





Company: Project:

Tug Hill Operating LLC

Wetzel County, West Virginia (UTM17 NAD83)

Site:

Lackawanna

Well: Wellbore: Lackawanna 3H (slot Z) Sidetrack 01 Lateral

Design:

Surveys Sidetrack 01 Lateral

Local Co-ordinate Reference:

TVD Reference:

MD Reference:

North Reference: Survey Calculation Method:

Database:

Well Lackawanna 3H (slot Z)

RKB=1306+18 @ 1324.00ft (Precision 528)

RKB=1306+18 @ 1324.00ft (Precision 528)

Minimum Curvature

DB_Jul2216dt v14 lt

RECEIVED Office of Oil and Gas

Project Wetzel County, West Virginia (UTM17 NAD83)

Map System:

Universal Transverse Mercator (US Survey Feet)

System Datum:

Mean Sea Level

SEP 3 0 2022

Geo Datum: Map Zone:

NAD83 West Virginia - HARN Zone 17N (84 W to 78 W)

WV Department of Environmental Protection

Site

From:

Lackawanna

Site Position:

Lat/Long

Northing: Easting:

14,383,374.84 usft 1.680,777.71 usft

Latitude:

Longitude:

39.60620769

Position Uncertainty:

0.00 ft Slot Radius:

13-3/16 "

Grid Convergence:

-80.85669942 0.091 °

Well Well Position Lackawanna 3H (slot Z)

+N/-S +E/-W

Northing: Easting:

14,383,334.89 usft 1,680,775.97 usft

Latitude:

Longitude:

39.60609798 -80.85670585

Position Uncertainty

0.00 ft

0,00 ft

0.00 ft

Wellhead Elevation:

ft

Ground Level:

66.745

1,306.00 ft

Wellbore

Sidetrack 01 Lateral

Magnetics

Model Name

Sample Date

Declination (°)

Dip Angle (°)

Field Strength (nT)

51,973.52146553

Design

Surveys Sidetrack 01 Lateral

IGRF2015

Audit Notes:

Version:

1.0

Phase:

ACTUAL

Tie On Depth:

2.873.00

Vertical Section:

Depth From (TVD)

+N/-S

+E/-W (ft)

Direction

(°)

Survey Program

0.00

7/16/2018

(ft) 0.00

-8.584

0.00

329.70

From (ft) 100.00

2,945.00

17,622.00

To (ft) Survey (Wellbore)

Date

2,873.00 Gyro 0-2873 MD (Original Hole) 17,571.00 MWD ST1 (Sidetrack 01 Lateral)

8/5/2019

17,622.00 Projection (Sidetrack 01 Lateral)

Tool Name NS-GYRO-MS

MWD

MWD

Description

North sensing gyrocompassing m/s MWD - Standard 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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.13	125.55	100.00	-0.07	0.09	-0,10	0.13	0.13	0.00
200.00	0.28	254.80	200.00	-0.20	-0.05	-0.14	0.38	0.15	129.25
300.00	0.27	272.55	300.00	-0,25	-0.52	0.05	0.09	-0.01	17.75
400.00	0.29	242.80	400.00	-0.35	-0.98	0.19	0.15	0.02	-29.75
500.00	0.29	260.92	500,00	-0.51	-1.46	0.29	0.09	0,00	18.12
600.00	0.10	257.77	600.00	-0.57	-1.79	0.41	0.19	-0.19	-3.15
700.00	0.29	214.14	699.99	-0.80	-2.02	0.33	0,23	0.19	-43.63
800.00	0.09	196.78	799.99	-1.08	-2.19	0.17	0.21	~0.20	-17 36





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RKB=1306+18 @ 1324.00ft (Precision 528)

RKB=1306+18 @ 1324.00ft (Precision 528)

Grid

ellbore:	Side	etrack 01 Lateral			Survey Ca	lculation Meth	od:	Minimum Curvature RECEIVED			
esign:	Sur	veys Sidetrack 0	1 Lateral		Database:			DB_Jul2216dt_v	14 lt Offic	RECEIVED e of Oil and Gas	
ırvey									SE	P 3 0 2022	
Measu	rod			Vertical							
Depti (ft)	th	Inclination (°)	Azimuth (°)	Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build WV Ratenviror (°/100ft)	Department of nmeritaleProtection (°/100ft)	
90	00.00	0.05	217.92	899.99	-1.19	-2.23	0.10	0.05	-0.04	21.14	
1.00	00.00	0.14	317.24	999.99	1 1 4	0.04	0.00	0.40			
	00.00	0.12	198.00	1,099.99	-1.14 -1.15	-2.34 -2.46	0.20	0.16	0.09	99.32	
	00.00	0.07	275.01	1,199.99	-1.13	-2.46 -2.55	0.25 0.22	0.22	-0.02	-119.24	
-	00.00	0.15	243.10	1,299.99	-1.29	-2.33 -2.73	0.22	0.12	-0.05	77.01	
	00.00	0.66	211,41	1,399.99	-1.84	-2.73 -3.15	0.00	0.10	0.08	-31.91	
•				1,000.00	-1.04	-5.15	0.00	0.54	0.51	-31.69	
1,50	00.00	1.13	202.75	1,499.98	-3.25	-3.83	-0.87	0.49	0.47	-8.66	
1,60	00.00	1.24	213.34	1,599.96	-5.06	-4.80	-1.94	0.24	0.11	10.59	
1,70	00.00	1.77	207.09	1,699.92	-7.34	-6.10	-3.26	0.55	0.53	-6.25	
1,80	00.00	1.48	206.59	1,799.88	-9.87	-7.38	-4.79	0.29	-0.29	-0.50	
1,90	00.00	2.18	212.39	1,899.83	-12.63	-8.98	-6.37	0.72	0.70	-0.50 5.80	
							,	41,2	0.70	3.60	
	00.00	2.02	204.51	1,999.76	-15.84	-10.73	-8.26	0.33	-0,16	-7.88	
-	00.00	2.38	207.56	2,099.69	-19.28	-12.42	-10.38	0.38	0.36	3.05	
	00.00	3.13	185.87	2,199.58	-23.84	-13.66	-13.69	1.27	0,75	-21.69	
2,30	00.00	4.12	183.78	2,299.37	-30.14	-14.18	-18.87	1.00	0.99	-2.09	
2,40	00.00	4.74	182.51	2,399.08	-37.85	-14.60	-25.32	0.63	0.62	-1.27	
2.50	00.00	4.79	180.97	2,498.73	-46.15	44.05	20.00				
	00.00	4.28	186.50	2,598.42	-54.04	-14.85	-32.36	0.14	0.05	-1.54	
	00.00	3.73	199.00	2,698.17		-15.34	-38.91	0.67	-0.51	5.53	
	00.00	3.08	176.21	2,798.00	-60.82	-16.82	-44.02	1.03	-0.55	12.50	
	73.00	3.13	182.33	2,790.00	-66.58	-17.70	-48.55	1.49	-0.65	-22.79	
-		nal hole @ 2873		2,010.09	-70.52	-17.66	-51.98	0.46	0.07	8.38	
	45.00	2.49	188.12	2,942.81	-74.04	-17.96	-54.86	0.97	-0.89	8.04	
	77.00	2.48	185.99	2,974.78	-75.41	-18.13	-55.97	0.29	-0.03	-6.66	
	34.00	3.80	165.18	3,031.69	-78.47	-17.77	-58.78	3.02	2.32	-36.51	
	72.00	4.54	161.50	3,069.59	-81.11	-16.97	-61.47	2.07	1.95	-9.68	
3,16	67.00	8.96	151.21	3,163,91	-91.16	-12.21	-72.55	4.81	4.65	-10.83	
3,26	50.00	11.16	148.36	3,255,48	-105.17	-4.00	-88.79	2.42	2.37	2.00	
3,35	55.00	12.91	146,11	3,348.39	-121.81	6.74	-108.57	1.91		-3.06	
3,45	50.00	15.36	148.32	3,440.50	-141.33	19.26	-131.75	2.64	1.84	-2.37	
3,54	45.00	18.47	152.90	3,531.39	-165.44	32.73	-159.36	3.56	2.58 3.27	2.33	
3,63	36.00	21.46	152.23	3,616.91	-193.01	47.06	-190.39	3.30	3.27	4.82 -0.74	
270	30.00	00 55	450.40	0.700						5.74	
		23.55	150.46	3,703.75	-224.57	64.33	-226.35	2.34	2.22	-1.88	
	25.00	26.21	149.52	3,789.92	-259.16	84.33	-266.31	2.83	2.80	-0.99	
	19.00	28.22	150,53	3,873.51	-296.41	105.80	-309.29	2.19	2.14	1.07	
	13.00	27.97	149.31	3,956.44	-334.71	127.98	-353.56	0.67	-0.27	-1.30	
4,10	08.00	27,77	149.71	4,040.42	-372.98	150.51	-397.97	0.29	-0.21	0.42	
	00.60	27.64	149.72	4,124.53	-411.12	172.79	-442.13	0.14	-0.14	0.01	
	98.00	27,73	148.43	4,208.65	-448.98	195.47	-486.27	0.64	0.09	-1.36	
4,39	91.00	27.23	147.06	4,291.16	-485.27	218.37	-529.15	0.87	-0.54	-1.47	
4,48	36.00	26.74	147.99	4,375.82	-521.64	241.51	-572.23	0.68	-0.52	0.98	
4,58	30.00	26.70	146.92	4,459.78	-557.26	264.25	-614.46	0.51	-0.04	-1.14	
4 67	75.00	25.64	149.37	4 545 04	500.00	200.07	650.00				
7,07	3.00	23.04	149.57	4,545.04	-592.83	286.37	-656.33	1.59	-1.12	2.58	





