



Well: Keith Stern N-14 HU (slot D)
Site: Keith Stern
Project: Marshall County, West Virginia.
Design: rev6

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=747+33 @ 780.00usft (Nabors X08)

Northing 14444878.03 Easting 1726903.06 Latitude 39.77479655 Longitude -80.69218531

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.973°



Azimuths to Grid North
 True North: -0.20°
 Magnetic North: -8.97°

Magnetic Field
 Strength: 51873.1snT
 Dip Angle: 66.73°
 Date: 1/12/2020
 Model: IGRF2015

SECTION DETAILS

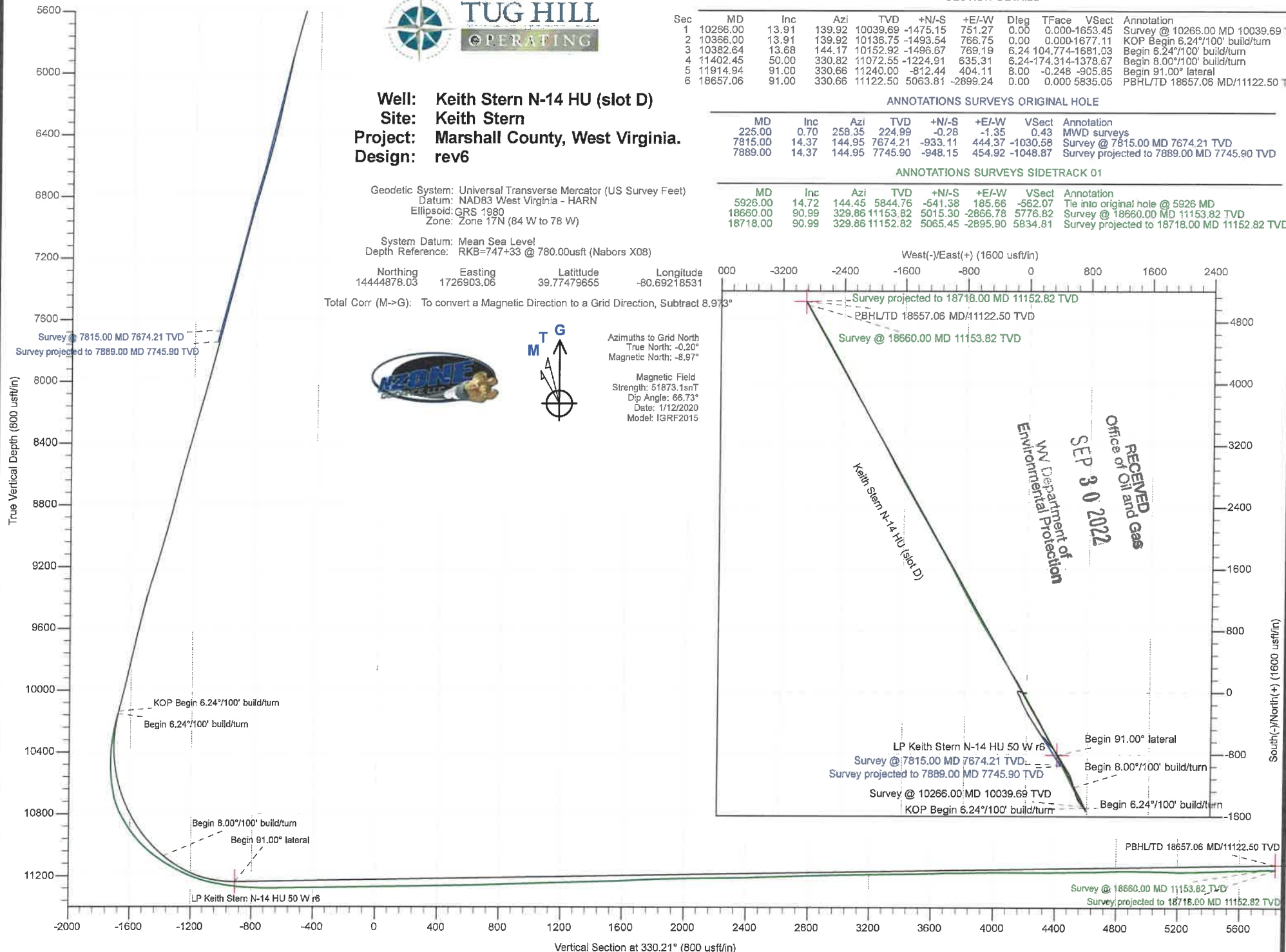
Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	V Sect	Annotation
1	10266.00	13.91	139.92	10039.69	-1475.15	751.27	0.00	0.000-1653.45		Survey @ 10266.00 MD 10039.69 TVD
2	10366.00	13.91	139.92	10136.75	-1493.54	766.75	0.00	0.000-1677.11		KOP Begin 6.24°/100' build/turn
3	10382.64	13.68	144.17	10152.92	-1496.67	769.19	6.24	104.774-1681.03		Begin 6.24°/100' build/turn
4	11402.45	50.00	330.82	11072.55	-1224.91	635.31	6.24	-174.314-1378.67		Begin 6.00°/100' build/turn
5	11914.94	91.00	330.66	11240.00	-812.44	404.11	8.00	-0.248 -905.85		Begin 91.00° lateral
6	18657.06	91.00	330.66	11122.50	5063.81	-2899.24	0.00	0.000 5835.05		PBHL/TD 18657.06 MD/11122.50 TVD

ANNOTATIONS SURVEYS ORIGINAL HOLE

MD	Inc	Azi	TVD	+N/-S	+E/-W	V Sect	Annotation
225.00	0.70	258.35	224.99	-0.28	-1.35	0.43	MWD surveys
7815.00	14.37	144.95	7674.21	-933.11	444.37	-1030.58	Survey @ 7815.00 MD 7674.21 TVD
7889.00	14.37	144.95	7745.90	-948.15	454.92	-1048.87	Survey projected to 7889.00 MD 7745.90 TVD

ANNOTATIONS SURVEYS SIDETRACK 01

MD	Inc	Azi	TVD	+N/-S	+E/-W	V Sect	Annotation
5926.00	14.72	144.45	5844.76	-541.38	185.66	-562.07	Tie into original hole @ 5926 MD
18660.00	90.99	329.86	11153.82	5015.30	-2866.78	5776.82	Survey @ 18660.00 MD 11153.82 TVD
18718.00	90.99	329.86	11152.82	5065.45	-2895.90	5834.81	Survey projected to 18718.00 MD 11152.82 TVD



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Orginal Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Orginal Hole	Database:	DB_Aug1919_v14

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Project	Marshall County, West Virginia.		
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)		

SEP 30 2022

WV Department of
Environmental Protection

Site	Keith Stem				
Site Position:		Northing:	14,444,890.33 usft	Latitude:	39.77483004
From:	Lat/Long	Easting:	1,726,932.47 usft	Longitude:	-80.69208048
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.197 °

Well	Keith Stem N-14 HU (slot D)					
Well Position	+N/-S	0.00 usft	Northing:	14,444,878.03 usft	Latitude:	39.77479655
	+E/-W	0.00 usft	Easting:	1,726,903.06 usft	Longitude:	-80.69218531
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level:	747.00 usft

Wellbore	Orginal Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	12/5/2019	-8.773	66.738	51,885.13354666

Design	Surveys Orginal Hole				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.00	0.00	0.00	330.21	

Survey Program	Date	12/21/2019			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
225.00	490.00	MWD surf (Orginal Hole)	MWD	MWD - Standard	
534.00	2,195.00	MWD int (Orginal Hole)	MWD	MWD - Standard	
2,329.00	7,815.00	MWD (Orginal Hole)	MWD	MWD - Standard	
7,889.00	7,889.00	Projection (Orginal Hole)	MWD	MWD - Standard	

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
225.00	0.70	258.35	224.99	-0.28	-1.35	0.43	0.31	0.31	0.00	
MWD surveys										
256.00	0.80	264.17	255.99	-0.34	-1.75	0.57	0.41	0.32	18.77	
287.00	0.74	265.11	286.99	-0.38	-2.16	0.75	0.20	-0.19	3.03	
319.00	0.65	264.36	318.99	-0.41	-2.55	0.91	0.28	-0.28	-2.34	
350.00	0.55	273.59	349.98	-0.42	-2.87	1.06	0.45	-0.32	29.77	
382.00	0.59	266.77	381.98	-0.42	-3.19	1.22	0.25	0.13	-21.31	

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Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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 Environmental Protection

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
413.00	0.44	274.02	412.98	-0.42	-3.47	1.36	0.53	-0.48	23.39
445.00	0.61	273.41	444.98	-0.40	-3.76	1.52	0.53	0.53	-1.91
490.00	0.89	283.46	489.98	-0.31	-4.34	1.89	0.69	0.62	22.33
534.00	1.07	304.71	533.97	0.01	-5.01	2.49	0.91	0.41	48.30
628.00	0.97	291.97	627.96	0.80	-6.47	3.91	0.26	-0.11	-13.55
723.00	0.77	283.92	722.94	1.26	-7.83	4.98	0.25	-0.21	-8.47
817.00	0.68	192.24	816.94	0.87	-8.57	5.01	1.11	-0.10	-97.53
912.00	0.86	163.62	911.93	-0.37	-8.48	3.89	0.44	0.19	-30.13
1,007.00	0.97	167.04	1,006.92	-1.84	-8.10	2.43	0.13	0.12	3.60
1,100.00	1.08	169.42	1,099.90	-3.47	-7.76	0.85	0.13	0.12	2.56
1,195.00	0.99	196.29	1,194.89	-5.13	-7.83	-0.56	0.51	-0.09	28.28
1,290.00	1.86	272.57	1,289.87	-5.85	-9.60	-0.31	1.99	0.92	80.29
1,385.00	2.91	277.43	1,384.78	-5.47	-13.53	1.98	1.12	1.11	5.12
1,479.00	3.89	283.15	1,478.62	-4.44	-19.00	5.59	1.10	1.04	6.09
1,574.00	4.64	284.73	1,573.35	-2.73	-25.86	10.48	0.80	0.79	1.66
1,668.00	4.68	285.22	1,667.04	-0.75	-33.24	15.86	0.06	0.04	0.52
1,763.00	5.62	284.74	1,761.66	1.45	-41.47	21.86	0.99	0.99	-0.51
1,858.00	5.57	285.54	1,856.20	3.87	-50.41	28.40	0.10	-0.05	0.84
1,952.00	5.25	286.80	1,949.79	6.33	-58.93	34.77	0.36	-0.34	1.34
2,047.00	5.32	289.62	2,044.38	9.07	-67.24	41.27	0.28	0.07	2.97
2,142.00	4.97	292.25	2,139.00	12.10	-75.19	47.86	0.44	-0.37	2.77
2,195.00	4.76	292.26	2,191.81	13.81	-79.35	51.41	0.40	-0.40	0.02
2,329.00	4.74	298.33	2,325.35	18.54	-89.37	60.49	0.38	-0.01	4.53
2,423.00	3.67	298.24	2,419.09	21.81	-95.44	66.34	1.14	-1.14	-0.10
2,518.00	3.02	281.86	2,513.93	23.76	-100.57	70.58	1.21	-0.68	-17.24
2,612.00	3.28	269.33	2,607.79	24.24	-105.68	73.54	0.78	0.28	-13.33
2,707.00	2.00	258.23	2,702.69	23.87	-110.02	75.37	1.44	-1.35	-11.68
2,802.00	1.49	253.79	2,797.65	23.18	-112.83	76.18	0.55	-0.54	-4.67
2,895.00	1.13	264.18	2,890.62	22.75	-114.90	76.83	0.46	-0.39	11.17
2,990.00	1.85	207.41	2,985.59	21.30	-116.54	76.38	1.63	0.76	-59.76
3,085.00	3.54	190.49	3,080.49	17.05	-117.78	73.31	1.95	1.78	-17.81
3,180.00	4.49	172.23	3,175.26	10.48	-117.81	67.63	1.66	1.00	-19.22
3,274.00	6.49	161.68	3,268.82	1.79	-115.65	59.01	2.37	2.13	-11.22
3,369.00	8.36	154.07	3,363.02	-9.52	-110.94	46.86	2.22	1.97	-8.01
3,463.00	9.39	144.50	3,455.90	-21.91	-103.50	32.41	1.91	1.10	-10.18
3,558.00	10.89	147.28	3,549.42	-35.77	-94.14	15.73	1.66	1.58	2.93
3,653.00	11.26	155.96	3,642.65	-51.79	-85.51	-2.46	1.80	0.39	9.14
3,747.00	12.19	160.29	3,734.69	-69.51	-78.43	-21.36	1.36	0.99	4.61
3,842.00	11.84	159.99	3,827.61	-88.11	-71.71	-40.84	0.37	-0.37	-0.32
3,937.00	12.51	156.68	3,920.48	-106.72	-64.30	-60.67	1.02	0.71	-3.48
4,034.00	13.22	156.52	4,015.04	-126.54	-55.72	-82.13	0.73	0.73	-0.16
4,130.00	15.00	153.09	4,108.14	-147.69	-45.73	-105.45	2.05	1.85	-3.57
4,224.00	16.88	153.30	4,198.52	-170.73	-34.09	-131.23	2.00	2.00	0.22

