,716.36	-90.87	-355.06	14,447,209.119	1,716,767.651	39.781288416	-80.728232772
4,777.00	11.74	256.160	4,746.67	-92.11	-361.45	14,447,207.879	1,716,761.261	39.781285064	-80.728255530
4,808.00	9.49	250.270	4,777.14	-93.73	-366.91	14,447,206.261	1,716,755.792	39.781280668	-80.728275013
4,839.00	8.00	246.580	4,807.78	-95.45	-371.30	14,447,204.541	1,716,751.407	39.781275980	-80.728290640
4,870.00	7.30	243.860	4,838.50	-97.17	-375.05	14,447,202.816	1,716,747.659	39.781271274	-80.728303998
4,963.00	8.57	253.170	4,930.62	-101.78	-386.98	14,447,198.206	1,716,735.722	39.781258714	-80.728346539
5,056.00	9.23	249.390	5,022.50	-106.41	-400.60	14,447,193.574	1,716,722.108	39.781246107	-80.728395046
5,149.00	10.37	255.460	5,114.14	-111.14	-415.68	14,447,188.847	1,716,707.023	39.781233251	-80.728448788
5,242.00	11.43	257.570	5,205.46	-115.23	-432.78	14,447,184.762	1,716,689.922	39.781222175	-80.728509704
5,336.00	12.57	254.490	5,297.41	-119.97	-451.74	14,447,180.022	1,716,670.969	39.781209315	-80.728577215
5,429.00	11.30	261.610	5,388.40	-124.00	-470.50	14,447,175.986	1,716,652.202	39.781198387	-80.728644058
5,522.00	10.95	269.520	5,479.66	-125.41	-488.35	14,447,174.583	1,716,634.355	39.781194681	-80.728707600
5,615.00	12.00	270.840	5,570.80	-125.34	-506.85	14,447,174.650	1,716,615.855	39.781195021	-80.728773448
5,707.00	12.62	266.360	5,660.68	-125.84	-526.45	14,447,174.152	1,716,596.261	39.781193817	-80.728843194
5,801.00	12.84	271.630	5,752.38	-126.19	-547.13	14,447,173.798	1,716,575.572	39.781193014	-80.728916839
5,893.00	13.10	270.840	5,842.03	-125.75	-567.78	14,447,174.241	1,716,554.929	39.781194404	-80.728990312
5,986.00	12.31	272.600	5,932.75	-125.14	-588.22	14,447,174.845	1,716,534.487	39.781196233	-80.729063068
6,079.00	12.48	270.310	6,023.58	-124.64	-608.17	14,447,175.350	1,716,514.534	39.781197784	-80.729134080
6,172.00	12.92	269.520	6,114.31	-124.67	-628.62	14,447,175.317	1,716,494.089	39.781197864	-80.729206853
6,266.00	13.63	267.760	6,205.80	-125.19	-650.19	14,447,174.796	1,716,472.513	39.781196612	-80.729283656
6,358.00	13.19	268.200	6,295.29	-125.95	-671.52	14,447,174.043	1,716,451.191	39.781194720	-80.729359561
6,451.00	13.19	267.670	6,385.83	-126.71	-692.72	14,447,173.278	1,716,429.984	39.781192796	-80.729435052
6,543.00	13.58	266.440	6,475.34	-127.81	-713.99	14,447,172.180	1,716,408.716	39.781189959	-80.729510765
6,636.00	14.07	268.290	6,565.64	-128.82	-736.19	14,447,171.165	1,716,386.519	39.781187355	-80.729589784
6,729.00	12.97	267.410	6,656.06	-129.63	-757.91	14,447,170.356	1,716,364.793	39.781185313	-80.729667124
6,823.00	11.56	269.870	6,747.92	-130.13	-777.87	14,447,169.858	1,716,344.836	39.781184111	-80.729738166
6,916.00	10.64	270.840	6,839.18	-130.02	-795.78	14,447,169.963	1,716,326.932	39.781184547	-80.729801890
7,009.00	10.68	271.800	6,930.57	-129.63	-812.97	14,447,170.359	1,716,309.734	39.781185778	-80.729863101
7,102.00	10.86	268.900	7,021.93	-129.53	-830.35	14,447,170.462	1,716,292.361	39.781186204	-80.729924936



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
7,196.00	10.73	268.110	7,114.27	-129.98	-847.95	14,447,170.003	1,716,274.762	39.781185090	-80.729987585
7,290.00	9.85	268.900	7,206.76	-130.43	-864.73	14,447,169.560	1,716,257.977	39.781184013	-80.730047333
7,383.00	9.54	268.550	7,298.43	-130.78	-880.39	14,447,169.213	1,716,242.320	39.781183187	-80.730103069
7,477.00	9.49	268.990	7,391.14	-131.11	-895.92	14,447,168.879	1,716,226.785	39.781182399	-80.730158368
7,570.00	9.36	270.050	7,482.88	-131.24	-911.15	14,447,168.750	1,716,211.556	39.781182172	-80.730212572
7,663.00	9.23	270.570	7,574.66	-131.16	-926.17	14,447,168.831	1,716,196.536	39.781182519	-80.730266036
7,757.00	9.80	271.450	7,667.37	-130.88	-941.71	14,447,169.109	1,716,181.000	39.781183409	-80.730321331
7,851.00	10.07	267.940	7,759.96	-130.97	-957.92	14,447,169.016	1,716,164.790	39.781183288	-80.730379030
7,945.00	10.07	264.510	7,852.51	-132.05	-974.31	14,447,167.934	1,716,148.397	39.781180453	-80.730437392
8,038.00	11.03	265.740	7,943.94	-133.49	-991.28	14,447,166.495	1,716,131.431	39.781176642	-80.730497795
8,131.00	11.43	266.360	8,035.16	-134.74	-1,009.34	14,447,165.249	1,716,113.363	39.781173370	-80.730562120
8,225.00	11.56	267.230	8,127.27	-135.78	-1,028.05	14,447,164.203	1,716,094.660	39.781170650	-80.730628702
8,318.00	11.78	268.030	8,218.35	-136.56	-1,046.84	14,447,163.426	1,716,075.865	39.781168672	-80.730695609
8,412.00	11.87	269.780	8,310.35	-136.93	-1,066.10	14,447,163.059	1,716,056.608	39.781167824	-80.730764157
8,505.00	10.95	268.200	8,401.51	-137.24	-1,084.49	14,447,162.745	1,716,038.215	39.781167113	-80.730829630
8,599.00	10.11	270.570	8,493.93	-137.44	-1,101.67	14,447,162.547	1,716,021.041	39.781166710	-80.730890760
8,692.00	9.85	270.050	8,585.52	-137.35	-1,117.78	14,447,162.635	1,716,004.924	39.781167085	-80.730948125
8,786.00	10.02	266.440	8,678.11	-137.85	-1,133.99	14,447,162.134	1,715,988.722	39.781165843	-80.731005801
8,879.00	11.08	265.920	8,769.54	-138.99	-1,150.98	14,447,160.996	1,715,971.733	39.781162858	-80.731066284
8,974.00	10.77	264.950	8,862.82	-140.42	-1,168.92	14,447,159.565	1,715,953.786	39.781159076	-80.731130181
9,067.00	11.21	266.440	8,954.11	-141.75	-1,186.60	14,447,158.239	1,715,936.108	39.781155580	-80.731193118
9,160.00	11.78	267.060	9,045.25	-142.80	-1,205.10	14,447,157.191	1,715,917.604	39.781152854	-80.731258990
9,254.00	12.00	265.650	9,137.23	-144.03	-1,224.43	14,447,155.957	1,715,898.278	39.781149626	-80.731327793
9,347.00	12.13	266.090	9,228.18	-145.43	-1,243.82	14,447,154.558	1,715,878.889	39.781145942	-80.731396819
9,440.00	11.96	266.530	9,319.13	-146.68	-1,263.19	14,447,153.308	1,715,859.522	39.781142670	-80.731465767
9,534.00	11.69	266.180	9,411.13	-147.90	-1,282.41	14,447,152.084	1,715,840.298	39.781139467	-80.731534205
9,627.00	11.43	268.290	9,502.25	-148.81	-1,301.02	14,447,151.182	1,715,821.687	39.781137141	-80.731600461
9,721.00	10.81	264.770	9,594.48	-149.89	-1,319.11	14,447,150.100	1,715,803.598	39.781134320	-80.731664856
9,815.00	10.46	265.210	9,686.87	-151.40	-1,336.39	14,447,148.584	1,715,786.317	39.781130299	-80.731726384
9,909.00	10.37	265.650	9,779.32	-152.76	-1,353.33	14,447,147.230	1,715,769.378	39.781126719	-80.731786690
10,002.00	9.36	263.460	9,870.95	-154.25	-1,369.19	14,447,145.734	1,715,753.518	39.781122740	-80.731843158
10,016.00	9.10	263.540	9,884.76	-154.51	-1,371.42	14,447,145.479	1,715,751.287	39.781122061	-80.731851102
10,055.00	8.48	261.300	9,923.31	-155.29	-1,377.33	14,447,144.697	1,715,745.380	39.781119962	-80.731872136
10,102.00	9.41	261.350	9,969.73	-156.39	-1,384.55	14,447,143.595	1,715,738.156	39.781116995	-80.731897862
10,149.00	10.16	269.900	10,016.05	-156.98	-1,392.50	14,447,143.010	1,715,730.211	39.781115453	-80.731926145
10,196.00	9.85	268.570	10,062.34	-157.09	-1,400.66	14,447,142.903	1,715,722.047	39.781115225	-80.731955206
10,242.00	10.12	242.130	10,107.66	-159.07	-1,408.17	14,447,140.914	1,715,714.537	39.781109826	-80.731981958
10,289.00	10.52	219.000	10,153.92	-164.34	-1,414.52	14,447,135.647	1,715,708.184	39.781095413	-80.732004627
10,334.00	10.83	211.150	10,198.15	-171.15	-1,419.30	14,447,128.836	1,715,703.412	39.781076748	-80.732021687
10,381.00	11.22	207.760	10,244.28	-178.98	-1,423.71	14,447,121.011	1,715,698.998	39.781055294	-80.732037481
10,427.00	12.90	196.830	10,289.27	-187.85	-1,427.28	14,447,112.134	1,715,695.426	39.781030945	-80.732050289
10,474.00	14.63	186.610	10,334.92	-198.77	-1,429.48	14,447,101.214	1,715,693.223	39.781000973	-80.732058246
10,520.00	15.91	176.210	10,379.31	-210.84	-1,429.74	14,447,089.149	1,715,692.971	39.780967843	-80.732059271
10,567.00	17.32	168.320	10,424.35	-224.12	-1,427.89	14,447,075.868	1,715,694.814	39.780931353	-80.732052855
10,614.00	17.99	157.130	10,469.15	-237.66	-1,423.66	14,447,062.325	1,715,699.052	39.780894126	-80.732037913
10,661.00	17.10	142.140	10,513.99	-249.81	-1,416.59	14,447,050.176	1,715,706.117	39.780860703	-80.732012894
10,707.00	17.23	136.810	10,557.94	-260.12	-1,407.78	14,447,039.869	1,715,714.931	39.780832324	-80.731981631
10,738.00	19.22	145.490	10,587.39	-267.67	-1,401.74	14,447,032.314	1,715,720.966	39.780811529	-80.731960231
10,769.00	21.08	151.800	10,616.49	-276.79	-1,395.21	14,447,023.195	1,715,726.493	39.780786438	-80.731940658
10,800.00	22.63	157.570	10,645.27	-287.22	-1,391.30	14,447,012.767	1,715,731.404	39.780757760	-80.731923289
10,831.00	24.70	163.340	10,673.66	-298.94	-1,387.17	14,447,001.046	1,715,735.537	39.780725538	-80.731908701
10,862.00	27.57	165.460	10,701.49	-312.09	-1,383.51	14,446,987.894	1,715,739.196	39.780689388	-80.731895818
10,893.00	30.18	165.240	10,728.63	-326.58	-1,379.72	14,446,973.412	1,715,742.983	39.780649587	-80.731882494
10,923.00	33.27	164.580	10,754.15	-341.80	-1,375.61	14,446,958.184	1,715,747.093	39.780607732	-80.731868026



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 02	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 02	Database:	DB_Decv0422v16

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
10,954.00	36.10	164.220	10,779.64	-358.79	-1,370.87	14,446,941.195	1,715,751.838	39.780561037	-80.731851317
10,986.00	38.67	164.090	10,805.06	-377.48	-1,365.56	14,446,922.506	1,715,757.143	39.780509668	-80.731832633
11,016.00	41.71	163.080	10,827.98	-396.05	-1,360.09	14,446,903.939	1,715,762.619	39.780458634	-80.731813343
11,048.00	44.72	163.390	10,851.30	-417.03	-1,353.77	14,446,882.961	1,715,768.937	39.780400971	-80.731791078
11,079.00	47.50	162.640	10,872.79	-438.39	-1,347.24	14,446,861.598	1,715,775.465	39.780342249	-80.731768068
11,110.00	50.24	162.370	10,893.17	-460.66	-1,340.22	14,446,839.331	1,715,782.485	39.780281039	-80.731743319
11,141.00	52.85	162.110	10,912.45	-483.77	-1,332.82	14,446,816.214	1,715,789.890	39.780217494	-80.731717208
11,175.00	56.35	162.120	10,932.14	-510.15	-1,324.31	14,446,789.844	1,715,798.400	39.780145002	-80.731687199
11,206.00	61.01	162.210	10,948.25	-535.35	-1,316.20	14,446,764.640	1,715,806.509	39.780075721	-80.731658608
11,237.00	65.45	163.170	10,962.21	-561.77	-1,307.97	14,446,738.222	1,715,814.737	39.780003102	-80.731629601
11,284.00	72.18	162.120	10,979.19	-603.57	-1,294.90	14,446,696.421	1,715,827.810	39.779888198	-80.731583515
11,330.00	76.26	159.390	10,991.70	-645.34	-1,280.30	14,446,654.646	1,715,842.406	39.779773350	-80.731532009
11,377.00	81.98	156.140	11,000.57	-688.04	-1,262.83	14,446,611.951	1,715,859.874	39.779655956	-80.731470293
11,424.00	89.19	151.480	11,004.19	-730.04	-1,242.16	14,446,569.945	1,715,880.544	39.779540426	-80.731397168
11,517.00	90.51	152.270	11,004.43	-812.06	-1,198.32	14,446,487.929	1,715,924.384	39.779314828	-80.731242009
11,610.00	89.32	152.630	11,004.57	-894.51	-1,155.31	14,446,405.477	1,715,967.397	39.779088036	-80.731089792
11,703.00	87.16	152.630	11,007.42	-977.06	-1,112.58	14,446,322.932	1,716,010.130	39.778860992	-80.730938577
11,795.00	87.47	152.890	11,011.73	-1,058.76	-1,070.51	14,446,241.225	1,716,052.194	39.778636256	-80.730789735
11,889.00	87.16	152.010	11,016.14	-1,142.01	-1,027.09	14,446,157.976	1,716,095.622	39.778407275	-80.730636051
Survey @ 11889 MD 11016.14 TVD ST2									
11,953.00	87.16	152.010	11,019.31	-1,198.46	-997.09	14,446,101.532	1,716,125.622	39.778252015	-80.730529880
Top of Fish @ 11953 MD 11019.31 TVD ST2									
11,982.00	87.16	152.010	11,020.74	-1,224.03	-983.49	14,446,075.956	1,716,139.215	39.778181663	-80.730481772
Survey Proj. to 11982 MD 11020.74 TVD ST2									

Design Annotations				
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
4,641.00	4,613.98	-89.69	-331.79	Tie into original hole @ 4641 MD
11,889.00	11,016.14	-1,142.01	-1,027.09	Survey @ 11889 MD 11016.14 TVD ST2
11,953.00	11,019.31	-1,198.46	-997.09	Top of Fish @ 11953 MD 11019.31 TVD ST2
11,982.00	11,020.74	-1,224.03	-983.49	Survey Proj. to 11982 MD 11020.74 TVD ST2

