



Well: Old Crow N-04 HM (slot N)
 Site: Old Crow Pad
 Project: Marshall County, West Virginia.
 Design: rev3

SECTION DETAILS

Sp	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	V Sect	Annotation
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	1732.50	0.00	0.00	1732.50	0.00	0.00	0.00	0.00	0.00	KOP Begin 2°/100' build
3	3489.68	35.14	21.85	3381.55	484.69	194.40	2.00	21.85	389.93	Begin 35.14° tangent
4	7002.30	35.14	21.85	6253.87	2361.33	947.08	0.00	0.00	1899.70	Begin 8°/100' build/turn
5	7274.36	50.00	357.94	6454.96	2540.30	972.79	8.00	-56.88	2059.32	Begin 10°/100' build/turn
6	7758.41	91.00	329.75	6616.00	2959.88	835.98	10.00	-39.17	2500.43	Begin 91.00° lateral
7	17672.05	91.00	329.75	6443.00	11522.24	-4157.63	0.00	0.00	12249.41	PBHL/TD 17672.05 MD 6443.00 TVD

DESIGN TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Shape
BHL Old Crow N-04H r3 - plan hits target center	6443.00	11522.24	-4157.63	14457670.56	1702817.15	39.81012400	-80.77779600	Point
LP Old Crow N-04H 50 E r3 - plan hits target center	6616.00	2959.88	835.98	14449108.19	1707810.76	39.78657406	-80.76009593	Point

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	V Sect	Annotation
186.00	0.40	269.14	186.00	-0.01	-0.65	0.21	MWD surveys
17597.00	91.25	328.82	6509.89	11469.42	-4132.63	12191.24	Survey @ 17597.00 MD 6509.89 TVD
17655.00	91.25	328.82	6508.62	11519.03	-4162.65	12248.09	Survey Proj. to 17655.00 MD 6508.62 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+32.5 @ 1297.50usft

Northing	Easting	Latitude	Longitude
14446148.32	1706974.78	39.77845155	-80.76309964

