



Well: Old Crow N-20 HU (slot F)
Site: Old Crow Pad
Project: Marshall County, West Virginia.
Design: rev10
Rig: Nabors B 28

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/S	+E/W	Dlog	TFace	VSEct	Annotation
1	11053.00	26.98	71.29	10213.12	1232.00	3278.83	0.00	0.00	532.60	Survey @ 11053.00 MD 10213.12 TVD
2	11153.49	26.98	71.29	10300.00	1246.18	3500.72	0.00	0.00	532.60	KOP Begin 4°/100' buildturn
3	11229.33	27.04	64.34	10370.25	1259.68	3533.83	4.00	-1.990	573.84	Begin 27.04° tangent
4	11501.82	27.04	64.34	10812.75	1313.28	3455.43	0.00	0.000	573.84	Begin 6°/100' buildturn
5	12260.84	50.00	955.98	11927.43	1698.44	3607.67	6.00	-83.346	923.56	Begin 6°/100' buildturn
6	12862.18	91.00	330.00	11423.68	2209.97	3433.55	8.00	-36.428	4457.98	Begin 91.00° lateral
7	25095.36	91.00	330.00	11210.00	12612.12	-2687.65	0.00	0.000	3090.98	PBHLTD 25095.36 MD/11210.00 TVD

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/S	+E/W	Dlog	TFace	VSEct	Annotation
173.00	0.31	4.58	473.00	0.47	0.04	0.45	0.00	0.00	MMWD surveys
11053.00	26.98	71.29	10213.12	1232.00	3278.83	532.60	0.00	0.00	Survey @ 11053.00 MD 10213.12 TVD
25036.00	50.81	323.75	11205.50	12769.96	-2669.11	13045.92	0.00	0.00	Survey @ 25036.00 MD 11205.50 TVD
25077.00	50.81	323.75	11204.92	12603.38	-2689.76	13084.82	0.00	0.00	Survey projected to 25077.00 MD 11204.92 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)

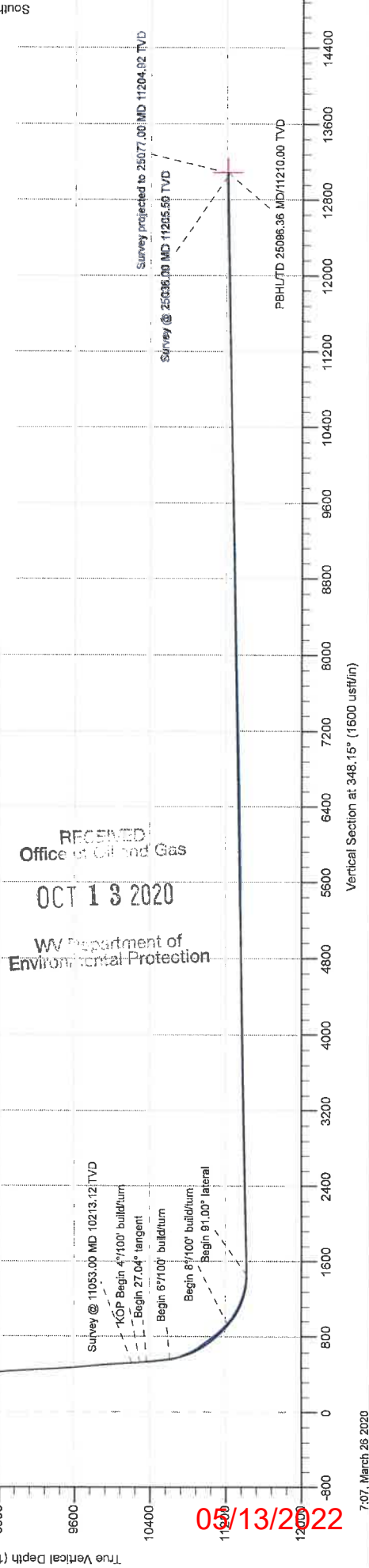
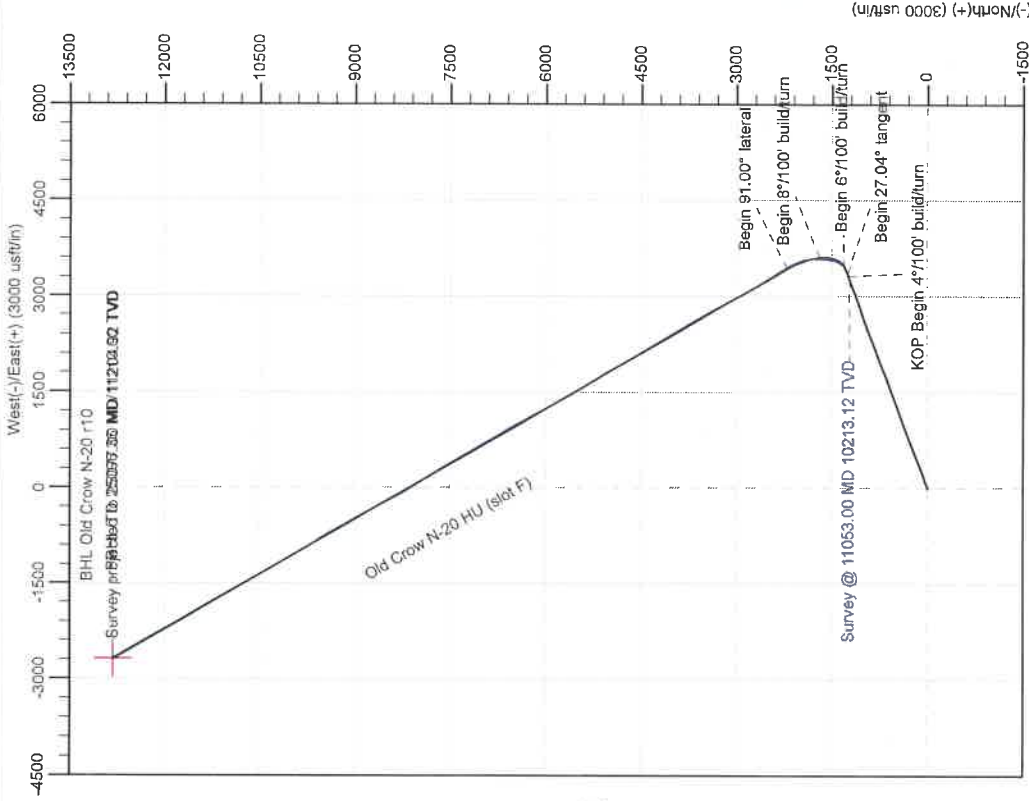
System Datum: Mean Sea Level
 Depth Reference: RKB=1265+26 @ 1291.00euf (Nabors B 28)

Northing 14446140.70 Easting 1707015.75
 Longitude -80.76295392

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.886°



Azimuths to Grid North
 True North: -0.15°
 Magnetic North: -8.89°
 Strength: 51800.1 nT
 Dip Angle: 66.73°
 Date: 3/11/2020
 Model: IGRF2015



05/13/2022



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-20 HU (slot F)
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 N-20 HU (slot F)	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 N-20 HU (slot F)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,140.70 usft	Latitude:	39.77843034
	+E/-W	0.00 usft	Easting:	1,707,015.74 usft	Longitude:	-80.76295392
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	3/11/2020	-8.734	66.728	51,860.07635601

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	348.15	

Survey Program	Date 3/26/2020			RECEIVED Office of Oil and Gas OCT 13 2020 WV Department of Environmental Protection	
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
173.00	967.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,058.00	2,759.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,860.00	11,053.00	MWD (Original Hole)	MWD	MWD - Standard	
11,121.00	25,036.00	MWD Lat (Original Hole)	MWD	MWD - Standard	
25,077.00	25,077.00	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	14,446,140.70	1,707,015.74	39.77843034	-80.76295392	
173.00	0.31	4.58	173.00	0.47	0.04	14,446,141.17	1,707,015.78	39.77843162	-80.76295378	
MWD surveys										
203.00	0.35	22.24	203.00	0.63	0.08	14,446,141.34	1,707,015.82	39.77843208	-80.76295364	
232.00	0.40	11.61	232.00	0.81	0.13	14,446,141.52	1,707,015.88	39.77843257	-80.76295344	
262.00	0.35	26.99	262.00	1.00	0.20	14,446,141.70	1,707,015.94	39.77843308	-80.76295322	
292.00	0.22	20.13	292.00	1.13	0.26	14,446,141.84	1,707,016.00	39.77843345	-80.76295300	
323.00	0.22	72.08	323.00	1.21	0.33	14,446,141.91	1,707,016.08	39.77843366	-80.76295272	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-20 HU (slot F)
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 N-20 HU (slot F)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