Checked By: _____ Approved By: _____ Date: _____



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

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
From:	Lat/Long	Easting:	1,717,188.440 usft
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "
		Latitude:	39.781725330
		Longitude:	-80.726733270

Well	Van Winkle S-21 HU (slot B)		
Well Position	+N/-S	0.00 ft	Northing: 14,447,299.987 usft
	+E/-W	0.00 ft	Easting: 1,717,122.706 usft
Position Uncertainty	0.00 ft	Wellhead Elevation:	ft
Grid Convergence:	0.17 °	Latitude:	39.781535000
		Longitude:	-80.726968000
		Ground Level:	753.00 ft

Wellbore	Sidetrack 03				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	12/4/2022	-8.65	66.39	51,597.91915650

Design	Surveys Sidetrack 03				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	11,237.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.00	0.00	0.00	155.849	

Survey Program	Date	1/3/2023			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
14.00	2,196.00	MWD surf (Original Hole)	MWD	MWD - Standard	
2,260.00	4,641.00	MWD (Original Hole)	MWD	MWD - Standard	
4,718.00	11,237.00	MWD ST2 (Sidetrack 02)	MWD	MWD - Standard	
11,284.00	26,114.00	MWD ST3 (Sidetrack 03)	MWD	MWD - Standard	
26,173.00	26,173.00	Projection ST3 (Sidetrack 03)	MWD	MWD - Standard	

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Bulld 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	0.00
14.00	0.00	0.000	14.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
184.00	0.48	72.650	184.00	0.21	0.68	0.08	0.28	0.28	0.00	0.00
213.00	0.40	92.950	213.00	0.24	0.90	0.14	0.60	-0.28	70.00	0.00
242.00	0.48	78.190	242.00	0.26	1.12	0.22	0.48	0.28	-50.90	0.00
270.00	0.31	39.870	270.00	0.35	1.28	0.21	1.09	-0.61	-136.86	0.00



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

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)
299.00	0.48	60.610	299.00	0.46	1.44	0.16	0.76	0.59	71.52
329.00	0.48	65.970	328.99	0.58	1.66	0.15	0.15	0.00	17.87
361.00	0.22	93.920	360.99	0.63	1.84	0.18	0.95	-0.81	87.34
392.00	0.62	78.270	391.99	0.66	2.07	0.25	1.33	1.29	-50.48
423.00	0.70	96.560	422.99	0.67	2.42	0.38	0.72	0.26	59.00
455.00	0.48	99.720	454.99	0.63	2.75	0.55	0.69	-0.69	9.88
487.00	0.70	133.290	486.99	0.47	3.02	0.81	1.25	0.69	104.91
522.00	0.48	137.340	521.99	0.21	3.28	1.14	0.64	-0.63	11.57
552.00	1.01	206.160	551.98	-0.12	3.24	1.43	3.16	1.77	229.40
583.00	0.88	181.020	582.98	-0.60	3.12	1.82	1.39	-0.42	-81.10
614.00	0.88	179.880	613.98	-1.07	3.12	2.26	0.06	0.00	-3.68
646.00	0.70	147.270	645.97	-1.48	3.22	2.67	1.49	-0.56	-101.91
678.00	0.79	157.730	677.97	-1.85	3.41	3.09	0.51	0.28	32.69
710.00	1.10	147.180	709.97	-2.32	3.66	3.61	1.11	0.97	-32.97
741.00	1.41	168.450	740.96	-2.94	3.90	4.28	1.79	1.00	68.61
773.00	1.41	151.930	772.95	-3.67	4.16	5.05	1.27	0.00	-51.63
805.00	1.41	153.510	804.94	-4.37	4.52	5.84	0.12	0.00	4.94
836.00	1.04	168.440	835.93	-4.99	4.75	6.50	1.57	-1.19	48.16
868.00	0.86	170.840	867.93	-5.51	4.85	7.01	0.58	-0.56	7.50
900.00	1.17	160.400	899.92	-6.06	4.99	7.57	1.12	0.97	-32.63
931.00	0.74	151.890	930.92	-6.53	5.20	8.08	1.46	-1.39	-27.45
963.00	0.74	153.220	962.92	-6.90	5.39	8.50	0.05	0.00	4.16
995.00	0.50	194.200	994.91	-7.22	5.44	8.81	1.53	-0.75	128.06
1,027.00	0.49	151.560	1,026.91	-7.47	5.48	9.06	1.13	-0.03	-133.25
1,058.00	0.29	192.140	1,057.91	-7.67	5.52	9.25	1.06	-0.65	130.90
1,090.00	0.62	147.930	1,089.91	-7.89	5.60	9.49	1.43	1.03	-138.16
1,122.00	0.50	131.170	1,121.91	-8.13	5.79	9.79	0.63	-0.38	-52.38
1,154.00	0.51	159.800	1,153.91	-8.36	5.95	10.06	0.78	0.03	89.47
1,186.00	0.40	208.550	1,185.91	-8.59	5.94	10.27	1.21	-0.34	152.34
1,217.00	0.47	214.890	1,216.91	-8.79	5.82	10.40	0.27	0.23	20.45
1,249.00	0.17	271.540	1,248.91	-8.89	5.70	10.45	1.26	-0.94	177.03
1,281.00	0.52	290.880	1,280.91	-8.84	5.51	10.32	1.14	1.09	60.44
1,312.00	1.09	269.170	1,311.90	-8.79	5.09	10.11	2.05	1.84	-70.03
1,344.00	1.24	292.870	1,343.90	-8.66	4.46	9.73	1.56	0.47	74.06
1,376.00	1.45	287.960	1,375.89	-8.40	3.76	9.21	0.75	0.66	-15.34
1,408.00	1.52	274.670	1,407.88	-8.25	2.95	8.73	1.10	0.22	-41.53
1,440.00	1.86	261.200	1,439.86	-8.29	2.02	8.39	1.63	1.06	-42.09
1,471.00	2.67	262.160	1,470.84	-8.47	0.80	8.05	2.62	2.61	3.10
1,503.00	3.09	254.260	1,502.80	-8.80	-0.77	7.72	1.80	1.31	-24.69
1,534.00	3.18	245.190	1,533.75	-9.39	-2.35	7.61	1.62	0.29	-29.26
1,566.00	3.46	235.710	1,565.70	-10.31	-3.95	7.79	1.92	0.88	-29.63
1,597.00	3.60	234.080	1,596.64	-11.40	-5.51	8.15	0.56	0.45	-5.26
1,629.00	4.09	230.200	1,628.57	-12.72	-7.20	8.66	1.73	1.53	-12.13
1,659.00	4.51	225.560	1,658.48	-14.23	-8.87	9.36	1.82	1.40	-15.47



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

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)
1,691.00	5.16	222.060	1,690.37	-16.18	-10.73	10.38	2.23	2.03	-10.94
1,722.00	4.88	217.470	1,721.25	-18.26	-12.47	11.57	1.58	-0.90	-14.81
1,753.00	4.98	217.900	1,752.14	-20.37	-14.10	12.82	0.34	0.32	1.39
1,785.00	4.15	226.230	1,784.03	-22.27	-15.79	13.86	3.31	-2.59	26.03
1,816.00	3.82	224.110	1,814.96	-23.79	-17.31	14.62	1.17	-1.06	-6.84
1,848.00	3.32	227.140	1,846.90	-25.18	-18.74	15.31	1.67	-1.56	9.47
1,880.00	3.36	236.280	1,878.84	-26.33	-20.19	15.77	1.67	0.13	28.56
1,911.00	2.92	239.720	1,909.80	-27.24	-21.63	16.00	1.54	-1.42	11.10
1,943.00	2.84	249.310	1,941.76	-27.93	-23.08	16.04	1.52	-0.25	29.97
1,975.00	2.92	266.850	1,973.72	-28.25	-24.63	15.70	2.75	0.25	54.81
2,006.00	3.07	269.470	2,004.67	-28.30	-26.25	15.09	0.65	0.48	8.45
2,038.00	3.70	275.350	2,036.62	-28.22	-28.14	14.23	2.25	1.97	18.38
2,070.00	4.10	272.560	2,068.54	-28.07	-30.31	13.21	1.38	1.25	-8.72
2,101.00	4.04	265.420	2,099.47	-28.11	-32.50	12.35	1.65	-0.19	-23.03
2,133.00	3.59	250.220	2,131.40	-28.53	-34.57	11.89	3.45	-1.41	-47.50
2,164.00	4.16	246.230	2,162.32	-29.32	-36.51	11.81	2.03	1.84	-12.87
2,196.00	4.22	240.260	2,194.24	-30.37	-38.60	11.92	1.38	0.19	-18.66
2,260.00	4.39	220.130	2,258.06	-33.41	-42.22	13.21	2.36	0.27	-31.45
2,292.00	4.61	216.530	2,289.96	-35.38	-43.77	14.37	1.12	0.69	-11.25
2,324.00	4.53	220.140	2,321.86	-37.38	-45.35	15.55	0.93	-0.25	11.28
2,356.00	3.91	225.390	2,353.77	-39.11	-46.95	16.48	2.28	-1.94	16.41
2,388.00	2.91	237.790	2,385.72	-40.31	-48.41	16.97	3.87	-3.13	38.75
2,419.00	2.39	239.880	2,416.68	-41.05	-49.63	17.15	1.71	-1.68	6.74
2,451.00	1.44	246.530	2,448.67	-41.55	-50.58	17.22	3.04	-2.97	20.78
2,481.00	1.45	242.770	2,478.66	-41.87	-51.26	17.23	0.32	0.03	-12.53
2,513.00	1.62	251.740	2,510.65	-42.20	-52.05	17.21	0.92	0.53	28.03
2,545.00	1.31	240.360	2,542.64	-42.52	-52.80	17.20	1.32	-0.97	-35.56
2,576.00	1.18	259.840	2,573.63	-42.75	-53.42	17.15	1.42	-0.42	62.84
2,608.00	1.08	253.690	2,605.62	-42.90	-54.04	17.03	0.49	-0.31	-19.22
2,640.00	1.43	245.610	2,637.61	-43.15	-54.69	16.99	1.22	1.09	-25.25
2,671.00	2.34	243.330	2,668.60	-43.59	-55.61	17.02	2.94	2.94	-7.35
2,703.00	2.84	228.130	2,700.56	-44.41	-56.78	17.29	2.64	1.56	-47.50
2,735.00	2.74	233.380	2,732.53	-45.40	-57.99	17.70	0.86	-0.31	16.41
2,767.00	3.42	233.030	2,764.48	-46.43	-59.36	18.08	2.13	2.13	-1.09
2,798.00	3.03	231.020	2,795.43	-47.50	-60.74	18.49	1.31	-1.26	-6.48
2,830.00	3.41	229.620	2,827.38	-48.65	-62.12	18.97	1.21	1.19	-4.38
2,862.00	3.29	230.490	2,859.33	-49.85	-63.55	19.48	0.41	-0.38	2.72
2,893.00	2.98	222.240	2,890.28	-51.01	-64.78	20.04	1.76	-1.00	-26.61
2,923.00	3.04	220.750	2,920.24	-52.19	-65.83	20.69	0.33	0.20	-4.97
2,955.00	3.02	225.960	2,952.19	-53.42	-66.99	21.34	0.86	-0.06	16.28
2,986.00	2.72	219.030	2,983.15	-54.56	-68.04	21.95	1.48	-0.97	-22.35
3,018.00	3.35	225.270	3,015.11	-55.81	-69.18	22.62	2.22	1.97	19.50
3,049.00	3.66	225.190	3,046.05	-57.14	-70.52	23.29	1.00	1.00	-0.26



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

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)
3,081.00	4.41	229.080	3,077.97	-58.67	-72.18	24.00	2.49	2.34	12.16
3,113.00	5.46	230.640	3,109.85	-60.44	-74.28	24.76	3.31	3.28	4.88
3,144.00	6.05	234.790	3,140.70	-62.32	-76.76	25.46	2.33	1.90	13.39
3,175.00	7.07	238.190	3,171.49	-64.26	-79.72	26.02	3.52	3.29	10.97
3,207.00	7.75	236.640	3,203.23	-66.49	-83.19	26.63	2.21	2.13	-4.84
3,238.00	8.19	239.290	3,233.93	-68.76	-86.84	27.22	1.85	1.42	8.55
3,270.00	8.57	239.630	3,265.59	-71.13	-90.85	27.74	1.20	1.19	1.06
3,302.00	8.97	239.360	3,297.21	-73.61	-95.06	28.28	1.26	1.25	-0.84
3,333.00	8.96	240.760	3,327.83	-76.02	-99.24	28.76	0.70	-0.03	4.52
3,365.00	8.64	239.900	3,359.46	-78.44	-103.50	29.23	1.08	-1.00	-2.69
3,397.00	8.57	241.590	3,391.10	-80.78	-107.67	29.66	0.82	-0.22	5.28
3,429.00	7.36	244.640	3,422.79	-82.80	-111.62	29.88	4.00	-3.78	9.53
3,461.00	6.72	252.670	3,454.55	-84.23	-115.26	29.70	3.66	-2.00	25.09
3,493.00	6.79	261.610	3,486.32	-85.07	-118.92	28.97	3.29	0.22	27.94
3,525.00	7.22	267.330	3,518.09	-85.44	-122.80	27.71	2.56	1.34	17.88
3,557.00	8.16	269.870	3,549.80	-85.53	-127.08	26.05	3.12	2.94	7.94
3,588.00	9.54	269.330	3,580.43	-85.57	-131.85	24.13	4.46	4.45	-1.74
3,620.00	10.83	272.020	3,611.92	-85.49	-137.51	21.75	4.30	4.03	8.41
3,652.00	11.24	271.670	3,643.33	-85.30	-143.63	19.07	1.30	1.28	-1.09
3,683.00	11.17	272.750	3,673.74	-85.07	-149.65	16.39	0.71	-0.23	3.48
3,715.00	10.67	273.580	3,705.16	-84.73	-155.70	13.61	1.64	-1.56	2.59
3,747.00	10.14	272.820	3,736.64	-84.41	-161.47	10.96	1.71	-1.66	-2.38
3,779.00	10.43	272.440	3,768.12	-84.15	-167.18	8.38	0.93	0.91	-1.19
3,810.00	10.47	270.940	3,798.61	-83.98	-172.80	5.93	0.89	0.13	-4.84
3,842.00	10.31	272.080	3,830.08	-83.83	-178.57	3.43	0.81	-0.50	3.56
3,874.00	10.90	271.610	3,861.54	-83.64	-184.45	0.85	1.86	1.84	-1.47
3,905.00	11.85	270.040	3,891.93	-83.56	-190.56	-1.73	3.22	3.06	-5.06
3,937.00	12.01	269.370	3,923.23	-83.59	-197.18	-4.40	0.66	0.50	-2.09
3,968.00	12.53	269.200	3,953.53	-83.67	-203.77	-7.02	1.68	1.68	-0.55
4,000.00	12.99	268.380	3,984.74	-83.82	-210.83	-9.77	1.54	1.44	-2.56
4,032.00	12.36	267.240	4,015.96	-84.09	-217.85	-12.40	2.12	-1.97	-3.56
4,063.00	12.12	266.010	4,046.25	-84.48	-224.41	-14.73	1.14	-0.77	-3.97
4,095.00	10.48	261.230	4,077.63	-85.15	-230.64	-16.66	5.90	-5.13	-14.94
4,126.00	10.24	260.110	4,108.13	-86.06	-236.14	-18.09	1.01	-0.77	-3.61
4,158.00	9.71	257.590	4,139.64	-87.12	-241.58	-19.34	2.15	-1.66	-7.88
4,190.00	9.96	256.480	4,171.17	-88.35	-246.90	-20.40	0.98	0.78	-3.47
4,222.00	9.96	258.120	4,202.69	-89.57	-252.30	-21.50	0.89	0.00	5.13
4,254.00	9.92	262.830	4,234.21	-90.48	-257.74	-22.89	2.54	-0.13	14.72
4,286.00	9.69	265.050	4,265.74	-91.06	-263.16	-24.58	1.38	-0.72	6.94
4,317.00	9.95	266.620	4,296.29	-91.44	-268.43	-26.39	1.20	0.84	5.06
4,349.00	9.88	269.140	4,327.81	-91.65	-273.94	-28.46	1.37	-0.22	7.88
4,381.00	10.69	270.160	4,359.30	-91.68	-279.65	-30.76	2.59	2.53	3.19
4,413.00	11.05	273.080	4,390.72	-91.51	-285.68	-33.39	2.06	1.13	9.13



