



Well: Old Crow S-14 HM (slot H)
 Site: Old Crow Pad
 Project: Marshall County, West Virginia.
 Design: rev4

SECTION DETAILS

MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSEct	Annotation
6939.00	38.41	31.57	5741.72	2941.12	1669.01	0.00	0.000	-208.44	Survey @ 6939.00 MD 5741.72 TVD
7039.00	38.41	31.57	5820.08	2994.05	1701.54	0.00	0.000	-210.11	Proj. Begin 8.31°/100' build/turn
7129.84	44.64	25.11	5888.09	3047.07	1729.89	8.31	-37.003	-215.31	Begin 8.31°/100' build/turn
7864.38	50.00	112.28	6438.62	3187.62	2139.21	8.31	119.036	50.78	Begin 10.00°/100' build/turn
8381.62	89.00	149.71	6621.99	2867.17	2476.18	10.00	50.717	508.07	Begin 89.00° lateral
16767.33	89.00	149.71	6768.00	-4372.35	6705.61	0.00	0.000	8005.16	PBHL/TD 16767.33 MD/6768.00 TVD

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	VSEct	Annotation
172.00	0.44	298.93	172.00	0.32	-0.58	-0.66	MWD surveys
6700.00	90.11	148.71	6661.03	-4328.77	6662.39	7945.16	Survey @ 16700.00 MD 6661.03 TVD
6766.00	90.11	148.71	6660.90	-4385.17	6696.67	8004.68	Survey projected to 16766.00 MD 6660.90 TVD

Geodetic System: Universal Transverse Mercator (US Survey Feet)
 Datum: NAD83 West Virginia - HARN
 Ellipsoid: GRS 1980
 Zone: Zone 17N (84 W to 78 W)

System Datum: Mean Sea Level
 Depth Reference: RKB=1265+26 @ 1291.00usft (Nabors B 28)

Northing: 14446125.03 Easting: 1707033.91 Latitude: 39.77838716 Longitude: -80.76288942

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.880°

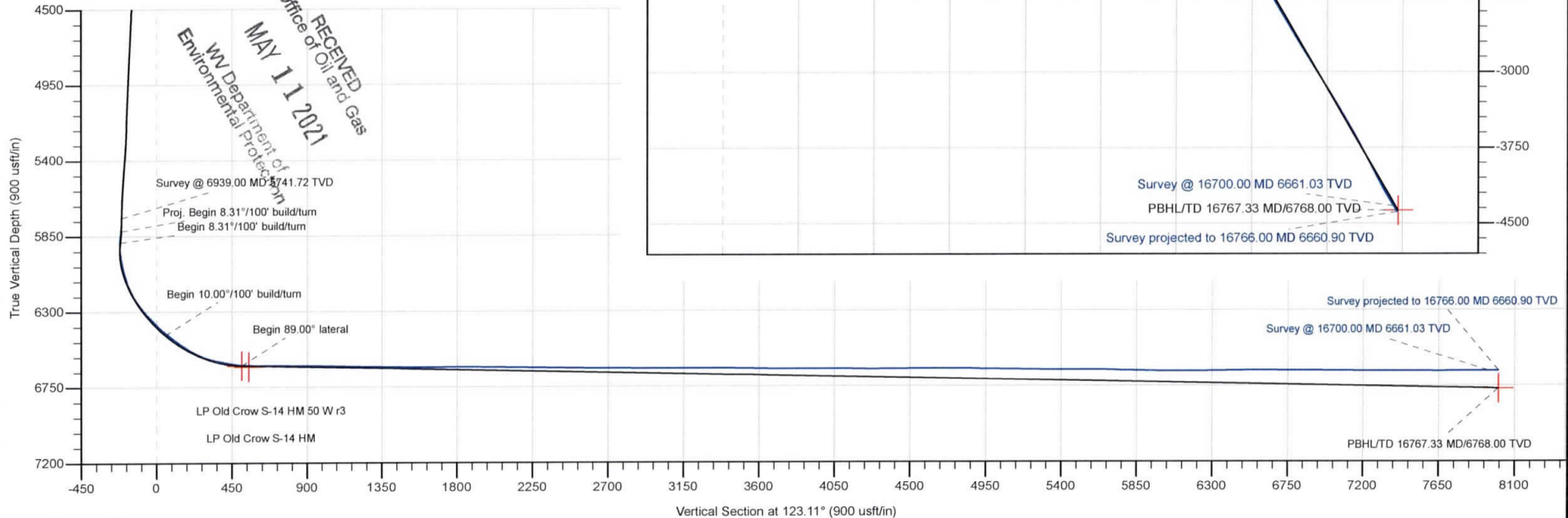


Azimuths to Grid North
 True North: -0.15°
 Magnetic North: -8.88°

Magnetic Field
 Strength: 51881.8snT
 Dip Angle: 66.74°
 Date: 1/2/2020
 Model: IGRF2015



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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-14 HM (slot H)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Well:	Old Crow S-14 HM (slot H)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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)		

Site	Old Crow Pad				
Site Position:	Northing:	14,446,179.89 usft	Latitude:	39.77853828	
From:	Lat/Long	Easting:	1,706,970.33 usft	Longitude:	-80.76311519
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.152 °

Well	Old Crow S-14 HM (slot H)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,125.03 usft	Latitude:	39.77838716
	+E/-W	0.00 usft	Easting:	1,707,033.91 usft	Longitude:	-80.76288942
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft	Ground Level:	1,265.00 usft	

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	1/2/2020	-8.728	66.744	51,881.77142553

Design	Surveys Original 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	123.11	

Survey Program	Date	1/10/2020			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
172.00	877.00	MWD surf (Original Hole)	MWD	MWD - Standard	
971.00	3,050.00	MWD int (Original Hole)	MWD	MWD - Standard	
3,156.00	16,700.00	MWD (Original Hole)	MWD	MWD - Standard	
16,766.00	16,766.00	Projection (Original Hole)	MWD	MWD - Standard	

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
172.00	0.44	298.93	172.00	0.32	-0.58	-0.66	0.26	0.26	0.00
MWD surveys									
202.00	0.26	283.29	202.00	0.39	-0.75	-0.84	0.67	0.30	-52.13
232.00	0.35	297.53	232.00	0.45	-0.89	-0.99	0.39	0.00	47.47
262.00	0.35	278.89	262.00	0.51	-1.06	-1.17	0.38	0.00	-52.13
291.00	0.31	297.61	291.00	0.56	-1.22	-1.33	0.39	-0.14	64.55
321.00	0.04	261.14	321.00	0.59	-1.30	-1.42	0.93	0.90	-121.57