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Surveys Sidetrack 01 Lateral

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RKB=1306+18 @ 1324.00ft (Precision 528)

RKB=1306+18 @ 1324.00ft (Precision 528)
Grid RECEIVED
Office of Oil and Gas

Minimum Curvature

DB_Jul2216dt_v14 lt

SEP 3 0 2022

y								_ WV De	partment of
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Environme Build Rate (°/100ft)	ntal Protection Turn Rate (°/100ft)
4,770.00		147.51	4,630.73	-627.78	307.84	-697.34	0.85	-0.13	-1.96
4,865.00	0 25.72	147.62	4,716.39	-662.45	329.87	-738,39	0.22	0.21	0.12
4,960.00	0 26.72	147.68	4,801.61	-697.91	352.33	-780.33	1.05	1.05	0.06
5,055.00	0 27.12	149.47	4,886.32	-734.61	374.75	-823,33	0.95	0.42	1.88
5,149.00	0 27.11	149.47	4,969.99	-771.51	396.51	-866.17	0.01	-0.01	0.00
5,244.00	0 27.14	151.73	5,054.54	-809.24	417.77	-909.47	1.09	0.03	2.38
5,337.00	0 27.38	150.92	5,137.22	-846.61	438.21	-952.05	0.48	0.03	
5,432.00	0 28.09	149.91	5,221.30	-885.06	460.04	-996.26	0.90		-0.87
5,527.00		149.15	5,305.40	-923.14	482.44	-1,040.44	0.87	0.75 -0.79	-1.06 -0.80
5,621.00	26,28	147.80	5,389.30	-959.28	504.60	-1,082.82	1.30	-1,13	-1.44
5,717.00	25.72	150,49	5,475.58	-995.39	526.19	-1,124.90	1.36	-0.58	2.80
5,812.00	26.60	149,66	5,560.85	-1,031,69	547.08	-1,166.78	1.00	0.93	-0.87
5,906.00	27.18	148.12	5,644.69	-1,068.08	569.05	-1,209.28			
5,943.00		148.04	5,677.63	-1,082,39	577.97		0.96	0.62	-1.64
0,0000	21.00	140,04	5,077.05	-1,002,35	5//,9/	-1,226.13	0.42	-0.41	-0.22
6,038.00		147.86	5,764.40	-1,115.07	598.42	-1,264.67	6.47	-6.47	-0.19
6,133.00		152.70	5,854.71	-1,140.47	613.14	-1,294.02	6.22	-6.02	5.09
6,228.00		148.74	5,947.72	-1,157.15	622.26	-1,313.03	7.62	-7.58	-4.17
6,322.00	2.55	182.14	6,041.31	-1,164.81	625.56	-1,321.31	6.38	-5.76	35.53
6,417.00	5.10	310.02	6,136.19	-1,164.21	622.25	-1,319.11	7.33	2.68	134.61
6,513.00		327.25	6,231.28	-1,154.09	614.23	-1,306.34	6.08	5.64	17.95
6,607.00	15.16	336.74	6,322.91	-1,135.58	604.74	-1,285.56	5.42	4.95	10.10
6,702.00	22.90	334.02	6,412.65	-1,107.51	591.71	-1,254.75	8.20	8.15	-2.86
6,797.00	32.13	331.12	6,496.82	-1,068.69	571.37	-1,210.97	9.81	9.72	-3.05
6,892.00	9 42.42	330.32	6,572.31	-1,018.59	543.23	-1,153.52	10.84	10.83	-0.84
6,987.00	53.36	330.85	6,635.92	-957,28	508.69	-1,083.16	11.52	11.52	0,56
7,082.00	66.02	329.97	6,683,77	-886.13	468.24	-1,001.32	13.35	13.33	-0.93
7,178.00	72.35	328.92	6,717.87	-808.90	422.63	-911,63	6.67	6.59	
7,273.00	81.32	329,18	6,739,48	-729.65	375,11	-819,23	9.45	9.44	-1.09 0.27
7,368.00	84.22	329.53	6,751.44	-648.58	327.08	-725.00	3.07	3.05	0.27
7,461.00	93.63	328.04	6,753.18	-569.15	278.94	-632.13	10.24	10.12	-1,60
7,529.00	92.40	328.65	6,749.60	-511.35	243.31	-564.25	2.02	-1.81	0.90
7,556.00	92.48	328.74	6,748.45	-488.30	229.29	-537.28	0.45	0.30	
7,651.00		325.40	6,746.74	-408.59	177.67	-442.42	4.66		0.33
7,747.00		328.92	6,748.85	-327.97	125.63	-346.55	4.06	-3.05 -1.74	-3.52 3.67
7,842.00	88.00	329.36	6,752.24	-246.47	76.93	-251.62	0.47	0.09	0.46
7,937.00	89.54	329,80	6,754.28	-164.57	28.84	-156.64	1.69	1,62	
8,032.00		329.53	6,754.78	-82.58	-19.14	-61.64			0.46
8,127.00		329,53	6,754.30	-02.30	-19.14 -67.31		0.43	0.33	-0.28
8,222.00		329.62	6,752.62	81.20	-67.31 -115.41	33.35	0.93	0.93	0.00
					-115,41	128.34	0.61	0.60	0.09
8,317.00		330.50	6,752.03	163,52	-162.82	223,33	2.19	-1,99	0.93
8,410.00		329.88	6,752.99	244.21	-209.05	316.32	0.67	0.00	-0.67
8,505.00		329.71	6,753.57	326.31	-256.84	411.32	0.54	0.51	-0.18
8,599.00		330.32	6,753.36	407.73	-303.82	505.31	0.83	0.51	0.65
8,694.00	91.08	330.15	6,752.15	490.18	-350,98	600.30	0.77	0.75	-0.18