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

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)
4,452.00	10.75	274.330	4,429.02	-91.03	-293.04	-36.83	0.98	-0.77	3.21
4,546.00	11.85	272.450	4,521.20	-89.96	-311.43	-45.34	1.23	1.17	-2.00
4,641.00	12.92	269.180	4,613.98	-89.69	-331.79	-53.91	1.35	1.13	-3.44
4,718.00	12.84	266.970	4,689.05	-90.27	-348.94	-60.40	0.65	-0.10	-2.87
4,746.00	12.53	261.700	4,716.36	-90.87	-355.06	-62.35	4.28	-1.11	-18.82
4,777.00	11.74	256.160	4,746.67	-92.11	-361.45	-63.84	4.54	-2.55	-17.87
4,808.00	9.49	250.270	4,777.14	-93.73	-366.91	-64.60	8.05	-7.26	-19.00
4,839.00	8.00	246.580	4,807.78	-95.45	-371.30	-64.82	5.13	-4.81	-11.90
4,870.00	7.30	243.860	4,838.50	-97.17	-375.05	-64.78	2.54	-2.26	-8.77
4,963.00	8.57	253.170	4,930.62	-101.78	-386.98	-65.46	1.94	1.37	10.01
5,056.00	9.23	249.390	5,022.50	-106.41	-400.60	-66.80	0.95	0.71	-4.06
5,149.00	10.37	255.460	5,114.14	-111.14	-415.68	-68.66	1.65	1.23	6.53
5,242.00	11.43	257.570	5,205.46	-115.23	-432.78	-71.93	1.22	1.14	2.27
5,336.00	12.57	254.490	5,297.41	-119.97	-451.74	-75.36	1.39	1.21	-3.28
5,429.00	11.30	261.610	5,388.40	-124.00	-470.50	-79.36	2.09	-1.37	7.66
5,522.00	10.95	269.520	5,479.66	-125.41	-488.35	-85.38	1.68	-0.38	8.51
5,615.00	12.00	270.840	5,570.80	-125.34	-506.85	-93.01	1.16	1.13	1.42
5,707.00	12.62	266.360	5,660.68	-125.84	-526.45	-100.57	1.24	0.67	-4.87
5,801.00	12.84	271.630	5,752.38	-126.19	-547.13	-108.71	1.26	0.23	5.61
5,893.00	13.10	270.840	5,842.03	-125.75	-567.78	-117.56	0.34	0.28	-0.86
5,986.00	12.31	272.600	5,932.75	-125.14	-588.22	-126.48	0.95	-0.85	1.89
6,079.00	12.48	270.310	6,023.58	-124.64	-608.17	-135.10	0.56	0.18	-2.46
6,172.00	12.92	269.520	6,114.31	-124.67	-628.62	-143.44	0.51	0.47	-0.85
6,266.00	13.63	267.760	6,205.80	-125.19	-650.19	-151.79	0.87	0.76	-1.87
6,358.00	13.19	268.200	6,295.29	-125.95	-671.52	-159.82	0.49	-0.48	0.48
6,451.00	13.19	267.670	6,385.83	-126.71	-692.72	-167.80	0.13	0.00	-0.57
6,543.00	13.58	266.440	6,475.34	-127.81	-713.99	-175.50	0.52	0.42	-1.34
6,636.00	14.07	268.290	6,565.64	-128.82	-736.19	-183.66	0.71	0.53	1.99
6,729.00	12.97	267.410	6,656.06	-129.63	-757.91	-191.81	1.20	-1.18	-0.95
6,823.00	11.56	269.870	6,747.92	-130.13	-777.87	-199.52	1.60	-1.50	2.62
6,916.00	10.64	270.840	6,839.18	-130.02	-795.78	-206.94	1.01	-0.99	1.04
7,009.00	10.68	271.800	6,930.57	-129.63	-812.97	-214.34	0.20	0.04	1.03
7,102.00	10.86	268.900	7,021.93	-129.53	-830.35	-221.54	0.61	0.19	-3.12
7,196.00	10.73	268.110	7,114.27	-129.98	-847.95	-228.32	0.21	-0.14	-0.84
7,290.00	9.85	268.900	7,206.76	-130.43	-864.73	-234.79	0.95	-0.94	0.84
7,383.00	9.54	268.550	7,298.43	-130.78	-880.39	-240.88	0.34	-0.33	-0.38
7,477.00	9.49	268.990	7,391.14	-131.11	-895.92	-246.93	0.09	-0.05	0.47
7,570.00	9.36	270.050	7,482.88	-131.24	-911.15	-253.04	0.23	-0.14	1.14
7,663.00	9.23	270.570	7,574.66	-131.16	-926.17	-259.26	0.17	-0.14	0.56
7,757.00	9.80	271.450	7,667.37	-130.88	-941.71	-265.87	0.63	0.61	0.94
7,851.00	10.07	267.940	7,759.96	-130.97	-957.92	-272.42	0.71	0.29	-3.73
7,945.00	10.07	264.510	7,852.51	-132.05	-974.31	-278.14	0.64	0.00	-3.65
8,038.00	11.03	265.740	7,943.94	-133.49	-991.28	-283.77	1.06	1.03	1.32
8,131.00	11.43	266.360	8,035.16	-134.74	-1,009.34	-290.02	0.45	0.43	0.67



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

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)
8,225.00	11.56	267.230	8,127.27	-135.78	-1,028.05	-296.72	0.23	0.14	0.93
8,318.00	11.78	268.030	8,218.35	-136.56	-1,046.84	-303.70	0.29	0.24	0.86
8,412.00	11.87	269.780	8,310.35	-136.93	-1,066.10	-311.24	0.39	0.10	1.86
8,505.00	10.95	268.200	8,401.51	-137.24	-1,084.49	-318.48	1.04	-0.99	-1.70
8,599.00	10.11	270.570	8,493.93	-137.44	-1,101.67	-325.33	1.01	-0.89	2.52
8,692.00	9.85	270.050	8,585.52	-137.35	-1,117.78	-332.00	0.30	-0.28	-0.56
8,786.00	10.02	266.440	8,678.11	-137.85	-1,133.99	-338.17	0.69	0.18	-3.84
8,879.00	11.08	265.920	8,769.54	-138.99	-1,150.98	-344.09	1.14	1.14	-0.56
8,974.00	10.77	264.950	8,862.82	-140.42	-1,168.92	-350.12	0.38	-0.33	-1.02
9,067.00	11.21	266.440	8,954.11	-141.75	-1,186.60	-356.15	0.56	0.47	1.60
9,160.00	11.78	267.060	9,045.25	-142.80	-1,205.10	-362.76	0.63	0.61	0.67
9,254.00	12.00	265.650	9,137.23	-144.03	-1,224.43	-369.54	0.39	0.23	-1.50
9,347.00	12.13	266.090	9,228.18	-145.43	-1,243.82	-376.20	0.17	0.14	0.47
9,440.00	11.96	266.530	9,319.13	-146.68	-1,263.19	-382.98	0.21	-0.18	0.47
9,534.00	11.69	266.180	9,411.13	-147.90	-1,282.41	-389.73	0.30	-0.29	-0.37
9,627.00	11.43	268.290	9,502.25	-148.81	-1,301.02	-396.52	0.53	-0.28	2.27
9,721.00	10.81	264.770	9,594.48	-149.89	-1,319.11	-402.94	0.98	-0.66	-3.74
9,815.00	10.46	265.210	9,686.87	-151.40	-1,336.39	-408.62	0.38	-0.37	0.47
9,909.00	10.37	265.650	9,779.32	-152.76	-1,353.33	-414.32	0.13	-0.10	0.47
10,002.00	9.36	263.460	9,870.95	-154.25	-1,369.19	-419.44	1.16	-1.09	-2.35
10,016.00	9.10	263.540	9,884.76	-154.51	-1,371.42	-420.12	1.86	-1.86	0.57
10,055.00	8.48	261.300	9,923.31	-155.29	-1,377.33	-421.83	1.82	-1.59	-5.74
10,102.00	9.41	261.350	9,969.73	-156.39	-1,384.55	-423.78	1.98	1.98	0.11
10,149.00	10.16	269.900	10,016.05	-156.98	-1,392.50	-426.49	3.47	1.60	18.19
10,196.00	9.85	268.570	10,062.34	-157.09	-1,400.66	-429.73	0.82	-0.66	-2.83
10,242.00	10.12	242.130	10,107.66	-159.07	-1,408.17	-430.99	9.90	0.59	-57.48
10,289.00	10.52	219.000	10,153.92	-164.34	-1,414.52	-428.79	8.80	0.85	-49.21
10,334.00	10.83	211.150	10,198.15	-171.15	-1,419.30	-424.52	3.30	0.69	-17.44
10,381.00	11.22	207.760	10,244.28	-178.98	-1,423.71	-419.19	1.61	0.83	-7.21
10,427.00	12.90	196.830	10,289.27	-187.85	-1,427.28	-412.55	6.15	3.65	-23.76
10,474.00	14.63	186.610	10,334.92	-198.77	-1,429.48	-403.49	6.34	3.68	-21.74
10,520.00	15.91	176.210	10,379.31	-210.84	-1,429.74	-392.58	6.56	2.78	-22.61
10,567.00	17.32	168.320	10,424.35	-224.12	-1,427.89	-379.71	5.65	3.00	-16.79
10,614.00	17.99	157.130	10,469.15	-237.66	-1,423.66	-365.62	7.35	1.43	-23.81
10,661.00	17.10	142.140	10,513.99	-249.81	-1,416.59	-351.64	9.77	-1.89	-31.89
10,707.00	17.23	136.810	10,557.94	-260.12	-1,407.78	-338.63	3.43	0.28	-11.59
10,738.00	19.22	145.490	10,587.39	-267.67	-1,401.74	-329.27	10.84	6.42	28.00
10,769.00	21.08	151.800	10,616.49	-276.79	-1,396.21	-318.69	9.22	6.00	20.35
10,800.00	22.63	157.570	10,645.27	-287.22	-1,391.30	-307.16	8.54	5.00	18.61
10,831.00	24.70	163.340	10,673.66	-298.94	-1,387.17	-294.78	10.01	6.68	18.61
10,862.00	27.57	165.460	10,701.49	-312.09	-1,383.51	-281.28	9.73	9.26	6.84
10,893.00	30.18	165.240	10,728.63	-326.58	-1,379.72	-266.51	8.43	8.42	-0.71
10,923.00	33.27	164.580	10,754.15	-341.80	-1,375.61	-250.94	10.36	10.30	-2.20



Survey Report



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	
10,954.00	36.10	164.220	10,779.64	-358.79	-1,370.87	-233.49	9.15	9.13	-1.16	
10,986.00	38.67	164.090	10,805.06	-377.48	-1,365.56	-214.27	8.04	8.03	-0.41	
11,016.00	41.71	163.080	10,827.98	-396.05	-1,360.09	-195.09	10.36	10.13	-3.37	
11,048.00	44.72	163.390	10,851.30	-417.03	-1,353.77	-173.36	9.43	9.41	0.97	
11,079.00	47.50	162.640	10,872.79	-438.39	-1,347.24	-151.20	9.14	8.97	-2.42	
11,110.00	50.24	162.370	10,893.17	-460.66	-1,340.22	-128.01	8.86	8.84	-0.87	
11,141.00	52.85	162.110	10,912.45	-483.77	-1,332.82	-103.88	8.44	8.42	-0.84	
11,175.00	56.35	162.120	10,932.14	-510.15	-1,324.31	-76.34	10.29	10.29	0.03	
11,206.00	61.01	162.210	10,948.25	-535.35	-1,316.20	-50.02	15.03	15.03	0.29	
11,237.00	65.45	163.170	10,962.21	-561.77	-1,307.97	-22.55	14.59	14.32	3.10	
Tie into sidetrack 02 @ 11237 MD										
11,284.00	72.18	162.120	10,979.19	-603.57	-1,294.90	20.94	14.47	14.32	-2.23	
11,330.00	72.75	164.050	10,993.05	-645.53	-1,282.14	64.45	4.19	1.24	4.20	
11,361.00	75.96	165.190	11,001.41	-674.31	-1,274.22	93.95	10.94	10.35	3.68	
11,392.00	79.74	164.580	11,007.93	-703.56	-1,266.32	123.87	12.34	12.19	-1.97	
11,423.00	82.68	162.820	11,012.67	-732.96	-1,257.72	154.22	11.02	9.48	-5.68	
11,454.00	84.75	161.330	11,016.06	-762.28	-1,248.24	184.85	8.21	6.68	-4.81	
11,485.00	85.27	160.890	11,018.76	-791.49	-1,238.24	215.60	2.19	1.68	-1.42	
11,516.00	88.84	157.810	11,020.35	-820.46	-1,227.32	246.49	15.20	11.52	-9.94	
11,547.00	91.16	156.670	11,020.35	-849.04	-1,215.33	277.48	8.34	7.48	-3.68	
11,578.00	91.65	156.490	11,019.59	-877.48	-1,203.01	308.47	1.68	1.58	-0.58	
11,625.00	88.18	156.320	11,019.66	-920.54	-1,184.20	355.46	7.39	-7.38	-0.36	
11,700.00	88.04	156.230	11,022.14	-989.16	-1,154.05	430.41	0.22	-0.19	-0.12	
11,793.00	89.85	154.380	11,023.85	-1,073.64	-1,115.20	523.39	2.78	1.95	-1.99	
11,885.00	89.19	154.300	11,024.62	-1,156.56	-1,075.36	615.35	0.72	-0.72	-0.09	
11,979.00	88.66	152.010	11,026.38	-1,240.41	-1,032.93	709.22	2.50	-0.56	-2.44	
12,072.00	88.57	149.110	11,028.63	-1,321.37	-987.23	801.79	3.12	-0.10	-3.12	
12,165.00	88.70	147.350	11,030.85	-1,400.41	-938.28	893.94	1.90	0.14	-1.89	
12,258.00	89.36	145.070	11,032.42	-1,477.68	-886.57	985.61	2.55	0.71	-2.45	
12,351.00	89.63	144.630	11,033.24	-1,553.72	-833.03	1,076.90	0.56	0.29	-0.47	
12,443.00	89.80	144.800	11,033.70	-1,628.82	-779.89	1,167.16	0.26	0.18	0.18	
12,537.00	90.51	145.070	11,033.44	-1,705.76	-725.89	1,259.46	0.81	0.76	0.29	
12,630.00	89.19	145.950	11,033.69	-1,782.41	-673.23	1,350.95	1.71	-1.42	0.95	
12,722.00	87.30	146.380	11,036.50	-1,858.79	-622.03	1,441.59	2.11	-2.05	0.47	
12,815.00	87.52	146.210	11,040.71	-1,936.08	-570.47	1,533.21	0.30	0.24	-0.18	
12,908.00	88.13	149.370	11,044.24	-2,014.70	-520.94	1,625.21	3.46	0.66	3.40	
13,002.00	87.47	151.130	11,047.85	-2,096.24	-474.34	1,718.69	2.00	-0.70	1.87	
13,095.00	87.74	150.690	11,051.73	-2,177.44	-429.16	1,811.26	0.55	0.29	-0.47	
13,189.00	87.69	150.780	11,055.48	-2,259.38	-383.25	1,904.81	0.11	-0.05	0.10	
13,282.00	89.23	151.750	11,057.98	-2,340.89	-338.55	1,997.48	1.96	1.66	1.04	
13,375.00	89.63	151.570	11,058.90	-2,422.74	-294.41	2,090.22	0.47	0.43	-0.19	
13,468.00	89.54	150.690	11,059.58	-2,504.18	-249.51	2,182.91	0.95	-0.10	-0.95	
13,561.00	89.41	151.480	11,060.43	-2,585.58	-204.54	2,275.58	0.86	-0.14	0.85	