RECEIVED
Office of Oil and Gas
OCT 13 2020

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	
356.00	0.13	59.33	356.00	1.25	0.43	14,446,141.95	1,707,016.17	39.77843376	-80.76295239	
386.00	0.18	65.57	386.00	1.28	0.50	14,446,141.99	1,707,016.24	39.77843386	-80.76295214	
416.00	0.18	56.08	416.00	1.33	0.58	14,446,142.03	1,707,016.32	39.77843399	-80.76295184	
446.00	0.18	81.13	446.00	1.36	0.67	14,446,142.07	1,707,016.41	39.77843408	-80.76295154	
476.00	0.18	120.68	476.00	1.35	0.75	14,446,142.05	1,707,016.50	39.77843403	-80.76295123	
506.00	0.18	101.27	506.00	1.31	0.84	14,446,142.02	1,707,016.58	39.77843394	-80.76295092	
536.00	0.09	180.71	536.00	1.28	0.89	14,446,141.98	1,707,016.63	39.77843385	-80.76295076	
565.00	0.09	187.83	565.00	1.23	0.88	14,446,141.94	1,707,016.63	39.77843372	-80.76295077	
596.00	0.22	122.26	596.00	1.18	0.93	14,446,141.88	1,707,016.67	39.77843357	-80.76295060	
625.00	0.13	111.72	625.00	1.14	1.01	14,446,141.84	1,707,016.75	39.77843346	-80.76295033	
655.00	0.09	206.99	655.00	1.10	1.03	14,446,141.81	1,707,016.77	39.77843336	-80.76295025	
685.00	0.13	230.19	685.00	1.06	0.99	14,446,141.76	1,707,016.73	39.77843325	-80.76295038	
715.00	0.13	227.64	715.00	1.02	0.94	14,446,141.72	1,707,016.68	39.77843312	-80.76295057	
745.00	0.26	188.62	745.00	0.93	0.90	14,446,141.63	1,707,016.65	39.77843288	-80.76295069	
775.00	0.26	181.76	775.00	0.79	0.89	14,446,141.49	1,707,016.64	39.77843250	-80.76295074	
807.00	0.18	224.22	806.99	0.68	0.85	14,446,141.39	1,707,016.60	39.77843221	-80.76295087	
838.00	0.18	240.56	837.99	0.62	0.78	14,446,141.33	1,707,016.52	39.77843205	-80.76295114	
870.00	0.40	216.39	869.99	0.51	0.67	14,446,141.21	1,707,016.41	39.77843173	-80.76295154	
901.00	0.40	226.94	900.99	0.35	0.53	14,446,141.05	1,707,016.27	39.77843129	-80.76295205	
932.00	0.48	232.39	931.99	0.19	0.34	14,446,140.90	1,707,016.09	39.77843087	-80.76295270	
964.00	0.48	235.47	963.99	0.04	0.13	14,446,140.74	1,707,015.87	39.77843044	-80.76295347	
1,058.00	0.97	253.57	1,057.98	-0.41	-0.96	14,446,140.29	1,707,014.78	39.77842922	-80.76295734	
1,152.00	0.83	261.13	1,151.97	-0.74	-2.40	14,446,139.96	1,707,013.35	39.77842832	-80.76296246	
1,199.00	1.67	253.22	1,198.96	-0.99	-3.39	14,446,139.71	1,707,012.35	39.77842764	-80.76296599	
1,246.00	1.18	264.90	1,245.95	-1.23	-4.53	14,446,139.47	1,707,011.22	39.77842699	-80.76297004	
1,341.00	0.79	257.53	1,340.93	-1.46	-6.14	14,446,139.24	1,707,009.60	39.77842637	-80.76297579	
1,375.00	0.57	216.39	1,374.93	-1.65	-6.47	14,446,139.06	1,707,009.27	39.77842586	-80.76297696	
1,407.00	0.62	216.48	1,406.93	-1.92	-6.67	14,446,138.79	1,707,009.08	39.77842513	-80.76297767	
1,438.00	0.53	146.61	1,437.93	-2.17	-6.69	14,446,138.53	1,707,009.06	39.77842443	-80.76297774	
1,469.00	0.97	151.53	1,468.92	-2.52	-6.48	14,446,138.18	1,707,009.26	39.77842347	-80.76297702	
1,500.00	0.57	138.70	1,499.92	-2.87	-6.26	14,446,137.84	1,707,009.49	39.77842251	-80.76297622	
1,532.00	0.88	132.90	1,531.92	-3.15	-5.97	14,446,137.55	1,707,009.77	39.77842172	-80.76297521	
1,626.00	0.26	74.36	1,625.91	-3.59	-5.24	14,446,137.12	1,707,010.51	39.77842053	-80.76297260	
1,720.00	0.53	335.84	1,719.91	-3.13	-5.21	14,446,137.57	1,707,010.53	39.77842177	-80.76297249	
1,815.00	0.83	10.73	1,814.91	-2.06	-5.26	14,446,138.65	1,707,010.48	39.77842473	-80.76297267	
1,910.00	1.80	66.54	1,909.88	-0.79	-3.77	14,446,139.92	1,707,011.98	39.77842821	-80.76296733	
2,004.00	1.71	82.71	2,003.84	-0.02	-1.02	14,446,140.68	1,707,014.72	39.77843029	-80.76295755	
2,099.00	0.35	127.18	2,098.82	-0.02	0.62	14,446,140.69	1,707,016.36	39.77843029	-80.76295172	
2,194.00	0.48	331.35	2,193.82	0.16	0.66	14,446,140.86	1,707,016.40	39.77843077	-80.76295158	
2,288.00	0.88	321.34	2,287.81	1.07	0.02	14,446,141.77	1,707,015.76	39.77843327	-80.76295385	
2,382.00	0.53	289.08	2,381.81	1.77	-0.84	14,446,142.48	1,707,014.90	39.77843521	-80.76295691	
2,475.00	0.83	168.85	2,474.80	1.25	-1.12	14,446,141.96	1,707,014.62	39.77843379	-80.76295789	
2,570.00	1.93	147.58	2,569.78	-0.77	-0.13	14,446,139.93	1,707,015.61	39.77842822	-80.76295439	
2,665.00	1.19	165.86	2,664.74	-3.08	0.97	14,446,137.62	1,707,016.71	39.77842187	-80.76295050	
2,759.00	0.88	218.85	2,758.73	-4.59	0.76	14,446,136.11	1,707,016.50	39.77841773	-80.76295128	
2,860.00	1.23	227.64	2,859.71	-5.92	-0.53	14,446,134.78	1,707,015.21	39.77841408	-80.76295587	
2,907.00	0.88	216.92	2,906.70	-6.55	-1.12	14,446,134.15	1,707,014.62	39.77841236	-80.76295798	
2,954.00	0.48	143.80	2,953.70	-7.00	-1.22	14,446,133.70	1,707,014.52	39.77841113	-80.76295834	
3,001.00	0.92	103.89	3,000.70	-7.25	-0.74	14,446,133.46	1,707,015.00	39.77841044	-80.76295662	
3,049.00	2.86	88.07	3,048.67	-7.30	0.83	14,446,133.40	1,707,016.58	39.77841028	-80.76295103	
3,093.00	4.26	80.16	3,092.58	-6.99	3.54	14,446,133.72	1,707,019.28	39.77841113	-80.76294139	
3,141.00	5.36	75.68	3,140.41	-6.13	7.47	14,446,134.58	1,707,023.21	39.77841346	-80.76292740	
3,188.00	6.90	68.74	3,187.14	-4.56	12.23	14,446,136.15	1,707,027.97	39.77841773	-80.76291045	
3,235.00	8.39	66.28	3,233.72	-2.16	18.00	14,446,138.55	1,707,033.74	39.77842429	-80.76288989	
3,282.00	9.58	64.17	3,280.15	0.93	24.66	14,446,141.63	1,707,040.40	39.77843271	-80.76286615	