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Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
4,319.00	15.31	151.57	4,289.80	-194.08	-21.92	-157.54	1.73	-1.65	-1.82
4,413.00	14.13	151.21	4,380.71	-215.05	-10.49	-181.42	1.26	-1.26	-0.38
4,508.00	13.93	151.96	4,472.88	-235.31	0.47	-204.45	0.28	-0.21	0.79
4,603.00	14.00	152.50	4,565.07	-255.59	11.16	-227.36	0.16	0.07	0.57
4,697.00	13.97	152.88	4,656.28	-275.78	21.58	-250.05	0.10	-0.03	0.40
4,792.00	14.20	149.26	4,748.43	-296.00	32.76	-273.16	0.96	0.24	-3.81
4,887.00	14.21	147.44	4,840.52	-315.84	44.99	-296.46	0.47	0.01	-1.92
4,981.00	15.28	147.13	4,931.43	-335.97	57.93	-320.35	1.14	1.14	-0.33
5,075.00	13.69	146.93	5,022.44	-355.70	70.72	-343.83	1.69	-1.69	-0.21
5,169.00	12.87	146.87	5,113.92	-373.78	82.51	-365.38	0.87	-0.87	-0.06
5,264.00	13.38	148.51	5,206.44	-392.02	94.03	-386.93	0.66	0.54	1.73
5,358.00	15.13	150.00	5,297.54	-411.92	105.85	-410.07	1.90	1.86	1.59
5,452.00	15.55	150.73	5,388.19	-433.53	118.14	-434.94	0.49	0.45	0.78
5,547.00	15.69	149.15	5,479.69	-455.67	130.96	-460.52	0.47	0.15	-1.66
5,641.00	16.79	148.36	5,569.93	-478.14	144.60	-486.79	1.19	1.17	-0.84
5,737.00	15.57	147.45	5,662.13	-500.81	158.80	-513.52	1.30	-1.27	-0.95
5,831.00	14.70	147.04	5,752.87	-521.45	172.08	-538.03	0.93	-0.93	-0.44
5,926.00	14.72	144.45	5,844.76	-541.38	185.66	-562.08	0.69	0.02	-2.73
6,023.00	14.14	140.63	5,938.70	-560.57	200.34	-586.02	1.15	-0.60	-3.94
6,118.00	13.48	142.82	6,030.95	-578.36	214.39	-608.44	0.89	-0.69	2.31
6,211.00	13.60	146.47	6,121.37	-596.11	226.98	-630.10	0.93	0.13	3.92
6,306.00	13.42	147.82	6,213.74	-614.75	239.02	-652.26	0.38	-0.19	1.42
6,398.00	13.81	147.05	6,303.15	-633.00	250.68	-673.90	0.47	0.42	-0.84
6,492.00	13.85	149.07	6,394.43	-652.07	262.56	-696.35	0.52	0.04	2.15
6,587.00	12.80	147.08	6,486.87	-670.66	274.13	-718.22	1.21	-1.11	-2.09
6,681.00	14.71	145.59	6,578.17	-689.24	286.53	-740.52	2.07	2.03	-1.59
6,775.00	15.99	146.76	6,668.82	-709.92	300.37	-765.34	1.40	1.36	1.24
6,870.00	16.19	147.84	6,760.10	-732.08	314.60	-791.63	0.38	0.21	1.14
6,964.00	15.07	149.49	6,850.62	-753.70	327.78	-816.95	1.28	-1.19	1.76
7,058.00	14.16	150.02	6,941.58	-774.19	339.72	-840.66	0.98	-0.97	0.56
7,153.00	14.13	148.55	7,033.70	-794.14	351.58	-863.87	0.38	-0.03	-1.55
7,247.00	13.82	147.12	7,124.91	-813.36	363.66	-886.55	0.49	-0.33	-1.52
7,342.00	14.01	144.79	7,217.13	-832.29	376.45	-909.33	0.62	0.20	-2.45
7,531.00	15.98	146.02	7,399.68	-872.56	404.19	-958.06	1.06	1.04	0.65
7,626.00	14.89	146.86	7,491.26	-893.62	418.17	-983.29	1.17	-1.15	0.88
7,720.00	14.42	146.97	7,582.20	-913.55	431.15	-1,007.03	0.50	-0.50	0.12
7,815.00	14.37	144.95	7,674.21	-933.11	444.37	-1,030.58	0.53	-0.05	-2.13
Survey @ 7815.00 MD 7674.21 TVD									
7,889.00	14.37	144.95	7,745.90	-948.15	454.92	-1,048.87	0.00	0.00	0.00
Survey projected to 7889.00 MD 7745.90 TVD									

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Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Design Annotations				
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		+N/-S (usft)	+E/-W (usft)	
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From:	Lat/Long	Easting:	1,726,932.47 usft	Longitude:	-80.69208048
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.197 °

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Environmental Protection

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	+E/-W	0.00 usft	Easting:	1,726,903.06 usft	Longitude:	-80.69218531
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft	Ground Level:	747.00 usft	

Wellbore	Orginal Hole				
Magnetics	Model Name	Sample Date	Declination	Dip Angle	Field Strength
	IGRF2015	12/5/2019	(°)	(°)	(nT)
			-8.773	66.738	51,885.13354666

Design	Surveys Orginal Hole				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W	Direction	
	(usft)	(usft)	(usft)	(°)	
	0.00	0.00	0.00	330.21	

Survey Program	Date	12/21/2019			
From	To	Survey (Wellbore)	Tool Name	Description	
(usft)	(usft)				
225.00	490.00	MWD surf (Orginal Hole)	MWD	MWD - Standard	
534.00	2,195.00	MWD int (Orginal Hole)	MWD	MWD - Standard	
2,329.00	7,815.00	MWD (Orginal Hole)	MWD	MWD - Standard	
7,889.00	7,889.00	Projection (Orginal Hole)	MWD	MWD - Standard	