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Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Well:	Old Crow S-14 HM (slot H)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	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)
351.00	0.22	261.14	351.00	0.58	-1.37	-1.47	0.60	0.60	0.00
381.00	0.22	274.85	381.00	0.58	-1.49	-1.56	0.18	0.00	45.70
411.00	0.13	230.29	411.00	0.56	-1.57	-1.62	0.52	-0.30	-148.53
458.00	0.26	156.90	458.00	0.43	-1.57	-1.55	0.54	0.28	-156.15
501.00	0.35	228.62	501.00	0.25	-1.63	-1.50	0.85	0.21	166.79
548.00	0.35	216.92	547.99	0.04	-1.82	-1.55	0.15	0.00	-24.89
595.00	0.22	206.38	594.99	-0.15	-1.95	-1.55	0.30	-0.28	-22.43
642.00	0.18	232.05	641.99	-0.28	-2.05	-1.56	0.21	-0.09	54.62
688.00	0.22	235.39	687.99	-0.37	-2.18	-1.62	0.09	0.09	7.26
733.00	0.04	81.14	732.99	-0.42	-2.23	-1.64	0.57	-0.40	-342.78
782.00	0.04	45.19	781.99	-0.41	-2.20	-1.62	0.05	0.00	-73.37
829.00	0.13	332.24	828.99	-0.35	-2.22	-1.67	0.26	0.19	-155.21
877.00	0.18	245.14	876.99	-0.33	-2.31	-1.75	0.45	0.10	-181.46
971.00	0.13	200.85	970.99	-0.49	-2.48	-1.81	0.13	-0.05	-47.12
1,065.00	0.35	309.66	1,064.99	-0.41	-2.74	-2.07	0.44	0.23	115.76
1,160.00	2.11	10.04	1,159.97	1.50	-2.66	-3.05	2.06	1.85	63.56
1,255.00	4.88	26.82	1,254.78	6.83	-0.53	-4.17	3.08	2.92	17.66
1,350.00	8.57	29.28	1,349.11	16.61	4.76	-5.09	3.90	3.88	2.59
1,444.00	12.00	26.74	1,441.59	31.45	12.58	-6.64	3.68	3.65	-2.70
1,539.00	13.97	30.95	1,534.16	50.11	22.92	-8.17	2.30	2.07	4.43
1,633.00	15.73	36.05	1,625.02	70.14	36.26	-7.94	2.33	1.87	5.43
1,729.00	18.50	40.01	1,716.76	92.33	53.71	-5.45	3.13	2.89	4.13
1,824.00	22.32	40.01	1,805.78	117.70	75.01	-1.47	4.02	4.02	0.00
1,920.00	23.73	34.65	1,894.14	147.56	97.71	1.24	2.63	1.47	-5.58
2,015.00	25.31	28.84	1,980.58	181.08	118.38	0.24	3.03	1.66	-6.12
2,110.00	28.83	27.88	2,065.16	219.13	138.90	-3.36	3.73	3.71	-1.01
2,204.00	31.16	29.99	2,146.57	260.23	161.65	-6.75	2.72	2.48	2.24
2,300.00	34.58	30.95	2,227.19	305.12	188.09	-9.13	3.60	3.56	1.00
2,394.00	37.18	29.64	2,303.35	352.69	215.86	-11.85	2.88	2.77	-1.39
2,489.00	39.16	26.30	2,378.04	404.55	243.35	-17.15	3.01	2.08	-3.52
2,584.00	41.84	24.01	2,450.28	460.39	269.54	-25.72	3.23	2.82	-2.41
2,678.00	43.46	24.27	2,519.41	518.51	295.59	-35.64	1.73	1.72	0.28
2,773.00	43.77	25.33	2,588.19	577.99	323.07	-45.11	0.84	0.33	1.12
2,868.00	43.51	26.56	2,656.94	636.95	351.75	-53.29	0.93	-0.27	1.29
2,963.00	42.63	29.64	2,726.35	694.17	382.29	-58.97	2.40	-0.93	3.24
3,050.00	42.45	29.55	2,790.45	745.31	411.34	-62.58	0.22	-0.21	-0.10
3,156.00	41.22	28.05	2,869.43	807.26	445.41	-67.88	1.50	-1.16	6.17
3,250.00	40.87	33.85	2,940.35	860.15	477.11	-70.21	4.07	-0.37	6.17
3,345.00	41.88	32.89	3,011.64	912.59	511.65	-69.93	1.26	1.06	-1.01
3,439.00	41.75	30.78	3,081.70	965.83	544.70	-71.33	1.50	-0.71	-2.24
3,533.00	40.78	25.68	3,152.38	1,020.40	574.03	-76.57	3.72	-1.03	1.93
3,628.00	39.42	27.53	3,225.04	1,075.11	601.42	-83.52	1.90	-1.43	1.95
3,722.00	38.85	30.69	3,297.96	1,126.94	630.26	-87.66	2.21	-0.71	3.36

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3,816.00	38.19	28.84	3,371.51	1,177.75	659.33	-91.07	1.41	-0.70	-1.97
3,910.00	38.45	29.37	3,445.26	1,228.67	687.68	-95.14	0.45	0.28	0.56
4,005.00	40.43	31.39	3,518.63	1,280.72	718.22	-97.99	2.48	2.08	2.13
4,099.00	42.58	32.27	3,589.02	1,333.63	751.08	-99.38	2.37	2.29	0.94
4,194.00	42.36	30.78	3,659.10	1,388.31	784.61	-101.15	1.08	-0.23	-1.57
4,288.00	43.68	29.99	3,727.82	1,443.63	817.05	-104.20	1.52	1.40	-0.84
4,382.00	40.96	29.20	3,797.32	1,498.65	848.31	-108.07	2.95	-2.89	-0.84
4,477.00	40.17	28.32	3,869.49	1,552.80	878.04	-112.75	1.03	-0.83	-0.93
4,572.00	39.02	30.25	3,942.69	1,605.61	907.64	-116.80	1.77	-1.21	2.03
4,665.00	39.64	30.16	4,014.63	1,656.55	937.29	-119.79	0.67	0.67	-0.10
4,761.00	39.90	27.79	4,088.42	1,710.27	967.03	-124.22	1.60	0.27	-2.47
4,856.00	39.86	28.41	4,161.32	1,764.00	995.72	-129.54	0.42	-0.04	0.65
4,950.00	40.21	29.11	4,233.29	1,817.01	1,024.82	-134.13	0.61	0.37	0.74
5,044.00	40.43	29.90	4,304.96	1,869.94	1,054.77	-137.95	0.59	0.23	0.84
5,139.00	41.48	29.81	4,376.71	1,923.95	1,085.77	-141.49	1.11	1.11	-0.09
5,234.00	41.92	29.11	4,447.64	1,978.97	1,116.85	-145.51	0.67	0.46	-0.74
5,328.00	40.91	30.87	4,518.13	2,032.83	1,147.92	-148.90	1.64	-1.07	1.87
5,423.00	42.71	29.02	4,588.94	2,087.71	1,179.51	-152.42	2.30	1.89	-1.95
5,518.00	42.01	30.95	4,659.14	2,143.15	1,211.50	-155.91	1.55	-0.74	2.03
5,612.00	42.45	30.43	4,728.75	2,197.48	1,243.74	-158.58	0.60	0.47	-0.55
5,706.00	40.65	30.43	4,799.09	2,251.24	1,275.32	-161.50	1.91	-1.91	0.00
5,800.00	40.47	29.81	4,870.51	2,304.11	1,305.99	-164.69	0.47	-0.19	-0.66
5,895.00	40.34	29.28	4,942.85	2,357.68	1,336.35	-168.51	0.39	-0.14	-0.56
5,990.00	40.08	30.16	5,015.40	2,410.94	1,366.76	-172.14	0.66	-0.27	0.93
6,084.00	39.99	29.99	5,087.37	2,463.26	1,397.06	-175.34	0.15	-0.10	-0.18
6,180.00	40.69	31.22	5,160.54	2,516.74	1,428.70	-178.06	1.10	0.73	1.28
6,274.00	41.26	31.22	5,231.51	2,569.46	1,460.65	-180.09	0.61	0.61	0.00
6,369.00	41.53	29.64	5,302.78	2,623.62	1,492.46	-183.03	1.14	0.28	-1.66
6,464.00	41.35	29.46	5,374.00	2,678.32	1,523.47	-186.93	0.23	-0.19	-0.19
6,559.00	41.04	27.26	5,445.48	2,733.37	1,553.19	-192.11	1.56	-0.33	-2.32
6,654.00	39.29	27.79	5,518.08	2,787.70	1,581.50	-198.08	1.88	-1.84	0.56
6,749.00	38.23	28.93	5,592.16	2,840.04	1,609.75	-203.01	1.35	-1.12	1.20
6,844.00	37.84	30.52	5,666.98	2,890.87	1,638.76	-206.47	1.11	-0.41	1.67
6,939.00	38.41	31.57	5,741.72	2,941.12	1,669.01	-208.58	0.91	0.60	1.11
6,975.00	37.71	31.11	5,770.06	2,960.07	1,680.56	-209.26	2.10	-1.94	-1.28
7,022.00	38.77	27.95	5,806.98	2,985.38	1,694.88	-211.09	4.73	2.26	-6.72
7,070.00	42.37	23.55	5,843.44	3,013.50	1,708.39	-215.13	9.58	7.50	8.98
7,117.00	42.02	27.77	5,878.27	3,041.94	1,722.05	-219.22	6.08	-0.74	8.98
7,164.00	40.00	34.45	5,913.75	3,068.33	1,737.94	-220.33	10.26	-4.30	14.21
7,211.00	37.76	41.22	5,950.36	3,091.63	1,755.98	-217.95	10.21	-4.77	14.40
7,259.00	36.66	45.79	5,988.59	3,112.68	1,775.94	-212.73	6.20	-2.29	8.98
7,306.00	36.22	49.92	6,026.41	3,131.41	1,796.62	-205.63	5.30	-0.94	8.98
7,354.00	35.47	56.51	6,065.33	3,148.23	1,819.10	-196.00	8.19	-1.56	13.73
7,401.00	35.12	59.41	6,103.69	3,162.63	1,842.11	-184.59	3.64	-0.74	6.17

