



Well: Old Crow S-12 HM (slot U)
 Site: Old Crow Pad
 Project: Marshall County, West Virginia.
 Design: rev5

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	Vsect	Annotation
1	6494.00	40.08	3.36	5558.96	2645.82	262.11	0.00	0.000	-1432.66	Survey @ 6494.00 MD 5558.96 TVD
2	6600.00	40.08	3.36	5640.06	2713.95	266.11	0.00	0.000	-1471.71	KOP Begin 8.26°/100' build/turn
3	6643.66	43.67	2.86	5672.57	2743.05	267.69	8.26	-5.456	-1488.49	Begin 8.26°/100' build/turn
4	7600.12	50.00	124.18	6453.93	2891.37	649.90	8.26	138.196	-1280.24	Begin 10.00°/100' build/turn
5	8053.72	89.00	149.65	6612.00	2581.73	922.59	10.00	37.183	-874.38	Begin 89.00° lateral
6	15179.26	89.00	149.65	6736.00	-3566.56	4522.11	0.00	0.000	5759.32	PBHL/TD 15179.26 MD/6736.00 TVD

ANNOTATIONS SURVEYS ORIGINAL HOLE

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
174.00	0.57	279.51	174.00	0.14	-0.85	-0.76	MWD surveys
4761.00	40.34	4.24	4248.05	1532.64	165.45	-819.15	Survey @ 4761.00 MD 4248.05 TVD
4828.00	40.34	4.24	4299.12	1575.89	168.65	-843.41	Survey projected to 4828.00 MD 4299.12 TVD OH

ANNOTATIONS SURVEYS SIDETRACK 01

MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Annotation
4194.00	38.58	5.03	3819.33	1163.63	128.32	-619.80	Tie into original hole @ 4194 MD
15135.00	88.75	149.24	6652.24	-3519.04	4507.44	5718.38	Survey @ 15135.00 MD 6652.24 TVD
15190.00	88.75	149.24	6653.44	-3566.29	4535.56	5769.72	Survey projected to 15190.00 MD 6653.44 TVD



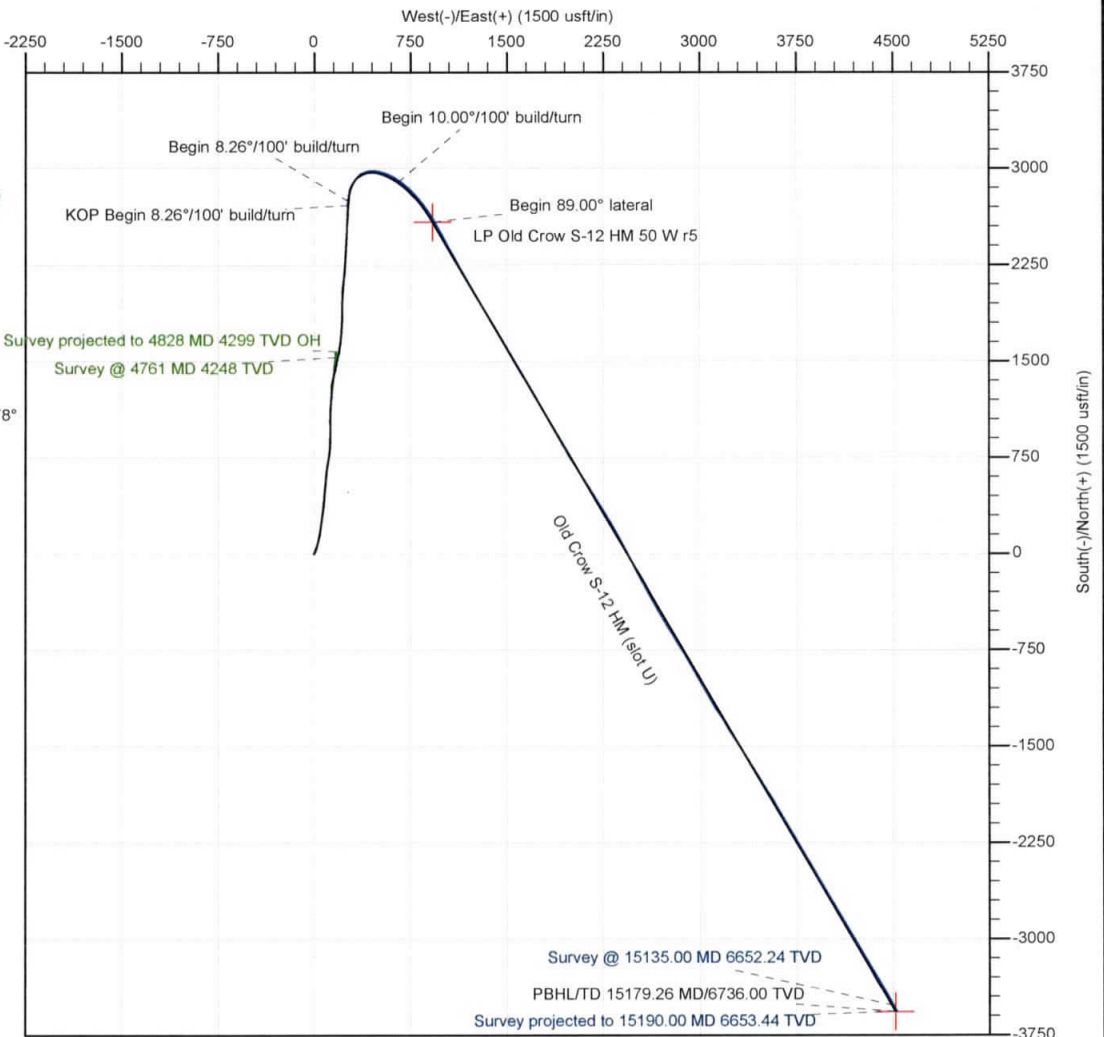
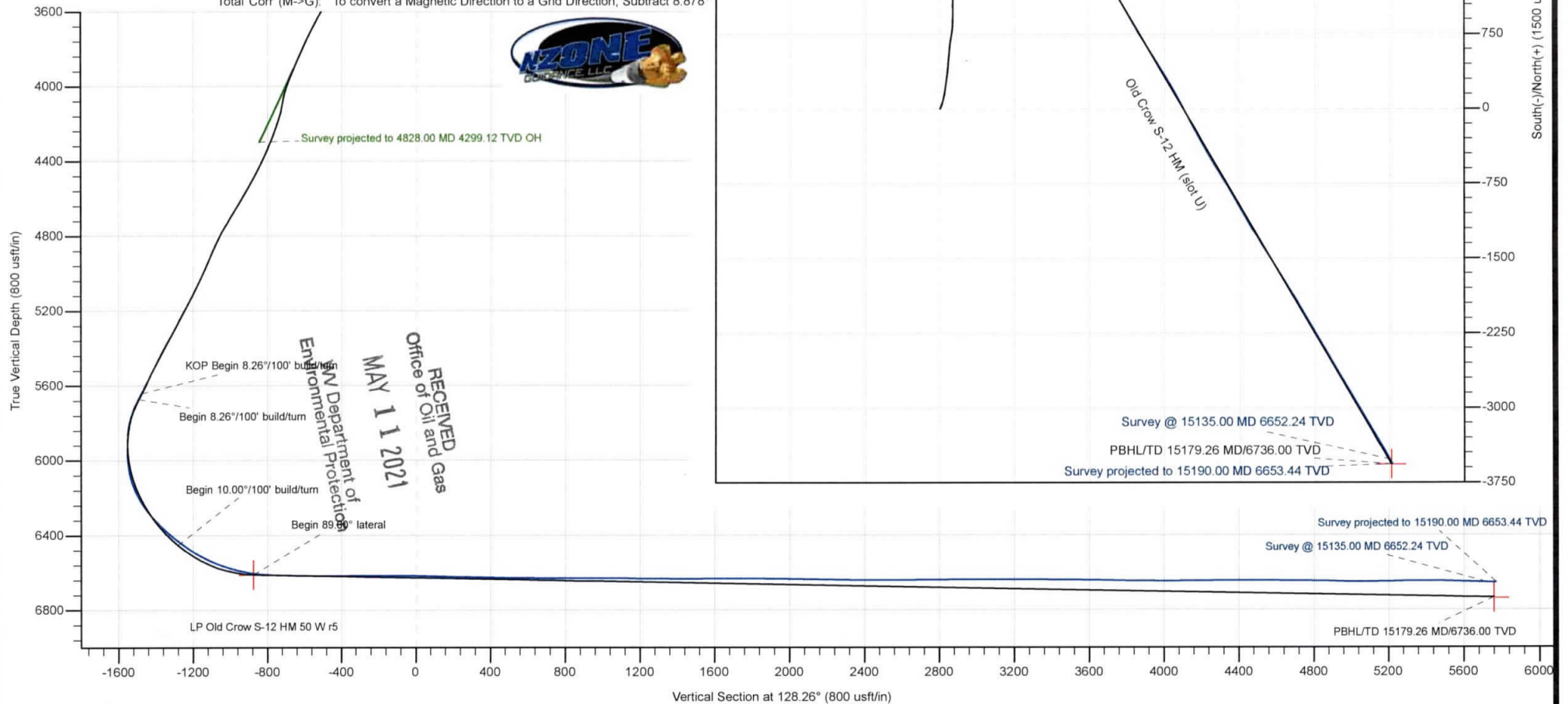
Azimuths to Grid North
 True North: -0.15°
 Magnetic North: -8.88°

Magnetic Field
 Strength: 51890.9snT
 Dip Angle: 66.75°
 Date: 12/4/2019
 Model: IGRF2015

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 B28)

Northing: 14446093.46
 Easting: 1707038.36
 Latitude: 39.77830044
 Longitude: -80.76287388
 Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.878°



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-12 HM (slot U)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	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-12 HM (slot U)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,093.46 usft	Latitude:	39.77830044
	+E/-W	0.00 usft	Easting:	1,707,038.36 usft	Longitude:	-80.76287388
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	5/15/2019	-8.708	66.798	51,955.00051487