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.77°

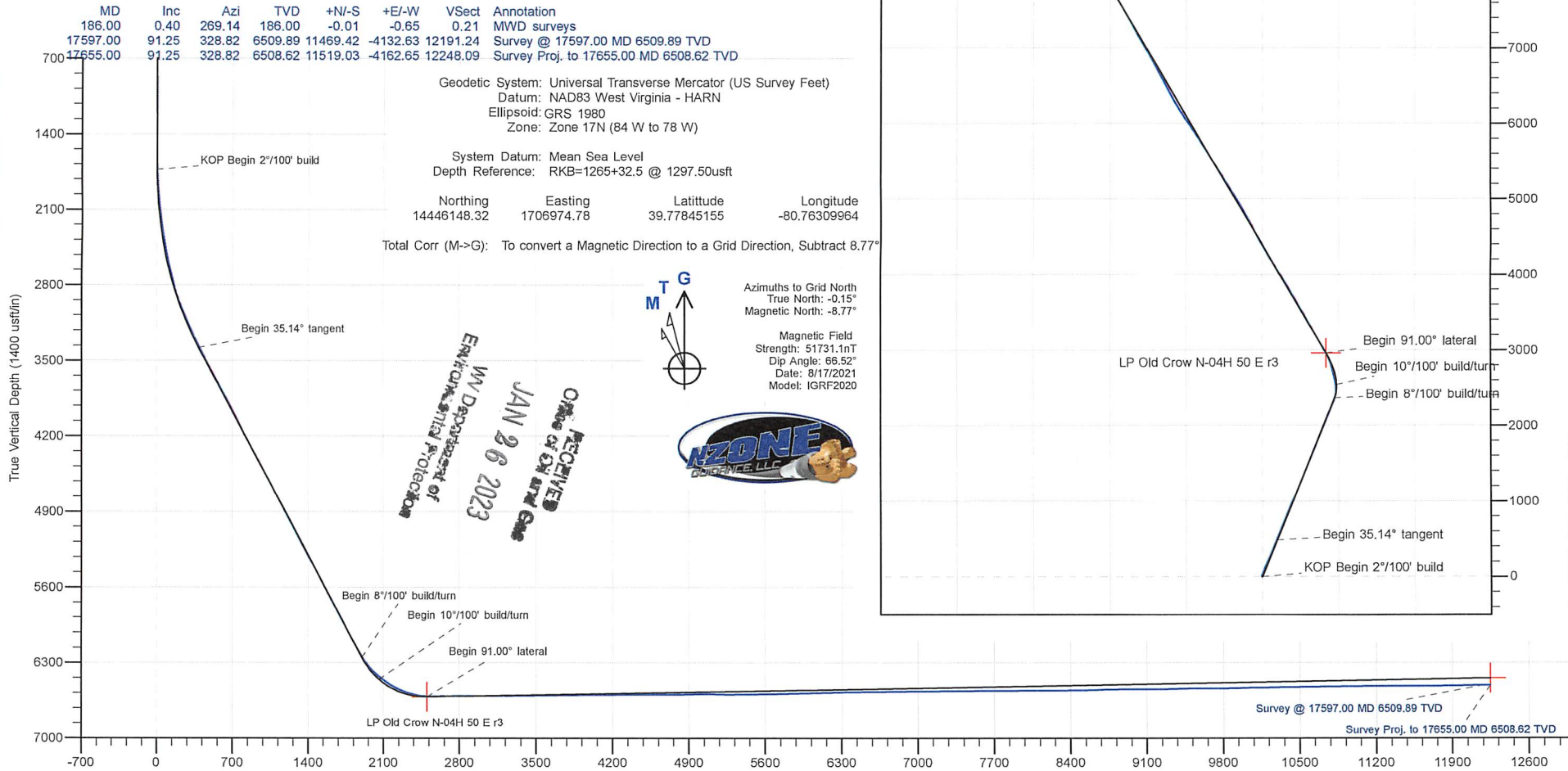


Azimuths to Grid North
 True North: -0.15°
 Magnetic North: -8.77°

Magnetic Field
 Strength: 51731.1nT
 Dip Angle: 66.52°
 Date: 8/17/2021
 Model: IGRF2020



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Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-04 HM (slot N)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+32.5 @ 1297.50usft
Site:	Old Crow Pad	MD Reference:	RKB=1265+32.5 @ 1297.50usft
Well:	Old Crow N-04 HM (slot N)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

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:	0.15 °

Well	Old Crow N-04 HM (slot N)					
Well Position	+N/-S	0.00 usft	Northing:	14,446,148.32 usft	Latitude:	39.77845155
	+E/-W	0.00 usft	Easting:	1,706,974.78 usft	Longitude:	-80.76309964
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)
	IGRF2020	8/17/2021	-8.62	66.52	51,731.09107163

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	340.16	

Survey Program	Date	12/25/2021			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
186.00	1,012.00	MWD surf (Original Hole)	MWD	MWD - Standard	
1,026.00	2,830.00	MWD int (Original Hole)	MWD	MWD - Standard	
2,877.00	17,597.00	MWD (Original Hole)	MWD	MWD - Standard	
17,655.00	17,655.00	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)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
0.00	0.00	0.00	0.00	0.00	0.00	14,446,148.32	1,706,974.78	39.77845155	-80.76309964	
186.00	0.40	269.14	186.00	-0.01	-0.65	14,446,148.31	1,706,974.13	39.77845153	-80.76310195	
MWD surveys										
233.00	0.24	316.46	233.00	0.06	-0.88	14,446,148.38	1,706,973.90	39.77845172	-80.76310278	
275.00	0.17	288.70	275.00	0.14	-1.00	14,446,148.46	1,706,973.78	39.77845195	-80.76310320	
322.00	0.15	358.60	322.00	0.23	-1.07	14,446,148.55	1,706,973.71	39.77845218	-80.76310344	
366.00	0.03	110.71	366.00	0.28	-1.06	14,446,148.60	1,706,973.72	39.77845233	-80.76310341	
413.00	0.14	3.85	413.00	0.33	-1.04	14,446,148.65	1,706,973.74	39.77845247	-80.76310335	
457.00	0.08	36.52	457.00	0.41	-1.02	14,446,148.73	1,706,973.76	39.77845269	-80.76310327	