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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)
7,448.00	35.69	66.00	6,142.02	3,175.09	1,866.28	-171.15	8.21	1.21	14.02
7,495.00	37.36	72.07	6,179.80	3,185.06	1,892.38	-154.73	8.46	3.55	12.91
7,542.00	40.09	77.43	6,216.47	3,192.75	1,920.73	-135.18	9.20	5.81	11.40
7,589.00	43.08	81.65	6,251.63	3,198.38	1,951.40	-112.57	8.71	6.36	8.98
7,637.00	44.84	87.10	6,286.19	3,201.62	1,984.53	-86.59	8.69	3.67	11.35
7,684.00	46.55	90.79	6,319.03	3,202.22	2,018.15	-58.76	6.69	3.64	7.85
7,732.00	47.25	95.97	6,351.83	3,200.15	2,053.11	-28.34	8.01	1.46	10.79
7,779.00	48.13	101.69	6,383.49	3,194.80	2,087.43	3.32	9.19	1.87	12.17
7,826.00	49.63	105.73	6,414.40	3,186.40	2,121.81	36.71	7.22	3.19	8.60
7,873.00	52.97	109.77	6,443.79	3,175.20	2,156.72	72.07	9.77	7.11	8.60
7,921.00	54.37	116.63	6,472.25	3,159.96	2,192.21	110.13	11.87	2.92	14.29
7,968.00	54.68	120.67	6,499.53	3,141.61	2,225.79	148.27	7.03	0.66	8.60
8,016.00	57.85	124.71	6,526.19	3,120.04	2,259.36	188.17	9.62	6.60	8.42
8,063.00	63.03	126.56	6,549.37	3,096.22	2,292.56	229.00	11.54	11.02	3.94
8,110.00	68.48	128.41	6,568.67	3,070.14	2,326.54	271.71	12.14	11.60	3.94
8,157.00	74.20	131.75	6,583.70	3,041.47	2,360.58	315.88	13.91	12.17	7.11
8,204.00	78.37	134.21	6,594.85	3,010.34	2,393.97	360.85	10.23	8.87	5.23
8,251.00	79.65	140.09	6,603.81	2,976.53	2,425.33	405.59	12.58	2.72	12.51
8,299.00	81.54	143.61	6,611.66	2,939.30	2,454.57	450.42	8.24	3.94	7.33
8,346.00	85.23	147.21	6,617.07	2,900.87	2,481.06	493.60	10.93	7.85	7.66
8,393.00	88.97	148.53	6,619.45	2,861.13	2,506.02	536.21	8.44	7.96	2.81
8,488.00	88.79	149.06	6,621.31	2,779.89	2,555.23	621.81	0.59	-0.19	0.56
8,582.00	90.11	150.99	6,622.21	2,698.47	2,602.19	705.62	2.49	1.40	2.05
8,678.00	90.02	151.26	6,622.10	2,614.41	2,648.54	790.37	0.30	-0.09	0.28
8,772.00	90.33	151.61	6,621.82	2,531.85	2,693.49	873.11	0.50	0.33	0.37
8,867.00	88.92	150.47	6,622.44	2,448.73	2,739.49	957.04	1.91	-1.48	-1.20
8,962.00	88.13	150.73	6,624.88	2,366.00	2,786.11	1,041.29	0.88	-0.83	0.27
9,057.00	89.58	149.06	6,626.78	2,283.83	2,833.75	1,126.07	2.33	1.53	-1.76
9,152.00	89.32	146.77	6,627.69	2,203.35	2,884.20	1,212.30	2.43	-0.27	-2.41
9,247.00	88.79	149.15	6,629.26	2,122.84	2,934.59	1,298.48	2.57	-0.56	2.51
9,342.00	89.89	150.55	6,630.35	2,040.70	2,982.30	1,383.32	1.87	1.16	1.47
9,437.00	89.58	150.03	6,630.79	1,958.19	3,029.38	1,467.82	0.64	-0.33	-0.55
9,532.00	89.41	150.11	6,631.63	1,875.86	3,076.78	1,552.50	0.20	-0.18	0.08
9,625.00	89.67	151.34	6,632.38	1,794.74	3,122.25	1,634.90	1.35	0.28	1.32
9,720.00	91.38	152.75	6,631.51	1,710.84	3,166.78	1,718.03	2.33	1.80	1.48
9,815.00	90.37	151.70	6,630.06	1,626.80	3,211.05	1,801.01	1.53	-1.06	-1.11
9,910.00	89.54	150.91	6,630.13	1,543.46	3,256.66	1,884.74	1.21	-0.87	-0.83
10,004.00	89.45	151.78	6,630.96	1,460.98	3,301.73	1,967.55	0.93	-0.19	-1.76
10,099.00	89.27	150.11	6,632.02	1,377.94	3,347.87	2,051.55	1.77	0.05	-0.56
10,192.00	89.32	149.59	6,633.16	1,297.53	3,394.57	2,134.60	0.56	-0.33	-0.33
10,286.00	89.01	149.32	6,634.53	1,216.59	3,442.34	2,218.83	0.44	-0.18	0.10
10,380.00	88.92	149.41	6,636.23	1,135.72	3,490.23	2,303.12	0.14	0.83	2.13
10,475.00	89.71	151.43	6,637.37	1,053.11	3,537.12	2,387.52	2.28		