Survey										
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Map	Map	Latitude	Longitude	
Depth	(°)	(°)	Depth	(usft)	(usft)	Northing	Easting			
(usft)			(usft)	(usft)	(usft)	(usft)	(usft)			
0.00	0.00	0.00	0.00	0.00	0.00	14,444,878.03	1,726,903.06	39.77479655	-80.69218531	
225.00	0.70	258.35	224.99	-0.28	-1.35	14,444,877.75	1,726,901.71	39.77479580	-80.69219010	
MWD surveys										
256.00	0.80	264.17	255.99	-0.34	-1.75	14,444,877.69	1,726,901.31	39.77479564	-80.69219153	
287.00	0.74	265.11	286.99	-0.38	-2.16	14,444,877.65	1,726,900.90	39.77479554	-80.69219301	
319.00	0.65	264.36	318.99	-0.41	-2.55	14,444,877.62	1,726,900.51	39.77479544	-80.69219438	
350.00	0.55	273.59	349.98	-0.42	-2.87	14,444,877.61	1,726,900.19	39.77479542	-80.69219554	
382.00	0.59	266.77	381.98	-0.42	-3.19	14,444,877.61	1,726,899.87	39.77479543	-80.69219667	
413.00	0.44	274.02	412.98	-0.42	-3.47	14,444,877.61	1,726,899.59	39.77479543	-80.69219766	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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Survey									WV Department of Environmental Protection	
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
445.00	0.61	273.41	444.98	-0.40	-3.76	14,444,877.63	1,726,899.30	39.77479548	-80.69219870	
490.00	0.89	283.46	489.98	-0.31	-4.34	14,444,877.72	1,726,898.72	39.77479575	-80.69220076	
534.00	1.07	304.71	533.97	0.01	-5.01	14,444,878.04	1,726,898.05	39.77479662	-80.69220314	
628.00	0.97	291.97	627.96	0.80	-6.47	14,444,878.84	1,726,896.59	39.77479882	-80.69220832	
723.00	0.77	283.92	722.94	1.26	-7.83	14,444,879.29	1,726,895.22	39.77480008	-80.69221318	
817.00	0.68	192.24	816.94	0.87	-8.57	14,444,878.90	1,726,894.49	39.77479901	-80.69221578	
912.00	0.86	163.62	911.93	-0.37	-8.48	14,444,877.66	1,726,894.57	39.77479562	-80.69221551	
1,007.00	0.97	167.04	1,006.92	-1.84	-8.10	14,444,876.19	1,726,894.96	39.77479158	-80.69221417	
1,100.00	1.08	169.42	1,099.90	-3.47	-7.76	14,444,874.57	1,726,895.29	39.77478711	-80.69221299	
1,195.00	0.99	196.29	1,194.89	-5.13	-7.83	14,444,872.90	1,726,895.23	39.77478253	-80.69221324	
1,290.00	1.86	272.57	1,289.87	-5.85	-9.60	14,444,872.18	1,726,893.46	39.77478057	-80.69221955	
1,385.00	2.91	277.43	1,384.78	-5.47	-13.53	14,444,872.56	1,726,889.53	39.77478166	-80.69223354	
1,479.00	3.89	283.15	1,478.62	-4.44	-19.00	14,444,873.59	1,726,884.05	39.77478455	-80.69225300	
1,574.00	4.64	284.73	1,573.35	-2.73	-25.86	14,444,875.30	1,726,877.20	39.77478931	-80.69227737	
1,668.00	4.68	285.22	1,667.04	-0.75	-33.24	14,444,877.28	1,726,869.82	39.77479480	-80.69230361	
1,763.00	5.62	284.74	1,761.66	1.45	-41.47	14,444,879.48	1,726,861.58	39.77480092	-80.69233290	
1,858.00	5.57	285.54	1,856.20	3.87	-50.41	14,444,881.90	1,726,852.64	39.77480765	-80.69236469	
1,952.00	5.25	286.80	1,949.79	6.33	-58.93	14,444,884.36	1,726,844.13	39.77481450	-80.69239496	
2,047.00	5.32	289.62	2,044.38	9.07	-67.24	14,444,887.10	1,726,835.82	39.77482209	-80.69242450	
2,142.00	4.97	292.25	2,139.00	12.10	-75.19	14,444,890.13	1,726,827.86	39.77483050	-80.69245278	
2,195.00	4.76	292.26	2,191.81	13.81	-79.35	14,444,891.84	1,726,823.70	39.77483522	-80.69246756	
2,329.00	4.74	298.33	2,325.35	18.54	-89.37	14,444,896.57	1,726,813.69	39.77484831	-80.69250316	
2,423.00	3.67	298.24	2,419.09	21.81	-95.44	14,444,899.84	1,726,807.62	39.77485734	-80.69252472	
2,518.00	3.02	281.86	2,513.93	23.76	-100.57	14,444,901.79	1,726,802.49	39.77486275	-80.69254295	
2,612.00	3.28	269.33	2,607.79	24.24	-105.68	14,444,902.27	1,726,797.38	39.77486411	-80.69256114	
2,707.00	2.00	258.23	2,702.69	23.87	-110.02	14,444,901.90	1,726,793.04	39.77486313	-80.69257659	
2,802.00	1.49	253.79	2,797.65	23.18	-112.83	14,444,901.21	1,726,790.23	39.77486128	-80.69258660	
2,895.00	1.13	264.18	2,890.62	22.75	-114.90	14,444,900.78	1,726,788.15	39.77486012	-80.69259398	
2,990.00	1.85	207.41	2,985.59	21.30	-116.54	14,444,899.33	1,726,786.52	39.77485614	-80.69259983	
3,085.00	3.54	190.49	3,080.49	17.05	-117.78	14,444,895.08	1,726,785.28	39.77484449	-80.69260430	
3,180.00	4.49	172.23	3,175.26	10.48	-117.81	14,444,888.51	1,726,785.24	39.77482645	-80.69260449	
3,274.00	6.49	161.68	3,268.82	1.79	-115.65	14,444,879.82	1,726,787.41	39.77480257	-80.69259688	
3,369.00	8.36	154.07	3,363.02	-9.52	-110.94	14,444,868.51	1,726,792.12	39.77477146	-80.69258026	
3,463.00	9.39	144.50	3,455.90	-21.91	-103.50	14,444,856.12	1,726,799.56	39.77473737	-80.69255393	
3,558.00	10.89	147.28	3,549.42	-35.77	-94.14	14,444,842.26	1,726,808.91	39.77469922	-80.69252081	
3,653.00	11.26	155.96	3,642.65	-51.79	-85.51	14,444,826.24	1,726,817.54	39.77465514	-80.69249030	
3,747.00	12.19	160.29	3,734.69	-69.51	-78.43	14,444,808.52	1,726,824.63	39.77460639	-80.69246529	
3,842.00	11.84	159.99	3,827.61	-88.11	-71.71	14,444,789.92	1,726,831.35	39.77455525	-80.69244161	
3,937.00	12.51	156.68	3,920.48	-106.72	-64.30	14,444,771.31	1,726,838.75	39.77450408	-80.69241547	
4,034.00	13.22	156.52	4,015.04	-126.54	-55.72	14,444,751.49	1,726,847.33	39.77444957	-80.69238519	
4,130.00	15.00	153.09	4,108.14	-147.69	-45.73	14,444,730.34	1,726,857.33	39.77439139	-80.69234986	
4,224.00	16.88	153.30	4,198.52	-170.73	-34.09	14,444,707.30	1,726,868.97	39.77432801	-80.69230872	
4,319.00	15.31	151.57	4,289.80	-194.08	-21.92	14,444,683.95	1,726,881.14	39.77426376	-80.69226570	
4,413.00	14.13	151.21	4,380.71	-215.05	-10.49	14,444,662.98	1,726,892.57	39.77420606	-80.69222526	
4,508.00	13.93	151.96	4,472.88	-235.31	0.47	14,444,642.72	1,726,903.53	39.77415033	-80.69218650	
4,603.00	14.00	152.50	4,565.07	-255.59	11.16	14,444,622.44	1,726,914.21	39.77409452	-80.69214873	
4,697.00	13.97	152.88	4,656.28	-275.78	21.58	14,444,602.25	1,726,924.64	39.77403899	-80.69211189	
4,792.00	14.20	149.26	4,748.43	-296.00	32.76	14,444,582.03	1,726,935.82	39.77398335	-80.69207233	
4,887.00	14.21	147.44	4,840.52	-315.84	44.99	14,444,562.19	1,726,948.05	39.77392874	-80.69202904	
4,981.00	15.28	147.13	4,931.43	-335.97	57.93	14,444,542.06	1,726,960.98	39.77387335	-80.69198326	
5,075.00	13.69	146.93	5,022.44	-355.70	70.72	14,444,522.34	1,726,973.78	39.77381905	-80.69193797	
5,169.00	12.87	146.87	5,113.92	-373.78	82.51	14,444,504.25	1,726,985.57	39.77376927	-80.69189623	
5,264.00	13.38	148.51	5,206.44	-392.02	94.03	14,444,486.01	1,726,997.09	39.77371908	-80.69185544	
5,358.00	15.13	150.00	5,297.54	-411.92	105.85	14,444,466.11	1,727,008.91	39.77366432	-80.69181363	
5,452.00	15.55	150.73	5,388.19	-433.53	118.14	14,444,444.50	1,727,021.20	39.77360484	-80.69177014	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Orginal Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Orginal Hole	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	WV Department of Environmental Protection	
								Latitude	Longitude
5,547.00	15.69	149.15	5,479.69	-455.67	130.96	14,444,422.36	1,727,034.01	39.77354393	-80.69172481
5,641.00	16.79	148.36	5,569.93	-478.14	144.60	14,444,399.89	1,727,047.65	39.77348209	-80.69167654
5,737.00	15.57	147.45	5,662.13	-500.81	158.80	14,444,377.23	1,727,061.86	39.77341971	-80.69162626
5,831.00	14.70	147.04	5,752.87	-521.45	172.08	14,444,356.58	1,727,075.14	39.77336290	-80.69157926
5,926.00	14.72	144.45	5,844.76	-541.38	185.66	14,444,336.65	1,727,088.71	39.77330803	-80.69153119
6,023.00	14.14	140.63	5,938.70	-560.57	200.34	14,444,317.46	1,727,103.39	39.77325520	-80.69147917
6,118.00	13.48	142.82	6,030.95	-578.36	214.39	14,444,299.67	1,727,117.45	39.77320620	-80.69142938
6,211.00	13.60	146.47	6,121.37	-596.11	226.98	14,444,281.92	1,727,130.04	39.77315733	-80.69138479
6,306.00	13.42	147.82	6,213.74	-614.75	239.02	14,444,263.28	1,727,142.08	39.77310602	-80.69134216
6,398.00	13.81	147.05	6,303.15	-633.00	250.68	14,444,245.03	1,727,153.74	39.77305579	-80.69130090
6,492.00	13.85	149.07	6,394.43	-652.07	262.56	14,444,225.96	1,727,165.62	39.77300332	-80.69125883
6,587.00	12.80	147.08	6,486.87	-670.66	274.13	14,444,207.37	1,727,177.18	39.77295216	-80.69121790
6,681.00	14.71	145.59	6,578.17	-689.24	286.53	14,444,188.79	1,727,189.59	39.77290100	-80.69117399
6,775.00	15.99	146.76	6,668.82	-709.92	300.37	14,444,168.11	1,727,203.43	39.77284408	-80.69112498
6,870.00	16.19	147.84	6,760.10	-732.08	314.60	14,444,145.95	1,727,217.65	39.77278310	-80.69107463
6,964.00	15.07	149.49	6,850.62	-753.70	327.78	14,444,124.33	1,727,230.83	39.77272360	-80.69102799
7,058.00	14.16	150.02	6,941.58	-774.19	339.72	14,444,103.84	1,727,242.78	39.77266722	-80.69098572
7,153.00	14.13	148.55	7,033.70	-794.14	351.58	14,444,083.89	1,727,254.64	39.77261230	-80.69094376
7,247.00	13.82	147.12	7,124.91	-813.36	363.66	14,444,064.67	1,727,266.72	39.77255941	-80.69090100
7,342.00	14.01	144.79	7,217.13	-832.29	376.45	14,444,045.74	1,727,279.51	39.77250732	-80.69085572
7,531.00	15.98	146.02	7,399.68	-872.56	404.19	14,444,005.48	1,727,307.24	39.77239646	-80.69075751
7,626.00	14.89	146.86	7,491.26	-893.62	418.17	14,443,984.41	1,727,321.23	39.77233848	-80.69070800
7,720.00	14.42	146.97	7,582.20	-913.55	431.15	14,443,964.48	1,727,334.21	39.77228364	-80.69066205
7,815.00	14.37	144.95	7,674.21	-933.11	444.37	14,443,944.92	1,727,347.43	39.77222977	-80.69061525
Survey @ 7815.00 MD 7674.21 TVD									
7,889.00	14.37	144.95	7,745.90	-948.15	454.92	14,443,929.88	1,727,357.97	39.77218838	-80.69057789
Survey projected to 7889.00 MD 7745.90 TVD									

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
225.00	224.99	-0.28	-1.35	MWD surveys
7,815.00	7,674.21	-933.11	444.37	Survey @ 7815.00 MD 7674.21 TVD
7,889.00	7,745.90	-948.15	454.92	Survey projected to 7889.00 MD 7745.90 TVD

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

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Project	Marshall County, West Virginia.		
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)		

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Site	Keith Stern				
Site Position:		Northing:	14,444,890.33 usft	Latitude:	39.77483004
From:	Lat/Long	Easting:	1,726,932.47 usft	Longitude:	-80.69208048
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.197 °

Well	Keith Stern N-14 HU (slot D)					
Well Position	+N-S	0.00 usft	Northing:	14,444,878.03 usft	Latitude:	39.77479655
	+E-W	0.00 usft	Easting:	1,726,903.06 usft	Longitude:	-80.69218531
Position Uncertainty	0.00 usft		Wellhead Elevation:	usft	Ground Level:	747.00 usft

Wellbore	Sidetrack 01				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	1/12/2020	-8.776	66.729	51,873.14759167

Design	Surveys Sidetrack 01				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	5,926.00
Vertical Section:	Depth From (TVD) (usft)	+N-S (usft)	+E-W (usft)	Direction (°)	
	0.00	0.00	0.00	330.21	

Survey Program	Date	1/28/2020			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
225.00	490.00	MWD surf (Original Hole)	MWD	MWD - Standard	
534.00	2,195.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,329.00	5,926.00	MWD (Original Hole)	MWD	MWD - Standard	
5,946.00	18,660.00	MWD ST1 (Sidetrack 01)	MWD	MWD - Standard	
18,718.00	18,718.00	Projection (Sidetrack 01)	MWD	MWD - Standard	

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N-S (usft)	+E-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
225.00	0.70	258.35	224.99	-0.28	-1.35	0.43	0.31	0.31	0.00	0.00
256.00	0.80	264.17	255.99	-0.34	-1.75	0.57	0.41	0.32	18.77	0.00
287.00	0.74	265.11	286.99	-0.38	-2.16	0.75	0.20	-0.19	3.03	0.00
319.00	0.65	264.36	318.99	-0.41	-2.55	0.91	0.28	-0.28	-2.34	0.00
350.00	0.55	273.59	349.98	-0.42	-2.87	1.06	0.45	-0.32	29.77	0.00
382.00	0.59	266.77	381.98	-0.42	-3.19	1.22	0.25	0.13	-21.31	0.00



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-14 HU (slot D)
Project:	Marshall County, West Virginia	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