Survey Report - Geographic



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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 N-20 HU (slot F)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

OCT 13 2020

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	
3,330.00	11.21	64.08	3,327.36	4.71	32.45	14,446,145.41	1,707,048.19	39.77844303	-80.76283838	
3,377.00	12.22	61.27	3,373.38	9.10	40.92	14,446,149.80	1,707,056.66	39.77845502	-80.76280819	
3,427.00	13.01	63.38	3,422.17	14.16	50.59	14,446,154.87	1,707,066.34	39.77846886	-80.76277372	
3,474.00	13.40	66.98	3,467.93	18.66	60.33	14,446,159.37	1,707,076.08	39.77848115	-80.76273900	
3,521.00	14.81	69.26	3,513.51	22.92	70.96	14,446,163.62	1,707,086.71	39.77849277	-80.76270112	
3,568.00	15.73	70.14	3,558.85	27.21	82.57	14,446,167.91	1,707,098.32	39.77850447	-80.76265976	
3,614.00	17.49	69.26	3,602.93	31.78	94.90	14,446,172.48	1,707,110.65	39.77851692	-80.76261583	
3,661.00	18.15	69.00	3,647.67	36.90	108.34	14,446,177.61	1,707,124.09	39.77853089	-80.76256795	
3,708.00	19.25	70.41	3,692.19	42.12	122.48	14,446,182.83	1,707,138.22	39.77854513	-80.76251759	
3,755.00	20.70	70.50	3,736.36	47.49	137.61	14,446,188.20	1,707,153.35	39.77855977	-80.76246369	
3,803.00	21.27	71.99	3,781.18	53.02	153.88	14,446,193.72	1,707,169.63	39.77857482	-80.76240570	
3,850.00	22.37	71.64	3,824.81	58.47	170.48	14,446,199.17	1,707,186.22	39.77858968	-80.76234658	
3,866.00	22.46	72.07	3,839.60	60.37	176.28	14,446,201.07	1,707,192.02	39.77859485	-80.76232593	
3,897.00	23.91	71.90	3,868.10	64.15	187.88	14,446,204.85	1,707,203.63	39.77860513	-80.76228458	
3,929.00	25.62	71.55	3,897.16	68.35	200.61	14,446,209.05	1,707,216.36	39.77861659	-80.76223924	
3,961.00	26.63	71.38	3,925.89	72.83	213.97	14,446,213.53	1,707,229.72	39.77862879	-80.76219165	
3,992.00	26.94	70.58	3,953.56	77.38	227.18	14,446,218.09	1,707,242.92	39.77864120	-80.76214460	
4,039.00	27.55	68.65	3,995.35	84.88	247.34	14,446,225.58	1,707,263.09	39.77866164	-80.76207276	
4,087.00	28.74	67.24	4,037.67	93.39	268.32	14,446,234.09	1,707,284.07	39.77868485	-80.76199800	
4,134.00	28.26	66.36	4,078.98	102.22	288.94	14,446,242.92	1,707,304.68	39.77870896	-80.76192455	
4,182.00	28.13	66.01	4,121.28	111.38	309.69	14,446,252.08	1,707,325.43	39.77873396	-80.76185061	
4,229.00	27.86	66.45	4,162.78	120.27	329.87	14,446,260.97	1,707,345.62	39.77875823	-80.76177867	
4,276.00	27.64	68.56	4,204.38	128.64	350.09	14,446,269.35	1,707,365.83	39.77878108	-80.76170664	
4,323.00	27.38	70.58	4,246.06	136.22	370.43	14,446,276.92	1,707,386.17	39.77880174	-80.76163417	
4,371.00	27.91	70.58	4,288.58	143.63	391.44	14,446,284.33	1,707,407.18	39.77882192	-80.76155934	
4,418.00	29.00	70.76	4,329.90	151.04	412.57	14,446,291.74	1,707,428.31	39.77884212	-80.76148405	
4,465.00	29.18	70.06	4,370.98	158.70	434.09	14,446,299.40	1,707,449.84	39.77886301	-80.76140736	
4,512.00	28.43	69.00	4,412.16	166.62	455.31	14,446,307.32	1,707,471.05	39.77888459	-80.76133177	
4,561.00	28.61	68.39	4,455.21	175.12	477.11	14,446,315.82	1,707,492.85	39.77890778	-80.76125411	
4,608.00	28.83	68.83	4,496.43	183.35	498.14	14,446,324.06	1,707,513.88	39.77893025	-80.76117918	
4,656.00	28.74	68.30	4,538.50	191.80	519.65	14,446,332.50	1,707,535.39	39.77895328	-80.76110252	
4,703.00	28.83	67.33	4,579.69	200.35	540.61	14,446,341.05	1,707,556.35	39.77897660	-80.76102786	
4,752.00	28.83	66.89	4,622.62	209.54	562.37	14,446,350.24	1,707,578.12	39.77900168	-80.76095029	
4,799.00	28.70	67.86	4,663.82	218.24	583.25	14,446,358.94	1,707,598.99	39.77902542	-80.76087590	
4,847.00	28.39	68.30	4,705.99	226.80	604.53	14,446,367.50	1,707,620.27	39.77904878	-80.76080009	
4,894.00	27.73	67.24	4,747.46	235.16	624.99	14,446,375.87	1,707,640.74	39.77907160	-80.76072717	
4,942.00	27.55	68.03	4,789.98	243.63	645.59	14,446,384.34	1,707,661.33	39.77909471	-80.76065379	
4,989.00	27.42	68.74	4,831.68	251.63	665.75	14,446,392.33	1,707,681.49	39.77911651	-80.76058194	
5,037.00	27.38	69.26	4,874.29	259.54	686.37	14,446,400.25	1,707,702.12	39.77913810	-80.76050846	
5,084.00	27.51	68.91	4,916.00	267.27	706.61	14,446,407.98	1,707,722.35	39.77915919	-80.76043637	
5,132.00	28.13	69.09	4,958.46	275.30	727.52	14,446,416.01	1,707,743.26	39.77918108	-80.76036185	
5,179.00	28.04	68.83	4,999.92	283.25	748.17	14,446,423.95	1,707,763.92	39.77920274	-80.76028827	
5,226.00	28.26	69.00	5,041.36	291.22	768.86	14,446,431.93	1,707,784.61	39.77922450	-80.76021456	
5,273.00	27.99	69.35	5,082.81	299.10	789.57	14,446,439.80	1,707,805.31	39.77924598	-80.76014078	
5,321.00	27.99	68.74	5,125.20	307.16	810.61	14,446,447.86	1,707,826.35	39.77926795	-80.76006582	
5,368.00	28.30	68.91	5,166.84	315.16	831.28	14,446,455.87	1,707,847.02	39.77928979	-80.75999216	
5,416.00	28.56	68.12	5,208.85	323.53	852.54	14,446,464.24	1,707,868.29	39.77931262	-80.75991640	
5,463.00	27.91	67.51	5,250.26	331.93	873.13	14,446,472.63	1,707,888.88	39.77933552	-80.75984304	
5,510.00	26.54	67.95	5,292.05	340.08	893.03	14,446,480.78	1,707,908.77	39.77935776	-80.75977214	
5,557.00	26.02	69.62	5,334.19	347.61	912.43	14,446,488.32	1,707,928.17	39.77937830	-80.75970303	
5,605.00	26.63	71.46	5,377.22	354.70	932.49	14,446,495.40	1,707,948.24	39.77939762	-80.75963153	
5,652.00	27.55	70.58	5,419.06	361.66	952.73	14,446,502.37	1,707,968.48	39.77941659	-80.75955943	
5,700.00	27.64	69.35	5,461.60	369.28	973.62	14,446,509.98	1,707,989.36	39.77943736	-80.75948501	
5,747.00	27.25	70.06	5,503.31	376.79	993.94	14,446,517.50	1,708,009.68	39.77945784	-80.75941263	
5,795.00	26.89	69.53	5,546.05	384.34	1,014.44	14,446,525.04	1,708,030.18	39.77947841	-80.75933959	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-20 HU (slot F)
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 N-20 HU (slot F)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