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-14 HM (slot H)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Well:	Old Crow S-14 HM (slot H)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	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)
10,569.00	89.67	151.70	6,637.88	970.45	3,581.88	2,470.16	0.29	-0.04	0.29
10,664.00	89.58	149.76	6,638.50	887.59	3,628.33	2,554.33	2.04	-0.09	-2.04
10,758.00	89.67	150.20	6,639.11	806.20	3,675.35	2,638.18	0.48	0.10	0.47
10,852.00	89.45	150.03	6,639.84	724.70	3,722.19	2,721.92	0.30	-0.23	-0.18
10,946.00	89.36	149.67	6,640.81	643.42	3,769.40	2,805.87	0.39	-0.10	-0.38
11,040.00	89.93	149.24	6,641.39	562.47	3,817.17	2,890.10	0.76	0.61	-0.46
11,135.00	89.05	148.71	6,642.24	481.06	3,866.13	2,975.58	1.08	-0.93	-0.56
11,230.00	90.73	149.06	6,642.42	399.73	3,915.22	3,061.13	1.81	1.77	0.37
11,325.00	90.55	149.41	6,641.36	318.11	3,963.81	3,146.41	0.41	-0.19	0.37
11,419.00	90.90	149.59	6,640.17	237.12	4,011.52	3,230.61	0.42	0.37	0.19
11,514.00	89.14	149.85	6,640.14	155.09	4,059.42	3,315.55	1.87	-1.85	0.27
11,608.00	89.14	149.76	6,641.55	73.85	4,106.69	3,399.52	0.10	0.00	-0.10
11,702.00	89.45	149.94	6,642.71	-7.43	4,153.90	3,483.46	0.38	0.33	0.19
11,797.00	89.58	149.32	6,643.51	-89.39	4,201.92	3,568.46	0.67	0.14	-0.65
11,891.00	89.67	149.76	6,644.13	-170.41	4,249.58	3,652.63	0.48	0.10	0.47
11,985.00	89.80	149.32	6,644.56	-251.44	4,297.23	3,736.81	0.49	0.14	-0.47
12,079.00	89.71	148.62	6,644.96	-331.98	4,345.68	3,821.39	0.75	-0.10	-0.74
12,174.00	89.98	148.88	6,645.22	-413.20	4,394.97	3,907.04	0.39	0.28	0.27
12,268.00	90.11	148.62	6,645.15	-493.56	4,443.73	3,991.78	0.31	0.14	-0.28
12,362.00	89.41	148.88	6,645.54	-573.92	4,492.49	4,076.52	0.79	-0.74	0.28
12,457.00	89.14	148.71	6,646.74	-655.17	4,541.71	4,162.13	0.34	-0.28	-0.18
12,552.00	88.97	150.38	6,648.31	-737.05	4,589.85	4,247.18	1.77	-0.18	1.76
12,645.00	90.73	151.08	6,648.55	-818.17	4,635.32	4,329.58	2.04	1.89	0.75
12,739.00	90.77	150.99	6,647.32	-900.41	4,680.84	4,412.63	0.10	0.04	-0.10
12,833.00	90.59	150.20	6,646.21	-982.29	4,726.99	4,496.01	0.86	-0.19	-0.84
12,927.00	90.42	150.82	6,645.38	-1,064.11	4,773.26	4,579.46	0.68	-0.18	0.66
13,021.00	90.24	150.99	6,644.84	-1,146.25	4,818.97	4,662.61	0.26	-0.19	0.18
13,116.00	90.20	149.24	6,644.47	-1,228.61	4,866.30	4,747.25	1.84	-0.04	-1.84
13,210.00	88.44	149.06	6,645.59	-1,309.30	4,914.50	4,831.70	1.88	-1.87	-0.19
13,305.00	89.01	150.64	6,647.70	-1,391.43	4,962.20	4,916.52	1.77	0.60	1.66
13,399.00	88.44	150.11	6,649.79	-1,473.12	5,008.65	5,000.05	0.83	-0.61	-0.56
13,493.00	89.76	149.67	6,651.27	-1,554.42	5,055.80	5,083.96	1.48	1.40	-0.47
13,587.00	89.80	151.87	6,651.63	-1,636.45	5,101.70	5,167.21	2.34	0.04	2.34
13,680.00	89.85	152.14	6,651.91	-1,718.56	5,145.35	5,248.63	0.30	0.05	0.29
13,774.00	89.45	149.76	6,652.49	-1,800.73	5,190.99	5,331.74	2.57	-0.43	-2.53
13,869.00	89.23	149.24	6,653.58	-1,882.58	5,239.21	5,416.84	0.59	-0.23	-0.55
13,964.00	89.98	150.82	6,654.24	-1,964.87	5,286.66	5,501.54	1.84	0.79	1.66
14,058.00	89.93	150.47	6,654.31	-2,046.80	5,332.74	5,584.89	0.38	-0.05	0.37
14,153.00	90.02	150.38	6,654.35	-2,129.42	5,379.63	5,669.30	0.13	0.00	0.00
14,248.00	88.04	149.50	6,655.96	-2,211.63	5,427.20	5,754.05	2.28	-2.08	-0.93
14,341.00	88.22	149.59	6,659.00	-2,291.76	5,474.32	5,837.28	0.22	0.19	0.10
14,436.00	88.84	150.03	6,661.43	-2,373.84	5,522.07	5,922.13	0.80	0.65	0.26
14,530.00	89.85	149.67	6,662.51	-2,455.12	5,569.28	6,006.07	1.14	1.07	0.38

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-14 HM (slot H)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Well:	Old Crow S-14 HM (slot H)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	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)
14,625.00	89.54	149.06	6,663.01	-2,536.86	5,617.69	6,091.26	0.72	-0.33	-0.64
14,719.00	90.77	148.53	6,662.76	-2,617.26	5,666.39	6,175.97	1.42	1.31	-0.56
14,814.00	90.81	148.00	6,661.45	-2,698.05	5,716.36	6,261.96	0.56	0.04	-0.56
14,909.00	90.68	148.36	6,660.21	-2,778.76	5,766.44	6,348.00	0.40	-0.14	0.38
15,002.00	90.86	148.53	6,658.96	-2,858.00	5,815.10	6,432.05	0.27	0.19	0.18
15,097.00	90.86	148.44	6,657.54	-2,938.98	5,864.76	6,517.87	0.09	0.00	-0.09
15,192.00	89.76	148.97	6,657.02	-3,020.16	5,914.10	6,603.55	1.29	-1.16	0.56
15,286.00	89.76	148.62	6,657.42	-3,100.56	5,962.80	6,688.26	0.37	0.00	-0.37
15,381.00	89.54	148.71	6,658.00	-3,181.70	6,012.21	6,773.96	0.25	-0.23	0.09
15,476.00	88.88	148.00	6,659.31	-3,262.56	6,062.04	6,859.88	1.02	-0.69	-0.75
15,568.00	89.76	149.06	6,660.40	-3,341.02	6,110.07	6,942.96	1.50	0.96	1.15
15,662.00	89.98	149.32	6,660.61	-3,421.76	6,158.21	7,027.39	0.36	0.23	0.28
15,756.00	89.54	149.41	6,661.01	-3,502.64	6,206.11	7,111.69	0.48	-0.47	0.10
15,851.00	89.36	149.24	6,661.92	-3,584.34	6,254.58	7,196.92	0.26	-0.19	-0.18
15,945.00	90.11	151.70	6,662.35	-3,666.12	6,300.90	7,280.40	2.74	0.80	2.62
16,040.00	90.07	151.61	6,662.20	-3,749.73	6,346.01	7,363.85	0.10	-0.04	-0.09
16,133.00	89.98	153.10	6,662.16	-3,832.11	6,389.16	7,444.99	1.61	-0.10	1.60
16,228.00	90.11	151.52	6,662.09	-3,916.23	6,433.30	7,527.92	1.67	0.14	-1.66
16,323.00	89.76	151.43	6,662.20	-3,999.70	6,478.67	7,611.51	0.38	-0.37	-0.09
16,416.00	90.24	153.01	6,662.20	-4,081.98	6,522.01	7,692.76	1.78	0.52	1.70
16,511.00	90.46	150.82	6,661.62	-4,165.78	6,566.73	7,776.00	2.32	0.23	-2.31
16,606.00	90.07	149.41	6,661.18	-4,248.15	6,614.06	7,860.64	1.54	-0.41	-1.48
16,700.00	90.11	148.71	6,661.03	-4,328.77	6,662.39	7,945.16	0.75	0.04	-0.74
Survey @ 16700.00 MD 6661.03 TVD									
16,766.00	90.11	148.71	6,660.90	-4,385.17	6,696.67	8,004.68	0.00	0.00	0.00
Survey projected to 16766.00 MD 6660.90 TVD									

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
172.00	172.00	0.32	-0.58	MWD surveys
16,700.00	6,661.03	-4,328.77	6,662.39	Survey @ 16700.00 MD 6661.03 TVD
16,766.00	6,660.90	-4,385.17	6,696.67	Survey projected to 16766.00 MD 6660.90 TVD

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-14 HM (slot H)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Well:	Old Crow S-14 HM (slot H)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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)		

Site	Old Crow Pad				
Site Position:	Northing:	14,446,179.89 usft	Latitude:	39.77853828	
From:	Lat/Long	Easting:	1,706,970.33 usft	Longitude:	-80.76311519
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.152 °