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Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
413.00	0.44	274.02	412.98	-0.42	-3.47	1.36	0.53	-0.48	23.39
445.00	0.61	273.41	444.98	-0.40	-3.76	1.52	0.53	0.53	-1.91
490.00	0.89	283.46	489.98	-0.31	-4.34	1.89	0.69	0.62	22.33
534.00	1.07	304.71	533.97	0.01	-5.01	2.50	0.91	0.41	48.30
628.00	0.97	291.97	627.96	0.80	-6.47	3.91	0.26	-0.11	-13.55
723.00	0.77	283.92	722.94	1.26	-7.83	4.99	0.25	-0.21	-8.47
817.00	0.68	192.24	816.94	0.87	-8.57	5.01	1.11	-0.10	-97.53
912.00	0.86	163.62	911.93	-0.37	-8.48	3.90	0.44	0.19	-30.13
1,007.00	0.97	167.04	1,006.92	-1.84	-8.10	2.43	0.13	0.12	3.60
1,100.00	1.08	169.42	1,099.90	-3.47	-7.76	0.85	0.13	0.12	2.56
1,195.00	0.99	196.29	1,194.89	-5.13	-7.83	-0.56	0.51	-0.09	28.28
1,290.00	1.86	272.57	1,289.87	-5.85	-9.60	-0.31	1.99	0.92	80.29
1,385.00	2.91	277.43	1,384.78	-5.47	-13.53	1.98	1.12	1.11	5.12
1,479.00	3.89	283.15	1,478.62	-4.44	-19.00	5.59	1.10	1.04	6.09
1,574.00	4.64	284.73	1,573.35	-2.73	-25.86	10.48	0.80	0.79	1.66
1,668.00	4.68	285.22	1,667.04	-0.75	-33.24	15.86	0.06	0.04	0.52
1,763.00	5.62	284.74	1,761.66	1.45	-41.47	21.86	0.99	0.99	-0.51
1,858.00	5.57	285.54	1,856.20	3.87	-50.41	28.40	0.10	-0.05	0.84
1,952.00	5.25	286.80	1,949.79	6.33	-58.93	34.77	0.36	-0.34	1.34
2,047.00	5.32	289.62	2,044.38	9.07	-67.24	41.28	0.28	0.07	2.97
2,142.00	4.97	292.25	2,139.00	12.10	-75.19	47.86	0.44	-0.37	2.77
2,195.00	4.76	292.26	2,191.81	13.81	-79.35	51.41	0.40	-0.40	0.02
2,329.00	4.74	298.33	2,325.35	18.54	-89.37	60.49	0.38	-0.01	4.53
2,423.00	3.67	298.24	2,419.09	21.81	-95.44	66.35	1.14	-1.14	-0.10
2,518.00	3.02	281.86	2,513.93	23.76	-100.57	70.59	1.21	-0.68	-17.24
2,612.00	3.28	269.33	2,607.79	24.24	-105.68	73.54	0.78	0.28	-13.33
2,707.00	2.00	258.23	2,702.69	23.87	-110.02	75.38	1.44	-1.35	-11.68
2,802.00	1.49	253.79	2,797.65	23.18	-112.83	76.18	0.55	-0.54	-4.67
2,895.00	1.13	264.18	2,890.62	22.75	-114.90	76.84	0.46	-0.39	11.17
2,990.00	1.85	207.41	2,985.59	21.30	-116.54	76.39	1.63	0.76	-59.76
3,085.00	3.54	190.49	3,080.49	17.05	-117.78	73.32	1.95	1.78	-17.81
3,180.00	4.49	172.23	3,175.26	10.48	-117.81	67.63	1.66	1.00	-19.22
3,274.00	6.49	161.68	3,268.82	1.79	-115.65	59.02	2.37	2.13	-11.22
3,369.00	8.36	154.07	3,363.02	-9.52	-110.94	46.86	2.22	1.97	-8.01
3,463.00	9.39	144.50	3,459.90	-21.91	-103.50	32.41	1.91	1.10	-10.18
3,558.00	10.89	147.28	3,549.42	-35.77	-94.14	15.74	1.66	1.58	2.93
3,653.00	11.26	155.96	3,642.65	-51.79	-85.51	-2.45	1.80	0.39	9.14
3,747.00	12.19	160.29	3,734.69	-69.51	-78.43	-21.36	1.36	0.99	4.61
3,842.00	11.84	159.99	3,827.61	-88.11	-71.71	-40.83	0.37	-0.37	-0.32
3,937.00	12.51	156.68	3,920.48	-106.72	-64.30	-60.66	1.02	0.71	-3.48
4,034.00	13.22	156.52	4,015.04	-126.54	-55.72	-82.13	0.73	0.73	-0.16
4,130.00	15.00	153.09	4,108.14	-147.69	-45.73	-105.45	2.05	1.85	-3.57
4,224.00	16.88	153.30	4,198.52	-170.73	-34.09	-131.23	2.00	2.00	0.22

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
4,319.00	15.31	151.57	4,289.80	-194.08	-21.92	-157.54	1.73	-1.65	-1.82
4,413.00	14.13	151.21	4,380.71	-215.05	-10.49	-181.42	1.26	-1.26	-0.38
4,508.00	13.93	151.96	4,472.88	-235.31	0.47	-204.44	0.28	-0.21	0.79
4,603.00	14.00	152.50	4,565.07	-255.59	11.16	-227.35	0.16	0.07	0.57
4,697.00	13.97	152.88	4,656.28	-275.78	21.58	-250.05	0.10	-0.03	0.40
4,792.00	14.20	149.26	4,748.43	-296.00	32.76	-273.15	0.96	0.24	-3.81
4,887.00	14.21	147.44	4,840.52	-315.84	44.99	-296.45	0.47	0.01	-1.92
4,981.00	15.28	147.13	4,931.43	-335.97	57.93	-320.34	1.14	1.14	-0.33
5,075.00	13.69	146.93	5,022.44	-355.70	70.72	-343.82	1.69	-1.69	-0.21
5,169.00	12.87	146.87	5,113.92	-373.78	82.51	-365.38	0.87	-0.87	-0.06
5,264.00	13.38	148.51	5,206.44	-392.02	94.03	-386.93	0.66	0.54	1.73
5,358.00	15.13	150.00	5,297.54	-411.92	105.85	-410.07	1.90	1.86	1.59
5,452.00	15.55	150.73	5,388.19	-433.53	118.14	-434.93	0.49	0.45	0.78
5,547.00	15.69	149.15	5,479.69	-455.67	130.96	-460.51	0.47	0.15	-1.66
5,641.00	16.79	148.36	5,569.93	-478.14	144.60	-486.79	1.19	1.17	-0.84
5,737.00	15.57	147.45	5,662.13	-500.81	158.80	-513.52	1.30	-1.27	-0.95
5,831.00	14.70	147.04	5,752.87	-521.45	172.08	-538.03	0.93	-0.93	-0.44
5,926.00	14.72	144.45	5,844.76	-541.38	185.66	-562.07	0.69	0.02	-2.73
Tie into original hole @ 5926 MD									
5,946.00	14.08	147.21	5,864.13	-545.49	188.45	-567.03	4.69	-3.20	13.80
5,977.00	12.49	141.52	5,894.30	-551.29	192.58	-574.11	6.63	-5.13	-18.35
6,017.00	11.90	129.38	5,933.40	-557.29	198.46	-582.24	6.57	-1.48	-30.35
6,040.00	12.88	125.20	5,955.87	-560.27	202.39	-586.78	5.77	4.26	-18.17
6,087.00	14.54	125.08	6,001.53	-566.68	211.50	-596.87	3.53	3.53	-0.26
6,135.00	14.29	126.14	6,048.01	-573.64	221.21	-607.73	0.76	-0.52	2.21
6,167.00	13.56	130.11	6,079.07	-578.39	227.27	-614.86	3.76	-2.28	12.41
6,199.00	12.71	135.54	6,110.24	-583.32	232.60	-621.79	4.68	-2.66	16.97
6,225.00	12.35	138.45	6,135.62	-587.44	236.45	-627.28	2.79	-1.38	11.19
6,293.00	12.52	135.06	6,202.03	-598.10	246.48	-641.51	1.10	0.25	-4.99
6,391.00	12.46	144.46	6,297.72	-614.22	260.13	-662.29	2.07	-0.06	9.59
6,485.00	13.10	144.72	6,389.39	-631.17	272.18	-682.98	0.68	0.68	0.28
6,580.00	14.52	148.02	6,481.64	-650.06	284.71	-705.60	1.71	1.49	3.47
6,674.00	15.72	142.07	6,572.39	-670.10	298.78	-729.98	2.09	1.28	-6.33
6,769.00	16.51	129.12	6,663.69	-688.78	317.16	-755.33	3.87	0.83	-13.63
6,864.00	16.25	134.04	6,754.83	-706.54	337.19	-780.69	1.49	-0.27	5.18
6,958.00	16.48	139.12	6,845.03	-725.76	355.37	-806.41	1.54	0.24	5.40
7,053.00	15.48	145.59	6,936.37	-746.41	371.36	-832.27	2.15	-1.05	6.81
7,147.00	15.23	142.88	7,027.01	-766.60	385.90	-857.02	0.81	-0.27	-2.88
7,242.00	14.39	146.61	7,118.86	-786.41	399.93	-881.18	1.34	-0.88	3.93
7,337.00	12.91	147.99	7,211.17	-805.27	412.05	-903.57	1.60	-1.56	1.45
7,558.00	14.67	148.96	7,425.79	-850.18	439.57	-956.22	0.80	0.80	0.44
7,620.00	14.95	150.64	7,485.73	-863.88	447.54	-972.06	0.83	0.45	2.71
7,715.00	14.84	147.43	7,577.54	-884.81	460.09	-996.47	0.88	-0.12	-3.38
7,809.00	14.22	149.05	7,668.54	-904.86	472.51	-1,020.04	0.79	-0.66	1.72

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
7,904.00	14.15	148.56	7,760.64	-924.77	484.57	-1,043.31	0.15	-0.07	-0.52
7,999.00	14.38	147.27	7,852.71	-944.60	497.01	-1,066.70	0.41	0.24	-1.36
8,094.00	14.94	146.38	7,944.62	-964.72	510.16	-1,090.70	0.64	0.59	-0.94
8,189.00	15.61	145.64	8,036.26	-985.47	524.16	-1,115.66	0.73	0.71	-0.78
8,283.00	15.78	144.29	8,126.76	-1,006.29	538.76	-1,140.98	0.43	0.18	-1.44
8,377.00	15.92	146.57	8,217.18	-1,027.43	553.32	-1,166.56	0.68	0.15	2.43
8,471.00	16.18	151.50	8,307.52	-1,049.70	566.67	-1,192.52	1.48	0.28	5.24
8,566.00	16.41	155.60	8,398.71	-1,073.55	578.53	-1,219.11	1.23	0.24	4.32
8,661.00	16.64	157.99	8,489.79	-1,098.38	589.17	-1,245.95	0.76	0.24	2.52
8,755.00	15.27	161.48	8,580.17	-1,122.60	598.15	-1,271.42	1.78	-1.46	3.71
8,849.00	14.39	161.67	8,671.03	-1,145.43	605.75	-1,295.01	0.94	-0.94	0.20
8,944.00	14.44	162.32	8,763.04	-1,167.92	613.06	-1,318.16	0.18	0.05	0.68
9,039.00	14.52	162.47	8,855.03	-1,190.56	620.25	-1,341.38	0.09	0.08	0.16
9,226.00	16.17	163.68	9,035.35	-1,237.91	634.63	-1,389.61	0.90	0.88	0.65
9,415.00	18.33	165.15	9,215.84	-1,291.90	649.64	-1,443.93	1.17	1.14	0.78
9,510.00	17.75	163.39	9,306.17	-1,320.21	657.61	-1,472.46	0.84	-0.61	-1.85
9,605.00	14.37	158.69	9,397.46	-1,345.08	666.04	-1,498.23	3.81	-3.56	-4.95
9,699.00	14.04	154.57	9,488.58	-1,366.25	675.17	-1,521.13	1.13	-0.35	-4.38
9,794.00	14.21	149.92	9,580.71	-1,386.74	685.96	-1,544.29	1.21	0.18	-4.89
9,888.00	13.27	147.92	9,672.02	-1,405.87	697.48	-1,566.60	1.12	-1.00	-2.13
9,983.00	13.13	143.51	9,764.52	-1,423.78	709.68	-1,588.21	1.07	-0.15	-4.64
10,076.00	13.44	141.33	9,855.03	-1,440.71	722.72	-1,609.38	0.63	0.33	-2.34
10,171.00	13.56	140.06	9,947.40	-1,457.87	736.77	-1,631.25	0.34	0.13	-1.34
10,266.00	13.91	139.92	10,039.69	-1,475.15	751.27	-1,653.45	0.37	0.37	-0.15
10,414.00	14.42	143.97	10,183.19	-1,503.66	773.56	-1,689.28	0.75	0.34	2.74
10,461.00	12.40	144.67	10,228.91	-1,512.51	779.93	-1,700.12	4.31	-4.30	1.49
10,508.00	10.20	144.41	10,274.99	-1,520.01	785.27	-1,709.28	4.68	-4.68	-0.55
10,556.00	7.91	146.61	10,322.39	-1,526.23	789.56	-1,716.81	4.82	-4.77	4.58
10,603.00	5.63	148.36	10,369.06	-1,530.89	792.55	-1,722.34	4.87	-4.85	3.72
10,650.00	2.99	156.71	10,415.92	-1,533.98	794.24	-1,725.86	5.76	-5.62	17.77
10,697.00	0.84	199.08	10,462.90	-1,535.43	794.61	-1,727.31	5.18	-4.57	90.15
10,745.00	2.15	308.41	10,510.88	-1,535.21	793.79	-1,726.70	5.32	2.73	227.77
10,840.00	6.55	331.18	10,605.59	-1,529.35	789.78	-1,719.63	4.89	4.63	23.97
10,935.00	14.51	331.35	10,698.92	-1,514.13	781.45	-1,702.28	8.38	8.38	0.18
10,982.00	21.36	330.30	10,743.61	-1,501.52	774.38	-1,687.82	14.59	14.57	-2.23
11,029.00	25.98	328.63	10,786.64	-1,485.28	764.77	-1,668.96	9.93	9.83	-3.55
11,076.00	29.05	328.01	10,828.32	-1,466.81	753.37	-1,647.26	6.56	6.53	-1.32
11,124.00	33.23	329.51	10,869.40	-1,445.58	740.51	-1,622.45	8.86	8.71	3.13
11,171.00	35.69	329.68	10,908.15	-1,422.65	727.06	-1,595.86	5.24	5.23	0.36
11,218.00	39.43	330.21	10,945.40	-1,397.85	712.71	-1,567.22	7.99	7.96	1.13
11,265.00	42.95	330.65	10,980.76	-1,370.93	697.45	-1,536.27	7.51	7.49	0.94
11,313.00	46.90	331.09	11,014.74	-1,341.33	680.95	-1,502.38	8.25	8.23	0.92
11,360.00	50.90	330.83	11,045.63	-1,310.37	663.76	-1,466.98	8.52	8.51	-0.55