OCT 13 2020

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
5,842.00	26.45	69.88	5,588.05	391.66	1,034.22	14,446,532.36	1,708,049.97	39.77949836	-80.75926909
5,890.00	26.10	69.88	5,631.09	398.96	1,054.17	14,446,539.67	1,708,069.92	39.77951828	-80.75919801
5,937.00	25.93	70.58	5,673.33	405.94	1,073.57	14,446,546.64	1,708,089.32	39.77953729	-80.75912889
5,985.00	25.88	71.29	5,716.51	412.79	1,093.39	14,446,553.49	1,708,109.14	39.77955595	-80.75905828
6,032.00	26.24	70.32	5,758.73	419.58	1,112.89	14,446,560.28	1,708,128.64	39.77957446	-80.75898882
6,080.00	26.54	70.58	5,801.73	426.72	1,133.00	14,446,567.42	1,708,148.74	39.77959391	-80.75891719
6,127.00	27.33	69.97	5,843.63	433.90	1,153.04	14,446,574.61	1,708,168.78	39.77961350	-80.75884579
6,174.00	27.86	69.00	5,885.28	441.53	1,173.43	14,446,582.24	1,708,189.17	39.77963431	-80.75877315
6,221.00	28.21	69.00	5,926.77	449.45	1,194.05	14,446,590.15	1,708,209.79	39.77965590	-80.75869966
6,269.00	28.34	67.59	5,969.04	457.86	1,215.17	14,446,598.56	1,708,230.92	39.77967883	-80.75862440
6,316.00	28.30	67.51	6,010.41	466.37	1,235.78	14,446,607.08	1,708,251.52	39.77970206	-80.75855097
6,363.00	28.61	67.95	6,051.74	474.86	1,256.50	14,446,615.56	1,708,272.25	39.77972522	-80.75847712
6,410.00	28.52	69.70	6,093.02	482.98	1,277.46	14,446,623.68	1,708,293.20	39.77974735	-80.75840247
6,457.00	28.70	69.79	6,134.28	490.77	1,298.57	14,446,631.47	1,708,314.32	39.77976860	-80.75832724
6,504.00	28.92	70.14	6,175.46	498.53	1,319.85	14,446,639.23	1,708,335.59	39.77978975	-80.75825142
6,552.00	28.83	69.09	6,217.49	506.60	1,341.58	14,446,647.31	1,708,357.32	39.77981176	-80.75817401
6,599.00	28.48	68.65	6,258.74	514.73	1,362.60	14,446,655.43	1,708,378.34	39.77983391	-80.75809911
6,646.00	28.43	68.83	6,300.06	522.85	1,383.47	14,446,663.55	1,708,399.21	39.77985606	-80.75802475
6,693.00	27.86	69.09	6,341.50	530.81	1,404.16	14,446,671.51	1,708,419.91	39.77987776	-80.75795102
6,740.00	26.67	69.35	6,383.28	538.45	1,424.29	14,446,679.15	1,708,440.04	39.77989859	-80.75787930
6,788.00	26.76	69.00	6,426.15	546.12	1,444.46	14,446,686.82	1,708,460.20	39.77991951	-80.75780744
6,866.00	27.99	69.62	6,495.42	558.78	1,478.01	14,446,699.49	1,708,493.76	39.77995405	-80.75768789
6,960.00	26.45	71.02	6,579.01	573.28	1,518.49	14,446,713.98	1,708,534.23	39.77999355	-80.75754368
6,991.00	26.81	70.87	6,606.72	577.84	1,531.62	14,446,718.54	1,708,547.36	39.78000597	-80.75749692
7,054.00	27.33	71.11	6,662.82	587.22	1,558.71	14,446,727.92	1,708,574.45	39.78003155	-80.75740041
7,101.00	27.60	71.99	6,704.52	594.08	1,579.27	14,446,734.78	1,708,595.01	39.78005023	-80.75732715
7,149.00	27.60	70.23	6,747.06	601.28	1,600.31	14,446,741.98	1,708,616.05	39.78006984	-80.75725220
7,196.00	27.77	69.70	6,788.68	608.76	1,620.82	14,446,749.46	1,708,636.56	39.78009024	-80.75717911
7,243.00	28.04	69.53	6,830.21	616.42	1,641.44	14,446,757.13	1,708,657.18	39.78011112	-80.75710564
7,290.00	28.39	69.53	6,871.63	624.19	1,662.26	14,446,764.90	1,708,678.00	39.78013231	-80.75703147
7,338.00	29.00	70.14	6,913.73	632.14	1,683.89	14,446,772.84	1,708,699.64	39.78015396	-80.75695439
7,385.00	29.53	69.35	6,954.73	640.09	1,705.45	14,446,780.80	1,708,721.19	39.78017565	-80.75687759
7,431.00	27.86	67.24	6,995.08	648.25	1,725.97	14,446,788.95	1,708,741.71	39.78019790	-80.75680447
7,479.00	27.77	66.19	7,037.54	657.10	1,746.54	14,446,797.81	1,708,762.28	39.78022006	-80.75673116
7,526.00	27.73	66.36	7,079.13	665.91	1,766.57	14,446,806.61	1,708,782.32	39.78024609	-80.75665977
7,574.00	26.89	67.33	7,121.78	674.57	1,786.82	14,446,815.27	1,708,802.56	39.78026973	-80.75658762
7,621.00	26.72	67.33	7,163.73	682.74	1,806.38	14,446,823.44	1,708,822.12	39.78029202	-80.75651793
7,668.00	26.10	66.63	7,205.83	690.91	1,825.62	14,446,831.62	1,708,841.36	39.78031432	-80.75644936
7,716.00	25.53	65.22	7,249.04	699.43	1,844.70	14,446,840.14	1,708,860.45	39.78033758	-80.75638135
7,763.00	25.27	68.83	7,291.50	707.30	1,863.25	14,446,848.01	1,708,879.00	39.78035905	-80.75631525
7,810.00	25.31	70.58	7,333.99	714.27	1,882.08	14,446,854.97	1,708,897.83	39.78037804	-80.75624816
7,857.00	25.44	70.23	7,376.46	721.02	1,901.06	14,446,861.73	1,708,916.80	39.78039645	-80.75618055
7,905.00	25.27	69.70	7,419.83	728.06	1,920.37	14,446,868.77	1,708,936.11	39.78041564	-80.75611175
7,952.00	25.53	69.00	7,462.29	735.17	1,939.23	14,446,875.88	1,708,954.98	39.78043503	-80.75604454
7,999.00	25.97	67.77	7,504.62	742.70	1,958.22	14,446,883.40	1,708,973.96	39.78045554	-80.75597690
8,046.00	27.03	68.91	7,546.69	750.43	1,977.71	14,446,891.14	1,708,993.45	39.78047664	-80.75590745
8,141.00	29.88	70.41	7,630.20	766.14	2,020.15	14,446,906.84	1,709,035.89	39.78051946	-80.75575622
8,188.00	30.23	70.85	7,670.88	773.94	2,042.36	14,446,914.65	1,709,058.10	39.78054073	-80.75567711
8,235.00	30.41	71.02	7,711.45	781.69	2,064.78	14,446,922.40	1,709,080.53	39.78056184	-80.75559721
8,283.00	28.92	69.79	7,753.16	789.66	2,087.16	14,446,930.36	1,709,102.91	39.78058354	-80.75551747
8,330.00	28.74	69.09	7,794.34	797.61	2,108.38	14,446,938.32	1,709,124.13	39.78060524	-80.75544186
8,378.00	28.43	68.47	7,836.49	805.93	2,129.79	14,446,946.63	1,709,145.54	39.78062790	-80.75536558
8,425.00	27.77	68.21	7,877.95	814.10	2,150.37	14,446,954.80	1,709,166.11	39.78065019	-80.75529227
8,472.00	27.95	68.30	7,919.50	822.23	2,170.77	14,446,962.94	1,709,186.51	39.78067238	-80.75521957
8,519.00	26.76	69.88	7,961.24	829.95	2,190.94	14,446,970.65	1,709,206.68	39.78069341	-80.75514770

WV Department of Environmental Protection



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-20 HU (slot F)
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 N-20 HU (slot F)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