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,								SEP	3 0 2022
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	WV De EWifonme Rate (°/100ft)	partment of ntal Protection Rate (°/100ft)
8,788.00	88.92	330.68	6,752.15	571.92	-397.39	694.29	2.37	-2.30	0.56
8,883.00	89.14	330.32	6,753.76	654.60	-444.16	789.27	0.44	0.23	-0.38
8,977.00	90.07	330.06	6,754.41	736.16	-490.89	883.26	1.03	0.99	-0.28
9,072.00	90.95	330.32	6,753.56	818.58	-538,11	978.25	0.97	0.93	0.27
9,168.00	89.71	330.76	6,753.01	902.16	-585.32	1,074.24	1.37	-1.29	0.46
9,263.00	90.33	330.94	6,752.98	985.13	-631.60	1,169.22	0.68	0.65	0.19
9,358.00	91.25	331.03	6,751.67	1,068.20	-677.67	1,264.18	0.97	0.97	
9,453.00	92.00	331.21	6,748.97	1,151.35	-723.54	1,359.12	0.81		0.09
9,548.00	90.77	330.32	6,746.68	1,234.22	-769.92	1,454.07		0.79	0.19
9,643.00	87.74	330.32	6,747.91	1,316.74	-816.95	1,549.04	1.60 3.19	-1.29 -3.19	-0.94 0.00
9,738.00	87.56	330.24	675404	4 200 40	004.04				
9,832.00	88.44	330.24	6,751.81	1,399.18	-864.01	1,643.96	0.21	-0.19	-0.08
9,926.00	89.01		6,755.09	1,480.80	-910.52	1,737.90	0.95	0.94	0.18
, ,		330.68	6,757.18	1,562.63	-956.73	1,831.86	0.67	0.61	0.29
10,021.00	89.71	331.12	6,758.24	1,645.63	-1,002.93	1,926.83	0.87	0.74	0.46
10,115.00	90.37	331.03	6,758.18	1,727.90	-1,048.39	2,020.81	0.71	0.70	-0.10
10,211.00	90.73	331,29	6,757.25	1,811.99	-1,094.69	2,116.77	0.46	0.38	0.27
10,306.00	90.95	330.41	6,755.86	1,894.95	-1,140.96	2,211.74	0.95	0.23	-0.93
10,399.00	91.60	330.59	6,753.79	1,975.87	-1,186.75	2,304.71	0.73	0.70	0.19
10,494.00	88.44	330.41	6,753.76	2,058.55	-1,233.52	2,399.69	3.33	-3.33	-0.19
10,589.00	89.14	330,24	6,755.77	2,141.07	-1,280.54	2,494.66	0.76	0.74	-0.19
10,684.00	89.45	328.48	6,756.93	2,222.80	-1,328.95	2,589.65	1.88	0.22	4.05
10,779.00	91.47	331,20	6,756.17	2,304.92	-1,376.68	2,684.63		0.33	-1.85
10,874.00	91.16	329.88	6,753.99	2,387.61	-1,423.38		3.57	2.13	2.86
10,969.00	91.43	326.54	6,751.84	2,468.33	-1,423.36	2,779.59	1.43	-0.33	-1.39
11,064.00	92.18	325.93	6,748.85	2,547.26	-1,473.41	2,874.52 2,969.30	3.53 1.02	0.28 0.79	-3.52 -0.64
11,159.00	92.88	220.00	0.744.00						5.51
11,253.00		329.09	6,744.66	2,627.31	-1,577.16	3,064.12	3.40	0.74	3.33
	93.45	329.09	6,739.47	2,707.83	-1,625.37	3,157.98	0.61	0.61	0.00
11,348.00	91.12	329.53	6,735.68	2,789.46	-1,673.82	3,252.89	2.50	-2.45	0.46
11,443.00	91.74	329.36	6,733.31	2,871.24	-1,722.10	3,347.86	0.68	0.65	-0.18
11,538.00	90.59	330.32	6,731.38	2,953.36	-1,769.81	3,442.84	1.58	-1.21	1.01
11,633.00	91.38	330.85	6,729.74	3,036.10	-1,816.46	3,537.81	1.00	0.83	0.56
11,727.00	92.09	331.55	6,726,90	3,118.43	-1,861.73	3,631.73	1.06	0.76	0.74
11,822.00	89.76	331.03	6,725.36	3,201.74	-1,907.35	3,726.68	2.51	-2.45	-0.55
11,917.00	89.98	331,29	6,725.58	3,284.95	-1,953,18	3,821.65	0.36	0.23	0.27
12,012.00	90.37	330.85	6,725.29	3,368.10	-1,999.13	3,916.62	0.62	0.41	-0.46
12,106.00	90.90	331.38	6,724.25	3,450.40	-2,044.54	4,010.58	0.80	0.56	0.50
12,201.00	91.82	331.91	6,721.99	3,533.98	-2,089.64	4,105.50			0.56
12,296.00	90.42	330.94	6,720.14	3,617.39	-2,135.07	4,200.44	1.12	0.97	0.56
12,390.00	90.73	330.15	6,719.19	3,699.23	-2,133.07	4,200.44	1.79	-1.47	-1.02
12,485.00	91.34	329.53	6,717.48	3,781.36	-2,101.29	4,389.40	0.90 0.92	0.33	-0.84
			-,	-,,,,,,,	-,-£0.01	7,000,40	0.32	0.64	-0.65
12,578.00	91.52	329.27	6,715.16	3,861.38	-2,276.34	4,482.37	0.34	0.19	-0.28
12,673.00	92.22	329.53	6,712.06	3,943.11	-2,324.67	4,577.32	0.79	0.74	0.27
12,767.00	90.20	329.18	6,710.07	4,023.96	-2,372.57	4,671.29	2.18	-2.15	-0.37





Company:

Tug Hill Operating LLC

Project:

Wetzel County, West Virginia (UTM17 NAD83)

Site:

Lackawanna

Well:

Lackawanna 3H (slot Z)

Wellbore:

Sidetrack 01 Lateral

Design:

Surveys Sidetrack 01 Lateral

Local Co-ordinate Reference:

TVD Reference:

MD Reference:

North Reference:

Survey Calculation Method:

Database:

Well Lackawanna 3H (slot Z)

RKB=1306+18 @ 1324.00ft (Precision 528)

RKB=1306+18 @ 1324.00ft (Precision 528)