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Well:	Van Winkle S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
13,655.00	87.96	151.570	11,062.59	-2,668.19	-159.74	2,369.29	1.55	-1.54	0.10
13,748.00	87.96	151.310	11,065.90	-2,749.82	-115.31	2,461.95	0.28	0.00	-0.28
13,842.00	87.91	151.480	11,069.29	-2,832.29	-70.33	2,555.61	0.19	-0.05	0.18
13,934.00	87.69	151.310	11,072.82	-2,913.00	-26.32	2,647.26	0.30	-0.24	-0.18
14,027.00	88.70	148.930	11,075.75	-2,993.59	19.99	2,739.74	2.78	1.09	-2.56
14,121.00	89.80	149.370	11,076.98	-3,074.28	68.19	2,833.09	1.26	1.17	0.47
14,215.00	89.63	148.850	11,077.44	-3,154.95	116.44	2,926.44	0.58	-0.18	-0.55
14,308.00	89.23	148.320	11,078.37	-3,234.31	164.92	3,018.69	0.71	-0.43	-0.57
14,402.00	89.45	148.410	11,079.45	-3,314.34	214.22	3,111.88	0.25	0.23	0.10
14,497.00	89.27	148.140	11,080.51	-3,395.14	264.17	3,206.05	0.34	-0.19	-0.28
14,590.00	89.58	148.230	11,081.45	-3,474.16	313.19	3,298.21	0.35	0.33	0.10
14,683.00	88.88	149.550	11,082.70	-3,553.78	361.24	3,390.52	1.61	-0.75	1.42
14,776.00	88.70	148.930	11,084.66	-3,633.68	408.79	3,482.88	0.69	-0.19	-0.67
14,869.00	88.79	151.130	11,086.70	-3,714.22	455.24	3,575.37	2.37	0.10	2.37
14,962.00	89.01	151.130	11,088.48	-3,795.64	500.13	3,668.04	0.24	0.24	0.00
15,055.00	89.05	150.690	11,090.06	-3,876.90	545.34	3,760.68	0.48	0.04	-0.47
15,148.00	89.05	150.520	11,091.60	-3,957.92	590.98	3,853.28	0.18	0.00	-0.18
15,241.00	89.05	150.250	11,093.14	-4,038.76	636.93	3,945.84	0.29	0.00	-0.29
15,334.00	88.13	150.600	11,095.43	-4,119.61	682.82	4,038.39	1.06	-0.99	0.38
15,428.00	88.13	150.690	11,098.50	-4,201.50	728.87	4,131.96	0.10	0.00	0.10
15,521.00	88.04	150.690	11,101.61	-4,282.55	774.38	4,224.53	0.10	-0.10	0.00
15,614.00	89.05	150.690	11,103.97	-4,363.62	819.89	4,317.12	1.09	1.09	0.00
15,707.00	89.45	150.780	11,105.18	-4,444.74	865.35	4,409.74	0.44	0.43	0.10
15,800.00	89.45	150.690	11,106.08	-4,525.87	910.81	4,502.37	0.10	0.00	-0.10
15,893.00	89.32	150.870	11,107.07	-4,607.03	956.20	4,595.00	0.24	-0.14	0.19
15,987.00	89.76	151.130	11,107.83	-4,689.24	1,001.77	4,688.66	0.54	0.47	0.28
16,080.00	89.67	151.220	11,108.29	-4,770.71	1,046.61	4,781.35	0.14	-0.10	0.10
16,173.00	88.35	149.990	11,109.90	-4,851.73	1,092.25	4,873.94	1.94	-1.42	-1.32
16,266.00	88.40	149.990	11,112.54	-4,932.23	1,138.75	4,966.42	0.05	0.05	0.00
16,359.00	88.31	150.160	11,115.21	-5,012.79	1,185.12	5,058.91	0.21	-0.10	0.18
16,452.00	88.26	149.640	11,117.99	-5,093.22	1,231.74	5,151.37	0.56	-0.05	-0.56
16,546.00	89.14	150.080	11,120.12	-5,174.49	1,278.93	5,244.83	1.05	0.94	0.47
16,639.00	89.76	150.250	11,121.01	-5,255.16	1,325.19	5,337.37	0.69	0.67	0.18
16,732.00	90.02	150.520	11,121.19	-5,336.01	1,371.15	5,429.94	0.40	0.28	0.29
16,825.00	90.07	150.600	11,121.12	-5,417.00	1,416.86	5,522.55	0.10	0.05	0.09
16,918.00	90.11	150.600	11,120.97	-5,498.02	1,462.51	5,615.16	0.04	0.04	0.00
17,011.00	90.37	150.340	11,120.58	-5,578.94	1,508.35	5,707.75	0.40	0.28	-0.28
17,104.00	89.23	150.080	11,120.91	-5,659.65	1,554.55	5,800.29	1.26	-1.23	-0.28
17,197.00	88.57	150.690	11,122.69	-5,740.48	1,600.50	5,892.85	0.97	-0.71	0.66
17,289.00	88.62	150.520	11,124.95	-5,820.61	1,645.65	5,984.44	0.19	0.05	-0.18
17,382.00	89.01	150.340	11,126.87	-5,901.48	1,691.53	6,077.01	0.46	0.42	-0.19
17,475.00	89.54	151.220	11,128.05	-5,982.64	1,736.93	6,169.63	1.10	0.57	0.95
17,568.00	89.41	150.080	11,128.90	-6,063.70	1,782.51	6,262.25	1.23	-0.14	-1.23
17,661.00	89.27	150.080	11,129.97	-6,144.30	1,828.89	6,354.77	0.15	-0.15	0.00



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Well:	Van Winkle S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

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)
17,754.00	88.57	149.200	11,131.73	-6,224.53	1,875.89	6,447.20	1.21	-0.75	-0.95
17,847.00	88.84	149.290	11,133.83	-6,304.43	1,923.43	6,539.56	0.31	0.29	0.10
17,939.00	89.58	149.200	11,135.10	-6,383.48	1,970.47	6,630.94	0.81	0.80	-0.10
18,032.00	88.48	149.990	11,136.67	-6,463.68	2,017.53	6,723.38	1.46	-1.18	0.85
18,125.00	89.01	149.720	11,138.71	-6,544.08	2,064.23	6,815.84	0.64	0.57	-0.29
18,219.00	88.57	150.600	11,140.69	-6,625.60	2,110.99	6,909.36	1.05	-0.47	0.94
18,311.00	89.32	151.310	11,142.39	-6,706.02	2,155.64	7,001.01	1.12	0.82	0.77
18,404.00	88.48	150.780	11,144.17	-6,787.38	2,200.66	7,093.66	1.07	-0.90	-0.57
18,498.00	87.56	150.870	11,147.42	-6,869.40	2,246.45	7,187.24	0.98	-0.98	0.10
18,591.00	88.13	150.600	11,150.92	-6,950.47	2,291.88	7,279.81	0.68	0.61	-0.29
18,684.00	88.57	150.870	11,153.60	-7,031.57	2,337.33	7,372.40	0.56	0.47	0.29
18,777.00	89.19	150.690	11,155.41	-7,112.72	2,382.72	7,465.02	0.69	0.67	-0.19
18,870.00	89.71	150.780	11,156.31	-7,193.84	2,428.18	7,557.64	0.57	0.56	0.10
18,963.00	89.10	150.780	11,157.27	-7,275.01	2,473.58	7,650.27	0.66	-0.66	0.00
19,056.00	88.62	149.720	11,159.12	-7,355.73	2,519.71	7,742.81	1.25	-0.52	-1.14
19,150.00	89.23	149.990	11,160.89	-7,437.00	2,566.91	7,836.28	0.71	0.65	0.29
19,243.00	88.04	148.760	11,163.10	-7,517.01	2,614.27	7,928.66	1.84	-1.28	-1.32
19,336.00	88.88	149.020	11,165.60	-7,596.60	2,662.31	8,020.94	0.95	0.90	0.28
19,429.00	89.41	148.930	11,166.99	-7,676.29	2,710.23	8,113.26	0.58	0.57	-0.10
19,522.00	88.57	149.550	11,168.63	-7,756.19	2,757.79	8,205.62	1.12	-0.90	0.67
19,615.00	89.36	150.870	11,170.31	-7,836.89	2,803.99	8,298.16	1.65	0.85	1.42
19,708.00	88.09	149.720	11,172.38	-7,917.64	2,850.06	8,390.69	1.84	-1.37	-1.24
19,802.00	88.92	149.900	11,174.83	-7,998.86	2,897.31	8,484.14	0.90	0.88	0.19
19,895.00	89.23	150.160	11,176.33	-8,079.42	2,943.76	8,576.65	0.44	0.33	0.28
19,990.00	89.49	149.640	11,177.39	-8,161.60	2,991.40	8,671.13	0.61	0.27	-0.55
20,084.00	88.26	149.990	11,179.24	-8,242.84	3,038.65	8,764.59	1.36	-1.31	0.37
20,177.00	88.92	149.110	11,181.53	-8,322.98	3,085.77	8,857.00	1.18	0.71	-0.95
20,270.00	89.49	148.670	11,182.82	-8,402.60	3,133.82	8,949.30	0.77	0.61	-0.47
20,363.00	88.84	149.290	11,184.17	-8,482.29	3,181.74	9,041.62	0.97	-0.70	0.67
20,456.00	89.36	148.930	11,185.63	-8,562.09	3,229.48	9,133.97	0.68	0.56	-0.39
20,549.00	88.79	150.870	11,187.13	-8,642.53	3,276.11	9,226.45	2.17	-0.61	2.09
20,643.00	87.82	152.010	11,189.91	-8,725.06	3,321.03	9,320.13	1.59	-1.03	1.21
20,736.00	88.04	151.830	11,193.27	-8,807.06	3,364.77	9,412.85	0.31	0.24	-0.19
20,829.00	88.48	151.390	11,196.10	-8,888.83	3,408.97	9,505.55	0.67	0.47	-0.47
20,922.00	87.56	151.130	11,199.31	-8,970.33	3,453.66	9,598.20	1.03	-0.99	-0.28
21,015.00	88.35	150.960	11,202.63	-9,051.65	3,498.66	9,690.81	0.87	0.85	-0.18
21,107.00	88.75	151.040	11,204.96	-9,132.09	3,543.25	9,782.45	0.44	0.43	0.09
21,200.00	89.45	150.340	11,206.42	-9,213.17	3,588.77	9,875.06	1.06	0.75	-0.75
21,293.00	89.98	149.810	11,206.88	-9,293.77	3,635.16	9,967.59	0.81	0.57	-0.57
21,386.00	88.66	149.200	11,207.98	-9,373.90	3,682.35	10,060.01	1.56	-1.42	-0.66
21,479.00	89.27	149.200	11,209.66	-9,453.77	3,729.96	10,152.37	0.66	0.66	0.00
21,572.00	89.89	148.580	11,210.35	-9,533.39	3,778.01	10,244.68	0.94	0.67	-0.67
21,665.00	89.19	149.550	11,211.09	-9,613.16	3,825.82	10,337.03	1.29	-0.75	1.04



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21,757.00	89.71	149.460	11,211.98	-9,692.43	3,872.50	10,428.46	0.57	0.57	-0.10
21,850.00	89.36	150.870	11,212.73	-9,773.10	3,918.77	10,521.00	1.56	-0.38	1.52
21,943.00	88.44	152.270	11,214.52	-9,854.86	3,963.03	10,613.72	1.80	-0.99	1.51
22,036.00	88.09	151.130	11,217.33	-9,936.71	4,007.10	10,706.43	1.28	-0.38	-1.23
22,130.00	88.53	150.520	11,220.10	-10,018.75	4,052.90	10,800.03	0.80	0.47	-0.65
22,224.00	88.79	150.250	11,222.30	-10,100.44	4,099.34	10,893.57	0.40	0.28	-0.29
22,316.00	89.14	149.720	11,223.96	-10,180.09	4,145.36	10,985.08	0.69	0.38	-0.58
22,409.00	89.76	149.020	11,224.86	-10,260.11	4,192.74	11,077.48	1.01	0.67	-0.75
22,503.00	88.75	149.640	11,226.08	-10,340.96	4,240.68	11,170.86	1.26	-1.07	0.66
22,597.00	89.23	149.110	11,227.74	-10,421.83	4,288.56	11,264.25	0.76	0.51	-0.56
22,690.00	89.89	148.410	11,228.45	-10,501.34	4,336.79	11,356.53	1.03	0.71	-0.75
22,784.00	89.05	149.020	11,229.32	-10,581.67	4,385.60	11,449.80	1.10	-0.89	0.65
22,877.00	89.63	148.490	11,230.39	-10,661.18	4,433.83	11,542.08	0.84	0.62	-0.57
22,970.00	88.40	149.460	11,231.99	-10,740.86	4,481.76	11,634.39	1.68	-1.32	1.04
23,064.00	88.97	148.670	11,234.15	-10,821.46	4,530.07	11,727.71	1.04	0.61	-0.84
23,158.00	88.48	149.990	11,236.24	-10,902.29	4,578.00	11,821.08	1.50	-0.52	1.40
23,252.00	88.53	150.340	11,238.69	-10,983.81	4,624.75	11,914.58	0.38	0.05	0.37
23,345.00	89.49	150.780	11,240.30	-11,064.78	4,670.46	12,007.17	1.14	1.03	0.47
23,438.00	90.15	150.340	11,240.59	-11,145.77	4,716.17	12,099.77	0.85	0.71	-0.47
23,531.00	89.49	151.310	11,240.88	-11,226.97	4,761.50	12,192.42	1.26	-0.71	1.04
23,625.00	90.20	150.870	11,241.14	-11,309.26	4,806.94	12,286.09	0.89	0.76	-0.47
23,719.00	88.97	151.390	11,241.82	-11,391.57	4,852.33	12,379.77	1.42	-1.31	0.55
23,812.00	88.09	151.220	11,244.20	-11,473.12	4,896.97	12,472.44	0.96	-0.95	-0.18
23,905.00	88.70	150.870	11,246.81	-11,554.47	4,941.97	12,565.08	0.76	0.66	-0.38
23,999.00	89.36	151.750	11,248.40	-11,636.91	4,987.09	12,658.77	1.17	0.70	0.94
24,093.00	88.09	150.690	11,250.49	-11,719.28	5,032.33	12,752.44	1.76	-1.35	-1.13
24,187.00	88.31	150.080	11,253.44	-11,800.96	5,078.76	12,845.96	0.69	0.23	-0.65
24,282.00	88.75	149.810	11,255.88	-11,883.16	5,126.33	12,940.43	0.54	0.46	-0.28
24,375.00	88.92	148.930	11,257.77	-11,963.16	5,173.70	13,032.81	0.96	0.18	-0.95
24,467.00	88.88	148.410	11,259.54	-12,041.73	5,221.53	13,124.08	0.57	-0.04	-0.57
24,561.00	88.48	149.110	11,261.70	-12,122.08	5,270.26	13,217.33	0.86	-0.43	0.74
24,654.00	89.54	150.080	11,263.31	-12,202.28	5,317.32	13,309.76	1.54	1.14	1.04
24,747.00	89.71	149.900	11,263.92	-12,282.81	5,363.84	13,402.27	0.27	0.18	-0.19
24,841.00	88.84	149.720	11,265.11	-12,364.05	5,411.10	13,495.74	0.95	-0.93	-0.19
24,934.00	88.00	150.080	11,267.67	-12,444.48	5,457.72	13,588.21	0.98	-0.90	0.39
25,028.00	88.35	150.250	11,270.67	-12,525.98	5,504.47	13,681.70	0.41	0.37	0.18
25,122.00	88.75	149.460	11,273.04	-12,607.24	5,551.66	13,775.15	0.94	0.43	-0.84
25,216.00	89.19	148.930	11,274.73	-12,687.96	5,599.79	13,868.50	0.73	0.47	-0.56
25,309.00	88.92	149.200	11,276.27	-12,767.72	5,647.59	13,960.84	0.41	-0.29	0.29
25,409.00	87.25	148.580	11,279.61	-12,853.29	5,699.23	14,060.04	1.78	-1.67	-0.62
25,502.00	87.47	148.670	11,283.89	-12,932.61	5,747.59	14,152.21	0.26	0.24	0.10
25,597.00	87.65	148.230	11,287.94	-13,013.49	5,797.26	14,246.33	0.50	0.19	-0.46
25,688.00	87.30	147.790	11,291.95	-13,090.60	5,845.42	14,336.39	0.62	-0.38	-0.48