OCT 13 2020

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
8,535.00	26.63	70.41	7,975.54	832.39	2,197.70	14,446,973.09	1,709,213.44	39.78070007	-80.75512362
8,582.00	26.32	69.53	8,017.61	839.56	2,217.38	14,446,980.27	1,709,233.13	39.78071962	-80.75505348
8,630.00	26.85	67.95	8,060.53	847.35	2,237.40	14,446,988.06	1,709,253.14	39.78074087	-80.75498216
8,677.00	26.85	67.77	8,102.47	855.35	2,257.06	14,446,996.06	1,709,272.81	39.78076269	-80.75491209
8,724.00	27.33	67.95	8,144.31	863.42	2,276.89	14,447,004.12	1,709,292.63	39.78078469	-80.75484145
8,771.00	27.51	67.51	8,186.03	871.62	2,296.92	14,447,012.33	1,709,312.66	39.78080707	-80.75477008
8,818.00	27.73	66.63	8,227.67	880.11	2,316.98	14,447,020.82	1,709,332.73	39.78083023	-80.75469857
8,865.00	27.38	68.56	8,269.34	888.40	2,337.08	14,447,029.10	1,709,352.83	39.78085284	-80.75462695
8,913.00	26.81	69.00	8,312.07	896.31	2,357.46	14,447,037.02	1,709,373.21	39.78087442	-80.75455434
8,960.00	26.28	68.12	8,354.12	903.99	2,377.01	14,447,044.69	1,709,392.76	39.78089536	-80.75448467
9,008.00	25.97	67.95	8,397.22	911.90	2,396.61	14,447,052.60	1,709,412.36	39.78091692	-80.75441482
9,055.00	25.84	66.45	8,439.49	919.85	2,415.54	14,447,060.56	1,709,431.29	39.78093863	-80.75434737
9,102.00	25.58	65.66	8,481.84	928.13	2,434.18	14,447,068.83	1,709,449.92	39.78096121	-80.75428097
9,149.00	26.02	66.28	8,524.16	936.46	2,452.86	14,447,077.16	1,709,468.60	39.78098394	-80.75421438
9,197.00	26.54	67.59	8,567.20	944.78	2,472.41	14,447,085.48	1,709,488.16	39.78100665	-80.75414471
9,244.00	27.03	69.62	8,609.15	952.50	2,492.13	14,447,093.21	1,709,507.88	39.78102771	-80.75407444
9,292.00	27.07	70.23	8,651.90	959.99	2,512.63	14,447,100.70	1,709,528.38	39.78104814	-80.75400139
9,339.00	27.60	70.32	8,693.65	967.28	2,532.95	14,447,107.98	1,709,548.69	39.78106799	-80.75392901
9,387.00	29.18	70.06	8,735.88	975.01	2,554.42	14,447,115.72	1,709,570.16	39.78108907	-80.75385251
9,434.00	30.67	70.41	8,776.61	982.94	2,576.49	14,447,123.64	1,709,592.23	39.78111067	-80.75377389
9,481.00	30.98	71.11	8,816.97	990.88	2,599.22	14,447,131.58	1,709,614.97	39.78113229	-80.75369288
9,528.00	31.33	71.20	8,857.19	998.73	2,622.24	14,447,139.43	1,709,637.98	39.78115369	-80.75361089
9,576.00	30.50	70.32	8,898.37	1,006.85	2,645.52	14,447,147.56	1,709,661.26	39.78117582	-80.75352794
9,623.00	29.58	69.00	8,939.06	1,015.03	2,667.58	14,447,155.73	1,709,683.32	39.78119810	-80.75344933
9,671.00	29.71	69.79	8,980.78	1,023.38	2,689.80	14,447,164.09	1,709,705.55	39.78122088	-80.75337015
9,718.00	28.61	72.34	9,021.82	1,030.82	2,711.46	14,447,171.52	1,709,727.20	39.78124114	-80.75329300
9,766.00	27.03	73.92	9,064.27	1,037.33	2,732.89	14,447,178.03	1,709,748.63	39.78125885	-80.75321665
9,813.00	26.72	74.80	9,106.20	1,043.06	2,753.35	14,447,183.76	1,709,769.09	39.78127443	-80.75314378
9,861.00	26.85	75.07	9,149.05	1,048.68	2,774.24	14,447,189.38	1,709,789.98	39.78128971	-80.75306937
9,908.00	26.45	72.96	9,191.06	1,054.48	2,794.50	14,447,195.19	1,709,810.24	39.78130549	-80.75299719
9,957.00	26.24	70.93	9,234.97	1,061.22	2,815.17	14,447,201.92	1,709,830.92	39.78132384	-80.75292354
10,047.00	26.72	70.85	9,315.53	1,074.36	2,853.09	14,447,215.06	1,709,868.83	39.78135963	-80.75278845
10,094.00	27.29	70.06	9,357.40	1,081.50	2,873.20	14,447,222.20	1,709,888.94	39.78137909	-80.75271680
10,142.00	27.51	70.50	9,400.02	1,088.95	2,893.99	14,447,229.65	1,709,909.74	39.78139940	-80.75264271
10,189.00	27.77	71.37	9,441.65	1,096.07	2,914.60	14,447,236.78	1,709,930.35	39.78141880	-80.75256929
10,235.00	28.13	72.17	9,482.29	1,102.82	2,935.08	14,447,243.52	1,709,950.82	39.78143717	-80.75249633
10,282.00	26.98	70.32	9,523.96	1,109.80	2,955.67	14,447,250.50	1,709,971.41	39.78145619	-80.75242298
10,329.00	26.94	70.67	9,565.85	1,116.91	2,975.75	14,447,257.62	1,709,991.50	39.78147557	-80.75235142
10,376.00	26.10	69.79	9,607.90	1,124.01	2,995.50	14,447,264.71	1,710,011.25	39.78149491	-80.75228106
10,425.00	26.24	68.65	9,651.88	1,131.68	3,015.71	14,447,272.38	1,710,031.45	39.78151581	-80.75220907
10,472.00	26.50	66.80	9,693.99	1,139.59	3,035.02	14,447,280.29	1,710,050.77	39.78153740	-80.75214024
10,519.00	26.45	66.63	9,736.06	1,147.87	3,054.27	14,447,288.58	1,710,070.01	39.78156000	-80.75207165
10,566.00	26.63	67.07	9,778.11	1,156.13	3,073.58	14,447,296.83	1,710,089.32	39.78158253	-80.75200284
10,614.00	26.59	66.80	9,821.02	1,164.55	3,093.36	14,447,305.26	1,710,109.10	39.78160551	-80.75193234
10,708.00	26.85	68.30	9,904.99	1,180.69	3,132.42	14,447,321.39	1,710,148.16	39.78164953	-80.75179315
10,802.00	26.45	70.50	9,989.00	1,195.53	3,171.88	14,447,336.23	1,710,187.62	39.78168997	-80.75165256
10,895.00	26.54	71.29	10,072.24	1,209.10	3,211.08	14,447,349.81	1,710,226.82	39.78172697	-80.75151288
10,990.00	27.11	71.37	10,157.01	1,222.83	3,251.69	14,447,363.53	1,710,267.44	39.78176434	-80.75136818
11,053.00	26.98	71.29	10,213.12	1,232.00	3,278.83	14,447,372.70	1,710,294.58	39.78178932	-80.75127149
Survey @ 11053.00 MD 10213.12 TVD									
11,145.00	27.21	73.20	10,295.03	1,244.77	3,318.74	14,447,385.48	1,710,334.48	39.78182410	-80.75112933
11,240.00	27.82	66.34	10,379.30	1,259.95	3,359.84	14,447,400.65	1,710,375.59	39.78186546	-80.75098286
11,335.00	27.16	65.82	10,463.58	1,277.73	3,399.93	14,447,418.43	1,710,415.67	39.78191398	-80.75084000
11,428.00	26.55	64.94	10,546.55	1,295.23	3,438.12	14,447,435.93	1,710,453.87	39.78196174	-80.75070389
11,501.00	25.63	63.27	10,612.11	1,309.24	3,467.00	14,447,449.94	1,710,482.75	39.78200000	-80.75060095