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

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WV Department of Environmental Protection

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
11,408.00	53.67	331.00	11,074.99	-1,277.19	645.31	-1,429.01	5.78	5.77	0.35
11,455.00	56.75	332.14	11,101.80	-1,243.25	626.94	-1,390.43	6.85	6.55	2.43
11,502.00	59.60	331.97	11,126.59	-1,207.97	608.23	-1,350.52	6.07	6.06	-0.36
11,549.00	61.63	331.79	11,149.65	-1,171.86	588.93	-1,309.59	4.33	4.32	-0.38
11,597.00	63.43	330.91	11,171.79	-1,134.49	568.50	-1,267.01	4.09	3.75	-1.83
11,644.00	65.93	331.00	11,191.89	-1,097.35	547.88	-1,224.53	5.32	5.32	0.19
11,691.00	68.75	331.88	11,209.99	-1,059.26	527.15	-1,181.18	6.24	6.00	1.87
11,738.00	73.10	332.85	11,225.35	-1,019.91	506.56	-1,136.80	9.46	9.26	2.06
11,786.00	76.22	333.29	11,238.05	-978.65	485.60	-1,090.57	6.56	6.50	0.92
11,833.00	77.93	333.81	11,248.56	-937.63	465.19	-1,044.84	3.79	3.64	1.11
11,880.00	80.66	333.73	11,257.29	-896.21	444.78	-998.75	5.81	5.81	-0.17
11,927.00	82.64	333.81	11,264.11	-854.50	424.23	-952.35	4.22	4.21	0.17
11,975.00	82.37	333.73	11,270.37	-811.81	403.20	-904.85	0.59	-0.56	-0.17
12,022.00	85.93	331.70	11,275.16	-770.27	381.77	-858.15	8.71	7.57	-4.32
12,069.00	86.99	331.18	11,278.07	-729.07	359.34	-811.25	2.51	2.26	-1.11
12,162.00	89.36	331.35	11,281.03	-647.57	314.66	-718.32	2.55	2.55	0.18
12,257.00	90.95	330.74	11,280.77	-564.44	268.67	-623.33	1.79	1.67	-0.64
12,351.00	91.03	331.26	11,279.15	-482.24	223.10	-529.36	0.56	0.09	0.55
12,446.00	90.86	331.53	11,277.58	-398.85	177.62	-434.39	0.34	-0.18	0.28
12,540.00	90.99	331.09	11,276.06	-316.40	132.50	-340.42	0.49	0.14	-0.47
12,635.00	90.73	331.35	11,274.64	-233.15	86.77	-245.44	0.39	-0.27	0.27
12,730.00	90.37	331.44	11,273.72	-149.75	41.29	-150.47	0.39	-0.38	0.09
12,824.00	91.43	330.39	11,272.25	-67.61	-4.40	-56.49	1.59	1.13	-1.12
12,919.00	91.03	329.77	11,270.21	14.71	-51.77	38.49	0.78	-0.42	-0.65
13,014.00	90.95	329.16	11,268.57	96.52	-100.03	133.46	0.65	-0.08	-0.64
13,108.00	90.95	329.16	11,267.01	177.22	-148.21	227.44	0.00	0.00	0.00
13,203.00	90.77	328.89	11,265.58	258.66	-197.10	322.40	0.34	-0.19	-0.28
13,297.00	91.38	329.42	11,263.82	339.35	-245.28	416.37	0.86	0.65	0.56
13,391.00	90.99	329.51	11,261.88	420.30	-293.03	510.34	0.43	-0.41	0.10
13,486.00	90.42	328.89	11,260.71	501.89	-341.67	605.32	0.89	-0.60	-0.65
13,581.00	92.57	329.68	11,258.23	583.53	-390.18	700.27	2.41	2.26	0.83
13,675.00	91.87	329.16	11,254.59	664.40	-437.96	794.19	0.93	-0.74	-0.55
13,770.00	91.43	329.24	11,251.85	745.96	-486.58	889.13	0.47	-0.46	0.08
13,864.00	91.78	329.77	11,249.22	826.93	-534.27	983.09	0.68	0.37	0.56
13,959.00	92.13	329.86	11,245.98	909.00	-582.01	1,078.03	0.38	0.37	0.09
14,053.00	91.69	330.03	11,242.84	990.31	-629.06	1,171.98	0.50	-0.47	0.18
14,147.00	91.34	329.95	11,240.36	1,071.68	-676.05	1,265.95	0.38	-0.37	-0.09
14,242.00	91.82	330.74	11,237.74	1,154.21	-723.04	1,360.91	0.97	0.51	0.83
14,336.00	92.04	331.70	11,234.57	1,236.55	-768.27	1,454.84	1.05	0.23	1.02
14,431.00	91.43	331.26	11,231.70	1,319.98	-813.61	1,549.77	0.79	-0.64	-0.46
14,525.00	92.00	331.70	11,228.88	1,402.54	-858.47	1,643.71	0.77	0.61	0.47
14,620.00	93.14	331.88	11,224.63	1,486.17	-903.33	1,738.57	1.21	1.20	0.19
14,715.00	93.10	332.50	11,219.45	1,570.07	-947.59	1,833.37	0.65	-0.04	0.65
14,809.00	90.95	331.70	11,216.13	1,653.09	-991.54	1,927.26	2.44	-2.29	-0.85

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem N-14 HU (slot D)
Project:	Marshall County, West Virginia	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
14,903.00	90.46	331.62	11,214.98	1,735.81	-1,036.16	2,021.22	0.53	-0.52	-0.09
14,998.00	91.12	331.35	11,213.67	1,819.28	-1,081.51	2,116.19	0.75	0.69	-0.28
15,093.00	90.86	330.91	11,212.03	1,902.46	-1,127.37	2,211.16	0.54	-0.27	-0.46
15,188.00	90.33	330.83	11,211.04	1,985.44	-1,173.61	2,306.15	0.56	-0.56	-0.08
15,282.00	92.09	330.65	11,209.05	2,067.43	-1,219.54	2,400.12	1.88	1.87	-0.19
15,377.00	91.91	330.91	11,205.74	2,150.29	-1,265.89	2,495.06	0.33	-0.19	0.27
15,472.00	91.38	330.39	11,203.01	2,233.06	-1,312.44	2,590.01	0.78	-0.56	-0.55
15,566.00	92.18	330.21	11,200.09	2,314.67	-1,358.99	2,683.97	0.87	0.85	-0.19
15,661.00	92.18	330.30	11,196.48	2,397.09	-1,406.08	2,778.90	0.09	0.00	0.09
15,756.00	91.56	330.03	11,193.38	2,479.46	-1,453.32	2,873.85	0.71	-0.65	-0.28
15,850.00	91.03	330.03	11,191.25	2,560.87	-1,500.27	2,967.82	0.56	-0.56	0.00
15,945.00	90.99	330.56	11,189.58	2,643.37	-1,547.34	3,062.81	0.56	-0.04	0.56
16,040.00	90.42	330.39	11,188.41	2,726.03	-1,594.15	3,157.80	0.63	-0.60	-0.18
16,134.00	91.12	330.47	11,187.15	2,807.78	-1,640.53	3,251.79	0.75	0.74	0.09
16,229.00	90.59	330.65	11,185.73	2,890.50	-1,687.22	3,346.78	0.59	-0.56	0.19
16,324.00	90.55	331.26	11,184.78	2,973.55	-1,733.34	3,441.76	0.64	-0.04	0.64
16,418.00	91.82	332.06	11,182.84	3,056.26	-1,777.95	3,535.71	1.60	1.35	0.85
16,513.00	91.87	332.23	11,179.78	3,140.21	-1,822.32	3,630.61	0.19	0.05	0.18
16,607.00	91.34	331.70	11,177.15	3,223.15	-1,866.48	3,724.52	0.80	-0.56	-0.56
16,702.00	90.90	331.88	11,175.29	3,306.85	-1,911.38	3,819.47	0.50	-0.46	0.19
16,797.00	90.68	330.03	11,173.98	3,389.89	-1,957.49	3,914.45	1.96	-0.23	-1.95
16,890.00	90.55	330.03	11,172.98	3,470.45	-2,003.95	4,007.44	0.14	-0.14	0.00
16,985.00	89.85	331.26	11,172.65	3,553.25	-2,050.52	4,102.44	1.49	-0.74	1.29
17,080.00	89.27	331.97	11,173.38	3,636.82	-2,095.68	4,197.40	0.97	-0.61	0.75
17,174.00	90.77	331.53	11,173.35	3,719.62	-2,140.17	4,291.37	1.66	1.60	-0.47
17,269.00	90.29	330.91	11,172.47	3,802.88	-2,185.90	4,386.35	0.83	-0.51	-0.65
17,364.00	90.73	331.00	11,171.62	3,885.93	-2,232.02	4,481.34	0.47	0.46	0.09
17,458.00	91.47	331.44	11,169.82	3,968.31	-2,277.27	4,575.30	0.92	0.79	0.47
17,553.00	91.60	331.26	11,167.27	4,051.65	-2,322.80	4,670.25	0.23	0.14	-0.19
17,647.00	92.31	331.18	11,164.07	4,133.99	-2,368.03	4,764.18	0.76	0.76	-0.09
17,742.00	89.76	331.88	11,162.35	4,217.48	-2,413.31	4,859.13	2.78	-2.68	0.74
17,837.00	89.27	331.53	11,163.16	4,301.12	-2,458.34	4,954.09	0.63	-0.52	-0.37
17,931.00	88.75	331.26	11,164.78	4,383.64	-2,503.33	5,048.06	0.62	-0.55	-0.29
18,029.00	88.79	329.95	11,166.88	4,469.00	-2,551.42	5,146.03	1.34	0.04	-1.34
18,124.00	90.07	329.86	11,167.83	4,551.18	-2,599.06	5,241.02	1.35	1.35	-0.09
18,219.00	91.43	330.39	11,166.59	4,633.55	-2,646.37	5,336.01	1.54	1.43	0.56
18,314.00	91.87	330.30	11,163.85	4,716.07	-2,693.36	5,430.97	0.47	0.46	-0.09
18,408.00	91.91	329.86	11,160.75	4,797.50	-2,740.22	5,524.92	0.47	0.04	-0.47
18,502.00	91.65	330.03	11,157.83	4,878.82	-2,787.27	5,618.88	0.33	-0.28	0.18
18,597.00	91.52	329.59	11,155.20	4,960.91	-2,835.03	5,713.84	0.48	-0.14	-0.46
18,660.00	90.99	329.86	11,153.82	5,015.30	-2,866.78	5,776.82	0.94	-0.84	0.43
Survey @ 18660.00 MD 11153.82 TVD									
18,718.00	90.99	329.86	11,152.82	5,065.45	-2,895.90	5,834.81	0.00	0.00	0.00