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	128.26	

Survey Program	Date 6/15/2019				
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
174.00	994.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,065.00	2,963.00	MWD int (Original Hole)	MWD	MWD - Standard	
3,058.00	4,761.00	MWD (Original Hole)	MWD	MWD - Standard	
4,828.00	4,828.00	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	
174.00	0.57	279.51	174.00	0.14	-0.85	-0.76	0.33	0.33	0.00	
MWD surveys										
205.00	0.62	279.68	205.00	0.20	-1.17	-1.04	0.16	0.16	0.55	
236.00	0.44	278.98	235.99	0.24	-1.45	-1.29	0.58	-0.58	-2.26	
266.00	0.31	294.54	265.99	0.30	-1.64	-1.47	0.55	-0.43	51.87	
326.00	0.31	272.74	325.99	0.37	-1.95	-1.76	0.20	0.00	-36.33	
415.00	0.22	299.46	414.99	0.47	-2.34	-2.13	0.17	-0.10	30.02	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-12 HM (slot U)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	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)
446.00	0.18	290.58	445.99	0.51	-2.44	-2.23	0.16	-0.13	-28.65
475.00	0.13	278.81	474.99	0.53	-2.51	-2.30	0.20	-0.17	-40.59
505.00	0.09	261.14	504.99	0.53	-2.57	-2.35	0.17	-0.13	-58.90
535.00	0.13	275.91	534.99	0.53	-2.63	-2.39	0.16	0.13	49.23
565.00	0.09	243.74	564.99	0.53	-2.68	-2.43	0.24	-0.13	-107.23
595.00	0.13	261.14	594.99	0.51	-2.74	-2.47	0.17	0.13	58.00
626.00	0.09	261.14	625.99	0.50	-2.80	-2.51	0.13	-0.13	0.00
657.00	0.04	198.30	656.99	0.49	-2.82	-2.52	0.26	-0.16	-202.71
689.00	0.09	261.14	688.99	0.47	-2.85	-2.53	0.25	0.16	196.38
720.00	0.09	154.09	719.99	0.45	-2.86	-2.53	0.47	0.00	-345.32
752.00	0.00	261.14	751.99	0.43	-2.85	-2.50	0.28	-0.28	0.00
782.00	0.03	222.30	781.99	0.42	-2.86	-2.51	0.10	0.10	0.00
813.00	0.00	81.14	812.99	0.41	-2.86	-2.51	0.10	-0.10	0.00
844.00	0.00	81.14	843.99	0.41	-2.86	-2.51	0.00	0.00	0.00
876.00	0.03	149.86	875.99	0.41	-2.86	-2.50	0.09	0.09	0.00
908.00	0.03	149.13	907.99	0.39	-2.85	-2.48	0.00	0.00	-2.28
939.00	0.03	208.59	938.99	0.38	-2.85	-2.47	0.10	0.00	191.81
971.00	0.11	190.56	970.99	0.34	-2.86	-2.46	0.26	0.25	-56.34
994.00	0.10	197.16	993.99	0.30	-2.87	-2.44	0.07	-0.04	28.70
1,065.00	0.26	225.29	1,064.99	0.13	-3.00	-2.44	0.25	0.23	39.62
1,160.00	0.32	240.69	1,159.99	-0.15	-3.39	-2.57	0.10	0.06	16.21
1,255.00	0.55	106.82	1,254.99	-0.42	-3.18	-2.24	0.85	0.24	-140.92
1,350.00	0.65	115.69	1,349.98	-0.78	-2.26	-1.29	0.14	0.11	9.34
1,444.00	0.27	117.45	1,443.98	-1.11	-1.58	-0.55	0.40	-0.40	1.87
1,539.00	0.15	265.41	1,538.98	-1.23	-1.51	-0.43	0.43	-0.13	155.75
1,633.00	0.46	283.07	1,632.98	-1.15	-2.00	-0.86	0.34	0.33	18.79
1,729.00	0.98	357.74	1,728.97	-0.24	-2.41	-1.74	1.01	0.54	77.78
1,824.00	2.96	27.19	1,823.91	2.75	-1.32	-2.74	2.27	2.08	31.00
1,920.00	5.83	29.66	1,919.62	9.19	2.23	-3.94	3.00	2.99	2.57
2,015.00	8.70	24.70	2,013.85	19.91	7.62	-6.35	3.09	3.02	-5.22
2,110.00	11.55	19.78	2,107.36	35.40	13.84	-11.05	3.13	3.00	-5.18
2,204.00	14.40	15.43	2,198.95	55.52	20.14	-18.57	3.20	3.03	-4.63
2,299.00	17.17	14.37	2,290.36	80.50	26.76	-28.83	2.93	2.92	-1.12
2,394.00	18.43	14.22	2,380.81	108.64	33.93	-40.63	1.33	1.33	-0.16
2,489.00	22.17	11.04	2,469.90	140.80	41.05	-54.95	4.10	3.94	-3.35
2,584.00	25.69	7.94	2,556.72	178.80	47.33	-73.55	3.93	3.71	-3.26
2,678.00	27.33	6.36	2,640.84	220.43	52.54	-95.24	1.90	1.74	-1.68
2,773.00	29.42	7.00	2,724.42	265.27	57.80	-118.88	2.22	2.08	0.67
2,826.00	31.17	8.25	2,770.18	291.76	61.35	-132.49	3.51	3.30	2.36
2,884.00	33.05	9.42	2,819.31	322.22	66.10	-147.63	3.41	3.24	2.02
2,963.00	36.08	5.64	2,884.36	366.64	71.91	-170.57	4.70	3.84	2.32
3,058.00	41.62	3.44	2,958.32	426.02	76.56	-203.69	6.01	5.83	4.78
3,156.00	42.32	7.93	3,031.20	491.20	83.06	-238.94	3.15	3.00	4.58

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Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	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)	
3,250.00	40.43	4.24	3,101.75	552.95	89.68	-271.98	3.28	-2.01	-3.93	
3,345.00	41.31	3.18	3,173.58	614.98	93.70	-307.24	1.18	0.93	-1.12	
3,439.00	42.14	10.83	3,243.79	676.97	101.35	-339.62	5.49	0.88	8.14	
3,533.00	40.34	8.45	3,314.47	738.05	111.75	-369.28	2.54	-1.91	-2.53	
3,628.00	41.31	7.75	3,386.36	799.53	120.50	-400.48	1.13	1.02	-0.74	
3,722.00	39.16	0.63	3,458.15	859.99	125.01	-434.38	5.40	-2.29	-7.57	
3,816.00	40.69	358.17	3,530.24	920.31	124.36	-472.24	2.34	1.63	-2.62	
3,910.00	40.65	359.84	3,601.54	981.55	123.29	-511.00	1.16	-0.04	1.78	
4,005.00	40.61	359.75	3,673.64	1,043.41	123.07	-549.48	0.07	-0.04	-0.09	
4,099.00	39.55	2.65	3,745.57	1,103.91	124.32	-585.96	2.28	-1.13	3.09	
4,194.00	38.58	5.03	3,819.33	1,163.63	128.32	-619.80	1.88	-1.02	2.51	
4,288.00	39.59	4.15	3,892.30	1,222.71	133.05	-652.66	1.23	1.07	-0.94	
4,382.00	40.87	5.73	3,964.06	1,283.19	138.29	-686.00	1.74	1.36	1.68	
4,477.00	41.70	8.28	4,035.45	1,345.39	145.95	-718.51	1.97	0.87	2.68	
4,572.00	41.92	5.82	4,106.27	1,408.23	153.72	-751.32	1.74	0.23	-2.59	
4,666.00	41.66	5.73	4,176.35	1,470.55	160.02	-784.96	0.28	-0.28	-0.10	
4,761.00	40.34	4.24	4,248.05	1,532.64	165.45	-819.15	1.73	-1.39	-1.57	
Survey @ 4761.00 MD 4248.05 TVD										
4,828.00	40.34	4.24	4,299.12	1,575.89	168.65	-843.41	0.00	0.00	0.00	
Survey projected to 4828.00 MD 4299.12 TVD OH										

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
174.00	174.00	0.14	-0.85	MWD surveys	
4,761.00	4,248.05	1,532.64	165.45	Survey @ 4761.00 MD 4248.05 TVD	
4,828.00	4,299.12	1,575.89	168.65	Survey projected to 4828.00 MD 4299.12 TVD OH	

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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-12 HM (slot U)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,093.46 usft	Latitude:	39.77830044
	+E/-W	0.00 usft	Easting:	1,707,038.36 usft	Longitude:	-80.76287388
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
	IGRF2015	5/15/2019	(°)	(°)	(nT)
			-8.708	66.798	51,955.00051487

Design	Surveys Original Hole				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W	Direction	
	(usft)	(usft)	(usft)	(°)	
	0.00	0.00	0.00	128.26	

Survey Program	Date 6/15/2019				
From	To	Survey (Wellbore)	Tool Name	Description	
(usft)	(usft)				
174.00	994.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,065.00	2,963.00	MWD int (Original Hole)	MWD	MWD - Standard	
3,058.00	4,761.00	MWD (Original Hole)	MWD	MWD - Standard	
4,828.00	4,828.00	Projection (Original Hole)	MWD	MWD - Standard	

Survey										
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Map	Map	Latitude	Longitude	
Depth	(°)	(°)	Depth	(usft)	(usft)	Northing	Easting			
(usft)			(usft)			(usft)	(usft)			
0.00	0.00	0.00	0.00	0.00	0.00	14,446,093.46	1,707,038.36	39.77830044	-80.76287388	
174.00	0.57	279.51	174.00	0.14	-0.85	14,446,093.61	1,707,037.50	39.77830084	-80.76287692	
MWD surveys										
205.00	0.62	279.68	205.00	0.20	-1.17	14,446,093.66	1,707,037.19	39.77830099	-80.76287805	
236.00	0.44	278.98	235.99	0.24	-1.45	14,446,093.71	1,707,036.90	39.77830112	-80.76287905	
266.00	0.31	294.54	265.99	0.30	-1.64	14,446,093.76	1,707,036.72	39.77830126	-80.76287972	
326.00	0.31	272.74	325.99	0.37	-1.95	14,446,093.83	1,707,036.41	39.77830147	-80.76288082	
415.00	0.22	299.46	414.99	0.47	-2.34	14,446,093.93	1,707,036.02	39.77830174	-80.76288221	
446.00	0.18	290.58	445.99	0.51	-2.44	14,446,093.98	1,707,035.92	39.77830187	-80.76288255	

