



Well: Old Crow S-10 HM (slot R)
 Site: Old Crow Pad
 Project: Marshall County, West Virginia.
 Design: rev3
 Rig: Nabors B 28

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	Vsect	Annotation
1	6163.00	38.58	342.97	5385.28	2222.79	-847.84	0.00	0.000-2285.82		Survey @ 6163.00 MD 5385.28 TVD
2	6263.00	38.58	342.97	5463.45	2282.41	-866.10	0.00	0.000-2344.45		Proj. Begin 8.09°/100' build/turn
3	6298.67	41.12	340.83	5490.84	2304.13	-873.21	8.09	-29.125-2366.08		Begin 8.09°/100' build/turn
4	7401.53	50.00	140.21	6466.55	2326.91	-681.49	8.09	164.345-2268.98		Begin 10.00°/100' build/turn
5	7800.88	89.00	149.66	6604.00	2024.74	-474.29	10.00	14.816-1902.95		Begin 89.00° lateral
6	15069.94	89.00	149.66	6731.00	-4247.78	3197.04	0.00	0.000 5316.45		PBHL/TD 15069.94 MD/6731.00 TVD

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
173.00	0.18	226.60	173.00	-0.19	-0.20	0.03	MWD surveys
14997.00	88.70	150.22	6628.87	-4150.84	3150.15	5210.80	Survey @ 14997.00 MD 6628.87 TVD
15103.00	88.70	150.22	6631.28	-4242.82	3202.78	5315.94	Survey projected to 15103.00 MD 6631.28 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)

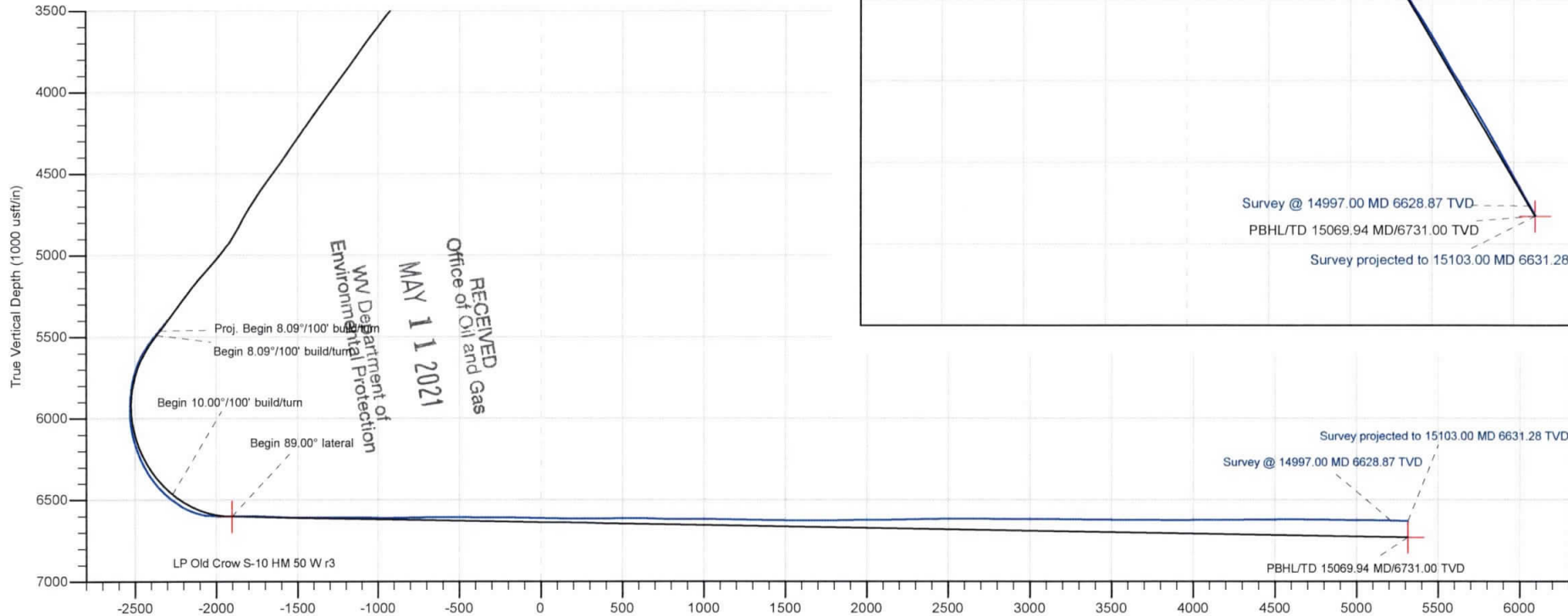
Northing 14446116.97 Easting 1707011.11 Latitude 39.77836520 Longitude -80.76297063

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.860°

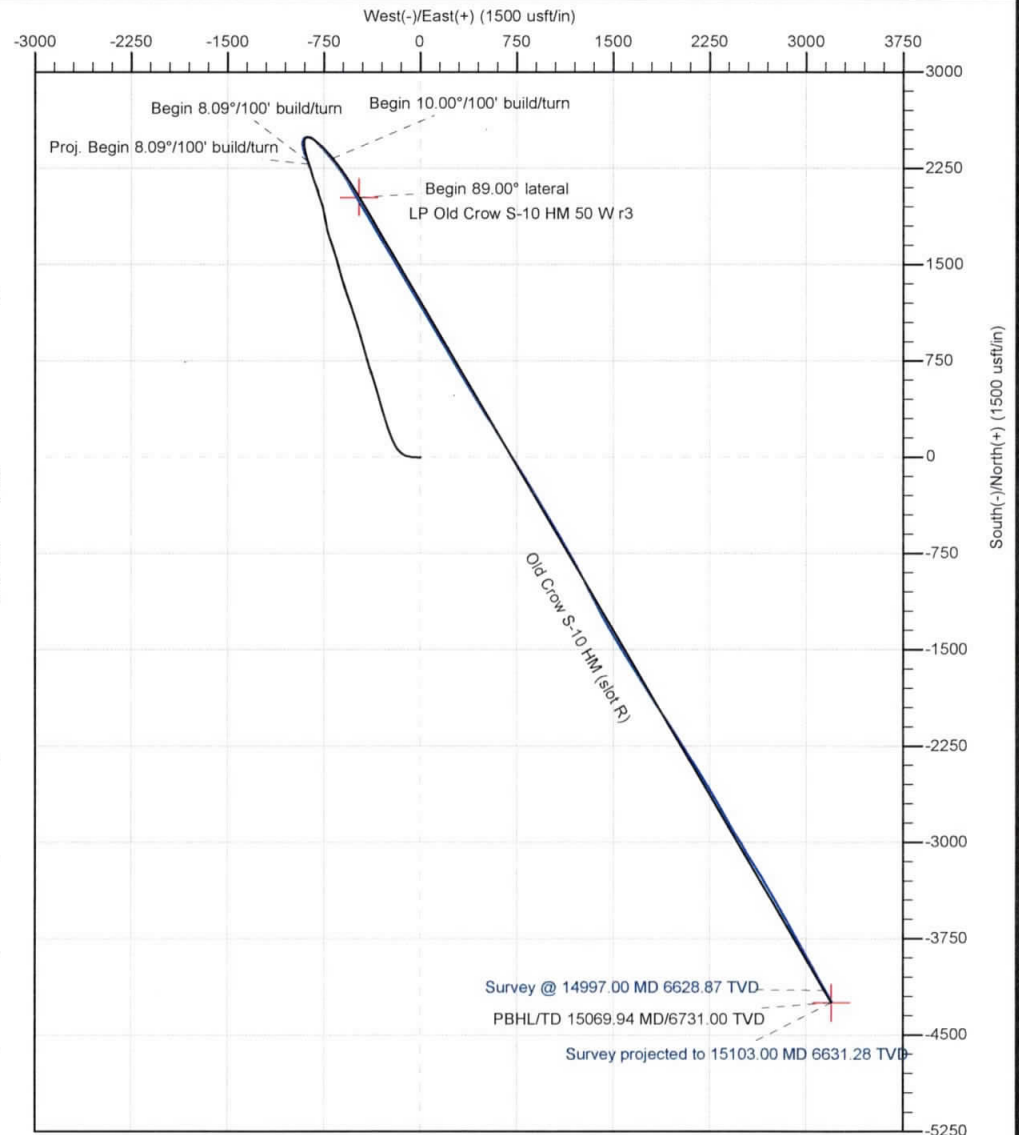


Azimuths to Grid North
 True North: -0.15°
 Magnetic North: -8.86°

Magnetic Field
 Strength: 51953.5snT
 Dip Angle: 66.80°
 Date: 5/20/2019
 Model: IGRF2015