05/13/2022

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-20 HU (slot F)
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 N-20 HU (slot F)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
11,523.00	25.71	56.59	10,631.94	1,314.01	3,475.24	14,447,454.71	1,710,490.98	39.78201304	-80.75057159
11,570.00	26.77	41.74	10,674.14	1,327.53	3,490.81	14,447,468.24	1,710,506.56	39.78205007	-80.75051602
11,617.00	28.40	36.11	10,715.81	1,344.46	3,504.45	14,447,485.17	1,710,520.19	39.78209646	-80.75046731
11,664.00	28.97	34.26	10,757.04	1,362.90	3,517.44	14,447,503.61	1,710,533.19	39.78214700	-80.75042087
11,711.00	29.76	31.80	10,798.00	1,382.22	3,530.00	14,447,522.93	1,710,545.74	39.78219996	-80.75037599
11,758.00	30.59	29.08	10,838.63	1,402.59	3,541.96	14,447,543.30	1,710,557.70	39.78225580	-80.75033322
11,805.00	33.41	22.31	10,878.50	1,425.03	3,552.69	14,447,565.73	1,710,568.43	39.78231733	-80.75029480
11,852.00	37.23	15.10	10,916.86	1,450.74	3,561.31	14,447,591.45	1,710,577.06	39.78238790	-80.75026385
11,900.00	37.98	12.38	10,954.89	1,479.19	3,568.26	14,447,619.90	1,710,584.01	39.78246597	-80.75023883
11,947.00	37.80	11.68	10,991.98	1,507.42	3,574.28	14,447,648.13	1,710,590.02	39.78254345	-80.75021714
11,994.00	38.33	12.20	11,028.99	1,535.77	3,580.27	14,447,676.48	1,710,596.02	39.78262126	-80.75019551
12,041.00	39.12	11.06	11,065.65	1,564.57	3,586.20	14,447,705.28	1,710,601.94	39.78270031	-80.75017414
12,088.00	40.13	7.28	11,101.86	1,594.15	3,590.96	14,447,734.86	1,710,606.71	39.78278151	-80.75015689
12,135.00	42.02	2.71	11,137.30	1,624.90	3,593.63	14,447,765.60	1,710,609.37	39.78286593	-80.75014710
12,182.00	45.32	1.13	11,171.29	1,657.33	3,594.70	14,447,798.03	1,710,610.44	39.78295498	-80.75014296
12,229.00	47.60	359.81	11,203.66	1,691.39	3,594.97	14,447,832.10	1,710,610.72	39.78304853	-80.75014165
12,277.00	50.86	358.06	11,235.01	1,727.73	3,594.28	14,447,868.44	1,710,610.03	39.78314833	-80.75014374
12,324.00	55.60	355.59	11,263.14	1,765.31	3,592.17	14,447,906.01	1,710,607.92	39.78325153	-80.75015088
12,372.00	59.47	354.19	11,288.90	1,805.63	3,588.56	14,447,946.34	1,710,604.30	39.78336231	-80.75016335
12,419.00	61.19	352.96	11,312.16	1,846.21	3,583.98	14,447,986.92	1,710,599.73	39.78347378	-80.75017923
12,466.00	63.82	351.37	11,333.86	1,887.51	3,578.29	14,448,028.21	1,710,594.04	39.78358724	-80.75019907
12,513.00	67.30	344.69	11,353.32	1,929.32	3,569.39	14,448,070.02	1,710,585.14	39.78370213	-80.75023033
12,561.00	70.20	340.04	11,370.72	1,971.93	3,555.83	14,448,112.63	1,710,571.57	39.78381926	-80.75027819
12,608.00	72.09	338.81	11,385.91	2,013.57	3,540.20	14,448,154.27	1,710,555.94	39.78393372	-80.75033342
12,655.00	75.74	338.19	11,398.93	2,055.58	3,523.65	14,448,196.28	1,710,539.39	39.78404922	-80.75039192
12,702.00	81.58	335.29	11,408.17	2,097.89	3,505.45	14,448,238.59	1,710,521.19	39.78416555	-80.75045628
12,750.00	82.86	333.09	11,414.67	2,140.69	3,484.74	14,448,281.40	1,710,500.49	39.78428327	-80.75052956
12,797.00	86.37	330.72	11,419.08	2,181.96	3,462.71	14,448,322.67	1,710,478.45	39.78439678	-80.75060758
12,843.00	89.85	328.17	11,420.60	2,221.54	3,439.34	14,448,362.25	1,710,455.09	39.78450566	-80.75069036
12,890.00	90.77	328.17	11,420.09	2,302.26	3,389.24	14,448,442.96	1,710,404.98	39.78472769	-80.75086791
13,033.00	91.87	329.23	11,417.90	2,383.41	3,339.90	14,448,524.11	1,710,355.64	39.78495093	-80.75104273
13,127.00	91.96	328.87	11,414.76	2,463.98	3,291.58	14,448,604.68	1,710,307.33	39.78517257	-80.75121392
13,218.00	90.95	328.87	11,412.45	2,541.85	3,244.55	14,448,682.55	1,710,260.30	39.78538678	-80.75138056
13,312.00	90.90	329.66	11,410.93	2,622.63	3,196.52	14,448,763.34	1,710,212.26	39.78560900	-80.75155074
13,407.00	91.08	329.84	11,409.29	2,704.68	3,148.67	14,448,845.39	1,710,164.41	39.78583470	-80.75172027
13,501.00	91.03	329.66	11,407.56	2,785.87	3,101.32	14,448,926.57	1,710,117.07	39.78605802	-80.75188800
13,596.00	90.95	329.75	11,405.91	2,867.88	3,053.41	14,449,008.59	1,710,069.15	39.78628362	-80.75205776
13,690.00	90.95	329.93	11,404.36	2,949.15	3,006.19	14,449,089.85	1,710,021.93	39.78650715	-80.75222505
13,785.00	90.95	330.37	11,402.78	3,031.53	2,958.91	14,449,172.24	1,709,974.65	39.78673376	-80.75239253
13,880.00	90.95	330.90	11,401.21	3,114.32	2,912.33	14,449,255.02	1,709,928.07	39.78696146	-80.75255752
13,974.00	91.03	330.63	11,399.58	3,196.33	2,866.43	14,449,337.03	1,709,882.17	39.78718704	-80.75272012
14,069.00	91.08	330.63	11,397.83	3,279.11	2,819.84	14,449,419.81	1,709,835.59	39.78741472	-80.75288513
14,164.00	90.99	331.51	11,396.12	3,362.24	2,773.90	14,449,502.94	1,709,789.64	39.78764337	-80.75304787
14,259.00	91.25	330.90	11,394.26	3,445.47	2,728.15	14,449,586.18	1,709,743.89	39.78787230	-80.75320992
14,353.00	91.03	331.51	11,392.39	3,527.83	2,682.88	14,449,668.54	1,709,698.62	39.78809883	-80.75337025
14,448.00	91.16	331.60	11,390.57	3,611.35	2,637.64	14,449,752.05	1,709,653.38	39.78832853	-80.75353049
14,542.00	91.65	329.40	11,388.27	3,693.13	2,591.36	14,449,833.84	1,709,607.11	39.78855348	-80.75369440
14,636.00	90.95	329.40	11,386.14	3,774.02	2,543.53	14,449,914.72	1,709,559.27	39.78877598	-80.75386390
14,730.00	91.03	329.84	11,384.51	3,855.10	2,496.00	14,449,995.81	1,709,511.74	39.78899901	-80.75403231
14,824.00	90.99	330.37	11,382.85	3,936.58	2,449.15	14,450,077.28	1,709,464.90	39.78922313	-80.75419826
14,918.00	91.03	330.02	11,381.20	4,018.13	2,402.44	14,450,158.84	1,709,418.18	39.78944744	-80.75436377
15,013.00	91.03	329.49	11,379.49	4,100.19	2,354.59	14,450,240.89	1,709,370.34	39.78967315	-80.75453328
15,107.00	90.90	329.75	11,377.91	4,181.27	2,307.06	14,450,321.97	1,709,322.81	39.78989618	-80.75470170
15,200.00	91.08	331.42	11,376.30	4,262.27	2,261.39	14,450,402.97	1,709,277.14	39.79011896	-80.75486347
15,293.00	91.56	329.49	11,374.16	4,343.15	2,215.55	14,450,483.85	1,709,231.29	39.79034143	-80.75502589