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Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	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	
475.00	0.13	278.81	474.99	0.53	-2.51	14,446,094.00	1,707,035.84	39.77830192	-80.76288282	
505.00	0.09	261.14	504.99	0.53	-2.57	14,446,094.00	1,707,035.79	39.77830193	-80.76288302	
535.00	0.13	275.91	534.99	0.53	-2.63	14,446,094.00	1,707,035.73	39.77830193	-80.76288323	
565.00	0.09	243.74	564.99	0.53	-2.68	14,446,093.99	1,707,035.67	39.77830191	-80.76288342	
595.00	0.13	261.14	594.99	0.51	-2.74	14,446,093.98	1,707,035.62	39.77830187	-80.76288362	
626.00	0.09	261.14	625.99	0.50	-2.80	14,446,093.97	1,707,035.56	39.77830184	-80.76288383	
657.00	0.04	198.30	656.99	0.49	-2.82	14,446,093.95	1,707,035.53	39.77830181	-80.76288392	
689.00	0.09	261.14	688.99	0.47	-2.85	14,446,093.94	1,707,035.51	39.77830177	-80.76288403	
720.00	0.09	154.09	719.99	0.45	-2.86	14,446,093.91	1,707,035.49	39.77830170	-80.76288407	
752.00	0.00	261.14	751.99	0.43	-2.85	14,446,093.89	1,707,035.50	39.77830163	-80.76288403	
782.00	0.03	222.30	781.99	0.42	-2.86	14,446,093.88	1,707,035.50	39.77830162	-80.76288405	
813.00	0.00	81.14	812.99	0.41	-2.86	14,446,093.88	1,707,035.49	39.77830160	-80.76288407	
844.00	0.00	81.14	843.99	0.41	-2.86	14,446,093.88	1,707,035.49	39.77830160	-80.76288407	
876.00	0.03	149.86	875.99	0.41	-2.86	14,446,093.87	1,707,035.50	39.77830158	-80.76288406	
908.00	0.03	149.13	907.99	0.39	-2.85	14,446,093.86	1,707,035.50	39.77830154	-80.76288403	
939.00	0.03	208.59	938.99	0.38	-2.85	14,446,093.84	1,707,035.50	39.77830150	-80.76288403	
971.00	0.11	190.56	970.99	0.34	-2.86	14,446,093.80	1,707,035.50	39.77830140	-80.76288406	
994.00	0.10	197.16	993.99	0.30	-2.87	14,446,093.76	1,707,035.49	39.77830129	-80.76288410	
1,065.00	0.26	225.29	1,064.99	0.13	-3.00	14,446,093.59	1,707,035.35	39.77830081	-80.76288457	
1,160.00	0.32	240.69	1,159.99	-0.15	-3.39	14,446,093.31	1,707,034.97	39.77830004	-80.76288594	
1,255.00	0.55	106.82	1,254.99	-0.42	-3.18	14,446,093.05	1,707,035.17	39.77829932	-80.76288522	
1,350.00	0.65	115.69	1,349.98	-0.78	-2.26	14,446,092.68	1,707,036.10	39.77829831	-80.76288194	
1,444.00	0.27	117.45	1,443.98	-1.11	-1.58	14,446,092.35	1,707,036.77	39.77829739	-80.76287953	
1,539.00	0.15	265.41	1,538.98	-1.23	-1.51	14,446,092.24	1,707,036.85	39.77829708	-80.76287927	
1,633.00	0.46	283.07	1,632.98	-1.15	-2.00	14,446,092.31	1,707,036.36	39.77829729	-80.76288101	
1,729.00	0.98	357.74	1,728.97	-0.24	-2.41	14,446,093.22	1,707,035.95	39.77829979	-80.76288245	
1,824.00	2.96	27.19	1,823.91	2.75	-1.32	14,446,096.21	1,707,037.04	39.77830800	-80.76287855	
1,920.00	5.83	29.66	1,919.62	9.19	2.23	14,446,102.66	1,707,040.58	39.77832567	-80.76286587	
2,015.00	8.70	24.70	2,013.85	19.91	7.62	14,446,113.38	1,707,045.98	39.77835508	-80.76284658	
2,110.00	11.55	19.78	2,107.36	35.40	13.84	14,446,128.86	1,707,052.20	39.77839755	-80.76282428	
2,204.00	14.40	15.43	2,198.95	55.52	20.14	14,446,148.99	1,707,058.49	39.77845278	-80.76280169	
2,299.00	17.17	14.37	2,290.36	80.50	26.76	14,446,173.96	1,707,065.12	39.77852132	-80.76277787	
2,394.00	18.43	14.22	2,380.81	108.64	33.93	14,446,202.10	1,707,072.29	39.77859855	-80.76275209	
2,489.00	22.17	11.04	2,469.90	140.80	41.05	14,446,234.27	1,707,079.41	39.77868682	-80.76272643	
2,584.00	25.69	7.94	2,556.72	178.80	47.33	14,446,272.27	1,707,085.69	39.77879114	-80.76270372	
2,678.00	27.33	6.36	2,640.84	220.43	52.54	14,446,313.89	1,707,090.90	39.77890542	-80.76268480	
2,773.00	29.42	7.00	2,724.42	265.27	57.80	14,446,358.73	1,707,096.15	39.77902852	-80.76266566	
2,826.00	31.17	8.25	2,770.18	291.76	61.35	14,446,385.23	1,707,099.71	39.77910126	-80.76265276	
2,884.00	33.05	9.42	2,819.31	322.22	66.10	14,446,415.69	1,707,104.45	39.77918487	-80.76263559	
2,963.00	36.08	5.64	2,884.36	366.64	71.91	14,446,460.10	1,707,110.27	39.77930681	-80.76261448	
3,058.00	41.62	3.44	2,958.32	426.02	76.56	14,446,519.48	1,707,114.91	39.77946985	-80.76259738	
3,156.00	42.32	7.93	3,031.20	491.20	83.06	14,446,584.66	1,707,121.42	39.77964880	-80.76257361	
3,250.00	40.43	4.24	3,101.75	552.95	89.68	14,446,646.41	1,707,128.04	39.77981834	-80.76254946	
3,345.00	41.31	3.18	3,173.58	614.98	93.70	14,446,708.44	1,707,132.06	39.77998866	-80.76253457	
3,439.00	42.14	10.83	3,243.79	676.97	101.35	14,446,770.44	1,707,139.71	39.78015886	-80.76250676	
3,533.00	40.34	8.45	3,314.47	738.05	111.75	14,446,831.51	1,707,150.11	39.78032651	-80.76246917	
3,628.00	41.31	7.75	3,386.36	799.53	120.50	14,446,893.00	1,707,158.85	39.78049530	-80.76243746	
3,722.00	39.16	0.63	3,458.15	859.99	125.01	14,446,953.46	1,707,163.37	39.78066131	-80.76242082	
3,816.00	40.69	358.17	3,530.24	920.31	124.36	14,447,013.77	1,707,162.71	39.78082895	-80.76242257	
3,910.00	40.65	359.84	3,601.54	981.55	123.29	14,447,075.02	1,707,161.65	39.78099516	-80.76242578	
4,005.00	40.61	359.75	3,673.64	1,043.41	123.07	14,447,136.88	1,707,161.43	39.78116505	-80.76242599	
4,099.00	39.55	2.65	3,745.57	1,103.91	124.32	14,447,197.37	1,707,162.68	39.78133117	-80.76242096	
4,194.00	38.58	5.03	3,819.33	1,163.63	128.32	14,447,257.10	1,707,166.67	39.78149514	-80.76240618	
4,288.00	39.59	4.15	3,892.30	1,222.71	133.05	14,447,316.17	1,707,171.41	39.78165706	-80.76238876	
4,382.00	40.87	5.73	3,964.06	1,283.19	138.29	14,447,376.65	1,707,176.65	39.78182341	-80.76236954	

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-12 HM (slot U)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	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	
4,477.00	41.70	8.28	4,035.45	1,345.39	145.95	14,447,438.85	1,707,184.30	39.78199418	-80.76234171	
4,572.00	41.92	5.82	4,106.27	1,408.23	153.72	14,447,501.69	1,707,192.07	39.78216671	-80.76231346	
4,666.00	41.66	5.73	4,176.35	1,470.55	160.02	14,447,564.02	1,707,198.38	39.78233782	-80.76229043	
4,761.00	40.34	4.24	4,248.05	1,532.64	165.45	14,447,626.10	1,707,203.80	39.78250828	-80.76227053	
Survey @ 4761.00 MD 4248.05 TVD										
4,828.00	40.34	4.24	4,299.12	1,575.89	168.65	14,447,669.35	1,707,207.01	39.78262704	-80.76225871	
Survey projected to 4828.00 MD 4299.12 TVD OH										

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
174.00	174.00	0.14	-0.85	MWD surveys	
4,761.00	4,248.05	1,532.64	165.45	Survey @ 4761.00 MD 4248.05 TVD	
4,828.00	4,299.12	1,575.89	168.65	Survey projected to 4828.00 MD 4299.12 TVD OH	

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-12 HM (slot U)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	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-12 HM (slot U)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,093.46 usft	Latitude:	39.77830044
	+E/-W	0.00 usft	Easting:	1,707,038.36 usft	Longitude:	-80.76287388
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft	Ground Level:	1,265.00 usft	

Wellbore	Sidetrack 01				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	12/4/2019	-8.726	66.751	51,890.88156178

Design	Surveys Sidetrack 01				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	4,194.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.00	0.00	0.00	128.26	

Survey Program	Date	12/11/2019			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
174.00	994.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,065.00	2,963.00	MWD int (Original Hole)	MWD	MWD - Standard	
3,058.00	4,194.00	MWD (Original Hole)	MWD	MWD - Standard	
4,287.00	6,494.00	MWD ST1 (Sidetrack 01)	MWD	MWD - Standard	
6,532.00	15,135.00	MWD ST1 lat (Sidetrack 01)	MWD	MWD - Standard	
15,190.00	15,190.00	Projection (Sidetrack 01)	MWD	MWD - Standard	

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
174.00	0.57	279.51	174.00	0.14	-0.85	-0.76	0.35	0.33	0.00
205.00	0.62	279.68	205.00	0.20	-1.17	-1.04	0.16	0.16	0.55
236.00	0.44	278.98	235.99	0.24	-1.45	-1.29	0.58	-0.58	0.26
266.00	0.31	294.54	265.99	0.30	-1.64	-1.47	0.55	0.43	51.87
326.00	0.31	272.74	325.99	0.37	-1.95	-1.76	0.20	0.00	-36.33