Grid RECEIVED
Minimum Curvature Office of Oil and Gas

у												
Measured Depth (ft)	Inclination (°)	Azimuth	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	WV Dep Environmer Rate (°/100ft)	partment of ntal Protection Rate (°/100ft)			
12,861.00	90.51	329.62	6,709.49	4,104.86	-2,420.42	4,765.29	0.57	0.33	0.47			
12,956.00	91.38	329,45	6,707.92	4,186.74	-2,468.58	4,860.28	0.93	0.92	-0.18			
13,051.00	91.78	329.27	6,705.30	4,268.44	-2,516.98	4,955.24	0.46	0.42	-0.19			
13,146.00	91.03	329.88	6,702.97	4,350.33	-2,565.07	5,050.21	1.02	-0.79	0.64			
13,241.00	91.12	328.74	6,701.19	4,432.01	-2,613.55	5,145.19	1.20	0.09	-1.20			
13,336.00	91,03	328,30	6,699.41	4,513.02	-2,663.15	5,240.15	0.47	-0.09	-0.46			
13,430.00	90.73	328.30	6,697.96	4,592.98	-2,712.54	5,334.11	0.32	-0.32	0.00			
13,525.00	90.81	328.48	6,696.69	4,673.88	-2,762.33	5,429.08	0.21	0.08	0.19			
13,620.00	90.81	329.09	6,695.35	4,755.12	-2,811.56	5,524.06	0.64	0.00	0.19			
13,714.00	90.64	329.36	6,694.16	4,835.88	-2,859.65	5,618.04	0.34	-0.18	0.29			
13,809.00	91.21	329.80	6,692.62	4,917.79	-2,907.74	5,713.03	0.76	0.60	0.46			
13,903.00	91.08	330,32	6,690.74	4,999.22	-2,954.65	5,807.01	0.57	-0.14	0.55			
13,999.00	91.03	329.97	6,688.98	5,082.47	-3,002.43	5,902.99	0.37	-0.05	-0.36			
14,093.00	91.08	328.13	6,687.25	5,163.07	-3,050.76	5,996.97	1.96	0.05	-1.96			
14,188.00	91.43	328.04	6,685.16	5,243.69	-3,100.97	6,091.90	0.38	0.37	-0.09			
14,282.00	90.55	328.65	6,683.54	5,323.69	-3,150.30	6,185.86	1.14	-0.94	0.65			
14,377.00	91.30	328.39	6,682.01	5,404.70	-3,199.90	6,280.83	0.84	0.79	-0.27			
14,472.00	90.37	329.45	6,680.62	5,486.05	-3,248.94	6,375.81	1.48	-0.98	1.12			
14,567.00	89.41	330.41	6,680.80	5,568.26	-3,296.53	6,470.81	1.43	-1.01	1.01			
14,662.00	89.76	330.41	6,681.49	5,650.87	-3,343.44	6,565,80	0.37	0.37	0.00			
14,757.00	90.15	330.59	6,681.57	5,733.55	-3,390.22	6,660.79	0.45	0.41	0.19			
14,852.00	90.90	330.85	6,680.70	5,816.41	-3,436.68	6,755.77	0.84	0.79	0.27			
14,947.00	91.47	330.76	6,678.73	5,899.33	-3,483.01	6,850.73	0.61	0.60	-0.09			
15,041.00	91.96	331.12	6,675.92	5,981.45	-3,528.65	6,944.66	0.65	0.52	0.38			
15,137.00	90.46	330.76	6,673.89	6,065.35	-3,575.27	7,040.62	1.61	-1.56	-0.38			
15,231.00	90.37	330.94	6,673.21	6,147.44	-3,621.05	7,134.59	0.21	-0.10	0.19			
15,325.00	90.77	331.38	6,672.28	6,229.78	-3,666.39	7,228.56	0.63	0.43	0.47			
15,419.00	90.99	331.64	6,670.83	6,312.38	-3,711.23	7,322.50	0.36	0.23	0.28			
15,514.00	91.34	332.61	6,668.90	6,396.34	-3,755.63	7,417.40	1.09	0.37	1.02			
15,608.00	91.52	332.26	6,666.55	6,479.65	-3,799.12	7,511.26	0.42	0.19	-0.37			
15,703.00	89.41	331.47	6,665.78	6,563.41	-3,843.91	7,606.18	2.37	-2.22	-0.83			
15,797.00	89.67	331.64	6,666.54	6,646.06	-3,888.68	7,700.13	0.33	0.28	0.18			
15,892.00	90.24	331.99	6,666.61	6,729.80	-3,933.55	7,795.06	0.70	0.60	0.37			
15,987.00	90.55	332,35	6,665.96	6,813,81	-3,977.90	7,889.97	0.50	0.33	0.38			
16,081.00	90.51	332.26	6,665.09	6,897.03	-4,021.59	7,983.87	0.10	-0.04	-0.10			
16,175.00	92,53	330.50	6,662.60	6,979.51	-4,066.60	8,077.79	2.85	2.15	-1.87			
16,269.00	93.01	330.24	6,658.05	7,061.13	-4,113.01	8,171.67	0.58	0.51	-0.28			
16,364.00	93,76	330.24	6,652.44	7,143.45	-4,160.09	8,266.50	0.79	0.79	0.00			
16,460.00	92.75	329.62	6,646.99	7,226.40	-4,208.11	8,362.35	1.23	-1.05	-0.65			
16,554.00	91.12	329,45	6,643.82	7,307.37	-4,255.74	8,456.29	1.74	-1.73	-0.18			
16,649.00	89.41	328.65	6,643.38	7,388.84	-4,304.60	8,551.28	1.99	-1.80	-0.84			
16,745.00	89.98	328.65	6,643.89	7,470.82	-4,354.54	8,647.26	0.59	0.59	0.00			
16,841.00	90.42	328.83	6,643.56	7,552.88	-4,404.36	8,743.24	0.50	0.46	0.19			





Company: Project:

Tug Hill Operating LLC

Wetzel County, West Virginia (UTM17 NAD83)

Site:

Lackawanna

Well: Wellbore: Lackawanna 3H (slot Z)

Sidetrack 01 Lateral

Design:

Surveys Sidetrack 01 Lateral

Local Co-ordinate Reference:

TVD Reference:

MD Reference:

North Reference:

Survey Calculation Method:

Database:

Well Lackawanna 3H (slot Z)

RKB=1306+18 @ 1324.00ft (Precision 528)

RKB=1306+18 @ 1324.00ft (Precision 528)

Grid

Minimum Curvature RECEIVED DB_Jul2216dt vaffice of Oil and Gas

Survey SEP 3 0 2022 Measured Vertical WAUDepartmention Environmental Protection Vertical Dogleg Depth Inclination Depth **Azimuth** +N/-S +E/-W Section Rate (ft) (ft) (°) (°) (ft) (ft) (ft) (°/100ft) (°/100ft) (°/100ft) 16,935.00 90.90 328.74 6.642.47 7,633.27 -4,453.07 8,837.23 0.52 0.51 -0.10 17,030,00 90.51 328.74 6.641.30 7,714,47 -4,502.36 8,932,21 0.41 -0.41 0.00 17,124.00 93.01 329.71 6,638.42 7,795.19 -4,550.43 9,026.15 2.85 2.66 1.03 17,219.00 92.92 329.71 6,633.50 7,877.11 -4,598.28 9,121,02 0.09 -0.09 0.00 17.314.00 93.54 329.88 6,628.15 7,959.08 -4.646.00 9,215.87 0.68 0.65 0.18 17,409,00 94.20 330.24 6,621.74 8,041,21 -4.693.31 9,310.65 0.79 0.69 0.38 17.504.00 94.51 329.71 6,614.52 8,123,23 -4,740.71 9,405.38 0.64 0.33 -0.56 17,571.00 95.43 329,62 6,608.72 8,180,84 -4,774.42 9,472.12 1.38 1.37 -0.13 Survey @ 17571.00 MD 6608.72 TVD 17,622.00 95,43 329.62 6.603.89 8.224.64 -4,800.09 9,522.89 0.00 0.00 0.00 Survey Projected to 17622.00 MD 6603.89 TVD

Design Annot	ations				
	Measured Depth (ft)	Vertical Depth (ft)	Local Coor +N/-S (ft)	rdinates +E/-W (ft)	Comment
	2,873.00 17,571.00 17,622.00	2,870.89 6,608.72 6,603.89	-70.52 8,180.84 8,224.64	-17.66 -4,774.42 -4,800.09	Tie into original hole @ 2873 MD Survey @ 17571.00 MD 6608.72 TVD Survey Projected to 17622.00 MD 6603.89 TVD



Survey Report - Geographic



Company:

Tug Hill Operating LLC

Project:

Wetzel County, West Virginia (UTM17 NAD83)

Site:

Lackawanna

Well:

Lackawanna 3H (slot Z)

Wellbore: Design:

Sidetrack 01 Lateral

Surveys Sidetrack 01 Lateral

Local Co-ordinate Reference:

TVD Reference:

MD Reference:

North Reference:

Survey Calculation Method: Database:

Well Lackawanna 3H (slot Z)

RKB=1306+18 @ 1324.00ft (Precision 528)

RKB=1306+18 @ 1324.00ft (Precision 528)

RECEIVED Office of Oil and Gas

Minimum Curvature DB_Jul2216dt_v14 lt

SEP 3 0 2022

Project	Wetzel County,	West Virginia	(UTM17 NAD83

Map System: Geo Datum:

Map Zone:

Universal Transverse Mercator (US Survey Feet)

0.00 ft

NAD83 West Virginia - HARN

Zone 17N (84 W to 78 W)

System Datum:

Mean Sea Level

WV Department of Environmental Protection

Site Lackawanna

Site Position:

From:

Lat/Long

Northing:

14,383,374.84 usft

Latitude:

39.60620769

Position Uncertainty:

Easting: Slot Radius: 1.680.777.71 usft 13-3/16 "

Longitude: **Grid Convergence:** -80.85669942 0.091 °

Well Lackawanna 3H (slot Z)

Well Position

+N/-S +E/-W

0.00 ft 0.00 ft Northing:

14,383,334.89 usft

-8.584

Latitude:

39,60609798

Position Uncertainty

0.00 ft

Easting: Wellhead Elevation:

1,680,775.97 usft

Longitude: Ground Level: -80.85670585 1,306.00 ft

Sidetrack 01 Lateral

Magnetics

Model Name

Sample Date

7/16/2018

Declination (°)

Dip Angle (°)

66.745

Field Strength (nT)

51,973.52146553

Design

Wellbore

Surveys Sidetrack 01 Lateral

IGRF2015

Audit Notes:

Version:

1.0

Phase:

ACTUAL

Tie On Depth:

2.873.00

Vertical Section:

Depth From (TVD)

+N/-S (ft)

+E/-W (ft)

Direction

100.00

2,945.00

17,622.00

17,571.00 MWD ST1 (Sidetrack 01 Lateral)