Vertical Section at 143.03° (1000 usft/in)



Survey @ 14997.00 MD 6628.87 TVD
 PBHL/TD 15069.94 MD/6731.00 TVD
 Survey projected to 15103.00 MD 6631.28 TVD

Survey @ 14997.00 MD 6628.87 TVD
 Survey projected to 15103.00 MD 6631.28 TVD
 PBHL/TD 15069.94 MD/6731.00 TVD

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-10 HM (slot R)
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-10 HM (slot R)	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-10 HM (slot R)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,116.97 usft	Latitude:	39.77836520
	+E/-W	0.00 usft	Easting:	1,707,011.11 usft	Longitude:	-80.76297063
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	5/20/2019	-8.708	66.797	51,953.46551782

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	143.03	

Survey Program	Date	11/26/2019			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
173.00	991.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,036.00	2,854.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,930.00	6,163.00	MWD (Original Hole)	MWD	MWD - Standard	
6,205.00	14,997.00	MWD lat (Original Hole)	MWD	MWD - Standard	
15,103.00	15,103.00	Projection (Original Hole)	MWD	MWD - Standard	

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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)	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
173.00	0.18	226.60	173.00	-0.19	-0.20	0.03	0.10	0.10	0.00	
MWD surveys										
234.00	0.13	122.89	234.00	-0.29	-0.21	0.11	0.40	-0.08	-170.02	
279.00	0.13	125.52	279.00	-0.35	-0.12	0.20	0.01	0.00	5.84	
324.00	0.40	179.75	324.00	-0.53	-0.08	0.38	0.76	0.60	120.51	
369.00	0.35	159.27	369.00	-0.82	-0.03	0.64	0.32	-0.11	-45.51	

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Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B 28)
Well:	Old Crow S-10 HM (slot R)	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)
414.00	0.35	172.55	414.00	-1.08	0.03	0.89	0.18	0.00	29.51
459.00	0.40	198.21	459.00	-1.37	0.00	1.10	0.39	0.11	57.02
504.00	0.22	216.93	504.00	-1.59	-0.10	1.21	0.45	-0.40	41.60
549.00	0.26	219.66	549.00	-1.74	-0.22	1.26	0.09	0.09	6.07
594.00	0.18	160.07	593.99	-1.88	-0.26	1.35	0.51	-0.18	-132.42
639.00	0.35	209.90	638.99	-2.07	-0.30	1.47	0.60	0.38	110.73
688.00	0.09	163.58	687.99	-2.23	-0.37	1.56	0.60	-0.53	-94.53
733.00	0.13	159.80	732.99	-2.32	-0.34	1.65	0.09	0.09	-8.40
781.00	0.35	204.19	780.99	-2.50	-0.38	1.77	0.57	0.46	92.48
826.00	0.26	233.19	825.99	-2.69	-0.52	1.84	0.39	-0.20	64.44
875.00	0.35	204.27	874.99	-2.89	-0.67	1.91	0.36	0.18	-59.02
920.00	0.35	199.52	919.99	-3.14	-0.77	2.05	0.06	0.00	-10.56
970.00	0.35	224.13	969.99	-3.40	-0.93	2.16	0.30	0.00	49.22
991.00	0.21	230.11	990.99	-3.47	-1.00	2.17	0.68	-0.67	28.48
1,036.00	0.17	198.12	1,035.99	-3.59	-1.09	2.21	0.25	-0.09	-71.09
1,159.00	1.45	263.25	1,158.98	-3.94	-2.69	1.53	1.13	1.04	52.95
1,254.00	1.76	265.62	1,253.94	-4.19	-5.34	0.14	0.33	0.33	2.49
1,349.00	2.64	284.26	1,348.87	-3.77	-8.91	-2.35	1.18	0.93	19.62
1,446.00	4.88	288.56	1,445.65	-1.90	-14.99	-7.49	2.33	2.31	4.43
1,541.00	6.72	276.17	1,540.17	-0.02	-24.35	-14.63	2.33	1.94	-13.04
1,635.00	10.94	273.27	1,633.03	1.08	-38.73	-24.15	4.51	4.49	-3.09
1,731.00	12.83	273.18	1,726.97	2.19	-58.46	-36.91	1.97	1.97	-0.09
1,826.00	12.70	277.93	1,819.63	4.22	-79.34	-51.08	1.11	-0.14	5.00
1,922.00	11.47	283.73	1,913.50	7.94	-99.07	-65.92	1.80	-1.28	6.04
2,017.00	12.52	293.22	2,006.43	14.24	-117.71	-82.17	2.35	1.11	9.99
2,112.00	14.28	304.65	2,098.86	24.97	-136.81	-102.23	3.34	1.85	12.03
2,207.00	16.61	312.61	2,190.43	40.82	-156.45	-126.70	3.31	2.45	8.38
2,302.00	19.16	323.36	2,280.86	62.54	-175.75	-155.66	4.38	2.68	11.32
2,397.00	21.09	330.31	2,370.07	89.90	-193.53	-188.21	3.23	2.03	7.32
2,491.00	22.54	333.82	2,457.34	120.76	-209.86	-222.69	2.07	1.54	3.73
2,586.00	24.34	337.69	2,544.50	155.22	-225.32	-259.52	2.49	1.89	4.07
2,680.00	26.10	340.15	2,629.54	192.59	-239.70	-298.03	2.18	1.87	2.62
2,776.00	30.14	343.23	2,714.19	235.55	-253.83	-340.85	4.47	4.21	3.21
2,854.00	34.23	342.70	2,780.19	275.26	-266.01	-379.90	5.26	5.24	-0.68
2,930.00	37.53	341.47	2,841.76	317.63	-279.73	-422.00	4.44	4.34	-1.62
3,056.00	37.22	345.95	2,941.91	391.00	-301.18	-493.52	2.17	-0.25	3.56
3,154.00	39.51	342.88	3,018.75	449.56	-317.55	-550.15	3.04	2.34	-3.13
3,248.00	41.22	344.72	3,090.38	508.02	-334.52	-607.06	2.22	1.82	1.96
3,343.00	42.28	343.93	3,161.25	568.92	-351.62	-666.00	1.90	1.12	-0.83
3,437.00	42.50	341.30	3,230.68	629.39	-370.55	-725.70	1.90	0.23	-2.80
3,532.00	38.76	340.24	3,302.77	687.79	-390.90	-784.60	4.00	-3.94	-1.12
3,626.00	36.39	343.93	3,377.27	742.30	-408.57	-838.77	3.48	1.58	3.93
3,721.00	37.75	345.95	3,453.07	797.59	-423.43	-891.89	1.80	1.43	2.13
3,815.00	38.89	343.93	3,526.83	853.86	-438.59	-945.96	1.80	1.21	-2.15