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-04 HM (slot N)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+32.5 @ 1297.50usft
Site:	Old Crow Pad	MD Reference:	RKB=1265+32.5 @ 1297.50usft
Well:	Old Crow N-04 HM (slot N)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
504.00	0.08	173.87	504.00	0.41	-1.00	14,446,148.72	1,706,973.78	39.77845267	-80.76310319	
548.00	0.10	329.50	548.00	0.41	-1.01	14,446,148.73	1,706,973.77	39.77845268	-80.76310325	
595.00	0.17	246.71	595.00	0.42	-1.10	14,446,148.73	1,706,973.68	39.77845270	-80.76310355	
639.00	0.03	278.57	639.00	0.39	-1.17	14,446,148.71	1,706,973.61	39.77845264	-80.76310380	
686.00	0.17	290.41	686.00	0.42	-1.25	14,446,148.74	1,706,973.53	39.77845271	-80.76310408	
730.00	0.03	207.74	730.00	0.43	-1.32	14,446,148.75	1,706,973.47	39.77845274	-80.76310432	
777.00	0.12	270.61	777.00	0.42	-1.37	14,446,148.74	1,706,973.41	39.77845271	-80.76310451	
824.00	0.17	310.56	824.00	0.47	-1.47	14,446,148.78	1,706,973.31	39.77845284	-80.76310488	
871.00	0.17	295.35	871.00	0.54	-1.59	14,446,148.86	1,706,973.19	39.77845305	-80.76310529	
918.00	0.10	257.93	918.00	0.56	-1.69	14,446,148.88	1,706,973.09	39.77845311	-80.76310566	
1,012.00	0.12	314.01	1,012.00	0.61	-1.84	14,446,148.93	1,706,972.94	39.77845325	-80.76310619	
1,026.00	0.07	161.70	1,026.00	0.62	-1.85	14,446,148.93	1,706,972.93	39.77845326	-80.76310622	
1,074.00	0.13	230.76	1,074.00	0.55	-1.88	14,446,148.87	1,706,972.90	39.77845308	-80.76310634	
1,121.00	0.31	293.87	1,121.00	0.57	-2.04	14,446,148.89	1,706,972.74	39.77845313	-80.76310690	
1,168.00	0.51	259.07	1,167.99	0.58	-2.36	14,446,148.90	1,706,972.42	39.77845317	-80.76310804	
1,215.00	0.57	248.96	1,214.99	0.46	-2.79	14,446,148.78	1,706,972.00	39.77845283	-80.76310955	
1,262.00	0.48	258.30	1,261.99	0.34	-3.20	14,446,148.65	1,706,971.59	39.77845250	-80.76311102	
1,309.00	0.37	239.35	1,308.99	0.22	-3.52	14,446,148.54	1,706,971.26	39.77845218	-80.76311217	
1,356.00	0.26	255.91	1,355.99	0.11	-3.75	14,446,148.43	1,706,971.03	39.77845189	-80.76311300	
1,403.00	0.51	289.87	1,402.99	0.16	-4.05	14,446,148.48	1,706,970.73	39.77845202	-80.76311407	
1,451.00	0.55	269.52	1,450.99	0.23	-4.49	14,446,148.55	1,706,970.30	39.77845222	-80.76311560	
1,498.00	0.52	271.66	1,497.98	0.23	-4.92	14,446,148.55	1,706,969.86	39.77845223	-80.76311717	
1,545.00	0.44	288.40	1,544.98	0.30	-5.31	14,446,148.62	1,706,969.47	39.77845241	-80.76311853	
1,592.00	0.81	317.59	1,591.98	0.60	-5.70	14,446,148.92	1,706,969.08	39.77845324	-80.76311994	
1,639.00	0.81	324.81	1,638.97	1.12	-6.12	14,446,149.44	1,706,968.66	39.77845466	-80.76312141	
1,686.00	0.88	321.96	1,685.97	1.67	-6.53	14,446,149.99	1,706,968.25	39.77845619	-80.76312288	
1,733.00	0.99	342.14	1,732.96	2.34	-6.88	14,446,150.66	1,706,967.90	39.77845804	-80.76312411	
1,780.00	1.46	359.87	1,779.95	3.33	-7.01	14,446,151.65	1,706,967.78	39.77846074	-80.76312455	
1,827.00	2.17	17.88	1,826.93	4.77	-6.73	14,446,153.09	1,706,968.05	39.77846471	-80.76312357	
1,874.00	2.96	21.00	1,873.88	6.75	-6.03	14,446,155.07	1,706,968.76	39.77847014	-80.76312103	
1,921.00	4.00	18.32	1,920.79	9.44	-5.08	14,446,157.76	1,706,969.71	39.77847752	-80.76311762	
1,968.00	5.19	20.06	1,967.64	13.00	-3.83	14,446,161.32	1,706,970.95	39.77848727	-80.76311316	
2,015.00	6.57	21.42	2,014.39	17.50	-2.12	14,446,165.82	1,706,972.66	39.77849962	-80.76310702	
2,062.00	7.64	21.20	2,061.03	22.91	-0.01	14,446,171.23	1,706,974.77	39.77851448	-80.76309946	
2,108.00	8.40	22.36	2,106.58	28.87	2.38	14,446,177.19	1,706,977.16	39.77853082	-80.76309091	
2,155.00	9.70	22.75	2,153.00	35.70	5.21	14,446,184.02	1,706,980.00	39.77854955	-80.76308075	
2,202.00	10.54	22.94	2,199.26	43.31	8.42	14,446,191.63	1,706,983.20	39.77857043	-80.76306927	
2,249.00	11.73	21.94	2,245.38	51.70	11.88	14,446,200.02	1,706,986.66	39.77859344	-80.76305687	
2,297.00	12.37	21.70	2,292.32	61.00	15.60	14,446,209.32	1,706,990.39	39.77861896	-80.76304353	
2,344.00	12.80	19.34	2,338.19	70.59	19.19	14,446,218.91	1,706,993.97	39.77864528	-80.76303067	
2,391.00	13.19	18.92	2,383.99	80.58	22.65	14,446,228.90	1,706,997.44	39.77867267	-80.76301825	
2,438.00	14.14	21.03	2,429.66	91.01	26.45	14,446,239.33	1,707,001.23	39.77870129	-80.76300464	
2,485.00	15.12	22.68	2,475.13	102.02	30.88	14,446,250.34	1,707,005.66	39.77873151	-80.76298879	
2,532.00	16.15	23.20	2,520.39	113.69	35.81	14,446,262.01	1,707,010.60	39.77876351	-80.76297110	
2,580.00	16.91	22.82	2,566.41	126.26	41.15	14,446,274.58	1,707,015.93	39.77879799	-80.76295198	
2,627.00	17.06	21.06	2,611.36	138.99	46.28	14,446,287.31	1,707,021.06	39.77883292	-80.76293361	
2,674.00	17.33	21.04	2,656.26	151.96	51.27	14,446,300.28	1,707,026.05	39.77886850	-80.76291572	
2,720.00	17.96	22.46	2,700.09	164.91	56.44	14,446,313.23	1,707,031.22	39.77890402	-80.76289720	
2,768.00	19.21	23.78	2,745.59	178.97	62.45	14,446,327.29	1,707,037.23	39.77894261	-80.76287567	
2,810.00	20.22	23.79	2,785.13	191.94	68.17	14,446,340.26	1,707,042.95	39.77897817	-80.76285521	
2,830.00	20.96	25.11	2,803.85	198.34	71.08	14,446,346.66	1,707,045.86	39.77899573	-80.76284479	
2,877.00	22.71	25.82	2,847.48	214.12	78.60	14,446,362.44	1,707,053.38	39.77903901	-80.76281787	
2,924.00	23.87	25.84	2,890.65	230.85	86.69	14,446,379.17	1,707,061.48	39.77908489	-80.76278890	
2,971.00	25.20	23.52	2,933.40	248.58	94.83	14,446,396.90	1,707,069.62	39.77913353	-80.76275976	
3,019.00	26.90	21.02	2,976.53	268.09	102.81	14,446,416.41	1,707,077.59	39.77918705	-80.76273120	