17,622.00 Projection (Sidetrack 01 Lateral)

0.00

0.00

0.00

(°)

329.70

Survey Program Date 8/5/2019 From To (ft) (ft)

Survey (Wellbore) 2,873.00 Gyro 0-2873 MD (Original Hole)

Tool Name NS-GYRO-MS MWD

MWD

Description

MWD - Standard

North sensing gyrocompassing m/s MWD - Standard

Suna

urvey									
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	0.00	0.00	0.00	0.00	14,383,334,89	1,680,775,97	39.60609798	-80.85670585
100.00	0.13	125.55	100.00	-0.07	0.09	14,383,334,83	1,680,776,06	39.60609780	-80.85670552
200.00	0.28	254.80	200.00	-0.20	-0.05	14,383,334.70	1,680,775.91	39.60609744	-80.85670603
300.00	0.27	272.55	300.00	-0.25	-0.52	14,383,334.64	1,680,775.44	39.60609730	-80.8567077
400.00	0.29	242.80	400.00	-0.35	-0.98	14,383,334.54	1,680,774,98	39.60609701	-80.85670934
500.00	0.29	260.92	500.00	-0.51	-1.46	14,383,334.38	1,680,774,51	39,60609659	-80.85671103
600.00		257.77	600.00	-0.57	-1.79	14,383,334.32	1,680,774.17	39,60609643	-80.85671222
700.00		214.14	699.99	-0.80	-2.02	14,383,334.10	1,680,773.94	39.60609580	-80.85671303
800.00		196.78	799.99	-1.08	-2.19	14,383,333.81	1,680,773.78	39.60609502	-80.85671362
900.00	0.05	217.92	899.99	-1.19	-2.23	14,383,333,70	1,680,773,73	39.60609472	-80 85671379







Company: Project:

Tug Hill Operating LLC

Wetzel County, West Virginia (UTM17 NAD83)

Site: Well: Lackawanna

Wellbore:

Lackawanna 3H (slot Z) Sidetrack 01 Lateral

Surveys Sidetrack 01 Lateral Design:

Local Co-ordinate Reference:

TVD Reference:

MD Reference:

North Reference:

Survey Calculation Method:

Database:

Well Lackawanna 3H (slot Z)

RKB=1306+18 @ 1324.00ft (Precision 528)

RKB=1306+18 @ 1324.00ft (Precision 528)

Minimum Curvature RECEIVED DB_Jul2216dt_v1Office of Oil and Gas

							SEP 3 0 2022			
leasured Depth (ft)	Inclination	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	WV Departm Environmental F Latitude	ent of Protection Longitude	
1,000.00	0.14	317.24	999.99	-1.14	-2.34	14,383,333.76	1,680,773.62	39.60609487	-80.8567	
1,100.00	0.12	198.00	1,099.99	-1.15	-2.46	14,383,333.75	1,680,773.51	39.60609485	-80.8567	
1,200.00	0.07	275.01	1,199.99	-1.24	-2.55	14,383,333.65	1,680,773.41	39.60609459	-80.8567	
1,300.00	0,15	243.10	1,299.99	-1.29	-2.73	14,383,333.60	1,680,773.23	39.60609444	-80.8567	
1,400.00	0.66	211.41	1,399.99	-1.84	-3.15	14,383,333.05	1,680,772.82	39.60609293	-80.8567	
1,500.00	1.13	202.75	1,499.98	-3.25	-3.83	14,383,331.65	1,680,772.14	39.60608908	-80.8567	
1,600.00	1.24	213.34	1,599.96	-5.06	-4.80	14,383,329.83	1,680,771.16	39.60608411	-80.8567	
1,700.00	1.77	207.09	1,699.92	-7.34	-6.10	14,383,327.55	1,680,769,86	39.60607786	-80.8567	
1,800.00	1.48	206.59	1,799.88	-9.87	-7.38	14,383,325.03	1,680,768.58	39.60607091	-80.8567	
1,900.00	2.18	212.39	1,899.83	-12.63	-8.98	14,383,322.26	1,680,766.98	39.60606334	-80.8567	
2,000.00	2.02	204.51	1,999.76	-15.84	-10.73	14,383,319.05	1,680,765.23	39.60605453	-80.8567	
2,100.00	2.38	207.56	2,099.69	-19.28	-12.42	14,383,315.61	1,680,763.54	39.60604508	-80.8567	
2,200.00	3.13	185.87	2,199.58	-23.84	-13.66	14,383,311.05	1,680,762.30	39.60603257	-80.8567	
2,300.00	4.12	183.78	2,299.37	-30.14	-14.18	14,383,304.75	1,680,761.79	39.60601527	-80.8567	
2,400.00	4.74	182,51	2,399.08	-37.85	-14,60	14,383,297.04	1,680,761.37	39.60599409	-80.8567	
2,500.00	4.79	180.97	2,498.73	-46.15	-14.85	14,383,288.74	1,680,761.12	39.60597129	-80.8567	
2,600.00	4.28	186.50	2,598.42	-54.04	-15.34	14,383,280.86	1,680,760.62	39.60594964	-80.8567	
2,700.00	3.73	199.00	2,698.17	-60.82	-16.82	14,383,274.07	1,680,759.14	39.60593102		
2,800.00	3.08	176.21	2,798.00	-66.58	-17.70	14,383,268.32	1,680,758.26	39.60591522	-80.8567 -80,8567	
2,873.00	3.13	182.33	2,870.89	-70.52	-17.66	14,383,264,37	1,680,758.31	39.60590437		
Tie into	original hole @	2873 MD			,	11,000,201.01	1,000,100,1	39.00390437	-80.8567	
2,945.00	2.49	188.12	2,942.81	-74.04	-17.96	14,383,260.86	1,680,758.01	39.60589473	00.0503	
2,977.00	2.48	185.99	2,974.78	-75.41	-18.13	14,383,259,48	1,680,757.84	39.60589095	-80.8567	
3,034.00	3.80	165.18	3,031.69	-78.47	-17.77	14,383,256.43	1,680,758.19		-80.8567	
3,072.00	4.54	161.50	3,069.59	-81.11	-16.97	14,383,253.78	1,680,758.99	39.60588256	-80.8567	
3,167.00	8.96	151.21	3,163.91	-91.16	-12.21	14,383,243.73	1,680,763.75	39.60587530	-80.8567	
3,260.00	11.16	148.36	3,255.48	-105.17	-4.00	14,383,229.72	1,680,771.96	39.60584766	-80.8567	
3,355.00	12,91	146.11	3,348.39	-121.81	6.74	14,383,213.08	1,680,782.70	39.60580915	-80.8567	
3,450.00	15.36	148,32	3,440.50	-141.33	19.26	14,383,193.56	1,680,795.23	39.60576341	-80.8566	
3,545.00	18.47	152.90	3,531.39	-165.44	32.73	14,383,169.45	1,680,808.70	39.60570974	-80.8566	
3,636.00	21.46	152,23	3,616.91	-193.01	47.06	14,383,141.88	1,680,823.02	39.60564347	-80.8565	
3,730.00	23.55	150.46	3,703.75	-224.57	64.33	14,383,110.33		39.60556770	-80.8565	
3,825.00	26.21	149.52	3,789.92	-259.16	84.33	14,383,075.73	1,680,840.29 1,680,860.30	39.60548096	-80.8564	
3,919.00	28.22	150.53	3,873.51	-296.41	105.80	14,383,038.49		39.60538585	-80.8564	
4,013.00	27.97	149,31	3,956.44	-334.71	127.98		1,680,881.76	39.60528347	-80.8563	
4,108.00	27.77	149.71	4,040.42	-372.98	150.51	14,383,000.18 14,382,961.91	1,680,903.95	39.60517818	-80.8562	
4,203.00	27.64	149.72	4,124,53	-411.12	172.79		1,680,926.48	39.60507298	-80.8561	
4,298.00	27.73	148.43	4,208.65	-448.98	195.47	14,382,923.77	1,680,948.75	39.60496814	-80.8560	
4,391.00	27.23	147.06	4,291.16	-485.27		14,382,885.91	1,680,971.43	39.60486406	-80.8560	
4,486.00	26.74	147.99	4,375.82		218.37	14,382,849.62	1,680,994.33	39.60476429	-80.8559	
4,580.00	26.70	146.92	4,459.78	-521.64	241.51	14,382,813.26	1,681,017.48	39.60466432	-80.8558	
4,675.00	25.64	149.37		-557.26	264.25	14,382,777.63	1,681,040.22	39.60456637	-80.8557	
4,770.00	25.52		4,545.04	-592.83	286.37	14,382,742.06	1,681,062.34	39.60446858	-80.8556	
4,865.00	25.72	147.51	4,630.73	-627.78	307.84	14,382,707.11	1,681,083.80	39.60437251	-80.8556	
4,960.00	26.72	147.62	4,716.39	-662.45	329.87	14,382,672.44	1,681,105.83	39.60427719	-80.8555	
		147.68	4,801.61	-697.91	352.33	14,382,636.98	1,681,128.29	39.60417971	-80.8554	
5,055.00	27.12	149.47	4,886.32	-734.61	374.75	14,382,600.28	1,681,150.71	39.60407882	-80.8553	
5,149.00	27.11	149.47	4,969.99	-771.51	396.51	14,382,563.38	1,681,172.48	39.60397737	-80.8553	
5,244.00	27.14	151.73	5,054.54	-809.24	417.77	14,382,525.65	1,681,193.73	39.60387366	-80.8552	
5,337.00	27.38	150.92	5,137.22	-846.61	438.21	14,382,488.28	1,681,214.17	39.60377094	-80.8551	
5,432.00	28.09	149.91	5,221.30	-885.06	460.04	14,382,449.84	1,681,236.01	39.60366526	-80.8550	
5,527.00	27.34	149.15	5,305.40	-923.14	482.44	14,382,411.76	1,681,258.41	39.60356058	-80.8549	
5,621.00	26.28	147,80	5,389.30	-959.28	504.60	14,382,375.61	1,681,280.56	39.60346122	-80.8549	
5,717.00	25.72	150.49	5,475.58	-995.39	526.19	14,382,339.50	1,681,302.15	39.60336194	-80.8548	
5,812.00	26.60	149.66	5,560.85	-1,031.69	547.08	14,382,303.20	1,681,323.05	39.60326217	-80.8547	
5,906.00	27.18	148.12	5,644.69	-1,068.08	569.05	14,382,266.81	1,681,345.02	39.60316212	-80.8546	