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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)
3,909.00	39.55	344.37	3,599.65	911.04	-454.82	-1,001.40	0.76	0.70	0.47
4,003.00	39.06	344.28	3,672.38	968.37	-470.91	-1,056.88	0.52	-0.52	-0.10
4,097.00	37.70	342.35	3,746.07	1,024.27	-487.65	-1,111.61	1.93	-1.45	-2.05
4,192.00	37.08	341.56	3,821.55	1,079.12	-505.51	-1,166.18	0.83	-0.65	-0.83
4,286.00	38.40	341.91	3,895.89	1,133.76	-523.54	-1,220.67	1.42	1.40	0.37
4,380.00	38.67	343.05	3,969.42	1,189.60	-541.17	-1,275.89	0.81	0.29	1.21
4,475.00	38.10	341.03	4,043.89	1,245.71	-559.35	-1,331.65	1.45	-0.60	-2.13
4,570.00	37.39	340.50	4,119.01	1,300.62	-578.51	-1,387.04	0.82	-0.75	-0.56
4,665.00	36.25	341.38	4,195.05	1,354.43	-597.10	-1,441.22	1.32	-1.20	0.93
4,759.00	35.68	343.84	4,271.14	1,407.10	-613.61	-1,493.22	1.65	-0.61	2.62
4,854.00	36.38	345.95	4,347.97	1,461.04	-628.16	-1,545.07	1.50	0.74	2.22
4,948.00	37.66	345.16	4,423.02	1,515.84	-642.28	-1,597.35	1.45	1.36	-0.84
5,043.00	37.75	342.97	4,498.18	1,571.71	-658.23	-1,651.57	1.41	0.09	-2.31
5,137.00	37.05	341.65	4,572.86	1,626.10	-675.58	-1,705.46	1.13	-0.74	-1.40
5,232.00	34.89	340.24	4,649.74	1,678.84	-693.77	-1,758.54	2.43	-2.27	-1.48
5,327.00	31.11	341.38	4,729.40	1,727.69	-710.80	-1,807.81	4.03	-3.98	1.20
5,421.00	29.66	348.32	4,810.51	1,773.49	-723.27	-1,851.90	4.04	-1.54	7.38
5,516.00	34.84	350.26	4,890.83	1,823.29	-732.63	-1,897.32	5.56	5.45	2.04
5,611.00	40.69	349.11	4,965.90	1,880.50	-743.08	-1,949.31	6.20	6.16	-1.21
5,705.00	43.06	346.13	5,035.90	1,941.76	-756.56	-2,006.36	3.29	2.52	-3.17
5,799.00	43.68	342.17	5,104.24	2,003.82	-774.20	-2,066.55	2.97	0.66	-4.21
5,894.00	40.25	340.94	5,174.87	2,064.08	-794.27	-2,126.77	3.71	-3.61	-1.29
5,988.00	38.45	338.92	5,247.56	2,120.06	-814.70	-2,183.78	2.35	-1.91	-2.15
6,083.00	37.70	343.49	5,322.36	2,175.48	-833.58	-2,239.42	3.07	-0.79	4.81
6,163.00	38.58	342.97	5,385.28	2,222.79	-847.84	-2,285.78	1.17	1.10	-0.65
6,205.00	39.69	341.47	5,417.86	2,248.03	-855.94	-2,310.82	3.47	2.64	-3.57
6,252.00	41.54	339.98	5,453.53	2,276.90	-866.04	-2,339.97	4.44	3.94	-3.17
6,300.00	41.89	339.63	5,489.36	2,306.88	-877.07	-2,370.55	0.88	0.73	-0.73
6,347.00	38.24	339.98	5,525.33	2,335.26	-887.52	-2,399.51	7.78	-7.77	0.74
6,393.00	34.99	341.12	5,562.24	2,361.13	-896.66	-2,425.67	7.22	-7.07	2.48
6,440.00	30.42	342.88	5,601.78	2,385.26	-904.53	-2,449.69	9.93	-9.72	3.74
6,485.00	26.42	345.60	5,641.35	2,405.85	-910.37	-2,469.65	9.34	-8.89	6.04
6,532.00	22.51	351.76	5,684.13	2,424.90	-914.26	-2,487.21	9.92	-8.32	13.11
6,580.00	19.91	359.67	5,728.89	2,442.17	-915.63	-2,501.83	8.04	-5.42	16.48
6,627.00	16.18	8.72	5,773.58	2,456.65	-914.68	-2,512.83	9.91	-7.94	19.26
6,675.00	11.91	17.77	5,820.14	2,467.99	-912.15	-2,520.37	9.98	-8.90	18.85
6,722.00	10.42	25.94	5,866.25	2,476.43	-908.82	-2,525.10	4.62	-3.17	17.38
6,769.00	9.93	34.29	5,912.51	2,483.60	-904.67	-2,528.34	3.30	-1.04	17.77
6,816.00	10.11	54.95	5,958.81	2,489.32	-899.01	-2,529.50	7.58	0.38	43.96
6,863.00	11.87	73.58	6,004.96	2,493.06	-890.99	-2,527.67	8.58	3.74	39.64
6,910.00	14.51	86.94	6,050.73	2,494.74	-880.47	-2,522.68	8.53	5.62	28.43
6,958.00	16.40	99.60	6,097.00	2,493.93	-867.78	-2,514.41	8.03	8.64	26.38
7,005.00	18.15	111.81	6,141.90	2,490.10	-854.44	-2,503.32	8.55	3.72	25.98