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
Survey projected to 18718.00 MD 11152.82 TVD									

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
5,926.00	5,844.76	-541.38	185.66	Tie into original hole @ 5926 MD
18,660.00	11,153.82	5,015.30	-2,866.78	Survey @ 18660.00 MD 11153.82 TVD

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

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Project	Marshall County, West Virginia.		
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)		

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Site	Keith Stern				
Site Position:		Northing:	14,444,890.33 usft	Latitude:	39.77483004
From:	Lat/Long	Easting:	1,726,932.47 usft	Longitude:	-80.69208048
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.197 °

Well	Keith Stern N-14 HU (slot D)					
Well Position	+N/-S	0.00 usft	Northing:	14,444,878.03 usft	Latitude:	39.77479655
	+E/-W	0.00 usft	Easting:	1,726,903.06 usft	Longitude:	-80.69218531
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level:	747.00 usft

Wellbore	Sidetrack 01				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	1/12/2020	-8.776	66.729	51,873.14759167

Design	Surveys Sidetrack 01				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	5,926.00
Vertical Section:		Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
		0.00	0.00	0.00	330.21

Survey Program	Date	1/28/2020			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
225.00	490.00	MWD surf (Orginal Hole)	MWD	MWD - Standard	
534.00	2,195.00	MWD int (Orginal Hole)	MWD	MWD - Standard	
2,329.00	5,926.00	MWD (Orginal Hole)	MWD	MWD - Standard	
5,946.00	18,660.00	MWD ST1 (Sidetrack 01)	MWD	MWD - Standard	
18,718.00	18,718.00	Projection (Sidetrack 01)	MWD	MWD - Standard	

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
0.00	0.00	0.00	0.00	0.00	0.00	14,444,878.03	1,726,903.06	39.77479655	-80.69218531	
225.00	0.70	258.35	224.99	-0.28	-1.35	14,444,877.75	1,726,901.71	39.77479580	-80.69219010	
256.00	0.80	264.17	255.99	-0.34	-1.75	14,444,877.69	1,726,901.31	39.77479564	-80.69219153	
287.00	0.74	265.11	286.99	-0.38	-2.16	14,444,877.65	1,726,900.90	39.77479554	-80.69219301	
319.00	0.65	264.36	318.99	-0.41	-2.55	14,444,877.62	1,726,900.51	39.77479544	-80.69219438	
350.00	0.55	273.59	349.98	-0.42	-2.87	14,444,877.61	1,726,900.19	39.77479542	-80.69219554	
382.00	0.59	266.77	381.98	-0.42	-3.19	14,444,877.61	1,726,899.87	39.77479543	-80.69219667	
413.00	0.44	274.02	412.98	-0.42	-3.47	14,444,877.61	1,726,899.59	39.77479543	-80.69219766	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stern N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stern	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stern N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
445.00	0.61	273.41	444.98	-0.40	-3.76	14,444,877.63	1,726,899.30	39.77479548	-80.69219870
490.00	0.89	283.46	489.98	-0.31	-4.34	14,444,877.72	1,726,898.72	39.77479575	-80.69220076
534.00	1.07	304.71	533.97	0.01	-5.01	14,444,878.04	1,726,898.05	39.77479662	-80.69220314
628.00	0.97	291.97	627.96	0.80	-6.47	14,444,878.84	1,726,896.59	39.77479882	-80.69220832
723.00	0.77	283.92	722.94	1.26	-7.83	14,444,879.29	1,726,895.22	39.77480008	-80.69221318
817.00	0.68	192.24	816.94	0.87	-8.57	14,444,878.90	1,726,894.49	39.77479901	-80.69221578
912.00	0.86	163.62	911.93	-0.37	-8.48	14,444,877.66	1,726,894.57	39.77479562	-80.69221551
1,007.00	0.97	167.04	1,006.92	-1.84	-8.10	14,444,876.19	1,726,894.96	39.77479158	-80.69221417
1,100.00	1.08	169.42	1,099.90	-3.47	-7.76	14,444,874.57	1,726,895.29	39.77478711	-80.69221299
1,195.00	0.99	196.29	1,194.89	-5.13	-7.83	14,444,872.90	1,726,895.23	39.77478253	-80.69221324
1,290.00	1.86	272.57	1,289.87	-5.85	-9.60	14,444,872.18	1,726,893.46	39.77478057	-80.69221955
1,385.00	2.91	277.43	1,384.78	-5.47	-13.53	14,444,872.56	1,726,889.53	39.77478166	-80.69223354
1,479.00	3.89	283.15	1,478.62	-4.44	-19.00	14,444,873.59	1,726,884.05	39.77478455	-80.69225300
1,574.00	4.64	284.73	1,573.35	-2.73	-25.86	14,444,875.30	1,726,877.20	39.77478931	-80.69227737
1,668.00	4.68	285.22	1,667.04	-0.75	-33.24	14,444,877.28	1,726,869.82	39.77479480	-80.69230361
1,763.00	5.62	284.74	1,761.66	1.45	-41.47	14,444,879.48	1,726,861.58	39.77480092	-80.69233290
1,858.00	5.57	285.54	1,856.20	3.87	-50.41	14,444,881.90	1,726,852.64	39.77480765	-80.69236469
1,952.00	5.25	286.80	1,949.79	6.33	-58.93	14,444,884.36	1,726,844.13	39.77481450	-80.69239496
2,047.00	5.32	289.62	2,044.38	9.07	-67.24	14,444,887.10	1,726,835.82	39.77482209	-80.69242450
2,142.00	4.97	292.25	2,139.00	12.10	-75.19	14,444,890.13	1,726,827.86	39.77483050	-80.69245278
2,195.00	4.76	292.26	2,191.81	13.81	-79.35	14,444,891.84	1,726,823.70	39.77483522	-80.69246756
2,329.00	4.74	298.33	2,325.35	18.54	-89.37	14,444,896.57	1,726,813.69	39.77484831	-80.69250316
2,423.00	3.67	298.24	2,419.09	21.81	-95.44	14,444,899.84	1,726,807.62	39.77485734	-80.69252472
2,518.00	3.02	281.86	2,513.93	23.76	-100.57	14,444,901.79	1,726,802.49	39.77486275	-80.69254295
2,612.00	3.28	269.33	2,607.79	24.24	-105.68	14,444,902.27	1,726,797.38	39.77486411	-80.69256114
2,707.00	2.00	258.23	2,702.69	23.87	-110.02	14,444,901.90	1,726,793.04	39.77486313	-80.69257659
2,802.00	1.49	253.79	2,797.65	23.18	-112.83	14,444,901.21	1,726,790.23	39.77486128	-80.69258660
2,895.00	1.13	264.18	2,890.62	22.75	-114.90	14,444,900.78	1,726,788.15	39.77486012	-80.69259398
2,990.00	1.85	207.41	2,985.59	21.30	-116.54	14,444,899.33	1,726,786.52	39.77485614	-80.69259983
3,085.00	3.54	190.49	3,080.49	17.05	-117.78	14,444,895.08	1,726,785.28	39.77484449	-80.69260430
3,180.00	4.49	172.23	3,175.26	10.48	-117.81	14,444,888.51	1,726,785.24	39.77482645	-80.69260449
3,274.00	6.49	161.68	3,268.82	1.79	-115.65	14,444,879.82	1,726,787.41	39.77480257	-80.69259688
3,369.00	8.36	154.07	3,363.02	-9.52	-110.94	14,444,868.51	1,726,792.12	39.77477146	-80.69258026
3,463.00	9.39	144.50	3,455.90	-21.91	-103.50	14,444,856.12	1,726,799.56	39.77473737	-80.69255393
3,558.00	10.89	147.28	3,549.42	-35.77	-94.14	14,444,842.26	1,726,808.91	39.77469922	-80.69252081
3,653.00	11.26	155.96	3,642.65	-51.79	-85.51	14,444,826.24	1,726,817.54	39.77465514	-80.69249030
3,747.00	12.19	160.29	3,734.69	-69.51	-78.43	14,444,808.52	1,726,824.63	39.77460639	-80.69246529
3,842.00	11.84	159.99	3,827.61	-88.11	-71.71	14,444,789.92	1,726,831.35	39.77455525	-80.69244161
3,937.00	12.51	156.68	3,920.48	-106.72	-64.30	14,444,771.31	1,726,838.75	39.77450408	-80.69241547
4,034.00	13.22	156.52	4,015.04	-126.54	-55.72	14,444,751.49	1,726,847.33	39.77444957	-80.69238519
4,130.00	15.00	153.09	4,108.14	-147.69	-45.73	14,444,730.34	1,726,857.33	39.77439139	-80.69234986
4,224.00	16.88	153.30	4,198.52	-170.73	-34.09	14,444,707.30	1,726,868.97	39.77432801	-80.69230872
4,319.00	15.31	151.57	4,289.80	-194.08	-21.92	14,444,683.95	1,726,881.14	39.77426376	-80.69226570
4,413.00	14.13	151.21	4,380.71	-215.05	-10.49	14,444,662.98	1,726,892.57	39.77420606	-80.69222526
4,508.00	13.93	151.96	4,472.88	-235.31	0.47	14,444,642.72	1,726,903.53	39.77415033	-80.69218650
4,603.00	14.00	152.50	4,565.07	-255.59	11.16	14,444,622.44	1,726,914.21	39.77409452	-80.69214873
4,697.00	13.97	152.88	4,656.28	-275.78	21.58	14,444,602.25	1,726,924.64	39.77403899	-80.69211189
4,792.00	14.20	149.26	4,748.43	-296.00	32.76	14,444,582.03	1,726,935.82	39.77398335	-80.69207233
4,887.00	14.21	147.44	4,840.52	-315.84	44.99	14,444,562.19	1,726,948.05	39.77392874	-80.69202904
4,981.00	15.28	147.13	4,931.43	-335.97	57.93	14,444,542.06	1,726,960.98	39.77387335	-80.69198326
5,075.00	13.69	146.93	5,022.44	-355.70	70.72	14,444,522.34	1,726,973.78	39.77381905	-80.69193797
5,169.00	12.87	146.87	5,113.92	-373.78	82.51	14,444,504.25	1,726,985.57	39.77376927	-80.69189623
5,264.00	13.38	148.51	5,206.44	-392.02	94.03	14,444,486.01	1,726,997.09	39.77371908	-80.69185544
5,358.00	15.13	150.00	5,297.54	-411.92	105.85	14,444,466.11	1,727,008.91	39.77366432	-80.69181363
5,452.00	15.55	150.73	5,388.19	-433.53	118.14	14,444,444.50	1,727,021.20	39.77360484	-80.69177014