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-12 HM (slot U)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	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)
415.00	0.22	299.46	414.99	0.47	-2.34	-2.13	0.17	-0.10	30.02
446.00	0.18	290.58	445.99	0.51	-2.44	-2.23	0.16	-0.13	-28.65
475.00	0.13	278.81	474.99	0.53	-2.51	-2.30	0.20	-0.17	-40.59
505.00	0.09	261.14	504.99	0.53	-2.57	-2.35	0.17	-0.13	-58.90
535.00	0.13	275.91	534.99	0.53	-2.63	-2.39	0.16	0.13	49.23
565.00	0.09	243.74	564.99	0.53	-2.68	-2.43	0.24	-0.13	-107.23
595.00	0.13	261.14	594.99	0.51	-2.74	-2.47	0.17	0.13	58.00
626.00	0.09	261.14	625.99	0.50	-2.80	-2.51	0.13	-0.13	0.00
657.00	0.04	198.30	656.99	0.49	-2.82	-2.52	0.26	-0.16	-202.71
689.00	0.09	261.14	688.99	0.47	-2.85	-2.53	0.25	0.16	196.38
720.00	0.09	154.09	719.99	0.45	-2.86	-2.53	0.47	0.00	-345.32
752.00	0.00	261.14	751.99	0.43	-2.85	-2.50	0.28	-0.28	0.00
782.00	0.03	222.30	781.99	0.42	-2.86	-2.51	0.10	0.10	0.00
813.00	0.00	81.14	812.99	0.41	-2.86	-2.51	0.10	-0.10	0.00
844.00	0.00	81.14	843.99	0.41	-2.86	-2.51	0.00	0.00	0.00
876.00	0.03	149.86	875.99	0.41	-2.86	-2.50	0.09	0.09	0.00
908.00	0.03	149.13	907.99	0.39	-2.85	-2.48	0.00	0.00	-2.28
939.00	0.03	208.59	938.99	0.38	-2.85	-2.47	0.10	0.00	191.81
971.00	0.11	190.56	970.99	0.34	-2.86	-2.46	0.26	0.25	-56.34
994.00	0.10	197.16	993.99	0.30	-2.87	-2.44	0.07	-0.04	28.70
1,065.00	0.26	225.29	1,064.99	0.13	-3.00	-2.44	0.25	0.23	39.62
1,160.00	0.32	240.69	1,159.99	-0.15	-3.39	-2.57	0.10	0.06	16.21
1,255.00	0.55	106.82	1,254.99	-0.42	-3.18	-2.24	0.85	0.24	-140.92
1,350.00	0.65	115.69	1,349.98	-0.78	-2.26	-1.29	0.14	0.11	9.34
1,444.00	0.27	117.45	1,443.98	-1.11	-1.58	-0.55	0.40	-0.40	1.87
1,539.00	0.15	265.41	1,538.98	-1.23	-1.51	-0.43	0.43	-0.13	155.75
1,633.00	0.46	283.07	1,632.98	-1.15	-2.00	-0.86	0.34	0.33	18.79
1,729.00	0.98	357.74	1,728.97	-0.24	-2.41	-1.74	1.01	0.54	77.78
1,824.00	2.96	27.19	1,823.91	2.75	-1.32	-2.74	2.27	2.08	31.00
1,920.00	5.83	29.66	1,919.62	9.19	2.23	-3.94	3.00	2.99	2.57
2,015.00	8.70	24.70	2,013.85	19.91	7.62	-6.35	3.09	3.02	-5.22
2,110.00	11.55	19.78	2,107.36	35.40	13.84	-11.05	3.13	3.00	-5.18
2,204.00	14.40	15.43	2,198.95	55.52	20.14	-18.57	3.20	3.03	-4.63
2,299.00	17.17	14.37	2,290.36	80.50	26.76	-28.83	2.93	2.92	-1.12
2,394.00	18.43	14.22	2,380.81	108.64	33.93	-40.63	1.33	1.33	-0.16
2,489.00	22.17	11.04	2,469.90	140.80	41.05	-54.95	4.10	3.94	-3.35
2,584.00	25.69	7.94	2,556.72	178.80	47.33	-73.55	3.93	3.71	-3.26
2,678.00	27.33	6.36	2,640.84	220.43	52.54	-95.24	1.90	1.90	-1.68
2,773.00	29.42	7.00	2,724.42	265.27	57.80	-118.88	2.22	2.22	0.67
2,826.00	31.17	8.25	2,770.18	291.76	61.35	-132.49	3.51	3.51	2.36
2,884.00	33.05	9.42	2,819.31	322.22	66.10	-147.63	3.41	3.24	3.88
2,963.00	36.08	5.64	2,884.36	366.64	71.91	-170.57	4.70	4.70	4.78
3,058.00	41.62	3.44	2,958.32	426.02	76.56	-203.69	6.01	6.01	-2.32
3,156.00	42.32	7.93	3,031.20	491.20	83.06	-238.94	3.15	0.71	4.58

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-12 HM (slot U)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	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)
3,250.00	40.43	4.24	3,101.75	552.95	89.68	-271.98	3.28	-2.01	-3.93
3,345.00	41.31	3.18	3,173.58	614.98	93.70	-307.24	1.18	0.93	-1.12
3,439.00	42.14	10.83	3,243.79	676.97	101.35	-339.62	5.49	0.88	8.14
3,533.00	40.34	8.45	3,314.47	738.05	111.75	-369.28	2.54	-1.91	-2.53
3,628.00	41.31	7.75	3,386.36	799.53	120.50	-400.48	1.13	1.02	-0.74
3,722.00	39.16	0.63	3,458.15	859.99	125.01	-434.38	5.40	-2.29	-7.57
3,816.00	40.69	358.17	3,530.24	920.31	124.36	-472.24	2.34	1.63	-2.62
3,910.00	40.65	359.84	3,601.54	981.55	123.29	-511.00	1.16	-0.04	1.78
4,005.00	40.61	359.75	3,673.64	1,043.41	123.07	-549.48	0.07	-0.04	-0.09
4,099.00	39.55	2.65	3,745.57	1,103.91	124.32	-585.96	2.28	-1.13	3.09
4,194.00	38.58	5.03	3,819.33	1,163.63	128.32	-619.80	1.88	-1.02	2.51
Tie into original hole @ 4194 MD									
4,287.00	36.61	2.48	3,893.02	1,220.23	132.06	-651.91	2.70	-2.12	-2.74
4,318.00	35.77	2.04	3,918.04	1,238.52	132.78	-662.67	2.84	-2.71	-1.42
4,381.00	33.22	0.98	3,969.96	1,274.19	133.73	-684.01	4.16	-4.05	-1.68
4,412.00	31.25	1.07	3,996.18	1,290.72	134.03	-694.01	6.36	-6.35	0.29
4,444.00	26.72	2.74	4,024.17	1,306.21	134.53	-703.21	14.38	-14.16	5.22
4,476.00	26.06	11.09	4,052.84	1,320.30	136.22	-710.61	11.77	-2.06	26.09
4,507.00	25.80	17.68	4,080.73	1,333.41	139.58	-716.09	9.33	-0.84	21.26
4,539.00	28.08	16.10	4,109.25	1,347.28	143.79	-721.38	7.47	7.13	-4.94
4,571.00	30.28	13.99	4,137.19	1,362.35	147.83	-727.53	7.59	6.88	-6.59
4,602.00	33.05	11.88	4,163.57	1,378.21	151.46	-734.50	9.62	8.94	-6.81
4,634.00	35.46	11.18	4,190.02	1,395.86	155.05	-742.61	7.63	7.53	-2.19
4,665.00	37.75	11.53	4,214.90	1,413.98	158.70	-750.97	7.42	7.39	1.13
4,760.00	44.03	13.46	4,286.69	1,474.64	172.21	-777.93	6.74	6.61	2.03
4,855.00	44.34	11.27	4,354.82	1,539.31	186.38	-806.84	1.64	0.33	-2.31
4,949.00	44.69	8.63	4,421.85	1,604.21	197.76	-838.10	2.00	0.37	-2.81
5,044.00	45.31	7.14	4,489.03	1,670.75	206.97	-872.07	1.29	0.65	-1.57
5,138.00	45.62	4.50	4,554.96	1,737.40	213.76	-908.01	2.03	0.33	-2.81
5,233.00	45.92	1.16	4,621.24	1,805.37	217.11	-947.46	2.54	0.32	-3.52
5,327.00	45.26	0.37	4,687.02	1,872.51	218.01	-988.33	0.92	-0.70	-0.84
5,422.00	42.54	0.28	4,755.46	1,938.38	218.39	-1,028.82	2.86	-2.86	-0.09
5,517.00	39.33	1.86	4,827.22	2,000.60	219.52	-1,066.46	3.55	-3.38	1.66
5,611.00	37.70	5.64	4,900.78	2,058.99	223.32	-1,099.64	3.05	-1.73	4.02
5,705.00	39.51	5.82	4,974.23	2,117.34	229.17	-1,131.17	1.93	1.93	0.19
5,800.00	41.88	6.08	5,046.26	2,178.95	235.60	-1,164.28	2.50	2.49	0.27
5,894.00	42.85	3.01	5,115.72	2,242.07	240.60	-1,199.44	2.43		
5,989.00	42.93	2.74	5,185.32	2,306.65	243.84	-1,236.88	0.21		
6,083.00	41.79	4.24	5,254.78	2,369.86	247.69	-1,273.00	1.62		
6,179.00	43.29	2.13	5,325.52	2,434.66	251.28	-1,310.31	2.16		
6,273.00	42.58	2.65	5,394.34	2,498.63	253.95	-1,347.83	0.84		
6,368.00	42.41	3.01	5,464.38	2,562.73	257.11	-1,385.03	0.31		
6,463.00	40.87	3.80	5,535.38	2,625.74	260.86	-1,421.11	1.71		

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-12 HM (slot U)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	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)
6,494.00	40.08	3.36	5,558.96	2,645.82	262.11	-1,432.56	2.71	-2.55	-1.42
6,532.00	38.81	1.23	5,588.30	2,669.94	263.09	-1,446.73	4.88	-3.34	-5.61
6,580.00	40.66	0.44	5,625.22	2,700.62	263.53	-1,465.38	4.00	3.85	-1.65
6,627.00	41.80	1.49	5,660.56	2,731.59	264.05	-1,484.15	2.84	2.43	2.23
6,675.00	42.90	6.15	5,696.05	2,763.83	266.22	-1,502.41	6.93	2.29	9.71
6,722.00	40.88	9.49	5,731.04	2,794.92	270.47	-1,518.32	6.40	-4.30	7.11
6,769.00	36.79	14.59	5,767.65	2,823.72	276.56	-1,531.38	11.04	-8.70	10.85
6,816.00	33.76	20.39	5,806.03	2,849.60	284.66	-1,541.05	9.60	-6.45	12.34
6,863.00	31.25	28.12	5,845.68	2,872.61	294.96	-1,547.20	10.32	-5.34	16.45
6,910.00	28.66	34.54	5,886.41	2,892.65	307.10	-1,550.08	8.76	-5.51	13.66
6,957.00	27.38	36.12	5,927.90	2,910.67	319.86	-1,551.22	3.15	-2.72	3.36
7,004.00	26.73	43.59	5,969.76	2,927.06	333.52	-1,550.64	7.36	-1.38	15.89
7,052.00	26.42	48.69	6,012.70	2,941.93	348.99	-1,547.70	4.80	-0.65	10.63
7,099.00	27.87	56.86	6,054.54	2,954.84	366.05	-1,542.30	8.50	3.09	17.38
7,147.00	30.51	65.56	6,096.46	2,966.02	386.55	-1,533.13	10.40	5.50	18.13
7,194.00	33.23	73.91	6,136.39	2,974.53	409.80	-1,520.14	11.01	5.79	17.77
7,242.00	34.81	82.61	6,176.19	2,979.94	436.04	-1,502.89	10.65	3.29	18.13
7,289.00	36.26	91.40	6,214.46	2,981.33	463.26	-1,482.38	11.29	3.09	18.70
7,336.00	38.33	98.70	6,251.87	2,978.78	491.58	-1,458.56	10.38	4.40	15.53
7,383.00	41.41	105.82	6,287.96	2,972.34	520.96	-1,431.50	11.71	6.55	15.15
7,431.00	44.26	111.18	6,323.17	2,961.95	551.87	-1,400.80	9.63	5.94	11.17
7,478.00	47.08	114.43	6,356.01	2,948.91	582.84	-1,368.40	7.77	6.00	6.91
7,524.00	49.67	118.39	6,386.57	2,933.60	613.62	-1,334.76	8.55	5.63	8.61
7,571.00	50.95	121.20	6,416.59	2,915.62	644.99	-1,298.99	5.35	2.72	5.98
7,618.00	53.93	126.12	6,445.25	2,894.96	675.96	-1,261.87	10.44	6.34	10.47
7,665.00	55.78	129.55	6,472.31	2,871.38	706.30	-1,223.45	7.15	3.94	7.30
7,712.00	58.42	133.68	6,497.84	2,845.17	735.78	-1,184.08	9.27	5.62	8.79
7,759.00	63.03	136.40	6,520.82	2,816.16	764.72	-1,143.39	11.03	9.81	5.79
7,807.00	67.08	139.74	6,541.07	2,783.78	793.77	-1,100.52	10.53	8.44	6.96
7,854.00	69.93	141.15	6,558.29	2,750.06	821.61	-1,057.78	6.68	6.06	3.00
7,901.00	73.54	142.56	6,573.01	2,714.96	849.17	-1,014.41	8.19	7.68	3.00
7,948.00	76.26	145.46	6,585.26	2,678.25	875.83	-970.75	8.30	5.79	6.17
7,996.00	79.34	145.63	6,595.40	2,639.57	902.37	-925.96	6.43	6.42	0.35
8,043.00	82.77	148.97	6,602.71	2,600.51	927.43	-882.08	10.13	7.30	7.11
8,090.00	83.30	152.05	6,608.41	2,559.90	950.40	-838.91	6.60	1.13	6.55
8,137.00	87.82	150.82	6,612.05	2,518.76	972.80	-795.84	9.96	9.62	-2.62
8,185.00	88.09	151.08	6,613.76	2,476.83	996.09	-751.59	0.78	0.56	0.54
8,277.00	89.63	150.64	6,615.59	2,396.49	1,040.88	-666.67	1.74		-0.48
8,372.00	89.54	151.52	6,616.28	2,313.34	1,086.82	-579.11	0.93	-0.09	0.93
8,466.00	89.76	152.31	6,616.86	2,230.41	1,131.07	-493.01	0.87	-0.21	0.84
8,560.00	89.89	149.67	6,617.14	2,148.21	1,176.65	-406.32	2.81	0.14	-2.81
8,654.00	90.20	149.67	6,617.07	2,067.08	1,224.12	-318.81	0.33	0.33	0.00
8,747.00	90.37	150.11	6,616.61	1,986.63	1,270.78	-232.36	0.51		0.47