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7,053.00	20.88	120.69	6,187.14	2,482.95	-840.14	-2,489.01	8.38	5.69	18.50
7,100.00	22.73	130.71	6,230.79	2,472.75	-826.04	-2,472.39	8.83	3.94	21.32
7,147.00	25.98	134.40	6,273.61	2,459.62	-811.80	-2,453.33	7.63	6.91	7.85
7,194.00	29.67	135.02	6,315.17	2,444.19	-796.22	-2,431.63	7.88	7.85	1.32
7,242.00	33.67	135.63	6,356.01	2,426.26	-778.51	-2,406.66	8.36	8.33	1.27
7,289.00	38.11	136.51	6,394.08	2,406.42	-759.41	-2,379.31	9.51	9.45	1.87
7,337.00	42.81	136.69	6,430.59	2,383.79	-738.01	-2,348.37	9.79	9.79	0.38
7,384.00	47.43	138.18	6,463.75	2,359.26	-715.51	-2,315.23	10.08	9.83	3.17
7,431.00	51.21	140.29	6,494.38	2,332.26	-692.25	-2,279.68	8.73	8.04	4.49
7,525.00	59.69	143.10	6,547.65	2,271.51	-644.39	-2,202.36	9.35	9.02	2.99
7,555.00	64.09	144.60	6,561.78	2,250.15	-628.79	-2,175.91	15.31	14.67	5.00
7,616.00	73.49	146.79	6,583.83	2,203.21	-596.81	-2,119.17	15.77	15.41	3.59
7,668.00	81.63	148.73	6,595.02	2,160.29	-569.76	-2,068.61	16.07	15.65	3.73
7,710.00	87.60	150.22	6,598.96	2,124.28	-548.53	-2,027.08	14.65	14.21	3.55
7,757.00	88.18	151.10	6,600.69	2,083.34	-525.52	-1,980.53	2.24	1.23	1.87
7,808.00	91.91	150.93	6,600.65	2,038.74	-500.81	-1,930.03	7.32	7.31	-0.33
7,902.00	89.58	149.96	6,599.43	1,956.98	-454.45	-1,836.83	2.68	-2.48	-1.03
7,997.00	88.13	149.43	6,601.33	1,874.98	-406.52	-1,742.50	1.63	-1.53	-0.56
8,091.00	87.56	149.26	6,604.86	1,794.18	-358.63	-1,649.14	0.63	-0.61	-0.18
8,186.00	89.58	148.90	6,607.23	1,712.71	-309.83	-1,554.70	2.16	2.13	-0.38
8,278.00	89.89	149.26	6,607.66	1,633.78	-262.56	-1,463.21	0.52	0.34	0.39
8,373.00	90.20	149.61	6,607.58	1,551.98	-214.25	-1,368.81	0.49	0.33	0.37
8,467.00	90.33	149.69	6,607.15	1,470.87	-166.75	-1,275.43	0.16	0.14	0.09
8,561.00	89.49	148.90	6,607.29	1,390.04	-118.76	-1,182.00	1.23	-0.89	-0.84
8,655.00	88.92	148.99	6,608.60	1,309.53	-70.27	-1,088.51	0.61	-0.61	0.10
8,748.00	88.40	148.82	6,610.77	1,229.91	-22.25	-996.02	0.59	-0.56	-0.18
8,842.00	90.95	149.96	6,611.31	1,149.02	25.61	-902.61	2.97	2.71	1.21
8,937.00	91.60	150.57	6,609.19	1,066.55	72.71	-808.39	0.94	0.68	0.64
9,031.00	90.42	149.61	6,607.54	985.08	119.58	-715.12	1.62	-1.26	-1.02
9,126.00	90.51	148.90	6,606.77	903.44	168.14	-620.68	0.75	0.09	-0.75
9,221.00	90.33	149.69	6,606.07	821.76	216.65	-526.26	0.85	-0.19	0.83
9,316.00	88.00	149.61	6,607.45	739.79	264.64	-431.91	2.45	-2.45	-0.08
9,410.00	90.11	149.34	6,609.00	658.84	312.37	-338.52	2.26	2.24	-0.29
9,505.00	90.33	149.61	6,608.64	577.00	360.63	-244.12	0.37	0.23	0.28
9,599.00	88.88	148.64	6,609.29	496.33	408.86	-150.66	1.86	-1.54	-1.03
9,695.00	88.62	148.20	6,611.38	414.57	459.12	-55.10	0.53	-0.27	-0.46
9,790.00	88.00	148.02	6,614.18	333.94	509.29	39.48	0.68	-0.65	-0.19
9,886.00	88.57	147.59	6,617.06	252.74	560.41	135.11	0.74	0.59	-0.45
9,981.00	90.81	149.08	6,617.57	171.89	610.28	229.69	0.21	2.36	1.57
10,076.00	90.90	148.90	6,616.15	90.48	659.22	324.16	0.21	0.09	-0.19
10,171.00	90.77	148.73	6,614.77	9.21	708.40	418.67	0.21	-0.14	-0.18
10,266.00	90.68	148.02	6,613.57	-71.67	758.21	513.25	0.75	-0.09	-0.75
10,361.00	88.97	148.38	6,613.86	-152.41	808.27	607.86	0.74	-1.80	0.38

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-10 HM (slot R)
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-10 HM (slot R)	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)
10,455.00	88.44	148.64	6,615.98	-232.54	857.36	701.40	0.63	-0.56	0.28
10,550.00	89.49	149.52	6,617.70	-314.03	906.16	795.86	1.44	1.11	0.93
10,644.00	89.85	149.26	6,618.24	-394.93	954.03	889.28	0.47	0.38	-0.28
10,739.00	90.29	149.43	6,618.12	-476.65	1,002.46	983.70	0.50	0.46	0.18
10,834.00	88.66	150.40	6,618.99	-558.85	1,050.08	1,078.01	2.00	-1.72	1.02
10,926.00	88.75	150.13	6,621.07	-638.71	1,095.70	1,169.25	0.31	0.10	-0.29
11,024.00	88.92	150.05	6,623.06	-723.64	1,144.56	1,266.49	0.19	0.17	-0.08
11,119.00	88.62	150.31	6,625.10	-806.04	1,191.79	1,360.73	0.42	-0.32	0.27
11,214.00	89.27	151.10	6,626.85	-888.88	1,238.26	1,454.86	1.08	0.68	0.83
11,308.00	90.59	153.47	6,626.97	-972.09	1,281.98	1,547.63	2.89	1.40	2.52
11,403.00	89.58	152.51	6,626.83	-1,056.72	1,325.12	1,641.19	1.47	-1.06	-1.01
11,497.00	90.55	154.35	6,626.72	-1,140.79	1,367.16	1,733.64	2.21	1.03	1.96
11,591.00	90.20	151.45	6,626.10	-1,224.46	1,409.98	1,826.24	3.11	-0.37	-3.09
11,686.00	90.46	151.54	6,625.56	-1,307.94	1,455.32	1,920.20	0.29	0.27	0.09
11,780.00	90.02	148.90	6,625.16	-1,389.52	1,502.00	2,013.46	2.85	-0.47	-2.81
11,874.00	91.08	147.59	6,624.26	-1,469.44	1,551.46	2,107.06	1.79	1.13	-1.39
11,969.00	91.30	148.20	6,622.29	-1,549.90	1,601.94	2,201.70	0.68	0.23	0.64
12,062.00	91.03	148.11	6,620.40	-1,628.88	1,651.00	2,294.30	0.31	-0.29	-0.10
12,157.00	91.21	148.11	6,618.54	-1,709.53	1,701.18	2,388.91	0.19	0.19	0.00
12,251.00	90.46	148.82	6,617.17	-1,789.64	1,750.34	2,482.48	1.10	-0.80	0.76
12,346.00	89.98	147.59	6,616.81	-1,870.38	1,800.39	2,577.09	1.39	-0.51	-1.29
12,440.00	89.71	145.92	6,617.06	-1,948.99	1,851.92	2,670.89	1.80	-0.29	-1.78
12,534.00	88.92	147.59	6,618.18	-2,027.60	1,903.45	2,764.68	1.97	-0.84	1.78
12,629.00	90.29	148.38	6,618.84	-2,108.14	1,953.81	2,859.32	1.66	1.44	0.83
12,724.00	89.85	147.67	6,618.72	-2,188.73	2,004.11	2,953.96	0.88	-0.46	-0.75
12,819.00	89.93	147.76	6,618.90	-2,269.04	2,054.86	3,048.64	0.13	0.08	0.09
12,913.00	89.89	147.67	6,619.05	-2,348.51	2,105.07	3,142.32	0.10	-0.04	-0.10
13,008.00	89.71	147.23	6,619.38	-2,428.59	2,156.18	3,237.04	0.50	-0.19	-0.46
13,102.00	88.88	148.46	6,620.54	-2,508.16	2,206.20	3,330.70	1.58	-0.88	1.31
13,197.00	88.48	149.43	6,622.73	-2,589.52	2,255.19	3,425.17	1.10	-0.42	1.02
13,291.00	89.89	150.84	6,624.07	-2,671.03	2,302.00	3,518.43	2.12	1.50	1.50
13,386.00	89.80	150.05	6,624.32	-2,753.66	2,348.85	3,612.63	0.84	-0.09	-0.83
13,480.00	90.15	150.57	6,624.36	-2,835.32	2,395.41	3,705.88	0.67	0.37	0.55
13,575.00	89.76	149.34	6,624.44	-2,917.56	2,442.98	3,800.18	1.36	-0.41	-1.29
13,670.00	89.63	148.73	6,624.94	-2,999.02	2,491.85	3,894.66	0.66	-0.14	-0.64
13,764.00	90.20	149.96	6,625.08	-3,079.88	2,539.78	3,988.09	1.44	0.61	1.31
13,858.00	89.41	148.11	6,625.40	-3,160.48	2,588.14	4,081.56	2.14	-0.84	-1.97
13,953.00	90.68	148.02	6,625.33	-3,241.10	2,638.39	4,176.20	1.34	1.34	-0.09
14,048.00	91.12	149.96	6,623.84	-3,322.50	2,687.33	4,270.67	2.09	0.46	2.04
14,142.00	91.30	149.87	6,621.85	-3,403.82	2,734.44	4,363.97	0.21	0.19	-0.10
14,237.00	89.36	150.05	6,621.30	-3,486.06	2,781.99	4,458.27	0.06	-2.04	0.19
14,332.00	90.33	151.36	6,621.56	-3,568.90	2,828.47	4,552.41	1.72	1.02	1.38
14,426.00	90.59	151.54	6,620.81	-3,651.47	2,873.40	4,645.40	0.41	0.28	0.19
14,521.00	88.84	150.66	6,621.28	-3,734.64	2,919.31	4,739.45	2.06	-1.84	-0.93