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

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)
25,781.00	87.25	147.700	11,296.37	-13,169.16	5,894.99	14,428.36	0.11	-0.05	-0.10
25,873.00	86.90	147.440	11,301.06	-13,246.71	5,944.27	14,519.28	0.47	-0.38	-0.28
25,967.00	86.86	147.090	11,306.18	-13,325.66	5,995.02	14,612.09	0.37	-0.04	-0.37
26,059.00	86.73	147.180	11,311.32	-13,402.82	6,044.87	14,702.89	0.17	-0.14	0.10
26,114.00	86.77	147.180	11,314.44	-13,448.96	6,074.63	14,757.17	0.07	0.07	0.00
Survey @ 26114.00 MD 11314.44 TVD ST3									
26,173.00	86.77	147.180	11,317.76	-13,498.47	6,106.56	14,815.40	0.00	0.00	0.00
Survey Proj. to 26173.00 MD 11317.76 TVD ST3									

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
11,237.00	10,962.21	-561.77	-1,307.97	Tie into sidetrack 02 @ 11237 MD
26,114.00	11,314.44	-13,448.96	6,074.63	Survey @ 26114.00 MD 11314.44 TVD ST3
26,173.00	11,317.76	-13,498.47	6,106.56	Survey Proj. to 26173.00 MD 11317.76 TVD ST3



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

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 S-21 HU (slot B)					
Well Position	+N/-S	0.00 ft	Northing:	14,447,299.987 usft	Latitude:	39.781535000
	+E/-W	0.00 ft	Easting:	1,717,122.706 usft	Longitude:	-80.726968000
Position Uncertainty		0.00 ft	Wellhead Elevation:	ft	Ground Level:	753.00 ft

Wellbore	Sidetrack 03				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	12/4/2022	-8.65	66.39	51,597.91915650

Design	Surveys Sidetrack 03				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	11,237.00
Vertical Section:		Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)
		0.00	0.00	0.00	155.849

Survey Program	Date 1/3/2023				
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
14.00	2,196.00	MWD surf (Original Hole)	MWD	MWD - Standard	
2,260.00	4,641.00	MWD (Original Hole)	MWD	MWD - Standard	
4,718.00	11,237.00	MWD ST2 (Sidetrack 02)	MWD	MWD - Standard	
11,284.00	26,114.00	MWD ST3 (Sidetrack 03)	MWD	MWD - Standard	
26,173.00	26,173.00	Projection ST3 (Sidetrack 03)	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	14,447,299.987	1,717,122.706	39.781535000	-80.726968000	
14.00	0.00	0.000	14.00	0.00	0.00	14,447,299.987	1,717,122.706	39.781535000	-80.726968000	
184.00	0.48	72.650	184.00	0.21	0.68	14,447,300.200	1,717,123.385	39.781535578	-80.726965579	
213.00	0.40	92.950	213.00	0.24	0.90	14,447,300.231	1,717,123.602	39.781535661	-80.726964806	
242.00	0.48	78.190	242.00	0.26	1.12	14,447,300.251	1,717,123.822	39.781535713	-80.726964022	
270.00	0.31	39.870	270.00	0.35	1.28	14,447,300.333	1,717,123.986	39.781535937	-80.726963440	
299.00	0.48	60.610	299.00	0.46	1.44	14,447,300.452	1,717,124.142	39.781536265	-80.726962883	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
329.00	0.48	65.970	328.99	0.58	1.66	14,447,300.565	1,717,124.366	39.781536573	-80.726962084
361.00	0.22	93.920	360.99	0.63	1.84	14,447,300.616	1,717,124.550	39.781536710	-80.726961429
392.00	0.62	78.270	391.99	0.66	2.07	14,447,300.646	1,717,124.773	39.781536790	-80.726960633
423.00	0.70	96.560	422.99	0.67	2.42	14,447,300.658	1,717,125.126	39.781536822	-80.726959379
455.00	0.48	99.720	454.99	0.63	2.75	14,447,300.613	1,717,125.452	39.781536696	-80.726958218
487.00	0.70	133.290	486.99	0.47	3.02	14,447,300.457	1,717,125.727	39.781536263	-80.726957243
522.00	0.48	137.340	521.99	0.21	3.28	14,447,300.202	1,717,125.981	39.781535562	-80.726956338
552.00	1.01	206.160	551.98	-0.12	3.24	14,447,299.872	1,717,125.950	39.781534657	-80.726956453
583.00	0.88	181.020	582.98	-0.60	3.12	14,447,299.389	1,717,125.825	39.781533331	-80.726956902
614.00	0.88	179.880	613.98	-1.07	3.12	14,447,298.913	1,717,125.822	39.781532023	-80.726956921
646.00	0.70	147.270	645.97	-1.48	3.22	14,447,298.503	1,717,125.928	39.781530896	-80.726956547
678.00	0.79	157.730	677.97	-1.85	3.41	14,447,298.134	1,717,126.117	39.781529882	-80.726955877
710.00	1.10	147.180	709.97	-2.32	3.66	14,447,297.672	1,717,126.367	39.781528611	-80.726954992
741.00	1.41	168.450	740.96	-2.94	3.90	14,447,297.048	1,717,126.605	39.781526896	-80.726954153
773.00	1.41	151.930	772.95	-3.67	4.16	14,447,296.315	1,717,126.869	39.781524880	-80.726953221
805.00	1.41	153.510	804.94	-4.37	4.52	14,447,295.615	1,717,127.230	39.781522955	-80.726951944
836.00	1.04	168.440	835.93	-4.99	4.75	14,447,294.998	1,717,127.456	39.781521259	-80.726951145
868.00	0.86	170.840	867.93	-5.51	4.85	14,447,294.477	1,717,127.553	39.781519826	-80.726950807
900.00	1.17	160.400	899.92	-6.06	4.99	14,447,293.932	1,717,127.701	39.781518328	-80.726950287
931.00	0.74	151.890	930.92	-6.53	5.20	14,447,293.457	1,717,127.901	39.781517023	-80.726949578
963.00	0.74	153.220	962.92	-6.90	5.39	14,447,293.091	1,717,128.092	39.781516014	-80.726948905
995.00	0.50	194.200	994.91	-7.22	5.44	14,447,292.771	1,717,128.150	39.781515135	-80.726948698
1,027.00	0.49	151.560	1,026.91	-7.47	5.48	14,447,292.515	1,717,128.181	39.781514433	-80.726948591
1,058.00	0.29	192.140	1,057.91	-7.67	5.52	14,447,292.322	1,717,128.228	39.781513902	-80.726948427
1,090.00	0.62	147.930	1,089.91	-7.89	5.60	14,447,292.096	1,717,128.303	39.781513281	-80.726948163
1,122.00	0.50	131.170	1,121.91	-8.13	5.79	14,447,291.857	1,717,128.500	39.781512624	-80.726947464
1,154.00	0.51	159.800	1,153.91	-8.36	5.95	14,447,291.632	1,717,128.654	39.781512003	-80.726946918
1,186.00	0.40	208.550	1,185.91	-8.59	5.94	14,447,291.400	1,717,128.650	39.781511366	-80.726946935
1,217.00	0.47	214.890	1,216.91	-8.79	5.82	14,447,291.201	1,717,128.525	39.781510820	-80.726947380
1,249.00	0.17	271.540	1,248.91	-8.89	5.70	14,447,291.094	1,717,128.403	39.781510529	-80.726947818
1,281.00	0.52	290.880	1,280.91	-8.84	5.51	14,447,291.147	1,717,128.220	39.781510676	-80.726948469
1,312.00	1.09	269.170	1,311.90	-8.79	5.09	14,447,291.193	1,717,127.794	39.781510806	-80.726949986
1,344.00	1.24	292.870	1,343.90	-8.66	4.46	14,447,291.323	1,717,127.170	39.781511168	-80.726952203
1,376.00	1.45	287.960	1,375.89	-8.40	3.76	14,447,291.583	1,717,126.466	39.781511887	-80.726954707
1,408.00	1.52	274.670	1,407.88	-8.25	2.95	14,447,291.742	1,717,125.658	39.781512331	-80.726957582
1,440.00	1.86	261.200	1,439.86	-8.29	2.02	14,447,291.697	1,717,124.722	39.781512216	-80.726960914
1,471.00	2.67	262.160	1,470.84	-8.47	0.80	14,447,291.522	1,717,123.509	39.781511744	-80.726965232
1,503.00	3.09	254.260	1,502.80	-8.80	-0.77	14,447,291.186	1,717,121.941	39.781510835	-80.726970819
1,534.00	3.18	245.190	1,533.75	-9.39	-2.35	14,447,290.599	1,717,120.356	39.781509235	-80.726976466
1,566.00	3.46	235.710	1,565.70	-10.31	-3.95	14,447,289.682	1,717,118.753	39.781506732	-80.726982183
1,597.00	3.60	234.080	1,596.64	-11.40	-5.51	14,447,288.584	1,717,117.191	39.781503730	-80.726987751
1,629.00	4.09	230.200	1,628.57	-12.72	-7.20	14,447,287.264	1,717,115.501	39.781500119	-80.726993782
1,659.00	4.51	225.560	1,658.48	-14.23	-8.87	14,447,285.754	1,717,113.837	39.781495984	-80.726999722
1,691.00	5.16	222.060	1,690.37	-16.18	-10.73	14,447,283.804	1,717,111.975	39.781490647	-80.727006372
1,722.00	4.88	217.470	1,721.25	-18.26	-12.47	14,447,281.723	1,717,110.239	39.781484945	-80.727012574
1,753.00	4.98	217.900	1,752.14	-20.37	-14.10	14,447,279.615	1,717,108.610	39.781479169	-80.727018394
1,785.00	4.15	226.230	1,784.03	-22.27	-15.79	14,447,277.718	1,717,106.921	39.781473973	-80.727024427
1,816.00	3.82	224.110	1,814.96	-23.79	-17.31	14,447,276.200	1,717,105.392	39.781469819	-80.727029885
1,848.00	3.32	227.140	1,846.90	-25.18	-18.74	14,447,274.804	1,717,103.971	39.781465998	-80.727034959
1,880.00	3.36	236.280	1,878.84	-26.33	-20.19	14,447,273.654	1,717,102.512	39.781462849	-80.727040165
1,911.00	2.92	239.720	1,909.80	-27.24	-21.63	14,447,272.751	1,717,101.074	39.781460383	-80.727045292
1,943.00	2.84	249.310	1,941.76	-27.93	-23.08	14,447,272.060	1,717,099.629	39.781458497	-80.727050444
1,975.00	2.92	266.850	1,973.72	-26.25	-24.63	14,447,271.735	1,717,098.073	39.781457618	-80.727055985
2,006.00	3.07	269.470	2,004.67	-28.30	-26.25	14,447,271.684	1,717,096.455	39.781457491	-80.727061746