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Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
8,841.00	90.68	149.06	6,615.74	1,905.57	1,318.36	-144.80	1.16	0.33	-1.12
8,936.00	89.10	149.50	6,615.93	1,823.90	1,366.89	-56.12	1.73	-1.66	0.46
9,030.00	89.23	149.85	6,617.30	1,742.77	1,414.34	31.38	0.40	0.14	0.37
9,125.00	87.91	149.41	6,619.67	1,660.83	1,462.36	119.82	1.46	-1.39	-0.46
9,220.00	89.01	149.15	6,622.22	1,579.20	1,510.87	208.46	1.19	1.16	-0.27
9,315.00	88.92	149.41	6,623.94	1,497.54	1,559.39	297.13	0.29	-0.09	0.27
9,409.00	88.92	149.24	6,625.71	1,416.71	1,607.34	384.83	0.18	0.00	-0.18
9,504.00	88.35	149.41	6,627.97	1,335.02	1,655.79	473.45	0.63	-0.60	0.18
9,598.00	90.07	150.38	6,629.27	1,253.72	1,702.93	560.82	2.10	1.83	1.03
9,694.00	89.71	150.20	6,629.45	1,170.34	1,750.51	649.81	0.42	-0.38	-0.19
9,789.00	89.67	150.55	6,629.97	1,087.76	1,797.47	737.82	0.37	-0.04	0.37
9,885.00	90.02	150.82	6,630.23	1,004.05	1,844.47	826.56	0.46	0.36	0.28
9,980.00	89.93	150.47	6,630.27	921.25	1,891.05	914.40	0.38	-0.09	-0.37
10,075.00	90.33	150.20	6,630.05	838.70	1,938.06	1,002.44	0.51	0.42	-0.28
10,170.00	89.27	148.00	6,630.38	757.19	1,986.85	1,091.21	2.57	-1.12	-2.32
10,265.00	89.49	147.48	6,631.41	676.86	2,037.55	1,180.77	0.59	0.23	-0.55
10,360.00	89.32	149.06	6,632.40	596.07	2,087.51	1,270.03	1.67	-0.18	1.66
10,454.00	89.67	148.53	6,633.23	515.67	2,136.21	1,358.05	0.68	0.37	-0.56
10,549.00	90.15	148.18	6,633.38	434.80	2,186.05	1,447.27	0.63	0.51	-0.37
10,643.00	90.20	147.65	6,633.09	355.15	2,235.98	1,535.79	0.57	0.05	-0.56
10,738.00	90.15	149.41	6,632.80	274.13	2,285.57	1,624.90	1.85	-0.05	1.85
10,833.00	90.55	150.29	6,632.22	191.99	2,333.29	1,713.23	1.02	0.42	0.93
10,928.00	89.27	151.52	6,632.37	108.98	2,379.48	1,800.91	1.87	-1.35	1.29
11,023.00	89.49	151.43	6,633.39	25.51	2,424.84	1,888.21	0.25	0.23	-0.09
11,118.00	89.85	152.58	6,633.94	-58.37	2,469.43	1,975.16	1.27	0.38	1.21
11,213.00	88.57	151.61	6,635.25	-142.31	2,513.89	2,062.05	1.69	-1.35	-1.02
11,307.00	88.88	151.61	6,637.34	-224.98	2,558.57	2,148.33	0.33	0.33	0.00
11,402.00	89.54	151.43	6,638.65	-308.48	2,603.87	2,235.60	0.72	0.69	-0.19
11,496.00	89.76	150.11	6,639.23	-390.51	2,649.77	2,322.44	1.42	0.23	-1.40
11,590.00	89.63	150.47	6,639.73	-472.15	2,696.35	2,409.57	0.41	-0.14	0.38
11,685.00	89.98	148.62	6,640.05	-554.04	2,744.50	2,498.09	1.98	0.37	-1.95
11,779.00	90.33	148.62	6,639.80	-634.29	2,793.45	2,586.21	0.37	0.37	0.00
11,873.00	90.90	148.80	6,638.79	-714.61	2,842.27	2,674.28	0.64	0.61	0.19
11,968.00	89.80	148.80	6,638.21	-795.87	2,891.48	2,763.24	1.16	-1.16	0.00
12,061.00	89.71	149.76	6,638.61	-875.82	2,938.99	2,850.05	1.04	-0.10	1.03
12,156.00	90.07	150.55	6,638.79	-958.22	2,986.26	2,938.20	0.91	0.38	0.83
12,250.00	90.42	150.11	6,638.39	-1,039.89	3,032.79	3,025.31	0.60	-0.18	-0.47
12,345.00	90.46	150.20	6,637.66	-1,122.29	3,080.07	3,113.45	0.10	-0.18	0.09
12,439.00	90.29	148.44	6,637.04	-1,203.13	3,128.03	3,201.17	1.88	-0.18	1.87
12,533.00	89.19	148.71	6,637.47	-1,283.34	3,177.04	3,289.32	1.20	0.29	0.29
12,628.00	89.49	148.18	6,638.56	-1,364.28	3,226.75	3,378.48	0.64	0.32	0.56
12,723.00	90.02	147.65	6,638.97	-1,444.77	3,277.21	3,467.94	0.79	-0.37	-0.56
12,818.00	89.67	149.15	6,639.23	-1,525.68	3,326.99	3,557.13	1.62	-0.37	1.58
12,912.00	88.66	148.62	6,640.59	-1,606.15	3,375.56	3,645.09	1.21	-1.07	-0.56

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Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
13,007.00	88.88	148.53	6,642.63	-1,687.20	3,425.08	3,734.16	0.25	0.23	-0.09
13,101.00	89.32	148.18	6,644.11	-1,767.21	3,474.39	3,822.43	0.60	0.47	-0.37
13,196.00	89.54	148.36	6,645.06	-1,848.01	3,524.35	3,911.69	0.30	0.23	0.19
13,290.00	89.80	148.88	6,645.60	-1,928.26	3,573.29	3,999.82	0.62	0.28	0.55
13,385.00	90.11	150.03	6,645.67	-2,010.07	3,621.57	4,088.39	1.25	0.33	1.21
13,479.00	90.24	149.94	6,645.38	-2,091.47	3,668.59	4,175.71	0.17	0.14	-0.10
13,574.00	90.81	149.85	6,644.51	-2,173.65	3,716.24	4,264.02	0.61	0.60	-0.09
13,669.00	91.25	149.85	6,642.81	-2,255.78	3,763.95	4,352.34	0.46	0.46	0.00
13,763.00	89.54	149.67	6,642.16	-2,336.98	3,811.29	4,439.79	1.83	-1.82	-0.19
13,857.00	89.63	150.20	6,642.84	-2,418.34	3,858.38	4,527.14	0.57	0.10	0.56
13,952.00	89.76	149.41	6,643.34	-2,500.44	3,906.16	4,615.50	0.84	0.14	-0.83
14,047.00	89.98	149.24	6,643.56	-2,582.15	3,954.62	4,704.15	0.29	0.23	-0.18
14,141.00	88.75	149.76	6,644.60	-2,663.14	4,002.33	4,791.76	1.42	-1.31	0.55
14,236.00	88.79	149.50	6,646.64	-2,745.08	4,050.35	4,880.21	0.28	0.04	-0.27
14,331.00	89.32	149.67	6,648.21	-2,827.00	4,098.43	4,968.69	0.59	0.56	0.18
14,425.00	89.63	149.41	6,649.07	-2,908.02	4,146.08	5,056.28	0.43	0.33	-0.28
14,520.00	90.42	149.15	6,649.03	-2,989.69	4,194.61	5,144.96	0.88	0.83	-0.27
14,615.00	90.95	149.24	6,647.89	-3,071.28	4,243.26	5,233.68	0.57	0.56	0.09
14,710.00	91.34	148.88	6,645.99	-3,152.74	4,292.09	5,322.47	0.56	0.41	-0.38
14,805.00	89.71	149.59	6,645.12	-3,234.37	4,340.68	5,411.17	1.87	-1.72	0.75
14,900.00	88.57	149.76	6,646.55	-3,316.36	4,388.64	5,499.60	1.21	-1.20	0.18
14,996.00	88.57	149.67	6,648.95	-3,399.23	4,437.04	5,588.91	0.09	0.00	-0.09
15,091.00	88.66	149.59	6,651.24	-3,481.17	4,485.06	5,677.36	0.13	0.09	-0.08
15,135.00	88.75	149.24	6,652.24	-3,519.04	4,507.44	5,718.38	0.82	0.20	-0.80
Survey @ 15135.00 MD 6652.24 TVD									
15,190.00	88.75	149.24	6,653.44	-3,566.29	4,535.56	5,769.72	0.00	0.00	0.00
Survey projected to 15190.00 MD 6653.44 TVD									