Well	Old Crow S-14 HM (slot H)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,125.03 usft	Latitude:	39.77838716
	+E/-W	0.00 usft	Easting:	1,707,033.91 usft	Longitude:	-80.76288942
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft	Ground Level:	1,265.00 usft	

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	1/2/2020	-8.728	66.744	51,881.77142553

Design	Surveys Original 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	123.11	

Survey Program	Date	1/10/2020			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
172.00	877.00	MWD surf (Original Hole)	MWD	MWD - Standard	
971.00	3,050.00	MWD int (Original Hole)	MWD	MWD - Standard	
3,156.00	16,700.00	MWD (Original Hole)	MWD	MWD - Standard	
16,766.00	16,766.00	Projection (Original Hole)	MWD	MWD - Standard	

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	14,446,125.03	1,707,033.91	39.77838716	-80.76288942
172.00	0.44	298.93	172.00	0.32	-0.58	14,446,125.35	1,707,033.33	39.77838804	-80.76289148
MWD surveys									
202.00	0.26	283.29	202.00	0.39	-0.75	14,446,125.42	1,707,033.16	39.77838824	-80.76289207
232.00	0.35	297.53	232.00	0.45	-0.89	14,446,125.48	1,707,033.01	39.77838840	-80.76289259
262.00	0.35	278.89	262.00	0.51	-1.06	14,446,125.53	1,707,032.84	39.77838856	-80.76289320
291.00	0.31	297.61	291.00	0.56	-1.22	14,446,125.58	1,707,032.69	39.77838870	-80.76289376
321.00	0.04	261.14	321.00	0.59	-1.30	14,446,125.62	1,707,032.60	39.77838880	-80.76289406
351.00	0.22	261.14	351.00	0.58	-1.37	14,446,125.61	1,707,032.54	39.77838877	-80.76289429

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Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Well:	Old Crow S-14 HM (slot H)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
381.00	0.22	274.85	381.00	0.58	-1.49	14,446,125.61	1,707,032.42	39.77838876	-80.76289470
411.00	0.13	230.29	411.00	0.56	-1.57	14,446,125.59	1,707,032.34	39.77838871	-80.76289500
458.00	0.26	156.90	458.00	0.43	-1.57	14,446,125.46	1,707,032.34	39.77838835	-80.76289500
501.00	0.35	228.62	501.00	0.25	-1.63	14,446,125.28	1,707,032.28	39.77838786	-80.76289521
548.00	0.35	216.92	547.99	0.04	-1.82	14,446,125.07	1,707,032.08	39.77838729	-80.76289591
595.00	0.22	206.38	594.99	-0.15	-1.95	14,446,124.88	1,707,031.96	39.77838675	-80.76289636
642.00	0.18	232.05	641.99	-0.28	-2.05	14,446,124.75	1,707,031.86	39.77838641	-80.76289671
688.00	0.22	235.39	687.99	-0.37	-2.18	14,446,124.65	1,707,031.73	39.77838615	-80.76289717
733.00	0.04	81.14	732.99	-0.42	-2.23	14,446,124.61	1,707,031.67	39.77838602	-80.76289737
782.00	0.04	45.19	781.99	-0.41	-2.20	14,446,124.62	1,707,031.70	39.77838606	-80.76289727
829.00	0.13	332.24	828.99	-0.35	-2.22	14,446,124.68	1,707,031.69	39.77838622	-80.76289731
877.00	0.18	245.14	876.99	-0.33	-2.31	14,446,124.70	1,707,031.60	39.77838627	-80.76289765
971.00	0.13	200.85	970.99	-0.49	-2.48	14,446,124.54	1,707,031.43	39.77838583	-80.76289826
1,065.00	0.35	309.66	1,064.99	-0.41	-2.74	14,446,124.62	1,707,031.17	39.77838606	-80.76289918
1,160.00	2.11	10.04	1,159.97	1.50	-2.66	14,446,126.53	1,707,031.25	39.77839129	-80.76289887
1,255.00	4.88	26.82	1,254.78	6.83	-0.53	14,446,131.86	1,707,033.38	39.77840591	-80.76289125
1,350.00	8.57	29.28	1,349.11	16.61	4.76	14,446,141.64	1,707,038.66	39.77843274	-80.76287234
1,444.00	12.00	26.74	1,441.59	31.45	12.58	14,446,156.48	1,707,046.49	39.77847344	-80.76284435
1,539.00	13.97	30.95	1,534.16	50.11	22.92	14,446,175.14	1,707,056.83	39.77852460	-80.76280736
1,633.00	15.73	36.05	1,625.02	70.14	36.26	14,446,195.17	1,707,070.17	39.77857953	-80.76275971
1,729.00	18.50	40.01	1,716.76	92.33	53.71	14,446,217.36	1,707,087.62	39.77864035	-80.76269737
1,824.00	22.32	40.01	1,805.78	117.70	75.01	14,446,242.73	1,707,108.92	39.77870987	-80.76262134
1,920.00	23.73	34.65	1,894.14	147.56	97.71	14,446,272.59	1,707,131.62	39.77879170	-80.76254024
2,015.00	25.31	28.84	1,980.58	181.08	118.38	14,446,306.11	1,707,152.29	39.77888360	-80.76246636
2,110.00	28.83	27.88	2,065.16	219.13	138.90	14,446,344.16	1,707,172.80	39.77898794	-80.76239298
2,204.00	31.16	29.99	2,146.57	260.23	161.65	14,446,385.26	1,707,195.56	39.77910066	-80.76231159
2,300.00	34.58	30.95	2,227.19	305.12	188.09	14,446,430.15	1,707,221.99	39.77922374	-80.76221709
2,394.00	37.18	29.64	2,303.35	352.69	215.86	14,446,477.72	1,707,249.76	39.77935419	-80.76211779
2,489.00	39.16	26.30	2,378.04	404.55	243.35	14,446,529.57	1,707,277.26	39.77949638	-80.76201945
2,584.00	41.84	24.01	2,450.28	460.39	269.54	14,446,585.42	1,707,303.45	39.77964956	-80.76192570
2,678.00	43.46	24.27	2,519.41	518.51	295.59	14,446,643.54	1,707,329.49	39.77980897	-80.76183245
2,773.00	43.77	25.33	2,588.19	577.99	323.07	14,446,703.02	1,707,356.98	39.77997213	-80.76173404
2,868.00	43.51	26.56	2,656.94	636.95	351.75	14,446,761.97	1,707,385.66	39.78013382	-80.76163140
2,963.00	42.63	29.64	2,726.35	694.17	382.29	14,446,819.19	1,707,416.20	39.78029074	-80.76152217
3,050.00	42.45	29.55	2,790.45	745.31	411.34	14,446,870.34	1,707,445.25	39.78043099	-80.76141828
3,156.00	41.22	28.05	2,869.43	807.26	445.41	14,446,932.29	1,707,479.32	39.78060086	-80.76129643
3,250.00	40.87	33.85	2,940.35	860.15	477.11	14,446,985.18	1,707,511.02	39.78074589	-80.76118308
3,345.00	41.88	32.89	3,011.64	912.59	511.65	14,447,037.62	1,707,545.55	39.78088966	-80.76105966
3,439.00	41.75	30.78	3,081.70	965.83	544.70	14,447,090.86	1,707,578.61	39.78103562	-80.76094150
3,533.00	40.78	25.68	3,152.38	1,020.40	574.03	14,447,145.43	1,707,607.94	39.78118527	-80.76083659
3,628.00	39.42	27.53	3,225.04	1,075.11	601.42	14,447,200.14	1,707,635.33	39.78133533	-80.76073858
3,722.00	38.85	30.69	3,297.96	1,126.94	630.26	14,447,251.97	1,707,664.17	39.78147744	-80.76063542
3,816.00	38.19	28.84	3,371.51	1,177.75	659.33	14,447,302.78	1,707,693.24	39.78161676	-80.76053148
3,910.00	38.45	29.37	3,445.26	1,228.67	687.68	14,447,353.70	1,707,721.59	39.78175641	-80.76043008
4,005.00	40.43	31.39	3,518.63	1,280.72	718.22	14,447,405.75	1,707,752.12	39.78189911	-80.76032089
4,099.00	42.58	32.27	3,589.02	1,333.63	751.08	14,447,458.66	1,707,784.98	39.78204419	-80.76020343
4,194.00	42.36	30.78	3,659.10	1,388.31	784.61	14,447,513.33	1,707,818.52	39.78219409	-80.76008353
4,288.00	43.68	29.99	3,727.82	1,443.63	817.05	14,447,568.66	1,707,850.95	39.78234578	-80.75996756
4,382.00	40.96	29.20	3,797.32	1,498.65	848.31	14,447,623.68	1,707,882.22	39.78249665	-80.75985576
4,477.00	40.17	28.32	3,869.49	1,552.80	878.04	14,447,677.83	1,707,911.94	39.78264516	-80.75974943
4,572.00	39.02	30.25	3,942.69	1,605.61	907.64	14,447,730.64	1,707,941.55	39.78279397	-80.75964355
4,665.00	39.64	30.16	4,014.63	1,656.55	937.29	14,447,781.58	1,707,971.20	39.78292965	-80.75953751
4,761.00	39.90	27.79	4,088.42	1,710.27	967.03	14,447,835.30	1,708,000.94	39.78307695	-80.75943193
4,856.00	39.86	28.41	4,161.32	1,764.00	995.72	14,447,889.03	1,708,029.63	39.78322430	-80.75932849
4,950.00	40.21	29.11	4,233.29	1,817.01	1,024.82	14,447,942.04	1,708,058.73	39.78336966	-80.75922443