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-04 HM (slot N)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+32.5 @ 1297.50usft
Site:	Old Crow Pad	MD Reference:	RKB=1265+32.5 @ 1297.50usft
Well:	Old Crow N-04 HM (slot N)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
3,067.00	28.30	21.11	3,019.06	288.84	110.80	14,446,437.16	1,707,085.58	39.77924398	-80.76270255
3,161.00	29.48	21.07	3,101.36	331.21	127.14	14,446,479.53	1,707,101.92	39.77936022	-80.76264399
3,208.00	30.65	21.59	3,142.04	353.14	135.71	14,446,501.46	1,707,110.49	39.77942039	-80.76261329
3,255.00	30.85	23.06	3,182.43	375.37	144.83	14,446,523.69	1,707,119.62	39.77948137	-80.76258059
3,302.00	30.63	22.41	3,222.83	397.53	154.12	14,446,545.85	1,707,128.90	39.77954215	-80.76254734
3,350.00	31.88	21.88	3,263.86	420.60	163.51	14,446,568.91	1,707,138.29	39.77960543	-80.76251371
3,397.00	33.55	22.23	3,303.40	444.14	173.04	14,446,592.46	1,707,147.83	39.77967001	-80.76247953
3,444.00	34.14	22.43	3,342.44	468.35	182.99	14,446,616.67	1,707,157.77	39.77973644	-80.76244391
3,538.00	33.92	21.37	3,420.34	517.16	202.61	14,446,665.48	1,707,177.39	39.77987033	-80.76237360
3,633.00	33.84	21.73	3,499.21	566.41	222.06	14,446,714.73	1,707,196.85	39.78000546	-80.76230390
3,728.00	35.69	23.02	3,577.25	616.49	242.70	14,446,764.81	1,707,217.48	39.78014285	-80.76222999
3,821.00	36.64	22.13	3,652.33	667.17	263.76	14,446,815.49	1,707,238.54	39.78028186	-80.76215454
3,916.00	35.46	20.53	3,729.14	719.24	284.10	14,446,867.56	1,707,258.89	39.78042471	-80.76208164
4,011.00	34.09	23.01	3,807.18	769.55	304.18	14,446,917.87	1,707,278.96	39.78056274	-80.76200972
4,106.00	35.93	21.88	3,884.98	819.93	324.97	14,446,968.25	1,707,299.75	39.78070094	-80.76193522
4,200.00	34.88	19.46	3,961.60	870.87	344.21	14,447,019.19	1,707,318.99	39.78084069	-80.76186628
4,294.00	33.59	21.99	4,039.32	920.33	362.90	14,447,068.64	1,707,337.68	39.78097637	-80.76179927
4,388.00	34.50	24.62	4,117.21	968.64	383.73	14,447,116.96	1,707,358.51	39.78110891	-80.76172468
4,482.00	35.61	23.15	4,194.16	1,018.01	405.58	14,447,166.33	1,707,380.36	39.78124432	-80.76164644
4,576.00	35.06	23.52	4,270.84	1,067.93	427.11	14,447,216.25	1,707,401.89	39.78138126	-80.76156932
4,670.00	35.32	24.88	4,347.67	1,117.33	449.32	14,447,265.65	1,707,424.10	39.78151678	-80.76148981
4,764.00	35.55	22.62	4,424.26	1,167.21	471.26	14,447,315.53	1,707,446.04	39.78165360	-80.76141123
4,858.00	35.31	22.60	4,500.85	1,217.52	492.21	14,447,365.83	1,707,466.99	39.78179159	-80.76133618
4,952.00	36.00	22.89	4,577.23	1,268.05	513.40	14,447,416.37	1,707,488.18	39.78193021	-80.76126029
5,047.00	35.74	20.64	4,654.22	1,319.73	534.04	14,447,468.05	1,707,508.82	39.78207201	-80.76118633
5,140.00	34.21	21.56	4,730.42	1,369.47	553.22	14,447,517.79	1,707,528.00	39.78220845	-80.76111758