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08/27/2021 Build 85

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-10 HM (slot R)
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-10 HM (slot R)	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)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
14,616.00	88.97	150.93	6,623.10	-3,817.54	2,965.65	4,833.56	0.32	0.14	0.28
14,711.00	89.23	151.10	6,624.59	-3,900.63	3,011.68	4,927.63	0.33	0.27	0.18
14,806.00	89.19	151.10	6,625.90	-3,983.80	3,057.59	5,021.68	0.04	-0.04	0.00
14,901.00	89.27	151.36	6,627.17	-4,067.06	3,103.31	5,115.70	0.29	0.08	0.27
14,997.00	88.70	150.22	6,628.87	-4,150.84	3,150.15	5,210.80	1.33	-0.59	-1.19
Survey @ 14997.00 MD 6628.87 TVD									
15,103.00	88.70	150.22	6,631.28	-4,242.82	3,202.78	5,315.94	0.00	0.00	0.00
Survey projected to 15103.00 MD 6631.28 TVD									

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
173.00	173.00	-0.19	-0.20	MWD surveys	
14,997.00	6,628.87	-4,150.84	3,150.15	Survey @ 14997.00 MD 6628.87 TVD	
15,103.00	6,631.28	-4,242.82	3,202.78	Survey projected to 15103.00 MD 6631.28 TVD	

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Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-10 HM (slot R)
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-10 HM (slot R)	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-10 HM (slot R)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,116.97 usft	Latitude:	39.77836520
	+E/-W	0.00 usft	Easting:	1,707,011.11 usft	Longitude:	-80.76297063
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	5/20/2019	-8.708	66.797	51,953.46551782

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	143.03	

Survey Program	Date	11/26/2019			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
173.00	991.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,036.00	2,854.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,930.00	6,163.00	MWD (Original Hole)	MWD	MWD - Standard	
6,205.00	14,997.00	MWD lat (Original Hole)	MWD	MWD - Standard	
15,103.00	15,103.00	Projection (Original Hole)	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	14,446,116.97	1,707,011.11	39.77836520	-80.76297063
173.00	0.18	226.60	173.00	-0.19	-0.20	14,446,116.79	1,707,010.91	39.77836469	-80.76297134
MWD surveys									
234.00	0.13	122.89	234.00	-0.29	-0.21	14,446,116.68	1,707,010.90	39.77836441	-80.76297138
279.00	0.13	125.52	279.00	-0.35	-0.12	14,446,116.63	1,707,010.99	39.77836425	-80.76297108
324.00	0.40	179.75	324.00	-0.53	-0.08	14,446,116.44	1,707,011.03	39.77836374	-80.76297093
369.00	0.35	159.27	369.00	-0.82	-0.03	14,446,116.15	1,707,011.08	39.77836295	-80.76297076
414.00	0.35	172.55	414.00	-1.08	0.03	14,446,115.89	1,707,011.15	39.77836222	-80.76297052

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-10 HM (slot R)
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-10 HM (slot R)	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	
459.00	0.40	198.21	459.00	-1.37	0.00	14,446,115.60	1,707,011.11	39.77836144	-80.76297064	
504.00	0.22	216.93	504.00	-1.59	-0.10	14,446,115.38	1,707,011.01	39.77836084	-80.76297100	
549.00	0.26	219.66	549.00	-1.74	-0.22	14,446,115.24	1,707,010.90	39.77836044	-80.76297142	
594.00	0.18	160.07	593.99	-1.88	-0.26	14,446,115.09	1,707,010.85	39.77836004	-80.76297156	
639.00	0.35	209.90	638.99	-2.07	-0.30	14,446,114.91	1,707,010.81	39.77835953	-80.76297172	
688.00	0.09	163.58	687.99	-2.23	-0.37	14,446,114.74	1,707,010.75	39.77835907	-80.76297195	
733.00	0.13	159.80	732.99	-2.32	-0.34	14,446,114.66	1,707,010.77	39.77835885	-80.76297185	
781.00	0.35	204.19	780.99	-2.50	-0.38	14,446,114.47	1,707,010.73	39.77835834	-80.76297200	
826.00	0.26	233.19	825.99	-2.69	-0.52	14,446,114.29	1,707,010.60	39.77835783	-80.76297250	
875.00	0.35	204.27	874.99	-2.89	-0.67	14,446,114.08	1,707,010.44	39.77835727	-80.76297303	
920.00	0.35	199.52	919.99	-3.14	-0.77	14,446,113.83	1,707,010.34	39.77835657	-80.76297340	
970.00	0.35	224.13	969.99	-3.40	-0.93	14,446,113.57	1,707,010.18	39.77835588	-80.76297396	
991.00	0.21	230.11	990.99	-3.47	-1.00	14,446,113.50	1,707,010.11	39.77835568	-80.76297423	
1,036.00	0.17	198.12	1,035.99	-3.59	-1.09	14,446,113.39	1,707,010.03	39.77835536	-80.76297453	
1,159.00	1.45	263.25	1,158.98	-3.94	-2.69	14,446,113.03	1,707,008.42	39.77835440	-80.76298023	
1,254.00	1.76	265.62	1,253.94	-4.19	-5.34	14,446,112.78	1,707,005.78	39.77835372	-80.76298966	
1,349.00	2.64	284.26	1,348.87	-3.77	-8.91	14,446,113.21	1,707,002.20	39.77835492	-80.76300238	
1,446.00	4.88	288.56	1,445.65	-1.90	-14.99	14,446,115.07	1,706,996.12	39.77836008	-80.76302400	
1,541.00	6.72	276.17	1,540.17	-0.02	-24.35	14,446,116.95	1,706,986.77	39.77836533	-80.76305729	
1,635.00	10.94	273.27	1,633.03	1.08	-38.73	14,446,118.05	1,706,972.39	39.77836845	-80.76310846	
1,731.00	12.83	273.18	1,726.97	2.19	-58.46	14,446,119.16	1,706,952.65	39.77837165	-80.76317870	
1,826.00	12.70	277.93	1,819.63	4.22	-79.34	14,446,121.19	1,706,931.77	39.77837736	-80.76325298	
1,922.00	11.47	283.73	1,913.50	7.94	-99.07	14,446,124.91	1,706,912.05	39.77838773	-80.76332316	
2,017.00	12.52	293.22	2,006.43	14.24	-117.71	14,446,131.21	1,706,893.41	39.77840517	-80.76338944	
2,112.00	14.28	304.65	2,098.86	24.97	-136.81	14,446,141.94	1,706,874.30	39.77843476	-80.76345735	
2,207.00	16.61	312.61	2,190.43	40.82	-156.45	14,446,157.80	1,706,854.66	39.77847845	-80.76352709	
2,302.00	19.16	323.36	2,280.86	62.54	-175.75	14,446,179.51	1,706,835.36	39.77853822	-80.76359560	
2,397.00	21.09	330.31	2,370.07	89.90	-193.53	14,446,206.87	1,706,817.58	39.77861350	-80.76365861	
2,491.00	22.54	333.82	2,457.34	120.76	-209.86	14,446,237.74	1,706,801.26	39.77869837	-80.76371643	
2,586.00	24.34	337.69	2,544.50	155.22	-225.32	14,446,272.19	1,706,785.79	39.77879311	-80.76377116	
2,680.00	26.10	340.15	2,629.54	192.59	-239.70	14,446,309.57	1,706,771.41	39.77889585	-80.76382198	
2,776.00	30.14	343.23	2,714.19	235.55	-253.83	14,446,352.52	1,706,757.28	39.77901393	-80.76387187	
2,854.00	34.23	342.70	2,780.19	275.26	-266.01	14,446,392.24	1,706,745.10	39.77912308	-80.76391485	
2,930.00	37.53	341.47	2,841.76	317.63	-279.73	14,446,434.61	1,706,731.39	39.77923954	-80.76396327	
3,056.00	37.22	345.95	2,941.91	391.00	-301.18	14,446,507.98	1,706,709.93	39.77944119	-80.76403894	
3,154.00	39.51	342.88	3,018.75	449.56	-317.55	14,446,566.53	1,706,693.56	39.77960213	-80.76409668	
3,248.00	41.22	344.72	3,090.38	508.02	-334.52	14,446,624.99	1,706,676.59	39.77976279	-80.76415652	
3,343.00	42.28	343.93	3,161.25	568.92	-351.62	14,446,685.90	1,706,659.50	39.77993017	-80.76421679	
3,437.00	42.50	341.30	3,230.68	629.39	-370.55	14,446,746.36	1,706,640.56	39.78009637	-80.76428362	
3,532.00	38.76	340.24	3,302.77	687.79	-390.90	14,446,804.77	1,706,620.21	39.78025691	-80.76435551	
3,626.00	36.39	343.93	3,377.27	742.30	-408.57	14,446,859.27	1,706,602.54	39.78040671	-80.76441790	
3,721.00	37.75	345.95	3,453.07	797.59	-423.43	14,446,914.56	1,706,587.68	39.78055867	-80.76447028	
3,815.00	38.89	343.93	3,526.83	853.86	-438.59	14,446,970.84	1,706,572.52	39.78071332	-80.76452369	
3,909.00	39.55	344.37	3,599.65	911.04	-454.82	14,447,028.01	1,706,556.29	39.78087046	-80.76458093	
4,003.00	39.06	344.28	3,672.38	968.37	-470.91	14,447,085.34	1,706,540.21	39.78102802	-80.76463766	
4,097.00	37.70	342.35	3,746.07	1,024.27	-487.65	14,447,141.24	1,706,523.46	39.78118166	-80.76469672	
4,192.00	37.08	341.56	3,821.55	1,079.12	-505.51	14,447,196.09	1,706,505.60	39.78133242	-80.76475980	
4,286.00	38.40	341.91	3,895.89	1,133.76	-523.54	14,447,250.73	1,706,487.57	39.78148260	-80.76482346	
4,380.00	38.67	343.05	3,969.42	1,189.60	-541.17	14,447,306.57	1,706,469.94	39.78163389	-80.76488568	
4,475.00	38.10	341.03	4,043.89	1,245.71	-559.35	14,447,362.68	1,706,451.76	39.78179031	-80.76494987	
4,570.00	37.39	340.50	4,119.01	1,300.62	-578.51	14,447,417.59	1,706,432.60	39.78194724	-80.76501754	
4,665.00	36.25	341.38	4,195.05	1,354.43	-597.10	14,447,471.40	1,706,414.01	39.78208915	-80.76508324	
4,759.00	35.68	343.84	4,271.14	1,407.10	-613.61	14,447,524.07	1,706,397.50	39.78223391	-80.76514149	
4,854.00	36.38	345.95	4,347.97	1,461.04	-628.16	14,447,578.01	1,706,382.95	39.78238216	-80.76519278	
4,948.00	37.66	345.16	4,423.02	1,515.84	-642.28	14,447,632.82	1,706,368.83	39.78253277	-80.76524254	