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
4,194.00	3,819.33	1,163.63	128.32	Tie into original hole @ 4194 MD
15,135.00	6,652.24	-3,519.04	4,507.44	Survey @ 15135.00 MD 6652.24 TVD

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-12 HM (slot U)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	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-12 HM (slot U)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,093.46 usft	Latitude:	39.77830044
	+E/-W	0.00 usft	Easting:	1,707,038.36 usft	Longitude:	-80.76287388
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level:	1,265.00 usft

Wellbore	Sidetrack 01				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	12/4/2019	-8.726	66.751	51,890.88156178

Design	Surveys Sidetrack 01				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	4,194.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.00	0.00	0.00	128.26	

Survey Program	Date	12/11/2019			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
174.00	994.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,065.00	2,963.00	MWD int (Original Hole)	MWD	MWD - Standard	
3,058.00	4,194.00	MWD (Original Hole)	MWD	MWD - Standard	
4,287.00	6,494.00	MWD ST1 (Sidetrack 01)	MWD	MWD - Standard	
6,532.00	15,135.00	MWD ST1 lat (Sidetrack 01)	MWD	MWD - Standard	
15,190.00	15,190.00	Projection (Sidetrack 01)	MWD	MWD - Standard	

Survey	<div style="text-align: right;"> RECEIVED Office of Oil and Gas MAY 11 2021 WV Department of Environmental Protection </div>									
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	14,446,093.46	1,707,038.36	39.77830044	-80.76287388	
174.00	0.57	279.51	174.00	0.14	-0.85	14,446,093.61	1,707,037.50	39.77830084	-80.76287692	
205.00	0.62	279.68	205.00	0.20	-1.17	14,446,093.66	1,707,037.19	39.77830099	-80.76287805	
236.00	0.44	278.98	235.99	0.24	-1.45	14,446,093.71	1,707,036.90	39.77830112	-80.76287905	
266.00	0.31	294.54	265.99	0.30	-1.64	14,446,093.76	1,707,036.72	39.77830126	-80.76287972	
326.00	0.31	272.74	325.99	0.37	-1.95	14,446,093.83	1,707,036.41	39.77830147	-80.76288082	
415.00	0.22	299.46	414.99	0.47	-2.34	14,446,093.93	1,707,036.02	39.77830174	-80.76288221	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-12 HM (slot U)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	Database:	DB_Aug1919_v14

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
446.00	0.18	290.58	445.99	0.51	-2.44	14,446,093.98	1,707,035.92	39.77830187	-80.76288255
475.00	0.13	278.81	474.99	0.53	-2.51	14,446,094.00	1,707,035.84	39.77830192	-80.76288282
505.00	0.09	261.14	504.99	0.53	-2.57	14,446,094.00	1,707,035.79	39.77830193	-80.76288302
535.00	0.13	275.91	534.99	0.53	-2.63	14,446,094.00	1,707,035.73	39.77830193	-80.76288323
565.00	0.09	243.74	564.99	0.53	-2.68	14,446,093.99	1,707,035.67	39.77830191	-80.76288342
595.00	0.13	261.14	594.99	0.51	-2.74	14,446,093.98	1,707,035.62	39.77830187	-80.76288362
626.00	0.09	261.14	625.99	0.50	-2.80	14,446,093.97	1,707,035.56	39.77830184	-80.76288383
657.00	0.04	198.30	656.99	0.49	-2.82	14,446,093.95	1,707,035.53	39.77830181	-80.76288392
689.00	0.09	261.14	688.99	0.47	-2.85	14,446,093.94	1,707,035.51	39.77830177	-80.76288403
720.00	0.09	154.09	719.99	0.45	-2.86	14,446,093.91	1,707,035.49	39.77830170	-80.76288407
752.00	0.00	261.14	751.99	0.43	-2.85	14,446,093.89	1,707,035.50	39.77830163	-80.76288403
782.00	0.03	222.30	781.99	0.42	-2.86	14,446,093.88	1,707,035.50	39.77830162	-80.76288405
813.00	0.00	81.14	812.99	0.41	-2.86	14,446,093.88	1,707,035.49	39.77830160	-80.76288407
844.00	0.00	81.14	843.99	0.41	-2.86	14,446,093.88	1,707,035.49	39.77830160	-80.76288407
876.00	0.03	149.86	875.99	0.41	-2.86	14,446,093.87	1,707,035.50	39.77830158	-80.76288406
908.00	0.03	149.13	907.99	0.39	-2.85	14,446,093.86	1,707,035.50	39.77830154	-80.76288403
939.00	0.03	208.59	938.99	0.38	-2.85	14,446,093.84	1,707,035.50	39.77830150	-80.76288403
971.00	0.11	190.56	970.99	0.34	-2.86	14,446,093.80	1,707,035.50	39.77830140	-80.76288406
994.00	0.10	197.16	993.99	0.30	-2.87	14,446,093.76	1,707,035.49	39.77830129	-80.76288410
1,065.00	0.26	225.29	1,064.99	0.13	-3.00	14,446,093.59	1,707,035.35	39.77830081	-80.76288457
1,160.00	0.32	240.69	1,159.99	-0.15	-3.39	14,446,093.31	1,707,034.97	39.77830004	-80.76288594
1,255.00	0.55	106.82	1,254.99	-0.42	-3.18	14,446,093.05	1,707,035.17	39.77829932	-80.76288522
1,350.00	0.65	115.69	1,349.98	-0.78	-2.26	14,446,092.68	1,707,036.10	39.77829831	-80.76288194
1,444.00	0.27	117.45	1,443.98	-1.11	-1.58	14,446,092.35	1,707,036.77	39.77829739	-80.76287953
1,539.00	0.15	265.41	1,538.98	-1.23	-1.51	14,446,092.24	1,707,036.85	39.77829708	-80.76287927
1,633.00	0.46	283.07	1,632.98	-1.15	-2.00	14,446,092.31	1,707,036.36	39.77829729	-80.76288101
1,729.00	0.98	357.74	1,728.97	-0.24	-2.41	14,446,093.22	1,707,035.95	39.77829979	-80.76288245
1,824.00	2.96	27.19	1,823.91	2.75	-1.32	14,446,096.21	1,707,037.04	39.77830800	-80.76287855
1,920.00	5.83	29.66	1,919.62	9.19	2.23	14,446,102.66	1,707,040.58	39.77832567	-80.76286587
2,015.00	8.70	24.70	2,013.85	19.91	7.62	14,446,113.38	1,707,045.98	39.77835508	-80.76284658
2,110.00	11.55	19.78	2,107.36	35.40	13.84	14,446,128.86	1,707,052.20	39.77839755	-80.76282428
2,204.00	14.40	15.43	2,198.95	55.52	20.14	14,446,148.99	1,707,058.49	39.77845278	-80.76280169
2,299.00	17.17	14.37	2,290.36	80.50	26.76	14,446,173.96	1,707,065.12	39.77852132	-80.76277787
2,394.00	18.43	14.22	2,380.81	108.64	33.93	14,446,202.10	1,707,072.29	39.77859855	-80.76275209
2,489.00	22.17	11.04	2,469.90	140.80	41.05	14,446,234.27	1,707,079.41	39.77868682	-80.76272643
2,584.00	25.69	7.94	2,556.72	178.80	47.33	14,446,272.27	1,707,085.69	39.77879114	-80.76270372
2,678.00	27.33	6.36	2,640.84	220.43	52.54	14,446,313.89	1,707,090.90	39.77890542	-80.76268480
2,773.00	29.42	7.00	2,724.42	265.27	57.80	14,446,358.73	1,707,096.15	39.77902852	-80.76266566
2,826.00	31.17	8.25	2,770.18	291.76	61.35	14,446,385.23	1,707,099.71	39.77910126	-80.76265276
2,884.00	33.05	9.42	2,819.31	322.22	66.10	14,446,415.69	1,707,104.45	39.77918487	-80.76263559
2,963.00	36.08	5.64	2,884.36	366.64	71.91	14,446,460.10	1,707,110.27	39.77930681	-80.76261448
3,058.00	41.62	3.44	2,958.32	426.02	76.56	14,446,519.48	1,707,114.91	39.77946985	-80.76259738
3,156.00	42.32	7.93	3,031.20	491.20	83.06	14,446,584.66	1,707,121.42	39.77964880	-80.76257361
3,250.00	40.43	4.24	3,101.75	552.95	89.68	14,446,646.41	1,707,128.04	39.77981834	-80.76254946
3,345.00	41.31	3.18	3,173.58	614.98	93.70	14,446,708.44	1,707,132.06	39.77998866	-80.76253457
3,439.00	42.14	10.83	3,243.79	676.97	101.35	14,446,770.44	1,707,139.71	39.78015886	-80.76250676
3,533.00	40.34	8.45	3,314.47	738.05	111.75	14,446,831.51	1,707,150.11	39.78032651	-80.76246917
3,628.00	41.31	7.75	3,386.36	799.53	120.50	14,446,893.00	1,707,158.85	39.78049330	-80.76243746
3,722.00	39.16	0.63	3,458.15	859.99	125.01	14,446,953.46	1,707,163.37	39.78066131	-80.76242082
3,816.00	40.69	358.17	3,530.24	920.31	124.36	14,447,013.77	1,707,162.71	39.78082695	-80.76242257
3,910.00	40.65	359.84	3,601.54	981.55	123.29	14,447,075.02	1,707,161.65	39.78099515	-80.76242578
4,005.00	40.61	359.75	3,673.64	1,043.41	123.07	14,447,136.88	1,707,161.43	39.78116505	-80.76242599
4,099.00	39.55	2.65	3,745.57	1,103.91	124.32	14,447,197.37	1,707,162.68	39.78133117	-80.76242096
4,194.00	38.58	5.03	3,819.33	1,163.63	128.32	14,447,257.10	1,707,166.67	39.78149516	-80.76240618