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West Virginia Department of Environmental Protection

08/27/2021

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-14 HM (slot H)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Well:	Old Crow S-14 HM (slot H)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
5,044.00	40.43	29.90	4,304.96	1,869.94	1,054.77	14,447,994.97	1,708,088.68	39.78351481	-80.75911729
5,139.00	41.48	29.81	4,376.71	1,923.95	1,085.77	14,448,048.98	1,708,119.68	39.78366289	-80.75900644
5,234.00	41.92	29.11	4,447.64	1,978.97	1,116.85	14,448,104.00	1,708,150.76	39.78381377	-80.75889529
5,328.00	40.91	30.87	4,518.13	2,032.83	1,147.92	14,448,157.86	1,708,181.83	39.78396145	-80.75878417
5,423.00	42.71	29.02	4,588.94	2,087.71	1,179.51	14,448,212.74	1,708,213.42	39.78411193	-80.75867119
5,518.00	42.01	30.95	4,659.14	2,143.15	1,211.50	14,448,268.18	1,708,245.40	39.78426395	-80.75855682
5,612.00	42.45	30.43	4,728.75	2,197.48	1,243.74	14,448,322.51	1,708,277.65	39.78441291	-80.75844152
5,706.00	40.65	30.43	4,799.09	2,251.24	1,275.32	14,448,376.27	1,708,309.22	39.78456031	-80.75832860
5,800.00	40.47	29.81	4,870.51	2,304.11	1,305.99	14,448,429.13	1,708,339.90	39.78470527	-80.75821891
5,895.00	40.34	29.28	4,942.85	2,357.68	1,336.35	14,448,482.70	1,708,370.26	39.78485217	-80.75811031
5,990.00	40.08	30.16	5,015.40	2,410.94	1,366.76	14,448,535.97	1,708,400.66	39.78499821	-80.75800157
6,084.00	39.99	29.99	5,087.37	2,463.26	1,397.06	14,448,588.29	1,708,430.97	39.78514169	-80.75789321
6,180.00	40.69	31.22	5,160.54	2,516.74	1,428.70	14,448,641.77	1,708,462.61	39.78528833	-80.75778006
6,274.00	41.26	31.22	5,231.51	2,569.46	1,460.65	14,448,694.49	1,708,494.56	39.78543285	-80.75766583
6,369.00	41.53	29.64	5,302.78	2,623.62	1,492.46	14,448,748.65	1,708,526.37	39.78558136	-80.75755207
6,464.00	41.35	29.46	5,374.00	2,678.32	1,523.47	14,448,803.34	1,708,557.38	39.78573134	-80.75744116
6,559.00	41.04	27.26	5,445.48	2,733.37	1,553.19	14,448,858.40	1,708,587.10	39.78588230	-80.75733484
6,654.00	39.29	27.79	5,518.08	2,787.70	1,581.50	14,448,912.73	1,708,615.41	39.78603132	-80.75723353
6,749.00	38.23	28.93	5,592.16	2,840.04	1,609.75	14,448,965.07	1,708,643.65	39.78617484	-80.75713249
6,844.00	37.84	30.52	5,666.98	2,890.87	1,638.76	14,449,015.90	1,708,672.67	39.78631422	-80.75702870
6,939.00	38.41	31.57	5,741.72	2,941.12	1,669.01	14,449,066.15	1,708,702.92	39.78645198	-80.75692054
6,975.00	37.71	31.11	5,770.06	2,960.07	1,680.56	14,449,085.10	1,708,714.46	39.78650395	-80.75687927
7,022.00	38.77	27.95	5,806.98	2,985.38	1,694.88	14,449,110.41	1,708,728.79	39.78657335	-80.75682803
7,070.00	42.37	23.55	5,843.44	3,013.50	1,708.39	14,449,138.53	1,708,742.30	39.78665047	-80.75677965
7,117.00	42.02	27.77	5,878.27	3,041.94	1,722.05	14,449,166.97	1,708,755.96	39.78672848	-80.75673075
7,164.00	40.00	34.45	5,913.75	3,068.33	1,737.94	14,449,193.36	1,708,771.85	39.78680084	-80.75667396
7,211.00	37.76	41.22	5,950.36	3,091.63	1,755.98	14,449,216.66	1,708,789.88	39.78686467	-80.75660952
7,259.00	36.66	45.79	5,988.59	3,112.68	1,775.94	14,449,237.71	1,708,809.84	39.78692234	-80.75653826
7,306.00	36.22	49.92	6,026.41	3,131.41	1,796.62	14,449,256.44	1,708,830.53	39.78697361	-80.75646445
7,354.00	35.47	56.51	6,065.33	3,148.23	1,819.10	14,449,273.26	1,708,853.00	39.78701964	-80.75638429
7,401.00	35.12	59.41	6,103.69	3,162.63	1,842.11	14,449,287.66	1,708,876.01	39.78705903	-80.75630223
7,448.00	35.69	66.00	6,142.02	3,175.09	1,866.28	14,449,300.12	1,708,900.19	39.78709307	-80.75621606
7,495.00	37.36	72.07	6,179.80	3,185.06	1,892.38	14,449,310.09	1,708,926.29	39.78712026	-80.75612305
7,542.00	40.09	77.43	6,216.47	3,192.75	1,920.73	14,449,317.78	1,708,954.64	39.78714116	-80.75602205
7,589.00	43.08	81.65	6,251.63	3,198.38	1,951.40	14,449,323.41	1,708,985.31	39.78715638	-80.75591284
7,637.00	44.84	87.10	6,286.19	3,201.62	1,984.53	14,449,326.65	1,709,018.44	39.78716503	-80.75579485
7,684.00	46.55	90.79	6,319.03	3,202.22	2,018.15	14,449,327.25	1,709,052.06	39.78716643	-80.75567518
7,732.00	47.25	95.97	6,351.83	3,200.15	2,053.11	14,449,325.18	1,709,087.02	39.78716047	-80.75555074
7,779.00	48.13	101.69	6,383.49	3,194.80	2,087.43	14,449,319.83	1,709,121.34	39.78714554	-80.75542864
7,826.00	49.63	105.73	6,414.40	3,186.40	2,121.81	14,449,311.43	1,709,155.72	39.78712221	-80.75530634
7,873.00	52.97	109.77	6,443.79	3,175.20	2,156.72	14,449,300.22	1,709,190.62	39.78709117	-80.75518219
7,921.00	54.37	116.63	6,472.25	3,159.96	2,192.21	14,449,284.99	1,709,226.12	39.78704906	-80.75505598
7,968.00	54.68	120.67	6,499.53	3,141.61	2,225.79	14,449,266.64	1,709,259.70	39.78699842	-80.75493663
8,016.00	57.85	124.71	6,526.19	3,120.04	2,259.36	14,449,245.07	1,709,293.26	39.78693893	-80.75481736
8,063.00	63.03	126.56	6,549.37	3,096.22	2,292.56	14,449,221.25	1,709,326.47	39.78687326	-80.75469940
8,110.00	68.48	128.41	6,568.67	3,070.14	2,326.54	14,449,195.17	1,709,360.45	39.78680138	-80.75457869
8,157.00	74.20	131.75	6,583.70	3,041.47	2,360.58	14,449,166.50	1,709,394.49	39.78672239	-80.75445781
8,204.00	78.37	134.21	6,594.85	3,010.34	2,393.97	14,449,135.37	1,709,427.87	39.78663666	-80.75433926
8,251.00	79.65	140.09	6,603.81	2,976.53	2,425.33	14,449,101.56	1,709,459.23	39.78654956	-80.75422796
8,299.00	81.54	143.61	6,611.66	2,939.30	2,454.57	14,449,064.32	1,709,488.48	39.78644109	-80.75412423
8,346.00	85.23	147.21	6,617.07	2,900.87	2,481.06	14,449,025.90	1,709,514.97	39.78633566	-80.75403031
8,393.00	88.97	148.53	6,619.45	2,861.13	2,506.02	14,448,986.16	1,709,539.92	39.78622803	-80.75392185
8,488.00	88.79	149.06	6,621.31	2,779.89	2,555.23	14,448,904.92	1,709,589.13	39.78600255	-80.75376747
8,582.00	90.11	150.99	6,622.21	2,698.47	2,602.19	14,448,823.50	1,709,636.09	39.78577869	-80.75360111
8,678.00	90.02	151.26	6,622.10	2,614.41	2,648.54	14,448,739.44	1,709,682.45	39.78554799	-80.75343692