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Environmental Protection

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-10 HM (slot R)
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-10 HM (slot R)	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
5,043.00	37.75	342.97	4,498.18	1,571.71	-658.23	14,447,688.68	1,706,352.88	39.78268630	-80.76529880
5,137.00	37.05	341.65	4,572.86	1,626.10	-675.58	14,447,743.07	1,706,335.54	39.78283580	-80.76536002
5,232.00	34.89	340.24	4,649.74	1,678.84	-693.77	14,447,795.81	1,706,317.34	39.78298077	-80.76542431
5,327.00	31.11	341.38	4,729.40	1,727.69	-710.80	14,447,844.66	1,706,300.31	39.78311504	-80.76548446
5,421.00	29.66	348.32	4,810.51	1,773.49	-723.27	14,447,890.46	1,706,287.84	39.78324093	-80.76552841
5,516.00	34.84	350.26	4,890.83	1,823.29	-732.63	14,447,940.26	1,706,278.49	39.78337775	-80.76556125
5,611.00	40.69	349.11	4,965.90	1,880.50	-743.08	14,447,997.47	1,706,268.04	39.78353493	-80.76559792
5,705.00	43.06	346.13	5,035.90	1,941.76	-756.56	14,448,058.73	1,706,254.55	39.78370327	-80.76564535
5,799.00	43.68	342.17	5,104.24	2,003.82	-774.20	14,448,120.80	1,706,236.92	39.78387385	-80.76570754
5,894.00	40.25	340.94	5,174.87	2,064.08	-794.27	14,448,181.05	1,706,216.84	39.78403947	-80.76577843
5,988.00	38.45	338.92	5,247.56	2,120.06	-814.70	14,448,237.03	1,706,196.41	39.78419335	-80.76585064
6,083.00	37.70	343.49	5,322.36	2,175.48	-833.58	14,448,292.46	1,706,177.53	39.78434569	-80.76591733
6,163.00	38.58	342.97	5,385.28	2,222.79	-847.84	14,448,339.76	1,706,163.27	39.78444751	-80.76596764
6,205.00	39.69	341.47	5,417.86	2,248.03	-855.94	14,448,365.00	1,706,155.17	39.78454508	-80.76599623
6,252.00	41.54	339.98	5,453.53	2,276.90	-866.04	14,448,393.87	1,706,145.07	39.78462445	-80.76603194
6,300.00	41.89	339.63	5,489.36	2,306.88	-877.07	14,448,423.85	1,706,134.04	39.78470685	-80.76607091
6,347.00	38.24	339.98	5,525.33	2,335.26	-887.52	14,448,452.24	1,706,123.60	39.78478488	-80.76610782
6,393.00	34.99	341.12	5,562.24	2,361.13	-896.66	14,448,478.10	1,706,114.45	39.78485597	-80.76614013
6,440.00	30.42	342.88	5,601.78	2,385.26	-904.53	14,448,502.23	1,706,106.59	39.78492231	-80.76616791
6,485.00	26.42	345.60	5,641.35	2,405.85	-910.37	14,448,522.83	1,706,100.74	39.78497891	-80.76618853
6,532.00	22.51	351.76	5,684.13	2,424.90	-914.26	14,448,541.87	1,706,096.85	39.78503123	-80.76620221
6,580.00	19.91	359.67	5,728.89	2,442.17	-915.63	14,448,559.14	1,706,095.48	39.78507868	-80.76620691
6,627.00	16.18	8.72	5,773.58	2,456.65	-914.68	14,448,573.63	1,706,096.43	39.78511845	-80.76620340
6,675.00	11.91	17.77	5,820.14	2,467.99	-912.15	14,448,584.96	1,706,098.96	39.78514956	-80.76619430
6,722.00	10.42	25.94	5,866.25	2,476.43	-908.82	14,448,593.40	1,706,102.30	39.78517271	-80.76618233
6,769.00	9.93	34.29	5,912.51	2,483.60	-904.67	14,448,600.57	1,706,106.44	39.78519238	-80.76616752
6,816.00	10.11	54.95	5,958.81	2,489.32	-899.01	14,448,606.29	1,706,112.10	39.78520804	-80.76614731
6,863.00	11.87	73.58	6,004.96	2,493.06	-890.99	14,448,610.03	1,706,120.12	39.78521825	-80.76611874
6,910.00	14.51	86.94	6,050.73	2,494.74	-880.47	14,448,611.71	1,706,130.64	39.78522279	-80.76608128
6,958.00	16.40	99.60	6,097.00	2,493.93	-867.78	14,448,610.90	1,706,143.33	39.78522048	-80.76603611
7,005.00	18.15	111.81	6,141.90	2,490.10	-854.44	14,448,607.07	1,706,156.67	39.78520987	-80.76598865
7,053.00	20.88	120.69	6,187.14	2,482.95	-840.14	14,448,599.93	1,706,170.98	39.78519014	-80.76593780
7,100.00	22.73	130.71	6,230.79	2,472.75	-826.04	14,448,589.72	1,706,185.07	39.78516202	-80.76588773
7,147.00	25.98	134.40	6,273.61	2,459.62	-811.80	14,448,576.59	1,706,199.31	39.78512586	-80.76583716
7,194.00	29.67	135.02	6,315.17	2,444.19	-796.22	14,448,561.16	1,706,214.89	39.78508336	-80.76578183
7,242.00	33.67	135.63	6,356.01	2,426.26	-778.51	14,448,543.24	1,706,232.60	39.78503401	-80.76571896
7,289.00	38.11	136.51	6,394.08	2,406.42	-759.41	14,448,523.39	1,706,251.70	39.78497937	-80.76565115
7,337.00	42.81	136.69	6,430.59	2,383.79	-738.01	14,448,500.76	1,706,273.10	39.78491708	-80.76557521
7,384.00	47.43	138.18	6,463.75	2,359.26	-715.51	14,448,476.23	1,706,295.61	39.78484955	-80.76549532
7,431.00	51.21	140.29	6,494.38	2,332.26	-692.25	14,448,449.23	1,706,318.86	39.78477523	-80.76541280
7,525.00	59.69	143.10	6,547.65	2,271.51	-644.39	14,448,388.48	1,706,366.72	39.78460805	-80.76524300
7,555.00	64.09	144.60	6,561.78	2,250.15	-628.79	14,448,367.12	1,706,382.32	39.78454927	-80.76518767
7,616.00	73.49	146.79	6,583.83	2,203.21	-596.81	14,448,320.18	1,706,414.30	39.78442013	-80.76507426
7,668.00	81.63	148.73	6,595.02	2,160.29	-569.76	14,448,277.26	1,706,441.36	39.78430207	-80.76497836
7,710.00	87.60	150.22	6,598.96	2,124.28	-548.53	14,448,241.26	1,706,462.58	39.78420304	-80.76490314
7,757.00	88.18	151.10	6,600.69	2,083.34	-525.52	14,448,200.31	1,706,485.60	39.78409043	-80.76482161
7,808.00	91.91	150.93	6,600.65	2,038.74	-500.81	14,448,155.71	1,706,510.31	39.78396776	-80.76473407
7,902.00	89.58	149.96	6,599.43	1,956.98	-454.45	14,448,073.95	1,706,556.66	39.78374290	-80.76456982
7,997.00	88.13	149.43	6,601.33	1,874.98	-406.52	14,447,991.95	1,706,604.59	39.78351736	-80.76439999
8,091.00	87.56	149.26	6,604.86	1,794.18	-358.63	14,447,911.15	1,706,652.48	39.78329510	-80.76423027
8,186.00	89.58	148.90	6,607.23	1,712.71	-309.83	14,447,829.68	1,706,701.28	39.78307101	-80.76405734
8,278.00	89.89	149.26	6,607.66	1,633.78	-262.56	14,447,750.75	1,706,748.55	39.78285392	-80.76388981
8,373.00	90.20	149.61	6,607.58	1,551.98	-214.25	14,447,668.95	1,706,796.86	39.78262892	-80.76371863
8,467.00	90.33	149.69	6,607.15	1,470.87	-166.75	14,447,587.84	1,706,844.36	39.78240581	-80.76355033
8,561.00	89.49	148.90	6,607.29	1,390.04	-118.76	14,447,507.02	1,706,892.36	39.78218351	-80.76338024