WV Department of Environmental Protection



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-20 HU (slot F)
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 N-20 HU (slot F)	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	
15,387.00	90.68	328.43	11,372.32	4,423.67	2,167.09	14,450,564.37	1,709,182.83	39.79056293	-80.75519761	
15,482.00	90.55	329.31	11,371.30	4,504.98	2,117.98	14,450,645.69	1,709,133.72	39.79078661	-80.75537165	
15,576.00	90.90	328.79	11,370.11	4,585.59	2,069.64	14,450,726.30	1,709,085.39	39.79100834	-80.75554295	
15,670.00	90.55	329.05	11,368.92	4,666.09	2,021.12	14,450,806.80	1,709,036.86	39.79122978	-80.75571490	
15,765.00	90.73	329.14	11,367.86	4,747.60	1,972.33	14,450,888.30	1,708,988.07	39.79145398	-80.75588780	
15,859.00	90.42	329.31	11,366.92	4,828.36	1,924.23	14,450,969.06	1,708,939.98	39.79167613	-80.75605823	
15,953.00	90.81	329.23	11,365.91	4,909.15	1,876.20	14,451,049.86	1,708,891.95	39.79189838	-80.75622843	
16,048.00	90.90	328.35	11,364.49	4,990.40	1,826.98	14,451,131.10	1,708,842.73	39.79212185	-80.75640287	
16,142.00	90.68	328.70	11,363.19	5,070.56	1,777.91	14,451,211.26	1,708,793.65	39.79234237	-80.75657680	
16,237.00	90.51	327.91	11,362.21	5,151.38	1,728.00	14,451,292.09	1,708,743.74	39.79256471	-80.75675369	
16,332.00	90.46	329.75	11,361.40	5,232.66	1,678.83	14,451,373.37	1,708,694.58	39.79278829	-80.75692794	
16,427.00	91.03	328.35	11,360.17	5,314.13	1,629.98	14,451,454.83	1,708,645.72	39.79301238	-80.75710107	
16,522.00	90.20	330.37	11,359.15	5,395.85	1,581.57	14,451,536.56	1,708,597.31	39.79323718	-80.75727262	
16,617.00	90.51	330.19	11,358.56	5,478.36	1,534.47	14,451,619.06	1,708,550.22	39.79346411	-80.75743949	
16,711.00	90.46	331.77	11,357.76	5,560.55	1,488.88	14,451,701.25	1,708,504.62	39.79369017	-80.75760103	
16,806.00	91.03	330.28	11,356.53	5,643.65	1,442.86	14,451,784.35	1,708,458.61	39.79391872	-80.75776404	
16,901.00	90.55	331.60	11,355.22	5,726.68	1,396.72	14,451,867.38	1,708,412.47	39.79414709	-80.75792750	
16,995.00	91.12	329.75	11,353.85	5,808.62	1,350.69	14,451,949.33	1,708,366.44	39.79437247	-80.75809058	
17,090.00	89.93	330.46	11,352.98	5,890.97	1,303.35	14,452,031.68	1,708,319.09	39.79459898	-80.75825835	
17,185.00	90.15	330.46	11,352.91	5,973.63	1,256.51	14,452,114.33	1,708,272.25	39.79482631	-80.75842430	
17,280.00	90.02	331.25	11,352.77	6,056.60	1,210.24	14,452,197.30	1,708,225.99	39.79505452	-80.75858822	
17,375.00	90.20	331.42	11,352.59	6,139.95	1,164.67	14,452,280.66	1,708,180.42	39.79528377	-80.75874965	
17,470.00	90.33	330.37	11,352.15	6,222.96	1,118.46	14,452,363.66	1,708,134.21	39.79551206	-80.75891336	
17,564.00	90.11	331.16	11,351.79	6,304.98	1,072.56	14,452,445.69	1,708,088.30	39.79573766	-80.75907602	
17,659.00	90.07	331.33	11,351.64	6,388.27	1,026.85	14,452,528.97	1,708,042.60	39.79596672	-80.75923792	
17,754.00	90.59	332.21	11,351.09	6,471.96	981.92	14,452,612.67	1,707,997.66	39.79619691	-80.75939710	
17,849.00	91.91	330.19	11,349.02	6,555.19	936.17	14,452,695.89	1,707,951.91	39.79642580	-80.75955919	
17,943.00	90.95	329.58	11,346.67	6,636.47	889.02	14,452,777.18	1,707,904.76	39.79664938	-80.75972627	
18,038.00	91.03	329.31	11,345.03	6,718.27	840.73	14,452,858.97	1,707,856.48	39.79687437	-80.75989740	
18,133.00	90.90	329.58	11,343.43	6,800.07	792.44	14,452,940.77	1,707,808.19	39.79709936	-80.76006854	
18,228.00	90.90	330.54	11,341.94	6,882.38	745.04	14,453,023.08	1,707,760.78	39.79732576	-80.76023653	
18,323.00	91.03	330.54	11,340.34	6,965.08	698.32	14,453,105.79	1,707,714.07	39.79755323	-80.76040206	
18,418.00	91.25	329.84	11,338.45	7,047.49	651.10	14,453,188.20	1,707,666.85	39.79777991	-80.76056938	
18,513.00	91.08	329.49	11,336.52	7,129.47	603.13	14,453,270.17	1,707,618.88	39.79800539	-80.76073939	
18,607.00	91.03	330.10	11,334.79	7,210.69	555.85	14,453,351.40	1,707,571.59	39.79822879	-80.76090696	
18,702.00	91.12	331.16	11,333.01	7,293.47	509.27	14,453,434.17	1,707,525.01	39.79845646	-80.76107202	
18,797.00	91.69	329.49	11,330.68	7,375.98	462.25	14,453,516.68	1,707,477.99	39.79868340	-80.76123863	
18,891.00	91.03	328.87	11,328.45	7,456.68	414.10	14,453,597.39	1,707,429.85	39.79890538	-80.76140928	
18,986.00	91.12	328.79	11,326.66	7,537.95	364.94	14,453,678.66	1,707,380.69	39.79912893	-80.76158354	
19,080.00	90.99	329.40	11,324.93	7,618.59	316.67	14,453,759.30	1,707,332.42	39.79935075	-80.76175464	
19,175.00	91.38	327.91	11,322.97	7,699.71	267.27	14,453,840.41	1,707,283.01	39.79957387	-80.76192977	
19,269.00	90.95	328.61	11,321.06	7,779.63	217.83	14,453,920.34	1,707,233.57	39.79979372	-80.76210504	
19,364.00	91.08	328.35	11,319.37	7,860.60	168.17	14,454,001.31	1,707,183.91	39.80001645	-80.76228107	
19,457.00	91.08	329.40	11,317.62	7,940.20	120.11	14,454,080.90	1,707,135.85	39.80023540	-80.76245145	
19,551.00	91.52	328.17	11,315.49	8,020.57	71.40	14,454,161.27	1,707,087.15	39.80045647	-80.76262408	
19,646.00	90.86	329.58	11,313.51	8,101.87	22.31	14,454,242.58	1,707,038.05	39.80068011	-80.76279811	
19,740.00	91.43	328.52	11,311.64	8,182.47	-26.02	14,454,323.18	1,706,989.72	39.80090180	-80.76296944	
19,834.00	90.33	330.28	11,310.19	8,263.37	-73.86	14,454,404.07	1,706,941.88	39.80112431	-80.76313901	
19,929.00	91.21	332.04	11,308.92	8,346.57	-119.68	14,454,487.28	1,706,896.06	39.80135315	-80.76330136	
20,023.00	91.34	330.90	11,306.82	8,429.14	-164.57	14,454,569.84	1,706,851.18	39.80158022	-80.76346039	
20,118.00	90.90	331.86	11,304.97	8,512.51	-210.06	14,454,653.22	1,706,805.68	39.80180952	-80.76362159	
20,210.00	91.34	331.07	11,303.17	8,593.32	-254.00	14,454,734.02	1,706,761.74	39.80203176	-80.76377728	
20,305.00	91.12	330.81	11,301.13	8,676.34	-300.13	14,454,817.04	1,706,715.61	39.80226009	-80.76394076	
20,399.00	90.99	331.51	11,299.40	8,758.67	-345.47	14,454,899.37	1,706,670.27	39.80248651	-80.76410140	
20,493.00	91.34	330.19	11,297.49	8,840.74	-391.25	14,454,981.45	1,706,624.50	39.80271224	-80.76426361	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-20 HU (slot F)
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 N-20 HU (slot F)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