5,235.00	35.12	22.24	4,808.55	1,419.60	573.38	14,447,567.92	1,707,548.16	39.78234598	-80.76104536
5,329.00	35.06	21.18	4,885.47	1,469.80	593.36	14,447,618.12	1,707,568.15	39.78248370	-80.76097373
5,378.00	34.25	20.11	4,925.78	1,495.88	603.19	14,447,664.19	1,707,577.97	39.78255523	-80.76093851
5,434.00	34.11	21.46	4,972.11	1,525.29	614.35	14,447,673.61	1,707,589.14	39.78263592	-80.76089850
5,526.00	35.08	21.02	5,047.84	1,573.97	633.27	14,447,722.29	1,707,608.06	39.78276949	-80.76083068
5,621.00	33.89	22.87	5,126.15	1,623.86	653.36	14,447,772.18	1,707,628.14	39.78290635	-80.76075871
5,714.00	35.25	22.69	5,202.72	1,672.52	673.79	14,447,820.84	1,707,648.57	39.78303982	-80.76068553
5,809.00	36.88	21.64	5,279.51	1,724.31	694.88	14,447,872.63	1,707,669.66	39.78318190	-80.76060997
5,903.00	36.66	22.43	5,354.81	1,776.47	715.99	14,447,924.79	1,707,690.77	39.78332499	-80.76053433
5,998.00	36.00	22.61	5,431.35	1,828.46	737.54	14,447,976.78	1,707,712.33	39.78346761	-80.76045711
6,092.00	35.21	22.87	5,507.77	1,878.93	758.70	14,448,027.25	1,707,733.48	39.78360606	-80.76038133
6,186.00	34.37	21.38	5,584.97	1,928.61	778.90	14,448,076.93	1,707,753.69	39.78374234	-80.76030894
6,280.00	34.11	21.90	5,662.68	1,977.77	798.41	14,448,126.09	1,707,773.19	39.78387721	-80.76023905
6,375.00	34.90	20.85	5,740.97	2,027.88	818.01	14,448,176.20	1,707,792.80	39.78401469	-80.76016877
6,470.00	35.30	21.73	5,818.69	2,078.78	837.85	14,448,227.10	1,707,812.63	39.78415432	-80.76009768
6,564.00	35.12	22.61	5,895.49	2,128.97	858.30	14,448,277.29	1,707,833.08	39.78429201	-80.76002441
6,659.00	34.64	21.90	5,973.43	2,179.25	878.88	14,448,327.57	1,707,853.66	39.78442993	-80.75995068
6,753.00	35.03	21.64	6,050.58	2,229.11	898.79	14,448,377.43	1,707,873.57	39.78456673	-80.75987932
6,847.00	35.69	21.20	6,127.24	2,279.75	918.66	14,448,428.07	1,707,893.44	39.78470566	-80.75980813
6,942.00	35.87	21.73	6,204.31	2,331.44	938.98	14,448,479.76	1,707,913.76	39.78484747	-80.75973528
6,989.00	36.35	18.56	6,242.29	2,357.44	948.51	14,448,505.76	1,707,923.30	39.78491879	-80.75970110
7,034.00	39.96	12.41	6,277.68	2,384.22	955.87	14,448,532.54	1,707,930.65	39.78499227	-80.75967467
7,081.00	42.77	10.21	6,312.95	2,414.67	961.94	14,448,562.99	1,707,936.73	39.78507586	-80.75965275
7,128.00	44.53	5.64	6,346.97	2,446.79	966.39	14,448,595.11	1,707,941.18	39.78516402	-80.75963661
7,175.00	47.52	359.84	6,379.61	2,480.54	967.97	14,448,628.86	1,707,942.75	39.78525671	-80.75963069
7,221.00	50.02	355.98	6,409.93	2,515.10	966.68	14,448,663.42	1,707,941.46	39.78535162	-80.75963493
7,268.00	52.04	351.67	6,439.50	2,551.41	962.73	14,448,699.73	1,707,937.52	39.78545137	-80.75964863
7,315.00	55.12	348.33	6,467.40	2,588.64	956.15	14,448,736.95	1,707,930.93	39.78555365	-80.75967172
7,362.00	57.14	347.01	6,493.60	2,626.76	947.81	14,448,775.07	1,707,922.59	39.78565840	-80.75970104