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-14 HM (slot H)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Well:	Old Crow S-14 HM (slot H)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
8,772.00	90.33	151.61	6,621.82	2,531.85	2,693.49	14,448,656.88	1,709,727.40	39.78532032	-80.75327774
8,867.00	88.92	150.47	6,622.44	2,448.73	2,739.49	14,448,573.76	1,709,773.39	39.78509172	-80.75311482
8,962.00	88.13	150.73	6,624.88	2,366.00	2,786.11	14,448,491.02	1,709,820.01	39.78486414	-80.75294969
9,057.00	89.58	149.06	6,626.78	2,283.83	2,833.75	14,448,408.86	1,709,867.65	39.78463814	-80.75278092
9,152.00	89.32	146.77	6,627.69	2,203.35	2,884.20	14,448,328.38	1,709,918.11	39.78441674	-80.75260211
9,247.00	88.79	149.15	6,629.26	2,122.84	2,934.59	14,448,247.87	1,709,968.50	39.78419525	-80.75242354
9,342.00	89.89	150.55	6,630.35	2,040.70	2,982.30	14,448,165.73	1,710,016.21	39.78396931	-80.75144437
9,437.00	89.58	150.03	6,630.79	1,958.19	3,029.38	14,448,083.22	1,710,063.29	39.78374235	-80.75208775
9,532.00	89.41	150.11	6,631.63	1,875.86	3,076.78	14,448,000.89	1,710,110.69	39.78351590	-80.75191984
9,625.00	89.67	151.34	6,632.38	1,794.74	3,122.25	14,447,919.77	1,710,156.16	39.78329278	-80.75175878
9,720.00	91.38	152.75	6,631.51	1,710.84	3,166.78	14,447,835.87	1,710,200.69	39.78306201	-80.75160110
9,815.00	90.37	151.70	6,630.06	1,626.80	3,211.05	14,447,751.82	1,710,244.95	39.78283087	-80.75144437
9,910.00	89.54	150.91	6,630.13	1,543.46	3,256.66	14,447,668.49	1,710,290.57	39.78260167	-80.75128284
10,004.00	89.45	151.78	6,630.96	1,460.98	3,301.73	14,447,586.01	1,710,335.64	39.78237481	-80.75112321
10,099.00	89.27	150.11	6,632.02	1,377.94	3,347.87	14,447,502.97	1,710,381.77	39.78214642	-80.75095983
10,192.00	89.32	149.59	6,633.16	1,297.53	3,394.57	14,447,422.56	1,710,428.48	39.78192523	-80.75079438
10,286.00	89.01	149.32	6,634.53	1,216.59	3,442.34	14,447,341.62	1,710,476.25	39.78170256	-80.75062515
10,380.00	88.92	149.41	6,636.23	1,135.72	3,490.23	14,447,260.75	1,710,524.14	39.78148011	-80.75045549
10,475.00	89.71	151.43	6,637.37	1,053.11	3,537.12	14,447,178.14	1,710,571.03	39.78125289	-80.75028941
10,569.00	89.67	151.70	6,637.88	970.45	3,581.88	14,447,095.48	1,710,615.79	39.78102554	-80.75013092
10,664.00	89.58	149.76	6,638.50	887.59	3,628.33	14,447,012.62	1,710,662.23	39.78079762	-80.74996642
10,758.00	89.67	150.20	6,639.11	806.20	3,675.35	14,446,931.23	1,710,709.26	39.78057374	-80.74979985
10,852.00	89.45	150.03	6,639.84	724.70	3,722.19	14,446,849.73	1,710,756.09	39.78034957	-80.74963395
10,946.00	89.36	149.67	6,640.81	643.42	3,769.40	14,446,768.45	1,710,803.30	39.78012599	-80.74946672
11,040.00	89.93	149.24	6,641.39	562.47	3,817.17	14,446,687.50	1,710,851.08	39.77990330	-80.74929750
11,135.00	89.05	148.71	6,642.24	481.06	3,866.13	14,446,606.09	1,710,900.04	39.77967937	-80.74912404
11,230.00	90.73	149.06	6,642.42	399.73	3,915.22	14,446,524.76	1,710,949.13	39.77945563	-80.74895012
11,325.00	90.55	149.41	6,641.36	318.11	3,963.81	14,446,443.14	1,710,997.72	39.77923109	-80.74877799
11,419.00	90.90	149.59	6,640.17	237.12	4,011.52	14,446,362.15	1,711,045.42	39.77900832	-80.74860900
11,514.00	89.14	149.85	6,640.14	155.09	4,059.42	14,446,280.12	1,711,093.32	39.77878265	-80.74843933
11,608.00	89.14	149.76	6,641.55	73.85	4,106.69	14,446,198.88	1,711,140.59	39.77855919	-80.74827189
11,702.00	89.45	149.94	6,642.71	-7.43	4,153.90	14,446,117.60	1,711,187.80	39.77833562	-80.74810467
11,797.00	89.58	149.32	6,643.51	-89.39	4,201.92	14,446,035.64	1,711,235.83	39.77811016	-80.74793455
11,891.00	89.67	149.76	6,644.13	-170.41	4,249.58	14,445,954.62	1,711,283.48	39.77788728	-80.74776576
11,985.00	89.80	149.32	6,644.56	-251.44	4,297.23	14,445,873.59	1,711,331.13	39.77766439	-80.74759697
12,079.00	89.71	148.62	6,644.96	-331.98	4,345.68	14,445,793.04	1,711,379.59	39.77744281	-80.74742532
12,174.00	89.98	148.88	6,645.22	-413.20	4,394.97	14,445,711.83	1,711,428.87	39.77721939	-80.74725072
12,268.00	90.11	148.62	6,645.15	-493.56	4,443.73	14,445,631.47	1,711,477.64	39.77699831	-80.74707797
12,362.00	89.41	148.88	6,645.54	-573.92	4,492.49	14,445,551.11	1,711,526.40	39.77677724	-80.74690521
12,457.00	89.14	148.71	6,646.74	-655.17	4,541.71	14,445,469.86	1,711,575.62	39.77655373	-80.74673087
12,552.00	88.97	150.38	6,648.31	-737.05	4,589.85	14,445,387.98	1,711,623.76	39.77632850	-80.74656034
12,645.00	90.73	151.08	6,648.55	-818.17	4,635.32	14,445,306.86	1,711,669.23	39.77610536	-80.74639933
12,739.00	90.77	150.99	6,647.32	-900.41	4,680.84	14,445,224.62	1,711,714.75	39.77587916	-80.74623815
12,833.00	90.59	150.20	6,646.21	-982.29	4,726.99	14,445,142.74	1,711,760.89	39.77565393	-80.74607473
12,927.00	90.42	150.82	6,645.38	-1,064.11	4,773.26	14,445,060.92	1,711,807.17	39.77542888	-80.74591087
13,021.00	90.24	150.99	6,644.84	-1,146.25	4,818.97	14,444,978.78	1,711,852.87	39.77520295	-80.74574902
13,116.00	90.20	149.24	6,644.47	-1,228.61	4,866.30	14,444,896.42	1,711,900.21	39.77497639	-80.74558139
13,210.00	88.44	149.06	6,645.59	-1,309.30	4,914.50	14,444,815.73	1,711,948.40	39.77475041	-80.74541067
13,305.00	89.01	150.64	6,647.70	-1,391.43	4,962.20	14,444,733.60	1,711,996.10	39.77452850	-80.74524173
13,399.00	88.44	150.11	6,649.79	-1,473.12	5,008.65	14,444,651.91	1,712,042.56	39.77430379	-80.74507322
13,493.00	89.76	149.67	6,651.27	-1,554.42	5,055.80	14,444,570.61	1,712,089.71	39.77408014	-80.74490424
13,587.00	89.80	151.87	6,651.63	-1,636.45	5,101.70	14,444,488.58	1,712,135.61	39.77385452	-80.74474772
13,680.00	89.85	152.14	6,651.91	-1,718.56	5,145.35	14,444,406.47	1,712,179.26	39.77362866	-80.74459319
13,774.00	89.45	149.76	6,652.49	-1,800.73	5,190.99	14,444,324.30	1,712,224.90	39.77340265	-80.74443159
13,869.00	89.23	149.24	6,653.58	-1,882.58	5,239.21	14,444,242.45	1,712,273.11	39.77317749	-80.74426083