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
2,038.00	3.70	275.350	2,036.62	-28.22	-28.14	14,447,271.773	1,717,094.570	39.781457750	-80.727068454
2,070.00	4.10	272.560	2,068.54	-28.07	-30.31	14,447,271.920	1,717,092.399	39.781458173	-80.727076180
2,101.00	4.04	265.420	2,099.47	-28.11	-32.50	14,447,271.882	1,717,090.203	39.781458088	-80.727083995
2,133.00	3.59	250.220	2,131.40	-28.53	-34.57	14,447,271.453	1,717,088.137	39.781456927	-80.727091355
2,164.00	4.16	246.230	2,162.32	-29.32	-36.51	14,447,270.671	1,717,086.194	39.781454796	-80.727098277
2,196.00	4.22	240.260	2,194.24	-30.37	-38.60	14,447,269.620	1,717,084.110	39.781451925	-80.727105708
2,260.00	4.39	220.130	2,258.06	-33.41	-42.22	14,447,266.578	1,717,080.486	39.781443603	-80.727118639
2,292.00	4.61	216.530	2,289.96	-35.38	-43.77	14,447,264.609	1,717,078.932	39.781438207	-80.727124195
2,324.00	4.53	220.140	2,321.86	-37.38	-45.35	14,447,262.609	1,717,077.351	39.781421329	-80.727129841
2,356.00	3.91	225.390	2,353.77	-39.11	-46.95	14,447,260.877	1,717,075.760	39.781427985	-80.727135524
2,388.00	2.91	237.790	2,385.72	-40.31	-48.41	14,447,259.678	1,717,074.296	39.781424704	-80.727140748
2,419.00	2.39	239.880	2,416.68	-41.05	-49.63	14,447,258.934	1,717,073.071	39.781422672	-80.727145116
2,451.00	1.44	246.530	2,448.67	-41.55	-50.58	14,447,258.439	1,717,072.125	39.781421321	-80.727148488
2,481.00	1.45	242.770	2,478.66	-41.87	-51.26	14,447,258.115	1,717,071.442	39.781420437	-80.727150924
2,513.00	1.62	251.740	2,510.65	-42.20	-52.05	14,447,257.788	1,717,070.652	39.781419546	-80.727153738
2,545.00	1.31	240.360	2,542.64	-42.52	-52.80	14,447,257.466	1,717,069.905	39.781418666	-80.727156402
2,576.00	1.18	259.840	2,573.63	-42.75	-53.42	14,447,257.234	1,717,069.283	39.781418035	-80.727158619
2,608.00	1.08	253.690	2,605.62	-42.90	-54.04	14,447,257.091	1,717,068.669	39.781417648	-80.727160805
2,640.00	1.43	245.610	2,637.61	-43.15	-54.69	14,447,256.842	1,717,068.016	39.781416968	-80.727163132
2,671.00	2.34	243.330	2,668.60	-43.59	-55.61	14,447,256.398	1,717,067.098	39.781415757	-80.727166404
2,703.00	2.84	228.130	2,700.56	-44.41	-56.78	14,447,255.576	1,717,065.924	39.781413508	-80.727170592
2,735.00	2.74	233.380	2,732.53	-45.40	-57.99	14,447,254.590	1,717,064.720	39.781411082	-80.727174889
2,767.00	3.42	233.030	2,764.48	-46.43	-59.36	14,447,253.560	1,717,063.343	39.781407995	-80.727179800
2,798.00	3.03	231.020	2,795.43	-47.50	-60.74	14,447,252.488	1,717,061.967	39.781405064	-80.727184708
2,830.00	3.41	229.620	2,827.38	-48.65	-62.12	14,447,251.340	1,717,060.585	39.781401921	-80.727189641
2,862.00	3.29	230.490	2,859.33	-49.85	-63.55	14,447,250.139	1,717,059.152	39.781398635	-80.727194756
2,893.00	2.98	222.240	2,890.28	-51.01	-64.78	14,447,248.977	1,717,057.924	39.781395453	-80.727199140
2,923.00	3.04	220.750	2,920.24	-52.19	-65.83	14,447,247.797	1,717,056.880	39.781392221	-80.727202867
2,955.00	3.02	225.960	2,952.19	-53.42	-66.99	14,447,246.568	1,717,055.720	39.781388856	-80.727207006
2,986.00	2.72	219.030	2,983.15	-54.56	-68.04	14,447,245.429	1,717,054.670	39.781385737	-80.727210759
3,018.00	3.35	225.270	3,015.11	-55.81	-69.18	14,447,244.181	1,717,053.528	39.781382320	-80.727214839
3,049.00	3.66	225.190	3,046.05	-57.14	-70.52	14,447,242.846	1,717,052.182	39.781378665	-80.727219642
3,081.00	4.41	229.080	3,077.97	-58.67	-72.18	14,447,241.321	1,717,050.528	39.781374489	-80.727225547
3,113.00	5.46	230.640	3,109.85	-60.44	-74.28	14,447,239.549	1,717,048.421	39.781369642	-80.727230365
3,144.00	6.05	234.790	3,140.70	-62.32	-76.76	14,447,237.672	1,717,045.946	39.781364507	-80.727241895
3,175.00	7.07	238.190	3,171.49	-64.26	-79.72	14,447,235.724	1,717,042.990	39.781359183	-80.727252438
3,207.00	7.75	236.640	3,203.23	-66.49	-83.19	14,447,233.500	1,717,039.514	39.781353103	-80.727264834
3,238.00	8.19	239.290	3,233.93	-68.76	-86.84	14,447,231.223	1,717,035.870	39.781346881	-80.727277830
3,270.00	8.57	239.630	3,265.59	-71.13	-90.85	14,447,228.853	1,717,031.853	39.781340407	-80.727292153
3,302.00	8.97	239.360	3,297.21	-73.61	-95.06	14,447,226.376	1,717,027.650	39.781333640	-80.727307142
3,333.00	8.96	240.760	3,327.83	-76.02	-99.24	14,447,223.966	1,717,023.464	39.781327054	-80.727322067
3,365.00	8.64	239.900	3,359.46	-78.44	-103.50	14,447,221.543	1,717,019.210	39.781320436	-80.727337234
3,397.00	8.57	241.590	3,391.10	-80.78	-107.67	14,447,219.203	1,717,015.034	39.781314046	-80.727352126
3,429.00	7.36	244.640	3,422.79	-82.80	-111.62	14,447,217.191	1,717,011.084	39.781308552	-80.727366205
3,461.00	6.72	252.670	3,454.55	-84.23	-115.26	14,447,215.755	1,717,007.445	39.781304640	-80.727379175
3,493.00	6.79	261.610	3,486.32	-85.07	-118.92	14,447,214.921	1,717,003.786	39.781302381	-80.727392208
3,525.00	7.22	267.330	3,518.09	-85.44	-122.80	14,447,214.552	1,716,999.906	39.781301398	-80.727406023
3,557.00	8.16	269.870	3,549.80	-85.53	-127.08	14,447,214.453	1,716,995.626	39.781301162	-80.727421257
3,588.00	9.54	269.330	3,580.43	-85.57	-131.85	14,447,214.418	1,716,990.857	39.781301106	-80.727438233
3,620.00	10.83	272.020	3,611.92	-85.49	-137.51	14,447,214.493	1,716,985.201	39.781301359	-80.727458365
3,652.00	11.24	271.670	3,643.33	-85.30	-143.63	14,447,214.690	1,716,979.079	39.781301951	-80.727480153
3,683.00	11.17	272.750	3,673.74	-85.07	-149.65	14,447,214.922	1,716,973.060	39.781302639	-80.727501575
3,715.00	10.67	273.580	3,705.16	-84.73	-155.70	14,447,215.255	1,716,967.007	39.781303606	-80.727523115
3,747.00	10.14	272.820	3,736.64	-84.41	-161.47	14,447,215.579	1,716,961.237	39.781304543	-80.727543650



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
3,779.00	10.43	272.440	3,768.12	-84.15	-167.18	14,447,215.841	1,716,955.529	39.781305310	-80.727563962	
3,810.00	10.47	270.940	3,798.61	-83.98	-172.80	14,447,216.007	1,716,949.910	39.781305811	-80.727583964	
3,842.00	10.31	272.080	3,830.08	-83.83	-178.57	14,447,216.158	1,716,944.141	39.781306276	-80.727604496	
3,874.00	10.90	271.610	3,861.54	-83.64	-184.45	14,447,216.347	1,716,938.255	39.781306844	-80.727625444	
3,905.00	11.85	270.040	3,891.93	-83.56	-190.56	14,447,216.432	1,716,932.142	39.781307127	-80.727647202	
3,937.00	12.01	269.370	3,923.23	-83.59	-197.18	14,447,216.397	1,716,925.527	39.781307088	-80.727670747	
3,968.00	12.53	269.200	3,953.53	-83.67	-203.77	14,447,216.315	1,716,918.940	39.781306917	-80.727694195	
4,000.00	12.99	268.380	3,984.74	-83.82	-210.83	14,447,216.165	1,716,911.874	39.781306564	-80.727719348	
4,032.00	12.36	267.240	4,015.96	-84.09	-217.85	14,447,215.898	1,716,904.858	39.781305890	-80.727744323	
4,063.00	12.12	266.010	4,046.25	-84.48	-224.41	14,447,215.512	1,716,898.297	39.781304884	-80.727767679	
4,095.00	10.48	261.230	4,077.63	-85.15	-230.64	14,447,214.835	1,716,892.069	39.781303076	-80.727789854	
4,126.00	10.24	260.110	4,108.13	-86.06	-236.14	14,447,213.931	1,716,886.568	39.781300641	-80.727809444	
4,158.00	9.71	257.590	4,139.64	-87.12	-241.58	14,447,212.863	1,716,881.131	39.781297752	-80.727828810	
4,190.00	9.96	256.480	4,171.17	-88.35	-246.90	14,447,211.636	1,716,875.804	39.781294427	-80.727847782	
4,222.00	9.96	258.120	4,202.69	-89.57	-252.30	14,447,210.419	1,716,870.406	39.781291131	-80.727867011	
4,254.00	9.92	262.830	4,234.21	-90.48	-257.74	14,447,209.506	1,716,864.963	39.781288667	-80.727886395	
4,286.00	9.69	265.050	4,265.74	-91.06	-263.16	14,447,208.929	1,716,859.545	39.781287130	-80.727905686	
4,317.00	9.95	266.620	4,296.29	-91.44	-268.43	14,447,208.546	1,716,854.272	39.781286122	-80.727924458	
4,349.00	9.88	269.140	4,327.81	-91.65	-273.94	14,447,208.342	1,716,848.767	39.781285607	-80.727944054	
4,381.00	10.69	270.160	4,359.30	-91.68	-279.65	14,447,208.309	1,716,843.054	39.781285564	-80.727964390	
4,413.00	11.05	273.080	4,390.72	-91.51	-285.68	14,447,208.482	1,716,837.024	39.781286090	-80.727985852	
4,452.00	10.75	274.330	4,429.02	-91.03	-293.04	14,447,208.958	1,716,829.665	39.781287457	-80.728012040	
4,546.00	11.85	272.450	4,521.20	-89.96	-311.43	14,447,210.032	1,716,811.280	39.781290561	-80.728077467	
4,641.00	12.92	269.180	4,613.98	-89.69	-331.79	14,447,210.297	1,716,790.915	39.781291458	-80.728149954	
4,718.00	12.84	266.970	4,689.05	-90.27	-348.94	14,447,209.722	1,716,773.763	39.781290021	-80.728211008	
4,746.00	12.53	261.700	4,716.36	-90.87	-355.06	14,447,209.119	1,716,767.651	39.781288416	-80.728232772	
4,777.00	11.74	256.160	4,746.67	-92.11	-361.45	14,447,207.879	1,716,761.261	39.781285064	-80.728255530	
4,808.00	9.49	250.270	4,777.14	-93.73	-366.91	14,447,206.261	1,716,755.792	39.781280668	-80.728275013	
4,839.00	8.00	246.580	4,807.78	-95.45	-371.30	14,447,204.541	1,716,751.407	39.781275980	-80.728290640	
4,870.00	7.30	243.860	4,838.50	-97.17	-375.05	14,447,202.816	1,716,747.659	39.781271274	-80.728303998	
4,963.00	8.57	253.170	4,930.62	-101.78	-386.98	14,447,198.206	1,716,735.722	39.781258714	-80.728346539	
5,056.00	9.23	249.390	5,022.50	-106.41	-400.60	14,447,193.574	1,716,722.108	39.781246107	-80.728395046	
5,149.00	10.37	255.460	5,114.14	-111.14	-415.68	14,447,188.847	1,716,707.023	39.781233251	-80.728448788	
5,242.00	11.43	257.570	5,205.46	-115.23	-432.78	14,447,184.762	1,716,689.922	39.781222175	-80.728509704	
5,336.00	12.57	254.490	5,297.41	-119.97	-451.74	14,447,180.022	1,716,670.969	39.781209315	-80.728577215	
5,429.00	11.30	261.610	5,388.40	-124.00	-470.50	14,447,175.986	1,716,652.202	39.781198387	-80.728644058	
5,522.00	10.95	269.520	5,479.66	-125.41	-488.35	14,447,174.583	1,716,634.355	39.781194681	-80.728707600	
5,615.00	12.00	270.840	5,570.80	-125.34	-506.85	14,447,174.650	1,716,615.855	39.781195021	-80.728773448	
5,707.00	12.62	266.360	5,660.68	-125.84	-526.45	14,447,174.152	1,716,596.261	39.781193817	-80.728843194	
5,801.00	12.84	271.630	5,752.38	-126.19	-547.13	14,447,173.798	1,716,575.572	39.781193014	-80.728916839	
5,893.00	13.10	270.840	5,842.03	-125.75	-567.78	14,447,174.241	1,716,554.929	39.781194404	-80.728990312	
5,986.00	12.31	272.600	5,932.75	-125.14	-588.22	14,447,174.845	1,716,534.487	39.781196233	-80.729067068	
6,079.00	12.48	270.310	6,023.58	-124.64	-608.17	14,447,175.350	1,716,514.534	39.781197784	-80.729134080	
6,172.00	12.92	269.520	6,114.31	-124.67	-628.62	14,447,175.317	1,716,494.089	39.781197864	-80.729206853	
6,266.00	13.63	267.760	6,205.80	-125.19	-650.19	14,447,174.796	1,716,472.513	39.781196612	-80.729283656	
6,358.00	13.19	268.200	6,295.29	-125.95	-671.52	14,447,174.043	1,716,451.191	39.781194720	-80.729359561	
6,451.00	13.19	267.670	6,385.83	-126.71	-692.72	14,447,173.278	1,716,429.984	39.781192796	-80.729435052	
6,543.00	13.58	266.440	6,475.34	-127.81	-713.99	14,447,172.180	1,716,408.716	39.781189959	-80.729510765	
6,636.00	14.07	268.290	6,565.64	-128.82	-736.19	14,447,171.165	1,716,386.519	39.781187355	-80.729589784	
6,729.00	12.97	267.410	6,656.06	-129.63	-757.91	14,447,170.356	1,716,364.793	39.781185313	-80.729667124	
6,823.00	11.56	269.870	6,747.92	-130.13	-777.87	14,447,169.858	1,716,344.836	39.781184111	-80.729738166	
6,916.00	10.64	270.840	6,839.18	-130.02	-795.78	14,447,169.963	1,716,326.932	39.781184547	-80.729801890	
7,009.00	10.68	271.800	6,930.57	-129.63	-812.97	14,447,170.359	1,716,309.734	39.781185778	-80.729863101	
7,102.00	10.86	268.900	7,021.93	-129.53	-830.35	14,447,170.462	1,716,292.361	39.781186204	-80.729924936	



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
7,196.00	10.73	268.110	7,114.27	-129.98	-847.95	14,447,170.003	1,716,274.762	39.781185090	-80.729987585
7,290.00	9.85	268.900	7,206.76	-130.43	-864.73	14,447,169.560	1,716,257.977	39.781184013	-80.730047333
7,383.00	9.54	268.550	7,298.43	-130.78	-880.39	14,447,169.213	1,716,242.320	39.781183187	-80.730103069
7,477.00	9.49	268.990	7,391.14	-131.11	-895.92	14,447,168.879	1,716,226.785	39.781182399	-80.730158368
7,570.00	9.36	270.050	7,482.88	-131.24	-911.15	14,447,168.750	1,716,211.556	39.781182172	-80.730212572
7,663.00	9.23	270.570	7,574.66	-131.16	-926.17	14,447,168.831	1,716,196.536	39.781182519	-80.730266036
7,757.00	9.80	271.450	7,667.37	-130.88	-941.71	14,447,169.109	1,716,181.000	39.781183409	-80.730321331
7,851.00	10.07	267.940	7,759.96	-130.97	-957.92	14,447,169.016	1,716,164.790	39.781183288	-80.730379030
7,945.00	10.07	264.510	7,852.51	-132.05	-974.31	14,447,162.934	1,716,148.397	39.781180453	-80.730437392
8,038.00	11.03	265.740	7,943.94	-133.49	-991.28	14,447,166.495	1,716,131.431	39.781176642	-80.730497795
8,131.00	11.43	266.360	8,035.16	-134.74	-1,009.34	14,447,165.249	1,716,113.363	39.781173370	-80.730562120
8,225.00	11.56	267.230	8,127.27	-135.78	-1,028.05	14,447,164.203	1,716,094.660	39.781170650	-80.730628702
8,318.00	11.78	268.030	8,218.35	-136.56	-1,046.84	14,447,162.636	1,716,075.865	39.781168672	-80.730695609
8,412.00	11.87	269.780	8,310.35	-136.93	-1,066.10	14,447,163.059	1,716,056.608	39.781167824	-80.730764157
8,505.00	10.95	268.200	8,401.51	-137.24	-1,084.49	14,447,162.745	1,716,038.215	39.781167113	-80.730829630
8,599.00	10.11	270.570	8,493.93	-137.44	-1,101.67	14,447,162.547	1,716,021.041	39.781166710	-80.730890760
8,692.00	9.85	270.050	8,585.52	-137.35	-1,117.78	14,447,162.635	1,716,004.924	39.781167085	-80.730948125
8,786.00	10.02	266.440	8,678.11	-137.85	-1,133.99	14,447,162.134	1,715,988.722	39.781165843	-80.731005801
8,879.00	11.08	265.920	8,769.54	-138.99	-1,150.98	14,447,160.996	1,715,971.733	39.781162858	-80.731066284
8,974.00	10.77	264.950	8,862.82	-140.42	-1,168.92	14,447,159.565	1,715,953.786	39.781159076	-80.731130181
9,067.00	11.21	266.440	8,954.11	-141.75	-1,186.60	14,447,158.239	1,715,936.108	39.781155580	-80.731193118
9,160.00	11.78	267.060	9,045.25	-142.80	-1,205.10	14,447,157.191	1,715,917.604	39.781152854	-80.731258990
9,254.00	12.00	265.650	9,137.23	-144.03	-1,224.43	14,447,155.957	1,715,898.278	39.781149626	-80.731327793
9,347.00	12.13	266.090	9,228.18	-145.43	-1,243.82	14,447,154.558	1,715,878.889	39.781145942	-80.731396819
9,440.00	11.96	266.530	9,319.13	-146.68	-1,263.19	14,447,153.308	1,715,859.522	39.781142670	-80.731465767
9,534.00	11.69	266.180	9,411.13	-147.90	-1,282.41	14,447,152.084	1,715,840.298	39.781139467	-80.731534205
9,627.00	11.43	268.290	9,502.25	-148.81	-1,301.02	14,447,151.182	1,715,821.687	39.781137141	-80.731600461
9,721.00	10.81	264.770	9,594.48	-149.89	-1,319.11	14,447,150.100	1,715,803.598	39.781134320	-80.731664856
9,815.00	10.46	265.210	9,686.87	-151.40	-1,336.39	14,447,148.584	1,715,786.317	39.781130299	-80.731726384
9,909.00	10.37	265.650	9,779.32	-152.76	-1,353.33	14,447,147.230	1,715,769.378	39.781126719	-80.731786690
10,002.00	9.36	263.460	9,870.95	-154.25	-1,369.19	14,447,145.734	1,715,753.518	39.781122740	-80.731843158
10,016.00	9.10	263.540	9,884.76	-154.51	-1,371.42	14,447,145.479	1,715,751.287	39.781122061	-80.731851102
10,055.00	8.48	261.300	9,923.31	-155.29	-1,377.33	14,447,144.697	1,715,745.380	39.781119962	-80.731872136
10,102.00	9.41	261.350	9,969.73	-156.39	-1,384.55	14,447,143.595	1,715,738.156	39.781116995	-80.731897862
10,149.00	10.16	269.900	10,016.05	-156.98	-1,392.50	14,447,143.010	1,715,730.211	39.781115453	-80.731926145
10,196.00	9.85	268.570	10,062.34	-157.09	-1,400.66	14,447,142.903	1,715,722.047	39.781115225	-80.731955206
10,242.00	10.12	242.130	10,107.66	-159.07	-1,408.17	14,447,140.914	1,715,714.537	39.781109826	-80.731981958
10,289.00	10.52	219.000	10,153.92	-164.34	-1,414.52	14,447,135.647	1,715,708.184	39.781095413	-80.732004627
10,334.00	10.83	211.150	10,198.15	-171.15	-1,419.30	14,447,128.836	1,715,703.412	39.781076748	-80.732021687
10,381.00	11.22	207.760	10,244.28	-178.98	-1,423.71	14,447,121.011	1,715,698.998	39.781056294	-80.732037481
10,427.00	12.90	196.830	10,289.27	-187.85	-1,427.28	14,447,112.134	1,715,695.426	39.781030945	-80.732050289
10,474.00	14.63	186.610	10,334.92	-198.77	-1,429.48	14,447,101.214	1,715,693.223	39.781000973	-80.732058246
10,520.00	15.91	176.210	10,379.31	-210.84	-1,429.74	14,447,089.149	1,715,692.971	39.780967843	-80.732059271
10,567.00	17.32	168.320	10,424.35	-224.12	-1,427.89	14,447,075.868	1,715,694.814	39.780931353	-80.732052855
10,614.00	17.99	157.130	10,469.15	-237.66	-1,423.66	14,447,062.325	1,715,699.052	39.780894126	-80.732037913
10,661.00	17.10	142.140	10,513.99	-249.81	-1,416.59	14,447,050.176	1,715,706.117	39.780860703	-80.732012894
10,707.00	17.23	136.810	10,557.94	-260.12	-1,407.78	14,447,039.869	1,715,714.931	39.780832324	-80.731981631
10,738.00	19.22	145.490	10,587.39	-267.67	-1,401.74	14,447,032.314	1,715,720.966	39.780811529	-80.731960231
10,769.00	21.08	151.800	10,616.49	-276.79	-1,396.21	14,447,023.195	1,715,726.493	39.780786438	-80.731940658
10,800.00	22.63	157.570	10,645.27	-287.22	-1,391.30	14,447,012.767	1,715,731.404	39.780757760	-80.731923289
10,831.00	24.70	163.340	10,673.66	-298.94	-1,387.17	14,447,001.046	1,715,735.537	39.780725538	-80.731908701
10,862.00	27.57	165.460	10,701.49	-312.09	-1,383.51	14,446,987.894	1,715,739.196	39.780689388	-80.731895818
10,893.00	30.18	165.240	10,728.63	-326.58	-1,379.72	14,446,973.412	1,715,742.983	39.780649587	-80.731882494
10,923.00	33.27	164.580	10,754.15	-341.80	-1,375.61	14,446,958.184	1,715,747.093	39.780607732	-80.731868026