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-04 HM (slot N)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+32.5 @ 1297.50usft
Site:	Old Crow Pad	MD Reference:	RKB=1265+32.5 @ 1297.50usft
Well:	Old Crow N-04 HM (slot N)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

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 Old Crow N-04 and Gas
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 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
7,409.00	59.43	346.84	6,518.30	2,665.70	938.76	14,448,814.02	1,707,913.55	39.78576542	-80.75973286
7,456.00	63.08	346.57	6,540.90	2,705.79	929.29	14,448,854.11	1,707,904.07	39.78587560	-80.75976621
7,504.00	67.60	345.52	6,560.93	2,748.12	918.76	14,448,896.43	1,707,893.55	39.78599191	-80.75980327
7,551.00	71.16	343.67	6,577.48	2,790.51	907.07	14,448,938.83	1,707,881.86	39.78610843	-80.75984448
7,598.00	75.03	340.07	6,591.14	2,833.23	893.07	14,448,981.55	1,707,867.85	39.78622584	-80.75989392
7,645.00	78.95	336.73	6,601.73	2,875.79	876.21	14,449,024.11	1,707,850.99	39.78634284	-80.75995353
7,692.00	82.99	333.12	6,609.10	2,917.81	856.54	14,449,066.13	1,707,831.32	39.78645839	-80.76002316
7,739.00	86.68	330.84	6,613.33	2,959.12	834.55	14,449,107.44	1,707,809.33	39.78657201	-80.76010103
7,787.00	91.43	330.84	6,614.13	3,001.02	811.17	14,449,149.34	1,707,785.96	39.78668724	-80.76018385
7,881.00	92.22	330.40	6,611.13	3,082.89	765.08	14,449,231.21	1,707,739.86	39.78691241	-80.76034714
7,975.00	90.77	329.96	6,608.68	3,164.41	718.35	14,449,312.73	1,707,693.14	39.78713664	-80.76051270
8,068.00	91.16	329.87	6,607.11	3,244.87	671.74	14,449,393.19	1,707,646.52	39.78735795	-80.76067786
8,162.00	90.42	330.31	6,605.82	3,326.34	624.87	14,449,474.66	1,707,599.66	39.78758204	-80.76084392
8,256.00	89.54	330.93	6,605.85	3,408.25	578.76	14,449,556.57	1,707,553.54	39.78780732	-80.76100731
8,350.00	89.67	330.75	6,606.50	3,490.34	532.96	14,449,638.66	1,707,507.74	39.78803308	-80.76116956
8,443.00	90.15	330.49	6,606.64	3,571.38	487.33	14,449,719.69	1,707,462.11	39.78825597	-80.76133121
8,537.00	90.68	331.02	6,605.96	3,653.39	441.41	14,449,801.71	1,707,416.19	39.78848154	-80.76149390
8,632.00	91.34	330.58	6,604.29	3,736.31	395.07	14,449,884.62	1,707,369.85	39.78870959	-80.76165808
8,726.00	91.91	328.73	6,601.62	3,817.39	347.60	14,449,965.71	1,707,322.39	39.78893262	-80.76182628
8,819.00	90.07	329.17	6,600.02	3,897.05	299.64	14,450,045.37	1,707,274.43	39.78915173	-80.76199625
8,913.00	90.37	328.47	6,599.66	3,977.47	250.98	14,450,125.79	1,707,225.76	39.78937294	-80.76216874
9,007.00	90.37	327.32	6,599.05	4,057.09	201.02	14,450,205.41	1,707,175.81	39.78959197	-80.76234582
9,102.00	90.15	328.55	6,598.62	4,137.60	150.59	14,450,285.92	1,707,125.37	39.78981343	-80.76252459
9,196.00	90.29	328.47	6,598.26	4,217.75	101.49	14,450,366.07	1,707,076.27	39.79003391	-80.76269862
9,290.00	89.80	329.70	6,598.18	4,298.40	53.20	14,450,446.72	1,707,027.98	39.79025573	-80.76286978