Company:

Tug Hill Operating LLC

Project: Wetzel County, West Virginia (UTM17 NAD83)

Site: Lackawanna

Well: Lackawanna 3H (slot Z) Wellbore: Sidetrack 01 Lateral

Design:

Surveys Sidetrack 01 Lateral

Local Co-ordinate Reference:

TVD Reference: MD Reference:

North Reference: **Survey Calculation Method:**

Database:

Well Lackawanna 3H (slot Z)

RKB=1306+18 @ 1324.00ft (Precision 528) RKB=1306+18 @ 1324.00ft (Precision 528)

Grid

Minimum Curvature

DB_Jul2216dt_v14 lt RECEIVED

							Office of Oil and Gas				
/ey								SEP 30	2022		
Measured			Vertical			Мар	Мар	JEI O V	2022		
Depth	Inclination	Azimuth	Depth	+N/-S	+E/-W	Northing	Easting	WV Depart	mont of		
(ft)	(°)	(°)	(ft)	(ft)	(ft)	(usft)	(usft)	Latinyironmental	Protection.		
5,943.00	27.03	148.04	5,677.63	-1,082.39	577.97	14,382,252.50	1,681,353.93	39.60312278	-80.854660		
6,038.00	20.88	147.86	5,764.40	-1,115.07	598.42	14,382,219.82	1,681,374.38	39.60303294	-80.8545876		
6,133.00	15,16	152.70	5,854.71	-1,140.47	613.14	14,382,194.42	1,681,389.10	39.60296312	-80.854535		
6,228.00	7.96	148.74	5,947.72	-1,157.15	622.26	14,382,177.74	1,681,398.22	39.60291727	-80.854503		
6,322.00	2.55	182.14	6,041.31	-1,164.81	625.56	14,382,170.08	1,681,401.53	39.60289621	-80.854491		
6,417.00	5.10	310.02	6,136.19	-1,164.21	622.25	14,382,170.68	1,681,398.21	39.60289789	-80.854503		
6,513.00	10.51	327.25	6,231.28	-1,154.09	614.23	14,382,180.80	1,681,390.20	39.60292571	-80.854531		
6,607.00	15.16	336.74	6,322.91	-1,135.58	604.74	14,382,199.32	1,681,380.70	39.60297660	-80.854565		
6,702.00	22.90	334.02	6,412.65	-1,107.51	591.71	14,382,227.39	1,681,367.68	39.60305375	-80.854611		
6,797.00	32.13	331.12	6,496.82	-1,068.69	571.37	14,382,266.21	1,681,347.33	39.60316046	-80.854683		
6,892.00	42.42	330,32	6,572.31	-1,018.59	543.23	14,382,316.30	1,681,319.19	39.60329816	-80.854782		
6,987.00	53,36	330,85	6,635.92	-957.28	508.69	14,382,377.61	1,681,284.66	39.60346669	-80,854905		
7,082.00	66.02	329.97	6,683.77	-886.13	468.24	14,382,448.77	1,681,244.21	39.60366228	-80.855048		
7,178.00	72.35	328.92	6,717.87	-808.90	422.63	14,382,525.99	1,681,198.60	39.60387457	-80.855209		
7,273.00	81.32	329,18	6,739.48	- 729.65	375.11	14,382,605.24	1,681,151.08	39.60409244	-80.855378		
7,368.00	84.22	329.53	6,751.44	-648.58	327.08	14,382,686.32	1,681,103.04	39.60431531	-80.855548		
7,461.00	93.63	328.04	6,753.18	-569.15	278.94	14,382,765.75	1,681,054.91	39.60453367	-80.855718		
7,529.00	92.40	328.65	6,749.60	-511.35	243.31	14,382,823.55	1,681,019.27	39.60469257	-80.855844		
7,556.00	92.48	328.74	6,748.45	-488.30	229.29	14,382,846.60	1,681,005,26	39.60475593	-80.855894		
7,651.00	89.58	325.40	6,746.74	-408.59	177.67	14,382,926.30	1,680,953.63	39.60497505	-80.856077		
7,747.00	87.91	328.92	6,748.85	-327.97	125.63	14,383,006.92	1,680,901.59	39.60519670	-80.85626		
7,842.00	88.00	329.36	6,752.24	-246.47	76.93	14,383,088.42	1,680,852.90	39.60542074	-80.85643		
7,937.00	89.54	329.80	6,754.28	-164,57	28.84	14,383,170.32	1,680,804.81	39.60564588	-80.856604		
8,032.00	89.85	329.53	6,754.78	-82.58	-19.14	14,383,252.31	1,680,756,83	39.60587127	-80.856774		
8,127.00	90.73	329.53	6,754.30	-0.70	-67.31	14,383,334.19	1,680,708.66	39.60609635	-80.856944		
8,222.00	91.30	329.62	6,752.62	81.20	-115.41	14,383,416.09	1,680,660.56	39.60632150	-80.857118		
8,317.00	89.41	330.50	6,752.03	163.52	-162,82	14,383,498.41	1,680,613.15	39.60654777	-80.857283		
8,410.00	89.41	329.88	6,752.99	244,21	-209.05	14,383,579.10	1,680,566.92	39.60676958	-80.857446		
8,505.00	89.89	329.71	6,753.57	326.31	-256.84	14,383,661.20	1,680,519.12	39.60699526	-80.85761		
8,599.00	90.37	330.32	6,753.36	407.73	-303.82	14,383,742.62	1,680,472.14	39.60721907	-80.857782		
8,694.00	91.08	330.15	6,752.15	490.18	-350.98	14,383,825.08	1,680,424.99	39.60744574	-80.857949		
8,788.00	88.92	330,68	6,752.15	571.92	-397.39	14,383,906.82	1,680,378.58	39.60767043	-80.858113		
8,883.00	89.14	330.32	6,753.76	654.60	-444.16	14,383,989.49	1,680,331.81	39.60789768	-80.858279		
8,977.00	90.07	330.06	6,754.41	736.16	-490.89	14,384,071.05	1,680,285.08	39.60812187	-80.858444		
9,072.00	90.95	330,32	6,753.56	818.58	-538.11	14,384,153.47	1,680,237.85	39.60834844	-80.85861		
9,168.00	89.71	330.76	6,753.01	902.16	-585,32	14,384,237.06	1,680,190.64	39.60857820	-80.858778		
9,263.00	90.33	330.94	6,752.98	985.13	-631,60	14,384,320.02	1,680,144.37	39.60880626	-80.858942		
9,358.00	91.25	331.03	6,751.67	1,068.20	-677.67	14,384,403.09	1,680,098.29	39.60903459	-80.85910		
9,453.00	92.00	331.21	6,748.97	1,151.35	-723.54	14,384,486.24	1,680,052,43	39.60926315	-80.859268		
9,548.00	90.77	330.32	6,746.68	1,234.22	-769.92	14,384,569.11	1,680,006.05	39.60949095	-80.85943;		
9,643.00	87.74	330.32	6,747.91	1,316.74	-816.95	14,384,651.63	1,679,959.02	39.60971778	-80.859599		
9,738.00	87.56	330.24	6,751.81	1,399.18	-864.01	14,384,734.07	1,679,911.96	39.60994438	-80.85976		
9,832.00	88.44	330.41	6,755.09	1,480.80	-910.52	14,384,815.69	1,679,865.45	39.61016874	-80.859930		
9,926.00	89.01	330.68	6,757.18	1,562.63	-956.73	14,384,897.52	1,679,819.24	39.61039367	-80.860094		
10,021.00	89.71	331.12	6,758.24	1,645.63	-1,002.93	14,384,980.52	1,679,773.04	39.61062182	-80.860257		
10,115.00	90.37	331.03	6,758.18	1,727.90	-1,048.39	14,385,062.79	1,679,727.58	39.61084797	-80.860418		
10,211.00	90.73	331.29	6,757.25	1,811.99	-1,094.69	14,385,146.88	1,679,681.27	39.61107910	-80.86058		
10,306.00	90.95	330.41	6,755.86	1,894.95	-1,140.96	14,385,229.84	1,679,635.00	39.61130713	-80.86074		
10,399.00	91.60	330.59	6,753.79	1,975.87	-1,186.75	14,385,310.76	1,679,589.22	39.61152957	-80.86090		
10,494.00	88.44	330.41	6,753.76	2,058.55	-1,233.52	14,385,393.44	1,679,542.45	39.61175682	-80.86107		
10,589.00	89,14	330,24	6,755.77	2,141.07	-1,280.54	14,385,475.96	1,679,495.42	39.61198365	-80,86124		
10,684.00	89.45	328.48	6,756.93	2,222.80	-1,328.95	14,385,557.68	1,679,447.01	39.61220831			
10,779.00	91.47	331.20	6,756.17	2,304.92	-1,376.68	14,385,639.81	1,679,399.29		-80.861412		
			-, /	-1-0-1.04	1,010.00	17,000,000.01	1,013,333.23	39.61243406	-80.861581		
10,874.00	91.16	329.88	6,753.99	2,387.61	-1,423.38	14,385,722.50	1,679,352.58	39.61266136	-80.861746		