Tie into original hole @ 4194 MD

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-12 HM (slot U)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	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	
4,287.00	36.61	2.48	3,893.02	1,220.23	132.06	14,447,313.70	1,707,170.42	39.78165058	-80.76239232	
4,318.00	35.77	2.04	3,918.04	1,238.52	132.78	14,447,331.99	1,707,171.14	39.78170080	-80.76238957	
4,381.00	33.22	0.98	3,969.96	1,274.19	133.73	14,447,367.65	1,707,172.09	39.78179873	-80.76238585	
4,412.00	31.25	1.07	3,996.18	1,290.72	134.03	14,447,384.18	1,707,172.39	39.78184413	-80.76238465	
4,444.00	26.72	2.74	4,024.17	1,306.21	134.53	14,447,399.67	1,707,172.88	39.78188668	-80.76238272	
4,476.00	26.06	11.09	4,052.84	1,320.30	136.22	14,447,413.76	1,707,174.58	39.78192535	-80.76237655	
4,507.00	25.80	17.68	4,080.73	1,333.41	139.58	14,447,426.88	1,707,177.94	39.78196134	-80.76236447	
4,539.00	28.08	16.10	4,109.25	1,347.28	143.79	14,447,440.75	1,707,182.14	39.78199941	-80.76234938	
4,571.00	30.28	13.99	4,137.19	1,362.35	147.83	14,447,455.81	1,707,186.18	39.78204075	-80.76233485	
4,602.00	33.05	11.88	4,163.57	1,378.21	151.46	14,447,471.67	1,707,189.81	39.78208428	-80.76232178	
4,634.00	35.46	11.18	4,190.02	1,395.86	155.05	14,447,489.32	1,707,193.41	39.78213272	-80.76230881	
4,665.00	37.75	11.53	4,214.90	1,413.98	158.70	14,447,507.44	1,707,197.05	39.78218246	-80.76229568	
4,760.00	44.03	13.46	4,286.69	1,474.64	172.21	14,447,568.11	1,707,210.56	39.78234896	-80.76224702	
4,855.00	44.34	11.27	4,354.82	1,539.31	186.38	14,447,632.78	1,707,224.74	39.78252646	-80.76219596	
4,949.00	44.69	8.63	4,421.85	1,604.21	197.76	14,447,697.68	1,707,236.12	39.78270461	-80.76215483	
5,044.00	45.31	7.14	4,489.03	1,670.75	206.97	14,447,764.21	1,707,245.33	39.78288727	-80.76212142	
5,138.00	45.62	4.50	4,554.96	1,737.40	213.76	14,447,830.86	1,707,252.12	39.78307026	-80.76209662	
5,233.00	45.92	1.16	4,621.24	1,805.37	217.11	14,447,898.83	1,707,255.47	39.78325690	-80.76208404	
5,327.00	45.26	0.37	4,687.02	1,872.51	218.01	14,447,965.97	1,707,256.37	39.78344128	-80.76208020	
5,422.00	42.54	0.28	4,755.46	1,938.38	218.39	14,448,031.84	1,707,256.75	39.78362216	-80.76207825	
5,517.00	39.33	1.86	4,827.22	2,000.60	219.52	14,448,094.06	1,707,257.88	39.78379303	-80.76207362	
5,611.00	37.70	5.64	4,900.78	2,058.99	223.32	14,448,152.45	1,707,261.67	39.78395335	-80.76205957	
5,705.00	39.51	5.82	4,974.23	2,117.34	229.17	14,448,210.80	1,707,267.53	39.78411357	-80.76203817	
5,800.00	41.88	6.08	5,046.26	2,178.95	235.60	14,448,272.41	1,707,273.95	39.78428271	-80.76201472	
5,894.00	42.85	3.01	5,115.72	2,242.07	240.60	14,448,335.54	1,707,278.96	39.78445603	-80.76199631	
5,989.00	42.93	2.74	5,185.32	2,306.65	243.84	14,448,400.11	1,707,282.20	39.78463335	-80.76198416	
6,083.00	41.79	4.24	5,254.78	2,369.86	247.69	14,448,463.33	1,707,286.04	39.78480693	-80.76196987	
6,179.00	43.29	2.13	5,325.52	2,434.66	251.28	14,448,528.12	1,707,289.63	39.78498485	-80.76195648	
6,273.00	42.58	2.65	5,394.34	2,498.63	253.95	14,448,592.10	1,707,292.30	39.78516052	-80.76194638	
6,368.00	42.41	3.01	5,464.38	2,562.73	257.11	14,448,656.19	1,707,295.47	39.78533652	-80.76193450	
6,463.00	40.87	3.80	5,535.38	2,625.74	260.86	14,448,719.20	1,707,299.21	39.78550953	-80.76192058	
6,494.00	40.08	3.36	5,588.96	2,645.82	262.11	14,448,739.28	1,707,300.47	39.78556468	-80.76191591	
6,532.00	38.81	1.23	5,588.30	2,669.94	263.09	14,448,763.40	1,707,301.44	39.78563091	-80.76191222	
6,580.00	40.66	0.44	5,625.22	2,700.62	263.53	14,448,794.08	1,707,301.89	39.78571516	-80.76191036	
6,627.00	41.80	1.49	5,660.56	2,731.59	264.05	14,448,825.05	1,707,302.41	39.78580021	-80.76190819	
6,675.00	42.90	6.15	5,696.05	2,763.83	266.22	14,448,857.30	1,707,304.58	39.78588874	-80.76190018	
6,722.00	40.88	9.49	5,731.04	2,794.92	270.47	14,448,888.38	1,707,308.83	39.78597407	-80.76188475	
6,769.00	36.79	14.59	5,767.65	2,823.72	276.56	14,448,917.19	1,707,314.91	39.78605314	-80.76186282	
6,816.00	33.76	20.39	5,806.03	2,849.60	284.66	14,448,943.06	1,707,323.01	39.78612414	-80.76183374	
6,863.00	31.25	28.12	5,845.68	2,872.61	294.96	14,448,966.07	1,707,333.31	39.78618725	-80.76179685	
6,910.00	28.66	34.54	5,886.41	2,892.65	307.10	14,448,986.11	1,707,345.46	39.78624221	-80.76175344	
6,957.00	27.38	36.12	5,927.90	2,910.67	319.86	14,449,004.13	1,707,358.22	39.78629159	-80.76170784	
7,004.00	26.73	43.59	5,969.76	2,927.06	333.52	14,449,020.52	1,707,371.88	39.78633651	-80.76165905	
7,052.00	26.42	48.69	6,012.70	2,941.93	348.99	14,449,035.39	1,707,387.35	39.78637723	-80.76160386	
7,099.00	27.87	56.86	6,054.54	2,954.84	366.05	14,449,048.30	1,707,404.41	39.78641257	-80.76154301	
7,147.00	30.51	65.56	6,096.46	2,966.02	386.55	14,449,059.49	1,707,424.91	39.78644313	-80.76146993	
7,194.00	33.23	73.91	6,136.39	2,974.53	409.80	14,449,068.00	1,707,448.16	39.78646633	-80.76138708	
7,242.00	34.81	82.61	6,176.19	2,979.94	436.04	14,449,073.41	1,707,474.40	39.78649100	-80.76129362	
7,289.00	36.26	91.40	6,214.46	2,981.33	463.26	14,449,074.79	1,707,501.62	39.78648461	-80.76119672	
7,336.00	38.33	98.70	6,251.87	2,978.78	491.58	14,449,072.25	1,707,529.94	39.78647774	-80.76109594	
7,383.00	41.41	105.82	6,287.96	2,972.34	520.96	14,449,065.80	1,707,559.32	39.78645949	-80.76099149	
7,431.00	44.26	111.18	6,323.17	2,961.95	551.87	14,449,055.42	1,707,590.23	39.78643074	-80.76088147	
7,478.00	47.08	114.43	6,356.01	2,948.91	582.84	14,449,042.37	1,707,621.20	39.78639468	-80.76077134	
7,524.00	49.67	118.39	6,386.57	2,933.60	613.62	14,449,027.06	1,707,651.97	39.78635242	-80.76066195	
7,571.00	50.95	121.20	6,416.59	2,915.62	644.99	14,449,009.09	1,707,683.35	39.78630282	-80.76055044	