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
5,547.00	15.69	149.15	5,479.69	-455.67	130.96	14,444,422.36	1,727,034.01	39.77354393	-80.69172481
5,641.00	16.79	148.36	5,569.93	-478.14	144.60	14,444,399.89	1,727,047.65	39.77348209	-80.69167654
5,737.00	15.57	147.45	5,662.13	-500.81	158.80	14,444,377.23	1,727,061.86	39.77341971	-80.69162626
5,831.00	14.70	147.04	5,752.87	-521.45	172.08	14,444,356.58	1,727,075.14	39.77336290	-80.69157926
5,926.00	14.72	144.45	5,844.76	-541.38	185.66	14,444,336.65	1,727,088.71	39.77330803	-80.69153119
Tie into original hole @ 5926 MD									
5,946.00	14.08	147.21	5,864.13	-545.49	188.45	14,444,332.54	1,727,091.51	39.77329671	-80.69152129
5,977.00	12.49	141.52	5,894.30	-551.29	192.58	14,444,326.74	1,727,095.64	39.77328075	-80.69150667
6,017.00	11.90	129.38	5,933.40	-557.29	198.46	14,444,320.74	1,727,101.52	39.77326421	-80.69148582
6,040.00	12.88	125.20	5,955.87	-560.27	202.39	14,444,317.76	1,727,105.44	39.77325598	-80.69147187
6,087.00	14.54	125.08	6,001.53	-566.68	211.50	14,444,311.35	1,727,114.55	39.77323829	-80.69143953
6,135.00	14.29	126.14	6,048.01	-573.64	221.21	14,444,304.39	1,727,124.27	39.77321909	-80.69140504
6,167.00	13.56	130.11	6,079.07	-578.39	227.27	14,444,299.64	1,727,130.33	39.77320600	-80.69138354
6,199.00	12.71	135.54	6,110.24	-583.32	232.60	14,444,294.71	1,727,135.66	39.77319241	-80.69136461
6,225.00	12.35	138.45	6,135.62	-587.44	236.45	14,444,290.59	1,727,139.51	39.77318106	-80.69135097
6,293.00	12.52	135.06	6,202.03	-598.10	246.48	14,444,279.93	1,727,149.54	39.77315169	-80.69131540
6,391.00	12.46	144.46	6,297.72	-614.22	260.13	14,444,263.81	1,727,163.19	39.77310728	-80.69126702
6,485.00	13.10	144.72	6,389.39	-631.17	272.18	14,444,246.86	1,727,175.24	39.77306062	-80.69122435
6,580.00	14.52	148.02	6,481.64	-650.06	284.71	14,444,227.97	1,727,187.76	39.77300862	-80.69118001
6,674.00	15.72	142.07	6,572.39	-670.10	298.78	14,444,207.93	1,727,201.83	39.77295345	-80.69113018
6,769.00	16.51	129.12	6,663.69	-688.78	317.16	14,444,189.25	1,727,220.22	39.77290199	-80.69106496
6,864.00	16.25	134.04	6,754.83	-706.54	337.19	14,444,171.50	1,727,240.25	39.77285303	-80.69099389
6,958.00	16.48	139.12	6,845.03	-725.76	355.37	14,444,152.27	1,727,258.43	39.77280007	-80.69092942
7,053.00	15.48	145.59	6,936.37	-746.41	371.36	14,444,131.62	1,727,274.42	39.77274320	-80.69087279
7,147.00	15.23	142.88	7,027.01	-766.60	385.90	14,444,111.43	1,727,288.96	39.77268761	-80.69082129
7,242.00	14.39	146.61	7,118.86	-786.41	399.93	14,444,091.62	1,727,302.99	39.77263308	-80.69077161
7,337.00	12.91	147.99	7,211.17	-805.27	412.05	14,444,072.76	1,727,315.11	39.77258118	-80.69072870
7,558.00	14.67	148.96	7,425.79	-850.18	439.57	14,444,027.85	1,727,342.63	39.77245757	-80.69063131
7,620.00	14.95	150.64	7,485.73	-863.88	447.54	14,444,014.15	1,727,350.60	39.77241988	-80.69060312
7,715.00	14.84	147.43	7,577.54	-884.81	460.09	14,443,993.22	1,727,363.15	39.77236227	-80.69055868
7,809.00	14.22	149.05	7,668.54	-904.86	472.51	14,443,973.17	1,727,375.57	39.77230710	-80.69051474
7,904.00	14.15	148.56	7,760.64	-924.77	484.57	14,443,953.26	1,727,387.63	39.77225230	-80.69047207
7,999.00	14.38	147.27	7,852.71	-944.60	497.01	14,443,933.43	1,727,400.06	39.77219772	-80.69042806
8,094.00	14.94	146.38	7,944.62	-964.72	510.16	14,443,913.31	1,727,413.22	39.77214234	-80.69038147
8,189.00	15.61	145.64	8,036.26	-985.47	524.16	14,443,892.56	1,727,427.22	39.77208522	-80.69033192
8,283.00	15.78	144.29	8,126.76	-1,006.29	538.76	14,443,871.74	1,727,441.81	39.77202791	-80.69028023
8,377.00	15.92	146.57	8,217.18	-1,027.43	553.32	14,443,850.60	1,727,456.38	39.77196972	-80.69022866
8,471.00	16.18	151.50	8,307.52	-1,049.70	566.67	14,443,828.33	1,727,469.73	39.77190844	-80.69018141
8,566.00	16.41	155.60	8,398.71	-1,073.55	578.53	14,443,804.48	1,727,481.59	39.77184282	-80.69013950
8,661.00	16.64	157.99	8,489.79	-1,098.38	589.17	14,443,779.65	1,727,492.23	39.77177452	-80.69010193
8,755.00	15.27	161.48	8,580.17	-1,122.60	598.15	14,443,755.43	1,727,501.21	39.77170793	-80.69007029
8,849.00	14.39	161.67	8,671.03	-1,145.43	605.75	14,443,732.60	1,727,508.81	39.77164517	-80.69004350
8,944.00	14.44	162.32	8,763.04	-1,167.92	613.06	14,443,710.11	1,727,516.12	39.77158334	-80.69001776
9,039.00	14.52	162.47	8,855.03	-1,190.56	620.25	14,443,687.47	1,727,523.31	39.77152109	-80.68999247
9,226.00	16.17	163.68	9,035.35	-1,237.91	634.63	14,443,640.12	1,727,537.69	39.77139093	-80.68994188
9,415.00	18.33	165.15	9,215.84	-1,291.90	649.64	14,443,586.13	1,727,552.70	39.77124251	-80.68988912
9,510.00	17.75	163.39	9,306.17	-1,320.21	657.61	14,443,557.82	1,727,560.67	39.77116467	-80.68986111
9,605.00	14.37	158.69	9,397.46	-1,345.08	666.04	14,443,532.95	1,727,569.09	39.77109630	-80.68983143
9,699.00	14.04	154.57	9,488.58	-1,366.25	675.17	14,443,511.79	1,727,578.23	39.77103809	-80.68979917
9,794.00	14.21	149.92	9,580.71	-1,386.74	685.96	14,443,491.29	1,727,589.02	39.77098169	-80.68976102
9,888.00	13.27	147.92	9,672.02	-1,405.87	697.48	14,443,472.16	1,727,600.53	39.77092906	-80.68972028
9,983.00	13.13	143.51	9,764.52	-1,423.78	709.68	14,443,454.25	1,727,612.74	39.77087975	-80.68967706
10,076.00	13.44	141.33	9,855.03	-1,440.71	722.72	14,443,437.32	1,727,625.78	39.77083313	-80.68963088
10,171.00	13.56	140.06	9,947.40	-1,457.87	736.77	14,443,420.16	1,727,639.83	39.77078587	-80.68958109
10,266.00	13.91	139.92	10,039.69	-1,475.15	751.27	14,443,402.88	1,727,654.33	39.77073829	-80.68952969



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	N-S (usft)	+E-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
10,414.00	14.42	143.97	10,183.19	-1,503.66	773.56	14,443,374.37	1,727,676.62	39.77065977	-80.68945071
10,461.00	12.40	144.67	10,228.91	-1,512.51	779.93	14,443,365.52	1,727,682.98	39.77063540	-80.68942818
10,508.00	10.20	144.41	10,274.99	-1,520.01	785.27	14,443,358.02	1,727,688.32	39.77061475	-80.68940926
10,556.00	7.91	146.61	10,322.39	-1,526.23	789.56	14,443,351.80	1,727,692.62	39.77059764	-80.68939407
10,603.00	5.63	148.36	10,369.06	-1,530.89	792.55	14,443,347.14	1,727,695.60	39.77058480	-80.68938348
10,650.00	2.99	156.71	10,415.92	-1,533.98	794.24	14,443,344.05	1,727,697.30	39.77057630	-80.68937749
10,697.00	0.84	199.08	10,462.90	-1,535.43	794.61	14,443,342.60	1,727,697.67	39.77057231	-80.68937618
10,745.00	2.15	308.41	10,510.88	-1,535.21	793.79	14,443,342.82	1,727,696.85	39.77057295	-80.68937910
10,840.00	6.55	331.18	10,605.59	-1,529.35	789.78	14,443,348.68	1,727,692.84	39.77058907	-80.68939330
10,935.00	14.51	331.35	10,698.92	-1,514.13	781.45	14,443,363.90	1,727,684.51	39.77063094	-80.68942277
10,982.00	21.36	330.30	10,743.61	-1,501.52	774.38	14,443,376.51	1,727,677.44	39.77066565	-80.68944778
11,029.00	25.98	328.63	10,786.64	-1,485.28	764.77	14,443,392.75	1,727,667.83	39.77071032	-80.68948176
11,076.00	29.05	328.01	10,828.32	-1,466.81	753.37	14,443,411.22	1,727,656.42	39.77076116	-80.68952213
11,124.00	33.23	329.51	10,869.40	-1,445.58	740.51	14,443,432.45	1,727,643.57	39.77081958	-80.68956761
11,171.00	35.69	329.68	10,908.15	-1,422.65	727.06	14,443,455.38	1,727,630.11	39.77088269	-80.68961522
11,218.00	39.43	330.21	10,945.40	-1,397.85	712.71	14,443,480.18	1,727,615.77	39.77095093	-80.68966595
11,265.00	42.95	330.65	10,980.76	-1,370.93	697.45	14,443,507.10	1,727,600.50	39.77102500	-80.68971996
11,313.00	46.90	331.09	11,014.74	-1,341.33	680.95	14,443,536.70	1,727,584.01	39.77110646	-80.68977829
11,360.00	50.90	330.83	11,045.63	-1,310.37	663.76	14,443,567.66	1,727,566.82	39.77119164	-80.68983909
11,408.00	53.67	331.00	11,074.99	-1,277.19	645.31	14,443,600.84	1,727,548.36	39.77128294	-80.68990436
11,455.00	56.75	332.14	11,101.80	-1,243.25	626.94	14,443,634.78	1,727,530.00	39.77137633	-80.68996931
11,502.00	59.60	331.97	11,126.59	-1,207.97	608.23	14,443,670.06	1,727,511.28	39.77147338	-80.69003547
11,549.00	61.63	331.79	11,149.65	-1,171.86	588.93	14,443,706.17	1,727,491.98	39.77157275	-80.69010372
11,597.00	63.43	330.91	11,171.79	-1,134.49	568.50	14,443,743.54	1,727,471.56	39.77167557	-80.69017593
11,644.00	65.93	331.00	11,191.89	-1,097.35	547.88	14,443,780.68	1,727,450.94	39.77177776	-80.69024888
11,691.00	68.75	331.88	11,209.99	-1,059.26	527.15	14,443,818.77	1,727,430.21	39.77188256	-80.69032218
11,738.00	73.10	332.85	11,225.35	-1,019.91	506.56	14,443,858.12	1,727,409.61	39.77199081	-80.69039499
11,786.00	76.22	333.29	11,238.05	-978.65	485.60	14,443,899.38	1,727,388.65	39.77210434	-80.69046908
11,833.00	77.93	333.81	11,248.56	-937.63	465.19	14,443,940.40	1,727,368.25	39.77221716	-80.69054119
11,880.00	80.66	333.73	11,257.29	-896.21	444.78	14,443,981.82	1,727,347.84	39.77233111	-80.69061332
11,927.00	82.64	333.81	11,264.11	-854.50	424.23	14,444,023.53	1,727,327.29	39.77244586	-80.69068595
11,975.00	82.37	333.73	11,270.37	-811.81	403.20	14,444,066.22	1,727,306.26	39.77256329	-80.69076028
12,022.00	85.93	331.70	11,275.16	-770.27	381.77	14,444,107.76	1,727,284.83	39.77267758	-80.69083604
12,069.00	86.99	331.18	11,278.07	-729.07	359.34	14,444,148.96	1,727,262.40	39.77279095	-80.69091535
12,162.00	89.36	331.35	11,281.03	-647.57	314.66	14,444,230.46	1,727,217.71	39.77301519	-80.69107338
12,257.00	90.95	330.74	11,280.77	-564.44	268.67	14,444,313.59	1,727,171.72	39.77324390	-80.69123604
12,351.00	91.03	331.26	11,279.15	-482.24	223.10	14,444,395.79	1,727,126.16	39.77347008	-80.69139719
12,446.00	90.86	331.53	11,277.58	-398.85	177.62	14,444,479.18	1,727,080.68	39.77369953	-80.69155802
12,540.00	90.99	331.09	11,276.06	-316.40	132.50	14,444,561.63	1,727,035.56	39.77392638	-80.69171760
12,635.00	90.73	331.35	11,274.64	-233.15	86.77	14,444,644.88	1,726,989.83	39.77415545	-80.69187934
12,730.00	90.37	331.44	11,273.72	-149.75	41.29	14,444,728.28	1,726,944.35	39.77438492	-80.69204019
12,824.00	91.43	330.39	11,272.25	-67.61	-4.40	14,444,810.42	1,726,898.66	39.77461091	-80.69220178
12,919.00	91.03	329.77	11,270.21	14.71	-51.77	14,444,892.74	1,726,851.29	39.77483743	-80.69236938
13,014.00	90.95	329.16	11,268.57	96.52	-100.03	14,444,974.55	1,726,803.03	39.77506257	-80.69254014
13,108.00	90.95	329.16	11,267.01	177.22	-148.21	14,445,055.25	1,726,754.85	39.77528464	-80.69271064
13,203.00	90.77	328.89	11,265.58	258.66	-197.10	14,445,136.69	1,726,705.96	39.77550876	-80.69288364
13,297.00	91.38	329.42	11,263.82	339.35	-245.28	14,445,217.38	1,726,657.77	39.77573081	-80.69305415
13,391.00	90.99	329.51	11,261.88	420.30	-293.03	14,445,298.33	1,726,610.03	39.77595356	-80.69322311
13,486.00	90.42	328.89	11,260.71	501.89	-341.67	14,445,379.92	1,726,561.39	39.77617809	-80.69339523
13,581.00	92.57	329.68	11,258.23	583.53	-390.18	14,445,461.56	1,726,512.88	39.77640275	-80.69356686
13,675.00	91.87	329.16	11,254.59	664.40	-437.96	14,445,542.43	1,726,465.10	39.77662528	-80.69373595
13,770.00	91.43	329.24	11,251.85	745.96	-486.58	14,445,623.99	1,726,416.47	39.77684974	-80.69390802
13,864.00	91.78	329.77	11,249.22	826.93	-534.27	14,445,704.96	1,726,368.79	39.77707254	-80.69407675
13,959.00	92.13	329.86	11,245.98	909.00	-582.01	14,445,787.03	1,726,321.05	39.77729837	-80.69424566
14,053.00	91.69	330.03	11,242.84	990.31	-629.06	14,445,868.34	1,726,274.00	39.77752213	-80.69441214