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OCT 13 2020

Survey									
Measured			Vertical			Map	Map	WV Department of Environmental Protection	
Depth (usft)	Inclination (°)	Azimuth (°)	Depth (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
20,587.00	90.86	331.86	11,295.68	8,922.96	-436.77	14,455,063.66	1,706,578.97	39.80293836	-80.76442494
20,680.00	91.38	331.25	11,293.86	9,004.72	-481.06	14,455,145.42	1,706,534.68	39.80316320	-80.76458186
20,774.00	91.16	330.98	11,291.78	9,087.00	-526.46	14,455,227.70	1,706,489.29	39.80338951	-80.76474273
20,869.00	91.08	331.42	11,289.92	9,170.23	-572.21	14,455,310.94	1,706,443.53	39.80361842	-80.76490487
20,963.00	91.91	329.49	11,287.47	9,251.98	-618.55	14,455,392.68	1,706,397.20	39.80384324	-80.76506908
21,058.00	90.90	329.05	11,285.14	9,333.61	-667.08	14,455,474.32	1,706,348.67	39.80406778	-80.76524111
21,153.00	91.34	328.17	11,283.29	9,414.69	-716.55	14,455,555.40	1,706,299.20	39.80429081	-80.76541650
21,249.00	91.03	328.61	11,281.30	9,496.43	-766.85	14,455,637.14	1,706,248.89	39.80451564	-80.76559486
21,342.00	90.95	329.58	11,279.69	9,576.21	-814.61	14,455,716.92	1,706,201.13	39.80473509	-80.76576417
21,437.00	91.25	328.87	11,277.87	9,657.82	-863.21	14,455,798.53	1,706,152.53	39.80495956	-80.76593645
21,531.00	90.90	329.75	11,276.11	9,738.64	-911.18	14,455,879.35	1,706,104.56	39.80518185	-80.76610650
21,627.00	91.30	329.84	11,274.26	9,821.59	-959.47	14,455,962.30	1,706,056.28	39.80541000	-80.76627766
21,722.00	90.99	330.19	11,272.36	9,903.86	-1,006.94	14,456,044.56	1,706,008.81	39.80563627	-80.76644592
21,818.00	91.34	329.31	11,270.41	9,986.77	-1,055.29	14,456,127.47	1,705,960.46	39.80586431	-80.76661731
21,913.00	91.21	329.31	11,268.30	10,068.44	-1,103.76	14,456,209.15	1,705,911.98	39.80608896	-80.76678916
22,008.00	90.99	330.02	11,266.48	10,150.42	-1,151.73	14,456,291.13	1,705,864.01	39.80631443	-80.76695921
22,103.00	91.16	330.10	11,264.69	10,232.73	-1,199.14	14,456,373.43	1,705,816.60	39.80654081	-80.76712724
22,198.00	91.21	329.84	11,262.73	10,314.96	-1,246.67	14,456,455.66	1,705,769.07	39.80676697	-80.76729573
22,293.00	91.38	329.14	11,260.58	10,396.78	-1,294.89	14,456,537.49	1,705,720.85	39.80699203	-80.76746667
22,388.00	90.99	329.23	11,258.62	10,478.35	-1,343.55	14,456,619.06	1,705,672.20	39.80721639	-80.76763916
22,482.00	90.99	330.81	11,256.99	10,559.76	-1,390.51	14,456,700.47	1,705,625.24	39.80744030	-80.76780563
22,576.00	91.34	330.54	11,255.08	10,641.70	-1,436.54	14,456,782.40	1,705,579.21	39.80766565	-80.76796877
22,672.00	91.21	329.49	11,252.94	10,724.83	-1,484.50	14,456,865.53	1,705,531.24	39.80789428	-80.76813880
22,766.00	90.99	330.19	11,251.14	10,806.09	-1,531.72	14,456,946.79	1,705,484.02	39.80811778	-80.76830619
22,861.00	91.21	329.49	11,249.32	10,888.21	-1,579.44	14,457,028.92	1,705,436.30	39.80834365	-80.76847535
22,956.00	91.21	329.49	11,247.31	10,970.04	-1,627.66	14,457,110.75	1,705,388.08	39.80856871	-80.76864630
23,051.00	90.86	330.02	11,245.59	11,052.10	-1,675.50	14,457,192.80	1,705,340.24	39.80879440	-80.76881591
23,146.00	91.34	329.75	11,243.77	11,134.26	-1,723.16	14,457,274.96	1,705,292.58	39.80902037	-80.76898485
23,240.00	91.08	329.31	11,241.79	11,215.26	-1,770.82	14,457,355.96	1,705,244.93	39.80924316	-80.76915380
23,335.00	91.16	329.23	11,239.93	11,296.90	-1,819.35	14,457,437.61	1,705,196.39	39.80946772	-80.76932587
23,429.00	91.16	329.49	11,238.03	11,377.76	-1,867.25	14,457,518.47	1,705,148.50	39.80969012	-80.76949569
23,523.00	91.08	330.10	11,236.19	11,458.98	-1,914.53	14,457,599.69	1,705,101.22	39.80991351	-80.76966331
23,618.00	91.08	330.19	11,234.40	11,541.36	-1,961.81	14,457,682.07	1,705,053.93	39.81014007	-80.76983092
23,712.00	91.52	329.31	11,232.27	11,622.54	-2,009.15	14,457,763.24	1,705,006.59	39.81036335	-80.76999876
23,806.00	91.08	329.66	11,230.13	11,703.50	-2,056.87	14,457,844.20	1,704,958.87	39.81058602	-80.77016794
23,901.00	90.99	330.63	11,228.42	11,785.88	-2,104.15	14,457,926.58	1,704,911.59	39.81081258	-80.77033556
23,994.00	91.25	330.54	11,226.60	11,866.87	-2,149.82	14,458,007.58	1,704,865.92	39.81103534	-80.77049743
24,089.00	91.21	330.46	11,224.56	11,949.59	-2,196.59	14,458,090.24	1,704,819.15	39.81126269	-80.77066322
24,184.00	91.03	330.98	11,222.70	12,032.38	-2,243.04	14,458,173.09	1,704,772.70	39.81149053	-80.77082789
24,278.00	91.47	329.14	11,220.65	12,113.82	-2,289.94	14,458,254.52	1,704,725.80	39.81171450	-80.77099416
24,373.00	90.86	330.54	11,218.72	12,195.94	-2,337.66	14,458,336.64	1,704,678.08	39.81194036	-80.77116333
24,468.00	91.25	330.46	11,216.97	12,278.61	-2,384.44	14,458,419.31	1,704,631.31	39.81216772	-80.77132914
24,562.00	91.08	330.72	11,215.06	12,360.47	-2,430.58	14,458,501.18	1,704,585.16	39.81239287	-80.77149273
24,657.00	91.38	329.84	11,213.02	12,442.96	-2,477.67	14,458,583.66	1,704,538.07	39.81261973	-80.77165966
24,752.00	91.08	329.49	11,210.98	12,524.93	-2,525.64	14,458,665.64	1,704,490.10	39.81284518	-80.77182973
24,847.00	91.03	330.19	11,209.23	12,607.06	-2,573.36	14,458,747.76	1,704,442.38	39.81307106	-80.77199892
24,942.00	91.34	329.14	11,207.27	12,689.03	-2,621.33	14,458,829.74	1,704,394.41	39.81329651	-80.77216900
25,036.00	90.81	329.75	11,205.50	12,769.96	-2,669.11	14,458,910.67	1,704,346.64	39.81351911	-80.77233841
Survey @ 25036.00 MD 11205.50 TVD									
25,077.00	90.81	329.75	11,204.92	12,805.38	-2,689.76	14,458,946.08	1,704,325.98	39.81361651	-80.77241163
Survey projected to 25077.00 MD 11204.92 TVD									



Survey Report - Geographic



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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 N-20 HU (slot F)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Aug1919_v14

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
173.00	173.00	0.47	0.04	MWD surveys	<p>RECEIVED Office of Oil and Gas</p> <p>OCT 13 2020</p> <p>WV Department of Environmental Protection</p>
11,053.00	10,213.12	1,232.00	3,278.83	Survey @ 11053.00 MD 10213.12 TVD	
25,036.00	11,205.50	12,769.96	-2,669.11	Survey @ 25036.00 MD 11205.50 TVD	
25,077.00	11,204.92	12,805.38	-2,689.76	Survey projected to 25077.00 MD 11204.92 TVD	