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-12 HM (slot U)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	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	
7,618.00	53.93	126.12	6,445.25	2,894.96	675.96	14,448,988.42	1,707,714.32	39.78624585	-80.76044038	
7,665.00	55.78	129.55	6,472.31	2,871.38	706.30	14,448,964.84	1,707,744.66	39.78618087	-80.76033262	
7,712.00	58.42	133.68	6,497.84	2,845.17	735.78	14,448,938.63	1,707,774.13	39.78610867	-80.76022794	
7,759.00	63.03	136.40	6,520.82	2,816.16	764.72	14,448,909.62	1,707,803.07	39.78602878	-80.76012520	
7,807.00	67.08	139.74	6,541.07	2,783.78	793.77	14,448,877.24	1,707,832.13	39.78593964	-80.76002208	
7,854.00	69.93	141.15	6,558.29	2,750.06	821.61	14,448,843.52	1,707,859.97	39.78584684	-80.75992329	
7,901.00	73.54	142.56	6,573.01	2,714.96	849.17	14,448,808.43	1,707,887.53	39.78575025	-80.75982554	
7,948.00	76.26	145.46	6,585.26	2,678.25	875.83	14,448,771.71	1,707,914.18	39.78564924	-80.75973101	
7,996.00	79.34	145.63	6,595.40	2,639.57	902.37	14,448,733.03	1,707,940.72	39.78554281	-80.75963691	
8,043.00	82.77	148.97	6,602.71	2,600.51	927.43	14,448,693.97	1,707,965.79	39.78543535	-80.75954804	
8,090.00	83.30	152.05	6,608.41	2,559.90	950.40	14,448,653.37	1,707,988.75	39.78532367	-80.75946669	
8,137.00	87.82	150.82	6,612.05	2,518.76	972.80	14,448,612.22	1,708,011.15	39.78521052	-80.75938735	
8,185.00	88.09	151.08	6,613.76	2,476.83	996.09	14,448,570.29	1,708,034.45	39.78509518	-80.75930483	
8,277.00	89.63	150.64	6,615.59	2,396.49	1,040.88	14,448,489.95	1,708,079.24	39.78487422	-80.75914617	
8,372.00	89.54	151.52	6,616.28	2,313.34	1,086.82	14,448,406.80	1,708,125.18	39.78464553	-80.75898344	
8,466.00	89.76	152.31	6,616.86	2,230.41	1,131.07	14,448,323.87	1,708,169.43	39.78441746	-80.75882672	
8,560.00	89.89	149.67	6,617.14	2,148.21	1,176.65	14,448,241.67	1,708,215.01	39.78419138	-80.75866525	
8,654.00	90.20	149.67	6,617.07	2,067.08	1,224.12	14,448,160.54	1,708,262.48	39.78396821	-80.75849707	
8,747.00	90.37	150.11	6,616.61	1,986.63	1,270.78	14,448,080.09	1,708,309.13	39.78374693	-80.75833177	
8,841.00	90.68	149.06	6,615.74	1,905.57	1,318.36	14,447,999.03	1,708,356.72	39.78352397	-80.75816317	
8,936.00	89.10	149.50	6,615.93	1,823.90	1,366.89	14,447,917.36	1,708,405.25	39.78329933	-80.75799122	
9,030.00	89.23	149.85	6,617.30	1,742.77	1,414.34	14,447,836.24	1,708,452.70	39.78307617	-80.75782308	
9,125.00	87.91	149.41	6,619.67	1,660.83	1,462.36	14,447,754.30	1,708,500.72	39.78285080	-80.75765296	
9,220.00	89.01	149.15	6,622.22	1,579.20	1,510.87	14,447,672.66	1,708,549.23	39.78262624	-80.75748107	
9,315.00	88.92	149.41	6,623.94	1,497.54	1,559.39	14,447,591.00	1,708,597.75	39.78240163	-80.75730914	
9,409.00	88.92	149.24	6,625.71	1,416.71	1,607.34	14,447,510.17	1,708,645.70	39.78217928	-80.75713926	
9,504.00	88.35	149.41	6,627.97	1,335.02	1,655.79	14,447,428.49	1,708,694.15	39.78195459	-80.75696758	
9,598.00	90.07	150.38	6,629.27	1,253.72	1,702.93	14,447,347.18	1,708,741.29	39.78173095	-80.75680057	
9,694.00	89.71	150.20	6,629.45	1,170.34	1,750.51	14,447,263.80	1,708,788.87	39.78150161	-80.75663202	
9,789.00	89.67	150.55	6,629.97	1,087.76	1,797.47	14,447,181.22	1,708,835.83	39.78127447	-80.75646567	
9,885.00	90.02	150.82	6,630.23	1,004.05	1,844.47	14,447,097.51	1,708,882.83	39.78104424	-80.75629918	
9,980.00	89.93	150.47	6,630.27	921.25	1,891.05	14,447,014.71	1,708,929.40	39.78081650	-80.75613422	
10,075.00	90.33	150.20	6,630.05	838.70	1,938.06	14,446,932.16	1,708,976.42	39.78058944	-80.75596767	
10,170.00	89.27	148.00	6,630.38	757.19	1,986.85	14,446,850.65	1,709,025.20	39.78036523	-80.75579482	
10,265.00	89.49	147.48	6,631.41	676.86	2,037.55	14,446,770.32	1,709,075.91	39.78014424	-80.75561513	
10,360.00	89.32	149.06	6,632.40	596.07	2,087.51	14,446,689.53	1,709,125.86	39.77992199	-80.75543810	
10,454.00	89.67	148.53	6,633.23	515.67	2,136.21	14,446,609.13	1,709,174.56	39.77970083	-80.75526554	
10,549.00	90.15	148.18	6,633.38	434.80	2,186.05	14,446,528.26	1,709,224.41	39.77947835	-80.75508892	
10,643.00	90.20	147.65	6,633.09	355.15	2,235.98	14,446,448.62	1,709,274.34	39.77925926	-80.75491198	
10,738.00	90.15	149.41	6,632.80	274.13	2,285.57	14,446,367.59	1,709,323.93	39.77903637	-80.75473626	
10,833.00	90.55	150.29	6,632.22	191.99	2,333.29	14,446,285.45	1,709,371.64	39.77881042	-80.75456723	
10,928.00	89.27	151.52	6,632.37	108.98	2,379.48	14,446,202.44	1,709,417.84	39.77858211	-80.75440363	
11,023.00	89.49	151.43	6,633.39	25.51	2,424.84	14,446,118.98	1,709,463.20	39.77835255	-80.75424298	
11,118.00	89.85	152.58	6,633.94	-58.37	2,469.43	14,446,035.10	1,709,507.79	39.77812186	-80.75408509	
11,213.00	88.57	151.61	6,635.25	-142.31	2,513.89	14,445,951.15	1,709,552.24	39.77789099	-80.75392768	
11,307.00	88.88	151.61	6,637.34	-224.98	2,558.57	14,445,868.48	1,709,596.93	39.77766361	-80.75376946	
11,402.00	89.54	151.43	6,638.65	-308.48	2,603.87	14,445,784.98	1,709,642.22	39.77743623	-80.75360905	
11,496.00	89.76	150.11	6,639.23	-390.51	2,649.77	14,445,702.96	1,709,688.12	39.77720885	-80.75344649	
11,590.00	89.63	150.47	6,639.73	-472.15	2,696.35	14,445,621.31	1,709,734.71	39.77698379	-80.75328148	
11,685.00	89.98	148.62	6,640.05	-554.04	2,744.50	14,445,539.43	1,709,782.86	39.77675858	-80.75311091	
11,779.00	90.33	148.62	6,639.80	-634.29	2,793.45	14,445,459.18	1,709,831.71	39.77653777	-80.75294937	
11,873.00	90.90	148.80	6,638.79	-714.61	2,842.27	14,445,378.85	1,709,880.62	39.77631682	-80.75278452	
11,968.00	89.80	148.80	6,638.21	-795.87	2,891.48	14,445,297.60	1,709,929.84	39.77609329	-80.75261917	
12,061.00	89.71	149.76	6,638.61	-875.82	2,938.99	14,445,217.65	1,709,977.34	39.77587337	-80.75245418	
12,156.00	90.07	150.55	6,638.79	-958.22	2,986.26	14,445,135.25	1,710,024.62	39.77564672	-80.75228442	

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Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow S-12 HM (slot U)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Site:	Old Crow Pad	MD Reference:	RKB=1265+26 @ 1291.00usft (Nabors B28)
Well:	Old Crow S-12 HM (slot U)	North Reference:	Grid
Wellbore:	Sidetrack 01	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Sidetrack 01	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	
12,250.00	90.42	150.11	6,638.39	-1,039.89	3,032.79	14,445,053.57	1,710,071.15	39.77542206	-80.75208962	
12,345.00	90.46	150.20	6,637.66	-1,122.29	3,080.07	14,444,971.18	1,710,118.43	39.77519542	-80.75192217	
12,439.00	90.29	148.44	6,637.04	-1,203.13	3,128.03	14,444,890.34	1,710,166.39	39.77497305	-80.75175228	
12,533.00	89.19	148.71	6,637.47	-1,283.34	3,177.04	14,444,810.13	1,710,215.39	39.77475239	-80.75157864	
12,628.00	89.49	148.18	6,638.56	-1,364.28	3,226.75	14,444,729.18	1,710,265.11	39.77452971	-80.75140252	
12,723.00	90.02	147.65	6,638.97	-1,444.77	3,277.21	14,444,648.69	1,710,315.57	39.77430828	-80.75122372	
12,818.00	89.67	149.15	6,639.23	-1,525.68	3,326.99	14,444,567.78	1,710,365.34	39.77408570	-80.75104736	
12,912.00	88.66	148.62	6,640.59	-1,606.15	3,375.56	14,444,487.31	1,710,413.91	39.77386435	-80.75087530	
13,007.00	88.88	148.53	6,642.63	-1,687.20	3,425.08	14,444,406.27	1,710,463.43	39.77364139	-80.75069986	
13,101.00	89.32	148.18	6,644.11	-1,767.21	3,474.39	14,444,326.25	1,710,512.74	39.77342127	-80.75052515	
13,196.00	89.54	148.36	6,645.06	-1,848.01	3,524.35	14,444,245.46	1,710,562.70	39.77319900	-80.75034814	
13,290.00	89.80	148.88	6,645.60	-1,928.26	3,573.29	14,444,165.21	1,710,611.65	39.77297824	-80.75017474	
13,385.00	90.11	150.03	6,645.67	-2,010.07	3,621.57	14,444,083.39	1,710,659.93	39.77275318	-80.75000373	
13,479.00	90.24	149.94	6,645.38	-2,091.47	3,668.59	14,444,002.00	1,710,706.95	39.77252929	-80.74983719	
13,574.00	90.81	149.85	6,644.51	-2,173.65	3,716.24	14,443,919.82	1,710,754.60	39.77230323	-80.74966843	
13,669.00	91.25	149.85	6,642.81	-2,255.78	3,763.95	14,443,837.68	1,710,802.31	39.77207730	-80.74949946	
13,763.00	89.54	149.67	6,642.16	-2,336.98	3,811.29	14,443,756.48	1,710,849.64	39.77185393	-80.74933180	
13,857.00	89.63	150.20	6,642.84	-2,418.34	3,858.38	14,443,675.13	1,710,896.73	39.77163016	-80.74916501	
13,952.00	89.76	149.41	6,643.34	-2,500.44	3,906.16	14,443,593.02	1,710,944.51	39.77140430	-80.74899579	
14,047.00	89.98	149.24	6,643.56	-2,582.15	3,954.62	14,443,511.31	1,710,992.98	39.77117954	-80.74882412	
14,141.00	88.75	149.76	6,644.60	-2,663.14	4,002.33	14,443,430.33	1,711,040.68	39.77095676	-80.74865516	
14,236.00	88.79	149.50	6,646.64	-2,745.08	4,050.35	14,443,348.38	1,711,088.70	39.77073134	-80.74848508	
14,331.00	89.32	149.67	6,648.21	-2,827.00	4,098.43	14,443,266.47	1,711,136.79	39.77050601	-80.74831476	
14,425.00	89.63	149.41	6,649.07	-2,908.02	4,146.08	14,443,185.44	1,711,184.44	39.77028313	-80.74814599	
14,520.00	90.42	149.15	6,649.03	-2,989.69	4,194.61	14,443,103.78	1,711,232.97	39.77005848	-80.74797410	
14,615.00	90.95	149.24	6,647.89	-3,071.28	4,243.26	14,443,022.18	1,711,281.62	39.76983403	-80.74780179	
14,710.00	91.34	148.88	6,645.99	-3,152.74	4,292.09	14,442,940.72	1,711,330.45	39.76960992	-80.74762882	
14,805.00	89.71	149.59	6,645.12	-3,234.37	4,340.68	14,442,859.10	1,711,379.04	39.76938538	-80.74745671	
14,900.00	88.57	149.76	6,646.55	-3,316.36	4,388.64	14,442,777.10	1,711,427.00	39.76915984	-80.74728686	
14,996.00	88.57	149.67	6,648.95	-3,399.23	4,437.04	14,442,694.23	1,711,475.40	39.76893188	-80.74711545	
15,091.00	88.66	149.59	6,651.24	-3,481.17	4,485.06	14,442,612.29	1,711,523.42	39.76870647	-80.74694540	
15,135.00	88.75	149.24	6,652.24	-3,519.04	4,507.44	14,442,574.42	1,711,545.80	39.76860230	-80.74686612	
Survey @ 15135.00 MD 6652.24 TVD										
15,190.00	88.75	149.24	6,653.44	-3,566.29	4,535.56	14,442,527.17	1,711,573.92	39.76847232	-80.74676652	
Survey projected to 15190.00 MD 6653.44 TVD										

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
4,194.00	3,819.33	1,163.63	128.32	Tie into original hole @ 4194 MD	
15,135.00	6,652.24	-3,519.04	4,507.44	Survey @ 15135.00 MD 6652.24 TVD	
15,190.00	6,653.44	-3,566.29	4,535.56	Survey projected to 15190.00 MD 6653.44 TVD	

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