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422y16

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
10,954.00	36.10	164.220	10,779.64	-358.79	-1,370.87	14,446,941.195	1,715,751.838	39.780561037	-80.731851317
10,986.00	38.67	164.090	10,805.06	-377.48	-1,365.56	14,446,922.506	1,715,757.143	39.780509668	-80.731832633
11,016.00	41.71	163.080	10,827.98	-396.05	-1,360.09	14,446,903.939	1,715,762.619	39.780458634	-80.731813343
11,048.00	44.72	163.390	10,851.30	-417.03	-1,353.77	14,446,882.961	1,715,768.937	39.780400971	-80.731791078
11,079.00	47.50	162.640	10,872.79	-438.39	-1,347.24	14,446,861.598	1,715,775.465	39.780342249	-80.731768068
11,110.00	50.24	162.370	10,893.17	-460.66	-1,340.22	14,446,839.331	1,715,782.485	39.780281039	-80.731743319
11,141.00	52.85	162.110	10,912.45	-483.77	-1,332.82	14,446,816.214	1,715,789.890	39.780217494	-80.731717208
11,175.00	56.35	162.120	10,932.14	-510.15	-1,324.31	14,446,789.844	1,715,798.400	39.780145002	-80.731687199
11,206.00	61.01	162.210	10,948.25	-535.35	-1,316.20	14,446,764.640	1,715,806.509	39.780075721	-80.731658608
11,237.00	65.45	163.170	10,962.21	-561.77	-1,307.97	14,446,738.222	1,715,814.737	39.780003102	-80.731629601
Tie into sidetrack 02 @ 11237 MD									
11,284.00	72.18	162.120	10,979.19	-603.57	-1,294.90	14,446,696.421	1,715,827.810	39.779888198	-80.731583515
11,330.00	72.75	164.050	10,993.05	-645.53	-1,282.14	14,446,654.459	1,715,840.570	39.779772852	-80.731538546
11,361.00	75.96	165.190	11,001.41	-674.31	-1,274.22	14,446,625.680	1,715,848.484	39.779693753	-80.731510685
11,392.00	79.74	164.580	11,007.93	-703.56	-1,266.32	14,446,596.429	1,715,856.386	39.779613356	-80.731482872
11,423.00	82.68	162.820	11,012.67	-732.96	-1,257.72	14,446,567.029	1,715,864.985	39.779532546	-80.731452579
11,454.00	84.75	161.330	11,016.06	-762.28	-1,248.24	14,446,537.714	1,715,874.469	39.779451960	-80.731419137
11,485.00	85.27	160.890	11,018.76	-791.49	-1,238.24	14,446,508.495	1,715,884.468	39.779371635	-80.731383862
11,516.00	88.84	157.810	11,020.35	-820.46	-1,227.32	14,446,479.534	1,715,895.384	39.779292009	-80.731345317
11,547.00	91.16	156.670	11,020.35	-849.04	-1,215.33	14,446,450.950	1,715,907.376	39.779213412	-80.731302940
11,578.00	91.65	156.490	11,019.59	-877.48	-1,203.01	14,446,422.513	1,715,919.694	39.779135214	-80.731259401
11,625.00	88.18	156.320	11,019.66	-920.54	-1,184.20	14,446,379.449	1,715,938.504	39.779016794	-80.731192912
11,700.00	88.04	156.230	11,022.14	-989.16	-1,154.05	14,446,310.825	1,715,968.663	39.778828085	-80.731086298
11,793.00	89.85	154.380	11,023.85	-1,073.64	-1,115.20	14,446,226.352	1,716,007.508	39.778595780	-80.730948942
11,885.00	89.19	154.300	11,024.62	-1,156.56	-1,075.36	14,446,143.428	1,716,047.345	39.778367721	-80.730808039
11,979.00	88.66	152.010	11,026.38	-1,240.41	-1,032.93	14,446,059.579	1,716,089.782	39.778137099	-80.730657890
12,072.00	88.57	149.110	11,028.63	-1,321.37	-987.23	14,445,978.621	1,716,135.475	39.777914387	-80.730496127
12,165.00	88.70	147.350	11,030.85	-1,400.41	-938.28	14,445,899.581	1,716,184.424	39.777696918	-80.730322751
12,258.00	89.36	145.070	11,032.42	-1,477.68	-886.57	14,445,822.307	1,716,236.135	39.777484275	-80.730139529
12,351.00	89.63	144.630	11,033.24	-1,553.72	-833.03	14,445,746.269	1,716,289.675	39.777275012	-80.729949787
12,443.00	89.80	144.800	11,033.70	-1,628.82	-779.89	14,445,671.172	1,716,342.817	39.777068334	-80.729761449
12,537.00	90.51	145.070	11,033.44	-1,705.76	-725.89	14,445,594.234	1,716,396.820	39.776856593	-80.729570069
12,630.00	89.19	145.950	11,033.69	-1,782.41	-673.23	14,445,517.584	1,716,449.480	39.776645655	-80.729383465
12,722.00	87.30	146.380	11,036.50	-1,858.79	-622.03	14,445,441.204	1,716,500.680	39.776435471	-80.729202060
12,815.00	87.52	146.210	11,040.71	-1,936.08	-570.47	14,445,363.916	1,716,552.234	39.776227899	-80.729019402
12,908.00	88.13	149.370	11,044.24	-2,014.70	-520.94	14,445,285.296	1,716,601.763	39.776006465	-80.728843970
13,002.00	87.47	151.130	11,047.85	-2,096.24	-474.34	14,445,203.749	1,716,648.371	39.775782128	-80.728678965
13,095.00	87.74	150.690	11,051.73	-2,177.44	-429.16	14,445,122.552	1,716,693.546	39.775558763	-80.728519056
13,189.00	87.69	150.780	11,055.48	-2,259.38	-383.25	14,445,040.615	1,716,739.461	39.775333359	-80.728356524
13,282.00	89.23	151.750	11,057.98	-2,340.89	-338.55	14,444,959.101	1,716,784.154	39.775109126	-80.728198340
13,375.00	89.63	151.570	11,058.90	-2,422.74	-294.41	14,444,877.251	1,716,828.299	39.774883978	-80.728042108
13,468.00	89.54	150.690	11,059.58	-2,504.18	-249.51	14,444,795.813	1,716,873.199	39.774659951	-80.727883183
13,561.00	89.41	151.480	11,060.43	-2,585.58	-204.54	14,444,714.411	1,716,918.164	39.774438023	-80.727724033
13,655.00	87.96	151.570	11,062.59	-2,668.19	-159.74	14,444,631.806	1,716,962.968	39.774208796	-80.727565468
13,748.00	87.96	151.310	11,065.90	-2,749.82	-115.31	14,444,550.175	1,717,007.401	39.773984242	-80.727408214
13,842.00	87.91	151.480	11,069.29	-2,832.29	-70.33	14,444,467.702	1,717,052.375	39.773757374	-80.727249041
13,934.00	87.69	151.310	11,072.82	-2,913.00	-26.32	14,444,386.991	1,717,096.390	39.773535352	-80.727093269
14,027.00	88.70	148.930	11,075.75	-2,993.59	19.99	14,444,306.401	1,717,142.694	39.773313642	-80.726929345
14,121.00	89.80	149.370	11,076.98	-3,074.28	88.19	14,444,225.709	1,717,190.892	39.773091637	-80.726758687
14,215.00	89.63	148.850	11,077.44	-3,154.95	116.44	14,444,145.044	1,717,239.149	39.772869705	-80.726587814
14,308.00	89.23	148.320	11,078.37	-3,234.31	164.92	14,444,065.681	1,717,287.621	39.772651346	-80.726416166
14,402.00	89.45	148.410	11,079.45	-3,314.34	214.22	14,443,985.655	1,717,336.922	39.772431157	-80.726241579
14,497.00	89.27	148.140	11,080.51	-3,395.14	264.17	14,443,904.855	1,717,386.873	39.772208839	-80.726064683
14,590.00	89.58	148.230	11,081.45	-3,474.16	313.19	14,443,825.832	1,717,435.898	39.771991409	-80.725891067