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N-S (usft)	+E-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
14,147.00	91.34	329.95	11,240.36	1,071.68	-676.05	14,445,949.71	1,726,227.00	39.77774603	-80.69457842
14,242.00	91.82	330.74	11,237.74	1,154.21	-723.04	14,446,032.24	1,726,180.02	39.77797311	-80.69474465
14,336.00	92.04	331.70	11,234.57	1,236.55	-768.27	14,446,114.58	1,726,134.79	39.77819966	-80.69490464
14,431.00	91.43	331.26	11,231.70	1,319.98	-813.61	14,446,198.01	1,726,089.45	39.77842921	-80.69506500
14,525.00	92.00	331.70	11,228.88	1,402.54	-858.47	14,446,280.57	1,726,044.59	39.77865635	-80.69522367
14,620.00	93.14	331.88	11,224.63	1,486.17	-903.33	14,446,364.20	1,725,999.73	39.77888644	-80.69538233
14,715.00	93.10	332.50	11,219.45	1,570.07	-947.59	14,446,448.10	1,725,955.47	39.77911727	-80.69553883
14,809.00	90.95	331.70	11,216.13	1,653.09	-991.54	14,446,531.12	1,725,911.52	39.77934567	-80.69569428
14,903.00	90.46	331.62	11,214.98	1,735.81	-1,036.16	14,446,613.84	1,725,866.90	39.77957327	-80.69585209
14,998.00	91.12	331.35	11,213.67	1,819.28	-1,081.51	14,446,697.31	1,725,821.55	39.77980292	-80.69601248
15,093.00	90.86	330.91	11,212.03	1,902.46	-1,127.37	14,446,780.49	1,725,775.69	39.78003178	-80.69617471
15,188.00	90.33	330.83	11,211.04	1,985.44	-1,173.61	14,446,863.47	1,725,729.45	39.78026009	-80.69633831
15,282.00	92.09	330.65	11,209.05	2,067.43	-1,219.54	14,446,945.46	1,725,683.51	39.78048567	-80.69650081
15,377.00	91.91	330.91	11,205.74	2,150.29	-1,265.89	14,447,028.32	1,725,637.17	39.78071366	-80.69666477
15,472.00	91.38	330.39	11,203.01	2,233.06	-1,312.44	14,447,111.09	1,725,590.62	39.78094141	-80.69682944
15,566.00	92.18	330.21	11,200.09	2,314.67	-1,358.99	14,447,192.70	1,725,544.07	39.78116597	-80.69699415
15,661.00	92.18	330.30	11,196.48	2,397.09	-1,406.08	14,447,275.12	1,725,496.97	39.78139276	-80.69716080
15,756.00	91.56	330.03	11,193.38	2,479.46	-1,453.32	14,447,357.49	1,725,449.74	39.78161939	-80.69732795
15,850.00	91.03	330.03	11,191.25	2,560.87	-1,500.27	14,447,438.90	1,725,402.79	39.78184340	-80.69749407
15,945.00	90.99	330.56	11,189.58	2,643.37	-1,547.34	14,447,521.40	1,725,355.72	39.78207041	-80.69766061
16,040.00	90.42	330.39	11,188.41	2,726.03	-1,594.15	14,447,604.06	1,725,308.91	39.78229784	-80.69782625
16,134.00	91.12	330.47	11,187.15	2,807.78	-1,640.53	14,447,685.81	1,725,262.53	39.78252277	-80.69799036
16,229.00	90.59	330.65	11,185.73	2,890.50	-1,687.22	14,447,768.53	1,725,215.84	39.78274888	-80.69815556
16,324.00	90.55	331.26	11,184.78	2,973.55	-1,733.34	14,447,851.58	1,725,169.72	39.78297888	-80.69831872
16,418.00	91.82	332.06	11,182.84	3,056.26	-1,777.95	14,447,934.29	1,725,125.11	39.78320645	-80.69847653
16,513.00	91.87	332.23	11,179.78	3,140.21	-1,822.32	14,448,018.24	1,725,080.74	39.78343741	-80.69863343
16,607.00	91.34	331.70	11,177.15	3,223.15	-1,866.48	14,448,101.18	1,725,036.58	39.78366558	-80.69879864
16,702.00	90.90	331.88	11,175.29	3,306.85	-1,911.38	14,448,184.88	1,724,991.68	39.78389586	-80.69896486
16,797.00	90.68	330.03	11,173.98	3,389.89	-1,957.49	14,448,267.92	1,724,945.57	39.78412433	-80.69911161
16,890.00	90.55	330.03	11,172.98	3,470.45	-2,003.95	14,448,348.48	1,724,899.11	39.78434600	-80.69927601
16,985.00	89.85	331.26	11,172.65	3,553.25	-2,050.52	14,448,431.28	1,724,852.54	39.78457382	-80.69944079
17,080.00	89.27	331.97	11,173.38	3,636.82	-2,095.68	14,448,514.85	1,724,807.38	39.78480375	-80.69960054
17,174.00	90.77	331.53	11,173.35	3,719.62	-2,140.17	14,448,597.65	1,724,762.89	39.78503156	-80.69975792
17,269.00	90.29	330.91	11,172.47	3,802.88	-2,185.90	14,448,680.91	1,724,717.15	39.78526063	-80.69991973
17,364.00	90.73	331.00	11,171.62	3,885.93	-2,232.02	14,448,763.96	1,724,671.03	39.78548913	-80.70008291
17,458.00	91.47	331.44	11,169.82	3,968.31	-2,277.27	14,448,846.34	1,724,625.79	39.78571577	-80.70024299
17,553.00	91.60	331.26	11,167.27	4,051.65	-2,322.80	14,448,929.68	1,724,580.25	39.78594505	-80.70040407
17,647.00	92.31	331.18	11,164.07	4,133.99	-2,368.03	14,449,012.02	1,724,535.03	39.78617160	-80.70056409
17,742.00	89.76	331.88	11,162.35	4,217.48	-2,413.31	14,449,095.51	1,724,489.75	39.78640130	-80.70072426
17,837.00	89.27	331.53	11,163.16	4,301.12	-2,458.34	14,449,179.15	1,724,444.72	39.78663142	-80.70088356
17,931.00	88.75	331.26	11,164.78	4,383.64	-2,503.33	14,449,261.67	1,724,399.72	39.78685844	-80.70104275
18,029.00	88.79	329.95	11,166.88	4,469.00	-2,551.42	14,449,347.03	1,724,354.63	39.78709331	-80.70121292
18,124.00	90.07	329.86	11,167.83	4,551.18	-2,599.06	14,449,429.22	1,724,309.00	39.78731945	-80.70138150
18,219.00	91.43	330.39	11,166.59	4,633.55	-2,646.37	14,449,511.58	1,724,263.69	39.78754609	-80.70154895
18,314.00	91.87	330.30	11,163.85	4,716.07	-2,693.36	14,449,594.10	1,724,218.12	39.78777314	-80.70171522
18,408.00	91.91	329.86	11,160.75	4,797.50	-2,740.22	14,449,675.53	1,724,172.84	39.78799719	-80.70188107
18,502.00	91.65	330.03	11,157.83	4,878.82	-2,787.27	14,449,756.85	1,724,127.15	39.78822095	-80.70204761
18,597.00	91.52	329.59	11,155.20	4,960.91	-2,835.03	14,449,838.94	1,724,081.03	39.78844681	-80.70221663
18,660.00	90.99	329.86	11,153.82	5,015.30	-2,866.78	14,449,893.33	1,724,036.28	39.78859648	-80.70232903
Survey @ 18660.00 MD 11153.82 TVD									
18,718.00	90.99	329.86	11,152.82	5,065.45	-2,895.90	14,449,943.48	1,724,007.16	39.78873448	-80.70243209
Survey projected to 18718.00 MD 11152.82 TVD									

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Keith Stem N-14 HU (slot D)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Site:	Keith Stem	MD Reference:	RKB=747+33 @ 780.00usft (Nabors X08)
Well:	Keith Stem N-14 HU (slot D)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
5,926.00	5,844.76	-541.38	185.66	Tie into original hole @ 5926 MD
18,660.00	11,153.82	5,015.30	-2,866.78	Survey @ 18660.00 MD 11153.82 TVD
18,718.00	11,152.82	5,065.45	-2,895.90	Survey projected to 18718.00 MD 11152.82 TVD

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