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-10 HM (slot R)
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-10 HM (slot R)	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	
8,655.00	88.92	148.99	6,608.60	1,309.53	-70.27	14,447,426.50	1,706,940.84	39.78196203	-80.76320842	
8,748.00	88.40	148.82	6,610.77	1,229.91	-22.25	14,447,346.88	1,706,988.86	39.78174304	-80.76303825	
8,842.00	90.95	149.96	6,611.31	1,149.02	25.61	14,447,265.99	1,707,036.72	39.78152054	-80.76286867	
8,937.00	91.60	150.57	6,609.19	1,066.55	72.71	14,447,183.52	1,707,083.82	39.78129371	-80.76270177	
9,031.00	90.42	149.61	6,607.54	985.08	119.58	14,447,102.06	1,707,130.69	39.78106964	-80.76253573	
9,126.00	90.51	148.90	6,606.77	903.44	168.14	14,447,020.41	1,707,179.25	39.78084507	-80.76236364	
9,221.00	90.33	149.69	6,606.07	821.76	216.65	14,446,938.73	1,707,227.76	39.78062040	-80.76219176	
9,316.00	88.00	149.61	6,607.45	739.79	264.64	14,446,856.77	1,707,275.75	39.78039495	-80.76202171	
9,410.00	90.11	149.34	6,609.00	658.84	312.37	14,446,775.81	1,707,323.49	39.78017227	-80.76185257	
9,505.00	90.33	149.61	6,608.64	577.00	360.63	14,446,693.98	1,707,371.74	39.77994718	-80.76168160	
9,599.00	88.88	148.64	6,609.29	496.33	408.86	14,446,613.30	1,707,419.97	39.77972528	-80.76151068	
9,695.00	88.62	148.20	6,611.38	414.57	459.12	14,446,531.54	1,707,470.23	39.77950037	-80.76133256	
9,790.00	88.00	148.02	6,614.18	333.94	509.29	14,446,450.91	1,707,520.40	39.77927858	-80.76115477	
9,886.00	88.57	147.59	6,617.06	252.74	560.41	14,446,369.71	1,707,571.53	39.77905520	-80.76097357	
9,981.00	90.81	149.08	6,617.57	171.89	610.28	14,446,288.86	1,707,621.39	39.77883280	-80.76079685	
10,076.00	90.90	148.90	6,616.15	90.48	659.22	14,446,207.45	1,707,670.33	39.77860886	-80.76062344	
10,171.00	90.77	148.73	6,614.77	9.21	708.40	14,446,126.19	1,707,719.51	39.77838533	-80.76044915	
10,266.00	90.68	148.02	6,613.57	-71.67	758.21	14,446,045.30	1,707,769.32	39.77816283	-80.76027264	
10,361.00	88.97	148.38	6,613.86	-152.41	808.27	14,445,964.56	1,707,819.38	39.77794073	-80.76009523	
10,455.00	88.44	148.64	6,615.98	-232.54	857.36	14,445,884.43	1,707,868.47	39.77772030	-80.75992128	
10,550.00	89.49	149.52	6,617.70	-314.03	906.16	14,445,802.94	1,707,917.28	39.77749616	-80.75974835	
10,644.00	89.85	149.26	6,618.24	-394.93	954.03	14,445,722.04	1,707,965.14	39.77727363	-80.75957877	
10,739.00	90.29	149.43	6,618.12	-476.65	1,002.46	14,445,640.32	1,708,013.58	39.77704884	-80.75940715	
10,834.00	88.66	150.40	6,618.99	-558.85	1,050.08	14,445,558.13	1,708,061.19	39.77682276	-80.75923845	
10,926.00	88.75	150.13	6,621.07	-638.71	1,095.70	14,445,478.26	1,708,106.81	39.77660309	-80.75907685	
11,024.00	88.92	150.05	6,623.06	-723.64	1,144.56	14,445,393.33	1,708,155.67	39.77636949	-80.75890378	
11,119.00	88.62	150.31	6,625.10	-806.04	1,191.79	14,445,310.93	1,708,202.90	39.77614284	-80.75873647	
11,214.00	89.27	151.10	6,626.85	-888.88	1,238.26	14,445,228.09	1,708,249.38	39.77591501	-80.75857185	
11,308.00	90.59	153.47	6,626.97	-972.09	1,281.98	14,445,144.88	1,708,293.09	39.77568617	-80.75841707	
11,403.00	89.58	152.51	6,626.83	-1,056.72	1,325.12	14,445,060.25	1,708,336.23	39.77545342	-80.75826433	
11,497.00	90.55	154.35	6,626.72	-1,140.79	1,367.16	14,444,976.18	1,708,378.27	39.77522223	-80.75811550	
11,591.00	90.20	151.45	6,626.10	-1,224.46	1,409.98	14,444,892.51	1,708,421.09	39.77499214	-80.75796392	
11,686.00	90.46	151.54	6,625.56	-1,307.94	1,455.32	14,444,809.03	1,708,466.43	39.77476254	-80.75780337	
11,780.00	90.02	148.90	6,625.16	-1,389.52	1,502.00	14,444,727.45	1,708,513.11	39.77453815	-80.75763801	
11,874.00	91.08	147.59	6,624.26	-1,469.44	1,551.46	14,444,647.53	1,708,562.58	39.77431830	-80.75746272	
11,969.00	91.30	148.20	6,622.29	-1,549.90	1,601.94	14,444,567.07	1,708,613.05	39.77409697	-80.75728384	
12,062.00	91.03	148.11	6,620.40	-1,628.88	1,651.00	14,444,488.09	1,708,662.11	39.77387969	-80.75711000	