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
14,683.00	88.88	149.550	11,082.70	-3,553.78	361.24	14,443,746.217	1,717,483.944	39.771772361	-80.725720943	
14,776.00	88.70	148.930	11,084.66	-3,633.68	408.79	14,443,666.319	1,717,531.497	39.771552539	-80.725552576	
14,869.00	88.79	151.130	11,086.70	-3,714.22	455.24	14,443,585.779	1,717,577.941	39.771330963	-80.725388166	
14,962.00	89.01	151.130	11,088.48	-3,795.64	500.13	14,443,504.352	1,717,622.835	39.771106966	-80.725229282	
15,055.00	89.05	150.690	11,090.06	-3,876.90	545.34	14,443,423.095	1,717,668.043	39.770883432	-80.725069278	
15,148.00	89.05	150.520	11,091.60	-3,957.92	590.98	14,443,342.080	1,717,713.684	39.770660556	-80.724907735	
15,241.00	89.05	150.250	11,093.14	-4,038.76	636.93	14,443,261.240	1,717,759.635	39.770438161	-80.724745085	
15,334.00	88.13	150.600	11,095.43	-4,119.61	682.82	14,443,180.383	1,717,805.522	39.770215717	-80.724582665	
15,428.00	88.13	150.690	11,098.50	-4,201.50	728.87	14,443,098.496	1,717,851.578	39.769990446	-80.724419656	
15,521.00	88.04	150.690	11,101.61	-4,282.55	774.38	14,443,017.447	1,717,897.079	39.769767478	-80.724258613	
15,614.00	89.05	150.690	11,103.97	-4,363.62	819.89	14,442,936.380	1,717,942.591	39.769544461	-80.724097536	
15,707.00	89.45	150.780	11,105.18	-4,444.74	865.35	14,442,855.257	1,717,988.050	39.769321291	-80.723936646	
15,800.00	89.45	150.690	11,106.08	-4,525.87	910.81	14,442,774.131	1,718,033.510	39.769098111	-80.723775751	
15,893.00	89.32	150.870	11,107.07	-4,607.03	956.20	14,442,692.970	1,718,078.907	39.768874836	-80.723615086	
15,987.00	89.76	151.130	11,107.83	-4,689.24	1,001.77	14,442,610.759	1,718,124.477	39.768648676	-80.723453815	
16,080.00	89.67	151.220	11,108.29	-4,770.71	1,046.61	14,442,529.283	1,718,169.315	39.768424541	-80.723295143	
16,173.00	88.35	149.990	11,109.90	-4,851.73	1,092.25	14,442,448.272	1,718,214.953	39.768201675	-80.723133620	
16,266.00	88.40	149.990	11,112.54	-4,932.23	1,138.75	14,442,367.772	1,718,261.449	39.767980206	-80.722969042	
16,359.00	88.31	150.160	11,115.21	-5,012.79	1,185.12	14,442,287.204	1,718,307.824	39.767758551	-80.722804893	
16,452.00	88.26	149.640	11,117.99	-5,093.22	1,231.74	14,442,206.782	1,718,354.443	39.767537292	-80.722639874	
16,545.00	89.14	150.080	11,120.12	-5,174.49	1,278.93	14,442,125.512	1,718,401.629	39.767313703	-80.722472850	
16,639.00	89.76	150.250	11,121.01	-5,255.16	1,325.19	14,442,044.843	1,718,447.895	39.767091769	-80.722309096	
16,732.00	90.02	150.520	11,121.19	-5,336.01	1,371.15	14,441,963.992	1,718,493.852	39.766869340	-80.722146440	
16,825.00	90.07	150.600	11,121.12	-5,417.00	1,416.86	14,441,883.001	1,718,539.563	39.766646527	-80.721984667	
16,918.00	90.11	150.600	11,120.97	-5,498.02	1,462.51	14,441,801.979	1,718,585.216	39.766423628	-80.721823096	
17,011.00	90.37	150.340	11,120.58	-5,578.94	1,508.35	14,441,721.061	1,718,631.054	39.766201014	-80.721660872	
17,104.00	89.23	150.080	11,120.91	-5,659.65	1,554.55	14,441,640.352	1,718,677.257	39.765978973	-80.721497345	
17,197.00	88.57	150.690	11,122.69	-5,740.48	1,600.50	14,441,559.517	1,718,723.206	39.765756585	-80.721334726	
17,289.00	88.62	150.520	11,124.95	-5,820.61	1,645.65	14,441,479.386	1,718,768.348	39.765536137	-80.721174969	
17,382.00	89.01	150.340	11,126.87	-5,901.48	1,691.53	14,441,398.517	1,718,814.232	39.765313655	-80.721012582	
17,475.00	89.54	151.220	11,128.05	-5,982.64	1,736.93	14,441,317.358	1,718,859.627	39.765090384	-80.720851940	
17,568.00	89.41	150.080	11,128.90	-6,063.70	1,782.51	14,441,236.301	1,718,905.208	39.764867387	-80.720690638	
17,661.00	89.27	150.080	11,129.97	-6,144.30	1,828.89	14,441,155.701	1,718,951.592	39.764645641	-80.720526472	
17,754.00	88.57	149.200	11,131.73	-6,224.53	1,875.89	14,441,075.470	1,718,998.588	39.764424903	-80.720361026	
17,847.00	88.84	149.290	11,133.83	-6,304.43	1,923.43	14,440,995.570	1,719,046.133	39.764205068	-80.720191824	
17,939.00	89.58	149.200	11,135.10	-6,383.48	1,970.47	14,440,916.517	1,719,093.174	39.763987563	-80.720025306	
18,032.00	88.48	149.990	11,136.67	-6,463.68	2,017.53	14,440,836.321	1,719,140.234	39.763766918	-80.719858734	
18,125.00	89.01	149.720	11,138.71	-6,544.08	2,064.23	14,440,755.918	1,719,186.926	39.763545710	-80.719693475	
18,219.00	88.57	150.600	11,140.69	-6,625.60	2,110.99	14,440,674.400	1,719,233.688	39.763321437	-80.719527983	
18,311.00	89.32	151.310	11,142.39	-6,706.02	2,155.64	14,440,593.985	1,719,278.345	39.763100211	-80.719369967	
18,404.00	88.48	150.780	11,144.17	-6,787.38	2,200.66	14,440,512.626	1,719,323.360	39.762876390	-80.719210692	
18,498.00	87.56	150.870	11,147.42	-6,869.40	2,246.45	14,440,430.602	1,719,369.155	39.762650734	-80.719048648	
18,591.00	88.13	150.600	11,150.92	-6,950.47	2,291.88	14,440,349.530	1,719,414.585	39.762427696	-80.718887891	
18,684.00	88.57	150.870	11,153.60	-7,031.57	2,337.33	14,440,268.433	1,719,460.029	39.762204592	-80.718727088	
18,777.00	89.19	150.690	11,155.41	-7,112.72	2,382.72	14,440,187.284	1,719,505.419	39.761981341	-80.718566477	
18,870.00	89.71	150.780	11,156.31	-7,193.84	2,428.18	14,440,106.158	1,719,550.880	39.761758154	-80.718405617	
18,963.00	89.10	150.780	11,157.27	-7,275.01	2,473.58	14,440,024.997	1,719,596.277	39.761534872	-80.718244986	
19,056.00	88.82	149.720	11,159.12	-7,355.73	2,519.71	14,439,944.272	1,719,642.415	39.761312780	-80.718081713	
19,150.00	89.23	149.990	11,160.89	-7,437.00	2,566.91	14,439,862.999	1,719,689.612	39.761089176	-80.717914679	
19,243.00	88.04	148.760	11,163.10	-7,517.01	2,614.27	14,439,782.997	1,719,736.972	39.760869058	-80.717747050	
19,336.00	88.88	149.020	11,165.60	-7,596.60	2,662.31	14,439,703.402	1,719,785.006	39.760650053	-80.717577023	
19,429.00	89.41	148.930	11,166.99	-7,676.29	2,710.23	14,439,623.716	1,719,832.933	39.760430797	-80.717407374	
19,522.00	88.57	149.550	11,168.63	-7,756.19	2,757.79	14,439,543.813	1,719,880.490	39.760210951	-80.717239051	
19,615.00	89.36	150.870	11,170.31	-7,836.89	2,803.99	14,439,463.118	1,719,926.685	39.759988941	-80.717075580	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
19,708.00	88.09	149.720	11,172.38	-7,917.64	2,850.06	14,439,382.363	1,719,972.756	39.759766765	-80.716912552
19,802.00	88.92	149.900	11,174.83	-7,998.86	2,897.31	14,439,301.141	1,720,020.009	39.759543298	-80.716745326
19,895.00	89.23	150.160	11,176.33	-8,079.42	2,943.76	14,439,220.587	1,720,066.461	39.759321671	-80.716580945
19,990.00	89.49	149.640	11,177.39	-8,161.60	2,991.40	14,439,138.404	1,720,114.101	39.759095558	-80.716412353
20,084.00	88.26	149.990	11,179.24	-8,242.84	3,038.65	14,439,057.167	1,720,161.354	39.758872049	-80.716245132
20,177.00	88.92	149.110	11,181.53	-8,322.98	3,085.77	14,438,977.020	1,720,208.470	39.758651534	-80.716078385
20,270.00	89.49	148.670	11,182.82	-8,402.60	3,133.82	14,438,897.404	1,720,256.516	39.758432468	-80.715908322
20,363.00	88.84	149.290	11,184.17	-8,482.29	3,181.74	14,438,817.713	1,720,304.437	39.758213199	-80.715738709
20,456.00	89.36	148.930	11,185.63	-8,562.09	3,229.48	14,438,737.915	1,720,352.176	39.757993635	-80.715569744
20,549.00	88.79	150.870	11,187.13	-8,642.53	3,276.11	14,438,657.471	1,720,398.808	39.757772307	-80.715404727
20,643.00	87.82	152.010	11,189.91	-8,725.06	3,321.03	14,438,574.948	1,720,443.727	39.757545284	-80.715245832
20,736.00	88.04	151.830	11,193.27	-8,807.06	3,364.77	14,438,492.949	1,720,487.473	39.757319709	-80.715091101
20,829.00	88.48	151.390	11,196.10	-8,888.83	3,408.97	14,438,411.172	1,720,531.672	39.757094742	-80.714934762
20,922.00	87.56	151.130	11,199.31	-8,970.33	3,453.66	14,438,329.679	1,720,576.362	39.756870547	-80.714776670
21,015.00	88.35	150.960	11,202.63	-9,051.65	3,498.66	14,438,248.356	1,720,621.356	39.756646820	-80.714617495
21,107.00	88.75	151.040	11,204.96	-9,132.09	3,543.25	14,438,167.917	1,720,665.944	39.756425523	-80.714459757
21,200.00	89.45	150.340	11,206.42	-9,213.17	3,588.77	14,438,086.834	1,720,711.465	39.756202447	-80.714298710
21,293.00	89.98	149.810	11,206.88	-9,293.77	3,635.16	14,438,006.235	1,720,757.858	39.755980693	-80.714134551
21,386.00	88.66	149.200	11,207.98	-9,373.90	3,682.35	14,437,926.107	1,720,805.048	39.755760226	-80.713967557
21,479.00	89.27	149.200	11,209.66	-9,453.77	3,729.96	14,437,846.237	1,720,852.659	39.755540465	-80.713799057
21,572.00	89.89	148.580	11,210.35	-9,533.39	3,778.01	14,437,766.616	1,720,900.709	39.755321381	-80.713628998
21,665.00	89.19	149.550	11,211.09	-9,613.16	3,825.82	14,437,686.849	1,720,948.515	39.755101900	-80.713459811
21,757.00	89.71	149.460	11,211.98	-9,692.43	3,872.50	14,437,607.579	1,720,995.199	39.754883793	-80.713294608
21,850.00	89.36	150.870	11,212.73	-9,773.10	3,918.77	14,437,526.910	1,721,041.464	39.754661847	-80.713130914
21,943.00	88.44	152.270	11,214.52	-9,854.86	3,963.03	14,437,445.145	1,721,085.730	39.754436906	-80.712974346
22,036.00	88.09	151.130	11,217.33	-9,936.71	4,007.10	14,437,363.299	1,721,129.799	39.754211748	-80.712818480
22,130.00	88.53	150.520	11,220.10	-10,018.75	4,052.90	14,437,281.261	1,721,175.602	39.753986045	-80.712656450
22,224.00	88.79	150.250	11,222.30	-10,100.44	4,099.34	14,437,199.563	1,721,222.041	39.753761272	-80.712492153
22,316.00	89.14	149.720	11,223.96	-10,180.09	4,145.36	14,437,119.915	1,721,268.054	39.753542129	-80.712329349
22,409.00	89.76	149.020	11,224.86	-10,260.11	4,192.74	14,437,039.895	1,721,315.434	39.753321956	-80.712161687
22,503.00	88.75	149.640	11,226.08	-10,340.96	4,240.88	14,436,959.052	1,721,363.378	39.753099516	-80.711992029
22,597.00	89.23	149.110	11,227.74	-10,421.83	4,288.56	14,436,878.177	1,721,411.255	39.752876986	-80.711822609
22,690.00	89.89	148.410	11,228.45	-10,501.34	4,336.79	14,436,798.665	1,721,459.485	39.752658199	-80.711651920
22,784.00	89.05	149.020	11,229.32	-10,581.67	4,385.60	14,436,718.338	1,721,508.296	39.752437167	-80.711479175
22,877.00	89.63	148.490	11,230.39	-10,661.18	4,433.83	14,436,638.833	1,721,556.531	39.752218398	-80.711308469
22,970.00	88.40	149.460	11,231.99	-10,740.86	4,481.76	14,436,559.152	1,721,604.456	39.751999147	-80.711138871
23,064.00	88.97	148.670	11,234.15	-10,821.46	4,530.07	14,436,478.546	1,721,652.765	39.751777352	-80.710967918
23,158.00	88.48	149.990	11,236.24	-10,902.29	4,578.00	14,436,397.717	1,721,700.700	39.751554949	-80.710798297
23,252.00	88.53	150.340	11,238.69	-10,983.81	4,624.75	14,436,316.203	1,721,747.450	39.751330676	-80.710632906
23,345.00	89.49	150.780	11,240.30	-11,064.78	4,670.46	14,436,235.226	1,721,793.153	39.751107884	-80.710471232
23,438.00	90.15	150.340	11,240.59	-11,145.77	4,716.17	14,436,154.236	1,721,838.863	39.750885058	-80.710309535
23,531.00	89.49	151.310	11,240.88	-11,226.97	4,761.50	14,436,073.036	1,721,884.197	39.750661658	-80.710149177
23,625.00	90.20	150.870	11,241.14	-11,309.26	4,806.94	14,435,990.752	1,721,929.639	39.750435279	-80.709988448
23,719.00	88.97	151.390	11,241.82	-11,391.57	4,852.33	14,435,908.439	1,721,975.023	39.750208820	-80.709827932
23,812.00	88.09	151.220	11,244.20	-11,473.12	4,896.97	14,435,826.888	1,722,019.661	39.749984462	-80.709670057
23,905.00	88.70	150.870	11,246.81	-11,554.47	4,941.97	14,435,745.546	1,722,064.666	39.749760673	-80.709510876
23,999.00	89.36	151.750	11,248.40	-11,636.91	4,987.09	14,435,663.099	1,722,109.786	39.749533850	-80.709351303
24,093.00	88.09	150.690	11,250.49	-11,719.28	5,032.33	14,435,580.734	1,722,155.029	39.749307249	-80.709191290
24,187.00	88.31	150.080	11,253.44	-11,800.96	5,078.76	14,435,499.054	1,722,201.457	39.749082521	-80.709027051
24,282.00	88.75	149.810	11,255.88	-11,883.16	5,126.33	14,435,416.855	1,722,249.020	39.748856355	-80.708858784
24,375.00	88.92	148.930	11,257.77	-11,963.16	5,173.70	14,435,336.849	1,722,296.393	39.748636211	-80.708691171
24,467.00	88.88	148.410	11,259.54	-12,041.73	5,221.53	14,435,258.278	1,722,344.221	39.748420009	-80.708521922
24,561.00	88.48	149.110	11,261.70	-12,122.08	5,270.26	14,435,177.930	1,722,392.958	39.748198915	-80.708349460
24,654.00	89.54	150.080	11,263.31	-12,202.28	5,317.32	14,435,097.735	1,722,440.018	39.747978255	-80.708182965



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Van Winkle S-21 HU (slot B)
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 S-21 HU (slot B)	North Reference:	Grid
Wellbore:	Sidetrack 03	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 03	Database:	DB_Decv0422v16

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
24,747.00	89.71	149.900	11,263.92	-12,282.81	5,363.84	14,435,017.204	1,722,486.530	39.747756681	-80.708018420
24,841.00	88.84	149.720	11,265.11	-12,364.05	5,411.10	14,434,935.962	1,722,533.796	39.747533143	-80.707851207
24,934.00	88.00	150.080	11,267.67	-12,444.48	5,457.72	14,434,855.534	1,722,580.418	39.747311849	-80.707686274
25,028.00	88.35	150.250	11,270.67	-12,525.98	5,504.47	14,434,774.035	1,722,627.159	39.747087609	-80.707520931
25,122.00	88.75	149.460	11,273.04	-12,607.24	5,551.66	14,434,692.775	1,722,674.350	39.746864023	-80.707353989
25,216.00	89.19	148.930	11,274.73	-12,687.96	5,599.79	14,434,612.050	1,722,722.481	39.746641900	-80.707183696
25,309.00	88.92	149.200	11,276.27	-12,767.72	5,647.59	14,434,532.291	1,722,770.282	39.746422429	-80.707014564
25,409.00	87.25	148.580	11,279.61	-12,853.29	5,699.23	14,434,446.724	1,722,821.919	39.746186976	-80.706831856
25,502.00	87.47	148.670	11,283.89	-12,932.61	5,747.59	14,434,367.407	1,722,870.287	39.745968715	-80.706660707
25,597.00	87.65	148.230	11,287.94	-13,013.49	5,797.26	14,434,286.524	1,722,919.950	39.745746139	-80.706484970
25,688.00	87.30	147.790	11,291.95	-13,090.60	5,845.42	14,434,209.418	1,722,968.112	39.745533953	-80.706314529
25,781.00	87.25	147.700	11,296.37	-13,169.16	5,894.99	14,434,130.859	1,723,017.688	39.745317761	-80.706139073
25,873.00	86.90	147.440	11,301.06	-13,246.71	5,944.27	14,434,053.308	1,723,066.961	39.745104341	-80.705964690
25,967.00	86.86	147.090	11,306.18	-13,325.66	5,995.02	14,433,974.355	1,723,117.716	39.744887055	-80.705785048
26,059.00	86.73	147.180	11,311.32	-13,402.82	6,044.87	14,433,897.200	1,723,167.563	39.744674718	-80.705608619
26,114.00	86.77	147.180	11,314.44	-13,448.96	6,074.63	14,433,851.054	1,723,197.325	39.744547719	-80.705503279
Survey @ 26114.00 MD 11314.44 TVD ST3									
26,173.00	86.77	147.180	11,317.76	-13,498.47	6,106.56	14,433,801.550	1,723,229.252	39.744411480	-80.705390277
Survey Proj. to 26173.00 MD 11317.76 TVD ST3									

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
11,237.00	10,962.21	-561.77	-1,307.97	Tie into sidetrack 02 @ 11237 MD
26,114.00	11,314.44	-13,448.96	6,074.63	Survey @ 26114.00 MD 11314.44 TVD ST3
26,173.00	11,317.76	-13,498.47	6,106.56	Survey Proj. to 26173.00 MD 11317.76 TVD ST3

Checked By: _____ Approved By: _____ Date: _____