Company: Tug Hill Operating LLC

Project:

Wetzel County, West Virginia (UTM17 NAD83)

Site: Lackawanna

Well: Lackawanna 3H (slot Z) Wellbore: Sidetrack 01 Lateral

Design: Surveys Sidetrack 01 Lateral Local Co-ordinate Reference:

TVD Reference: MD Reference: North Reference:

Survey Calculation Method:

Database:

Well Lackawanna 3H (slot Z)

RKB=1306+18 @ 1324.00ft (Precision 528)

RKB=1306+18 @ 1324.00ft (Precision 528)

Minimum Curvature Office of Oil and Gas
DB_Jul2216dt_v14 lt

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vey								SEP 3 0 2022		
Measured Depth (ft)	Inclination	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	WV Depar Environmenta Latitude	tment of al Protection Longitude	
11,064.00	92.18	325.93	6,748.85	2,547.26	-1,526.18	14,385,882.15	1,679,249.78	39.61310026	-80.86211	
11,159.00	92.88	329.09	6,744.66	2,627.31	-1,577.16	14,385,962.19	1,679,198.81	39.61332030	-80.86229	
11,253.00	93,45	329.09	6,739.47	2,707.83	-1,625.37	14,386,042.72	1,679,150.60	39.61354165	-80.86246	
11,348.00	91.12	329.53	6,735.68	2,789.46	-1,673.82	14,386,124.34	1,679,102.15	39.61376603	-80.86263	
11,443.00	91.74	329.36	6,733.31	2,871.24	-1,722.10	14,386,206.13	1,679,053.87	39.61399083	-80.86280	
11,538.00	90.59	330.32	6,731.38	2,953.36	-1,769.81	14,386,288.25	1,679,006.16	39.61421656	-80.86297	
11,633.00	91.38	330.85	6,729.74	3,036.10	-1,816.46	14,386,370.99	1,678,959.51	39.61444399	-80.86313	
11,727.00	92.09	331.55	6,726.90	3,118.43	-1,861.73	14,386,453.32	1,678,914.24	39.61467030	-80.86329	
11,822.00	89.76	331.03	6,725.36	3,201.74	-1,907.35	14,386,536.62	1,678,868.61	39.61489928	-80.86346	
11,917.00	89.98	331.29	6,725.58	3,284.95	-1,953.18	14,386,619.84	1,678,822.79	39.61512801	-80.86362	
12,012.00	90.37	330,85	6,725.29	3,368.10	-1,999.13	14,386,702,98	1,678,776.84	39.61535655	-80.86378	
12,106.00	90.90	331.38	6,724.25	3,450.40	-2,044.54	14,386,785.28	1,678,731.43	39.61558276	-80.86394	
12,201.00	91.82	331.91	6,721.99	3,533.98	-2,089.64	14,386,868.86	1,678,686.33	39.61581248	-80.86410	
12,296.00	90.42	330.94	6,720.14	3,617.39	-2,135.07	14,386,952.27	1,678,640.90	39.61604174	-80.86426	
12,390.00	90.73	330.15	6,719.19	3,699.23	-2,181,29	14,387,034.12	1,678,594.68	39.61626671	-80.8644	
12,485.00	91.34	329.53	6,717.48	3,781.36	-2,229.01	14,387,116.24	1,678,546.96	39.61649245	-80.8645	
12,578.00	91.52	329.27	6,715.16	3,861.38	-2,276,34	14,387,196.26	1,678,499.63	39.61671242		
12,673.00	92.22	329.53	6,712.06	3,943.11	-2,324.67	14,387,277.99	1,678,451.30	39.61693707	-80.86476 -80.86493	
12,767.00	90.20	329.18	6,710.07	4,023.96	-2,372.57	14,387,358.84	1,678,403,40			
12,861.00	90.51	329.62	6,709,49	4,104.86	-2,420.42	14,387,439.75	1,678,355.55	39.61715931	-80,86510	
12,956.00	91.38	329.45	6,707.92	4,186.74	-2,468.58	14,387,521.62		39.61738171	-80.8652	
13,051.00	91.78	329.27	6,705.30	4,268.44	-2,516.98	14,387,603.32	1,678,307.39	39.61760676	-80.8654	
13,146.00	91,03	329.88	6,702.97	4,350.33	-2,516.90	14,387,685.22	1,678,258.99	39.61783135	-80.8656	
13,241.00	91,12	328.74	6,701.19	4,432.01	-2,613.55		1,678,210.90	39.61805646	-80.8657	
13,336.00	91.03	328.30	6,699.41	4,513.02	-2,613.35	14,387,766.90	1,678,162.42	39.61828097	-80.8659	
13,430.00	90.73	328.30	6,697.96	4,592.98	-2,003.15 -2,712.54	14,387,847.90	1,678,112.82	39.61850364	-80.8661	
13,525.00	90.81	328.48	6,696.69	4,673.88	-2,712.34	14,387,927.87	1,678,063.43	39.61872346	-80.8663	
13,620.00	90.81	329.09	6,695.35	4,755.12	-2,762.33	14,388,008.76	1,678,013.64	39.61894584	-80.8664	
13,714.00	90.64	329.36	6,694.16	4,835.88	-2,859.65	14,388,090.00	1,677,964.41	39.61916915	-80.8666	
13,809.00	91.21	329.80	6,692.62	4,917.79	-2,009.00	14,388,170.76	1,677,916.32	39.61939113	-80.8668	
13,903.00	91.08	330.32	6,690.74	4,999.22		14,388,252.67	1,677,868.23	39.61961629	-80.8670	
13,999.00	91.03	329.97	6,688.98	5,082.47	-2,954.65	14,388,334.11	1,677,821.32	39.61984014	-80.8671	
14,093.00	91.08	328.13	6,687.25	5,163.07	-3,002.43	14,388,417.35	1,677,773.54	39.62006895	-80.8673	
14,188.00	91.43	328.04	6,685.16	5,243.69	-3,050.76	14,388,497.95	1,677,725.21	39.62029050	-80.8675	
14,282.00	90.55	328.65	6,683.54		-3,100.97	14,388,578.57	1,677,675.00	39.62051212	-80.8676	
14,377.00	91.30	328.39	6,682.01	5,323.69	-3,150.30	14,388,658.57	1,677,625.67	39.62073203	-80.8678	
14,472.00	90.37	329.45		5,404.70	-3,199,90	14,388,739.58	1,677,576.07	39.62095470	-80.8680	
14,567.00	89.41	330.41	6,680.62	5,486.05	-3,248.94	14,388,820.93	1,677,527.04	39.62117832	-80.8682	