9,384.00	89.93	328.99	6,598.40	4,379.26	5.27	14,450,527.58	1,706,980.05	39.79047815	-80.76303963
9,478.00	89.89	330.93	6,598.55	4,460.63	-41.78	14,450,608.95	1,706,933.00	39.79070196	-80.76320638
9,572.00	91.25	332.16	6,597.62	4,543.27	-86.57	14,450,691.59	1,706,888.21	39.79092923	-80.76336503
9,666.00	91.74	332.07	6,595.16	4,626.32	-130.52	14,450,774.64	1,706,844.27	39.79115764	-80.76352070
9,761.00	90.29	331.37	6,593.48	4,709.97	-175.52	14,450,858.29	1,706,799.26	39.79138768	-80.76368011
9,855.00	89.76	332.25	6,593.44	4,792.82	-219.92	14,450,941.14	1,706,754.86	39.79161553	-80.76383741
9,949.00	89.67	329.70	6,593.91	4,875.00	-265.53	14,451,023.32	1,706,709.26	39.79184156	-80.76399899
10,043.00	90.07	329.26	6,594.12	4,955.98	-313.26	14,451,104.30	1,706,661.52	39.79206429	-80.76416817
10,137.00	90.59	328.82	6,593.58	5,036.59	-361.62	14,451,184.90	1,706,613.16	39.79228601	-80.76433956
10,231.00	91.34	329.17	6,592.00	5,117.14	-410.03	14,451,265.46	1,706,564.75	39.79250759	-80.76451116
10,325.00	89.85	328.73	6,591.02	5,197.67	-458.51	14,451,345.99	1,706,516.27	39.79272908	-80.76468299
10,419.00	88.92	328.47	6,592.03	5,277.90	-507.48	14,451,426.21	1,706,467.30	39.79294976	-80.76485658
10,513.00	89.32	327.85	6,593.47	5,357.74	-557.07	14,451,506.06	1,706,417.72	39.79316940	-80.76503235
10,607.00	89.49	329.17	6,594.45	5,437.89	-606.16	14,451,586.21	1,706,368.62	39.79338987	-80.76520639
10,702.00	90.15	329.35	6,594.75	5,519.54	-654.72	14,451,667.86	1,706,320.06	39.79361445	-80.76537850
10,796.00	91.56	328.55	6,593.35	5,600.06	-703.20	14,451,748.38	1,706,271.58	39.79383593	-80.76555033
10,891.00	90.46	328.47	6,591.67	5,681.06	-752.81	14,451,829.38	1,706,221.97	39.79405872	-80.76572620
10,985.00	91.74	328.20	6,589.87	5,761.05	-802.15	14,451,909.37	1,706,172.63	39.79427875	-80.76590110
11,079.00	90.55	326.44	6,587.99	5,840.15	-852.89	14,451,988.47	1,706,121.89	39.79449634	-80.76608011
11,173.00	91.21	325.65	6,586.54	5,918.11	-905.39	14,452,066.43	1,706,069.40	39.79471082	-80.76626717
11,268.00	91.12	324.69	6,584.61	5,996.07	-959.63	14,452,144.39	1,706,015.15	39.79492532	-80.76645957
11,362.00	93.41	325.04	6,580.90	6,072.88	-1,013.69	14,452,221.20	1,705,961.10	39.79513664	-80.76665129
11,456.00	91.21	328.11	6,577.11	6,151.26	-1,065.41	14,452,299.57	1,705,909.37	39.79535225	-80.76683472
11,550.00	91.38	328.82	6,574.98	6,231.35	-1,114.56	14,452,379.67	1,705,860.22	39.79557257	-80.76700896
11,645.00	90.68	330.93	6,573.28	6,313.50	-1,162.23	14,452,461.82	1,705,812.55	39.79579852	-80.76717791
11,737.00	90.81	330.93	6,572.08	6,393.91	-1,206.93	14,452,542.23	1,705,767.85	39.79601965	-80.76733629
11,831.00	90.07	331.89	6,571.36	6,476.44	-1,251.91	14,452,624.76	1,705,722.87	39.79624663	-80.76749567
11,926.00	90.64	332.51	6,570.77	6,560.47	-1,296.21	14,452,708.79	1,705,678.57	39.79647772	-80.76765262
12,021.00	90.81	333.04	6,569.57	6,644.94	-1,339.67	14,452,793.26	1,705,635.11	39.79671000	-80.76780656
12,115.00	90.20	331.98	6,568.74	6,728.32	-1,383.06	14,452,876.64	1,705,591.72	39.79693930	-80.76796026