12,157.00	91.21	148.11	6,618.54	-1,709.53	1,701.18	14,444,407.44	1,708,712.29	39.77365784	-80.75693219	
12,251.00	90.46	148.82	6,617.17	-1,789.64	1,750.34	14,444,327.34	1,708,761.45	39.77343748	-80.75675801	
12,346.00	89.98	147.59	6,616.81	-1,870.38	1,800.39	14,444,246.59	1,708,811.50	39.77321536	-80.75658066	
12,440.00	89.71	145.92	6,617.06	-1,948.99	1,851.92	14,444,167.98	1,708,863.03	39.77299909	-80.75639802	
12,534.00	88.92	147.59	6,618.18	-2,027.60	1,903.45	14,444,089.38	1,708,914.56	39.77278283	-80.75621540	
12,629.00	90.29	148.38	6,618.84	-2,108.14	1,953.81	14,444,008.83	1,708,964.92	39.77256125	-80.75603695	
12,724.00	89.85	147.67	6,618.72	-2,188.73	2,004.11	14,443,928.24	1,709,015.23	39.77233956	-80.75585869	
12,819.00	89.93	147.76	6,618.90	-2,269.04	2,054.86	14,443,847.93	1,709,065.97	39.77211862	-80.75567888	
12,913.00	89.89	147.67	6,619.05	-2,348.51	2,105.07	14,443,768.46	1,709,116.18	39.77190000	-80.75550096	
13,008.00	89.71	147.23	6,619.38	-2,428.59	2,156.18	14,443,688.38	1,709,167.29	39.77167970	-80.75531983	
13,102.00	88.88	148.46	6,620.54	-2,508.16	2,206.20	14,443,608.81	1,709,217.31	39.77146080	-80.75514258	
13,197.00	88.48	149.43	6,622.73	-2,589.52	2,255.19	14,443,527.45	1,709,266.31	39.77123699	-80.75496901	
13,291.00	89.89	150.84	6,624.07	-2,671.03	2,302.00	14,443,445.95	1,709,313.11	39.77101280	-80.75480325	
13,386.00	89.80	150.05	6,624.32	-2,753.66	2,348.85	14,443,363.31	1,709,359.92	39.77078551	-80.75463729	
13,480.00	90.15	150.57	6,624.36	-2,835.32	2,395.41	14,443,281.65	1,709,406.52	39.77056090	-80.75447239	
13,575.00	89.76	149.34	6,624.44	-2,917.56	2,442.98	14,443,199.42	1,709,454.09	39.77033470	-80.75430392	
13,670.00	89.63	148.73	6,624.94	-2,999.02	2,491.85	14,443,117.96	1,709,502.97	39.77011063	-80.75413076	
13,764.00	90.20	149.96	6,625.08	-3,079.88	2,539.78	14,443,037.09	1,709,550.89	39.76988819	-80.75396099	

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-10 HM (slot R)
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-10 HM (slot R)	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	
13,858.00	89.41	148.11	6,625.40	-3,160.48	2,588.14	14,442,956.50	1,709,599.25	39.76966648	-80.75378967	
13,953.00	90.68	148.02	6,625.33	-3,241.10	2,638.39	14,442,875.88	1,709,649.50	39.76944470	-80.75361163	
14,048.00	91.12	149.96	6,623.84	-3,322.50	2,687.33	14,442,794.47	1,709,698.44	39.76922076	-80.75343828	
14,142.00	91.30	149.87	6,621.85	-3,403.82	2,734.44	14,442,713.15	1,709,745.55	39.76899708	-80.75327142	
14,237.00	89.36	150.05	6,621.30	-3,486.06	2,781.99	14,442,630.92	1,709,793.10	39.76877088	-80.75310299	
14,332.00	90.33	151.36	6,621.56	-3,568.90	2,828.47	14,442,548.07	1,709,839.59	39.76854301	-80.75293839	
14,426.00	90.59	151.54	6,620.81	-3,651.47	2,873.40	14,442,465.50	1,709,884.51	39.76831592	-80.75277932	
14,521.00	88.84	150.66	6,621.28	-3,734.64	2,919.31	14,442,382.34	1,709,930.42	39.76808718	-80.75261676	
14,616.00	88.97	150.93	6,623.10	-3,817.54	2,965.65	14,442,299.43	1,709,976.76	39.76785914	-80.75245265	
14,711.00	89.23	151.10	6,624.59	-3,900.63	3,011.68	14,442,216.34	1,710,022.79	39.76763060	-80.75228966	
14,806.00	89.19	151.10	6,625.90	-3,983.80	3,057.59	14,442,133.18	1,710,068.70	39.76740186	-80.75212711	
14,901.00	89.27	151.36	6,627.17	-4,067.06	3,103.31	14,442,049.91	1,710,114.42	39.76717285	-80.75196523	
14,997.00	88.70	150.22	6,628.87	-4,150.84	3,150.15	14,441,966.13	1,710,161.26	39.76694241	-80.75179936	
Survey @ 14997.00 MD 6628.87 TVD										
15,103.00	88.70	150.22	6,631.28	-4,242.82	3,202.78	14,441,874.16	1,710,213.89	39.76668942	-80.75161296	
Survey projected to 15103.00 MD 6631.28 TVD										

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
173.00	173.00	-0.19	-0.20	MWD surveys	
14,997.00	6,628.87	-4,150.84	3,150.15	Survey @ 14997.00 MD 6628.87 TVD	
15,103.00	6,631.28	-4,242.82	3,202.78	Survey projected to 15103.00 MD 6631.28 TVD	

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