14,662.00	89.76	330.41	6,680.80	5,568.26	-3,296.53	14,388,903.14	1,677,479.44	39.62140430	-80.8683	
14,757.00	90.15	330.59	6,681.49	5,650.87	-3,343.44	14,388,985.75	1,677,432.53	39.62163136	-80.86854	
14,852.00			6,681.57	5,733,55	-3,390.22	14,389,068.43	1,677,385.75	39.62185863	-80,8687	
14,947.00	90.90	330.85	6,680.70	5,816.41	-3,436.68	14,389,151.29	1,677,339.29	39.62208637	-80.8688	
	91.47	330.76	6,678.73	5,899.33	-3,483.01	14,389,234.21	1,677,292.96	39.62231427	-80.86904	
15,041.00 15,137.00	91.96	331.12	6,675.92	5,981.45	-3,528.65	14,389,316.34	1,677,247.32	39.62254001	-80.86920	
	90.46	330.76	6,673.89	6,065.35	-3,575.27	14,389,400.23	1,677,200.70	39.62277060	-80.86936	
15,231.00	90.37	330.94	6,673.21	6,147.44	-3,621.05	14,389,482.32	1,677,154.92	39.62299623	-80.8695	
15,325.00	90.77	331.38	6,672.28	6,229.78	-3,666.39	14,389,564.66	1,677,109.58	39.62322254	-80.8696	
15,419.00	90.99	331.64	6,670.83	6,312.38	-3,711.23	14,389,647.26	1,677,064.75	39.62344959	-80.86984	
15,514.00	91.34	332.61	6,668.90	6,396.34	-3,755.63	14,389,731.22	1,677,020.34	39.62368034	-80.87000	
15,608.00	91.52	332.26	6,666.55	6,479.65	-3,799.12	14,389,814.53	1,676,976.85	39.62390930	-80.8701	
15,703.00	89.41	331.47	6,665.78	6,563.41	-3,843.91	14,389,898.29	1,676,932.06	39.62413953	-80.8703°	
15,797.00	89.67	331.64	6,666.54	6,646.06	-3,888.68	14,389,980.94	1,676,887.29	39.62436669	-80.87047	
15,892.00	90.24	331.99	6,666.61	6,729.80	-3,933.55	14,390,064.68	1,676,842.42	39.62459683	-80,87063	
15,987.00	90.55	332.35	6,665.96	6,813.81	-3,977.90	14,390,148.69	1,676,798.07	39.62482773	-80.87079	
16,081.00	90.51	332.26	6,665.09	6,897.03	-4,021.59	14,390,231.91	1,676,754.38	39.62505647	-80.87094	
16,175.00	92.53	330.50	6,662.60	6,979.51	-4,066.60	14,390,314.39	1,676,709.38	39.62528317	-80.87110	



Survey Report - Geographic



Company: Project:

Tug Hill Operating LLC

Wetzel County, West Virginia (UTM17 NAD83)

Site: Well: Lackawanna

Wellbore:

Lackawanna 3H (slot Z)

Sidetrack 01 Lateral Surveys Sidetrack 01 Lateral Design:

Local Co-ordinate Reference:

TVD Reference:

MD Reference:

North Reference:

Survey Calculation Method: Database:

Well Lackawanna 3H (slot Z)

RKB=1306+18 @ 1324.00ft (Precision 528)

RKB=1306+18 @ 1324.00ft (Precision 528)

Grid

Minimum Curvature

DB_Jul2216dt_v14 lt

Measured Depth (ft)	Inclination (°)	Azimuth	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
16,269.00	93.01	330.24	6,658.05	7,061.13	-4,113.01	14,390,396.00	1,676,662.96	39.62550749	-80.87127
16,364.00	93.76	330.24	6,652.44	7,143.45	-4,160.09	14,390,478.33	1,676,615.89	39.62573377	-80.87143
16,460.00	92.75	329,62	6,646.99	7,226.40	-4,208.11	14,390,561.27	1,676,567.86	39.62596175	-80.87160
16,554.00	91.12	329,45	6,643.82	7,307.37	-4,255.74	14,390,642,25	1,676,520,23	39.62618432	-80,87177
16,649.00	89.41	328.65	6,643.38	7,388.84	-4,304.60	14,390,723.72	1,676,471.38	39.62640826	-80.8719
16,745.00	89.98	328.65	6,643.89	7,470.82	-4,354,54	14,390,805.70	1,676,421.43	39.62663361	-80.8719
16,841.00	90.42	328.83	6,643.56	7,552.88	-4,404.36	14,390,887,76	1,676,371.62	39.62685917	-80.8723
16,935.00	90.90	328.74	6,642.47	7,633.27	-4,453.07	14,390,968.15	1,676,322.91	39.62708013	-80.8724
17,030.00	90.51	328.74	6,641.30	7,714.47	-4,502.36	14,391,049.35	1,676,273.61	39.62730333	-80.8726
17,124.00	93.01	329.71	6,638.42	7,795.19	-4,550,43	14,391,130.06	1,676,225.54	39.62752520	-80.8728
17,219.00	92.92	329.71	6,633.50	7,877.11	-4,598.28	14,391,211.99	1,676,177.69	39.62775037	-80.8729
17,314.00	93.54	329.88	6,628.15	7,959.08	-4,646.00	14,391,293.96	1,676,129.97	39.62797568	-80.87316
17,409.00	94.20	330.24	6,621.74	8,041.21	-4,693.31	14,391,376,09	1,676,082,67	39.62820143	-80.8733
17,504.00	94.51	329.71	6,614.52	8,123.23	-4,740.71	14,391,458.10	1,676,035.27	39.62842685	-80.8734
17,571.00	95.43	329.62	6,608.72	8,180.84	-4,774.42	14,391,515,71	1,676,001,56	39.62858520	-80.8736
Survey @	17571.00 MI	6608.72 TV	D			, ,	,,		-55,5750
17,622.00	95.43	329.62	6,603.89	8,224.64	-4,800.09	14,391,559.51	1,675,975.88	39.62870558	-80.8737

esign Annotations				
Measured Depth (ft)	Vertical Depth (ft)	Local Coo +N/-S (ft)	rdinates +E/-W (ft)	Comment
2,873.00	2,870.89	-70.52	-17.66	Tie into original hole @ 2873 MD
17,571.00	6,608.72	8,180.84	-4,774.42	_
17,622.00	6,603.89	8,224.64	-4,800.09	



Office of Oil and Gas

SEP 3 0 2022

WV Department of Environmental Protection