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-14 HM (slot H)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Well:	Old Crow S-14 HM (slot H)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
13,964.00	89.98	150.82	6,654.24	-1,964.87	5,286.66	14,444,160.16	1,712,320.57	39.77295112	-80.74409278
14,058.00	89.93	150.47	6,654.31	-2,046.80	5,332.74	14,444,078.23	1,712,366.65	39.77272576	-80.74392962
14,153.00	90.02	150.38	6,654.35	-2,129.42	5,379.63	14,443,995.60	1,712,413.54	39.77249848	-80.74376358
14,248.00	88.04	149.50	6,655.96	-2,211.63	5,427.20	14,443,913.40	1,712,461.11	39.77227235	-80.74359510
14,341.00	88.22	149.59	6,659.00	-2,291.76	5,474.32	14,443,833.27	1,712,508.22	39.77205193	-80.74342824
14,436.00	88.84	150.03	6,661.43	-2,373.84	5,522.07	14,443,751.19	1,712,555.98	39.77182612	-80.74325912
14,530.00	89.85	149.67	6,662.51	-2,455.12	5,569.28	14,443,669.91	1,712,603.19	39.77160254	-80.74309193
14,625.00	89.54	149.06	6,663.01	-2,536.86	5,617.69	14,443,588.17	1,712,651.60	39.77137768	-80.74292049
14,719.00	90.77	148.53	6,662.76	-2,617.26	5,666.39	14,443,507.77	1,712,700.30	39.77115650	-80.74274799
14,814.00	90.81	148.00	6,661.45	-2,698.05	5,716.36	14,443,426.98	1,712,750.26	39.77093424	-80.74257100
14,909.00	90.68	148.36	6,660.21	-2,778.76	5,766.44	14,443,346.27	1,712,800.35	39.77071218	-80.74239358
15,002.00	90.86	148.53	6,658.96	-2,858.00	5,815.10	14,443,267.03	1,712,849.01	39.77049418	-80.74222120
15,097.00	90.86	148.44	6,657.54	-2,938.98	5,864.76	14,443,186.05	1,712,898.66	39.77027139	-80.74204533
15,192.00	89.76	148.97	6,657.02	-3,020.16	5,914.10	14,443,104.87	1,712,948.01	39.77004807	-80.74187055
15,286.00	89.76	148.62	6,657.42	-3,100.56	5,962.80	14,443,024.47	1,712,996.71	39.76982689	-80.74169805
15,381.00	89.54	148.71	6,658.00	-3,181.70	6,012.21	14,442,943.33	1,713,046.11	39.76960366	-80.74152307
15,476.00	88.88	148.00	6,659.31	-3,262.56	6,062.04	14,442,862.47	1,713,095.95	39.76938119	-80.74134654
15,568.00	89.76	149.06	6,660.40	-3,341.02	6,110.07	14,442,784.00	1,713,143.98	39.76916533	-80.74117644
15,662.00	89.98	149.32	6,660.61	-3,421.76	6,158.21	14,442,703.27	1,713,192.12	39.76894323	-80.74100593
15,756.00	89.54	149.41	6,661.01	-3,502.64	6,206.11	14,442,622.39	1,713,240.02	39.76872073	-80.74083630
15,851.00	89.36	149.24	6,661.92	-3,584.34	6,254.58	14,442,540.69	1,713,288.48	39.76849597	-80.74066467
15,945.00	90.11	151.70	6,662.35	-3,666.12	6,300.90	14,442,458.91	1,713,334.81	39.76827101	-80.74050065
16,040.00	90.07	151.61	6,662.20	-3,749.73	6,346.01	14,442,375.30	1,713,379.91	39.76804103	-80.74034100
16,133.00	89.98	153.10	6,662.16	-3,832.11	6,389.16	14,442,292.92	1,713,423.06	39.76781445	-80.74018829
16,228.00	90.11	151.52	6,662.09	-3,916.23	6,433.30	14,442,208.80	1,713,467.21	39.76758309	-80.74003206
16,323.00	89.76	151.43	6,662.20	-3,999.70	6,478.67	14,442,125.33	1,713,512.57	39.76735350	-80.73987148
16,416.00	90.24	153.01	6,662.20	-4,081.98	6,522.01	14,442,043.05	1,713,555.92	39.76712719	-80.73971808
16,511.00	90.46	150.82	6,661.62	-4,165.78	6,566.73	14,441,959.25	1,713,600.64	39.76689668	-80.73955981
16,606.00	90.07	149.41	6,661.18	-4,248.15	6,614.06	14,441,876.88	1,713,647.97	39.76667011	-80.73939222
16,700.00	90.11	148.71	6,661.03	-4,328.77	6,662.39	14,441,796.26	1,713,696.30	39.76644830	-80.73922107
Survey @ 16700.00 MD 6661.03 TVD									
16,766.00	90.11	148.71	6,660.90	-4,385.17	6,696.67	14,441,739.86	1,713,730.58	39.76629314	-80.73909967
Survey projected to 16766.00 MD 6660.90 TVD									

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
172.00	172.00	0.32	-0.58	MWD surveys	
16,700.00	6,661.03	-4,328.77	6,662.39	Survey @ 16700.00 MD 6661.03 TVD	
16,766.00	6,660.90	-4,385.17	6,696.67	Survey projected to 16766.00 MD 6660.90 TVD	

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