Survey Report - Geographic



Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-04 HM (slot N)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+32.5 @ 1297.50usft
Site:	Old Crow Pad	MD Reference:	RKB=1265+32.5 @ 1297.50usft
Well:	Old Crow N-04 HM (slot N)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
12,210.00	90.24	332.25	6,568.37	6,812.29	-1,427.49	14,452,960.61	1,705,547.29	39.79717022	-80.76811767
12,304.00	90.33	332.07	6,567.91	6,895.41	-1,471.39	14,453,043.73	1,705,503.39	39.79739880	-80.76827319
12,398.00	90.42	330.49	6,567.29	6,977.84	-1,516.56	14,453,126.16	1,705,458.23	39.79762550	-80.76843324
12,492.00	91.25	330.93	6,565.92	7,059.82	-1,562.54	14,453,208.14	1,705,412.24	39.79785094	-80.76859619
12,586.00	91.91	330.75	6,563.33	7,141.87	-1,608.32	14,453,290.19	1,705,366.46	39.79807661	-80.76875844
12,681.00	90.90	329.87	6,561.00	7,224.37	-1,655.36	14,453,372.69	1,705,319.42	39.79830352	-80.76892516
12,775.00	89.80	330.75	6,560.43	7,306.03	-1,701.92	14,453,454.35	1,705,272.87	39.79852810	-80.76909016
12,869.00	89.93	331.10	6,560.65	7,388.18	-1,747.60	14,453,536.50	1,705,227.19	39.79875404	-80.76925204
12,964.00	89.85	329.70	6,560.83	7,470.78	-1,794.52	14,453,619.10	1,705,180.26	39.79898121	-80.76941835
13,058.00	89.54	329.78	6,561.33	7,551.97	-1,841.89	14,453,700.29	1,705,132.89	39.79920452	-80.76958625
13,152.00	89.76	329.35	6,561.90	7,633.02	-1,889.50	14,453,781.34	1,705,085.28	39.79942743	-80.76975503
13,246.00	90.15	328.73	6,561.98	7,713.63	-1,937.86	14,453,861.95	1,705,036.92	39.79964914	-80.76992646
13,341.00	90.59	329.08	6,561.36	7,794.97	-1,986.92	14,453,943.29	1,704,987.86	39.79987288	-80.77010040
13,433.00	90.88	328.38	6,560.34	7,873.60	-2,034.67	14,454,021.92	1,704,940.11	39.80008916	-80.77026969
13,528.00	91.12	328.55	6,558.85	7,954.56	-2,084.36	14,454,102.88	1,704,890.43	39.80031185	-80.77044584
13,622.00	90.11	328.55	6,557.84	8,034.75	-2,133.40	14,454,183.07	1,704,841.39	39.80053240	-80.77061971
13,717.00	89.63	328.82	6,558.06	8,115.91	-2,182.77	14,454,264.23	1,704,792.01	39.80075564	-80.77079477
13,811.00	91.38	330.14	6,557.23	8,196.88	-2,230.50	14,454,345.20	1,704,744.28	39.80097833	-80.77096398
13,905.00	91.47	330.05	6,554.89	8,278.34	-2,277.35	14,454,426.66	1,704,697.43	39.80120237	-80.77113005
13,999.00	91.43	329.78	6,552.51	8,359.65	-2,324.46	14,454,507.97	1,704,650.32	39.80142600	-80.77129702
14,094.00	91.21	329.26	6,550.33	8,441.50	-2,372.63	14,454,589.82	1,704,602.15	39.80165112	-80.77146780
14,188.00	90.77	329.43	6,548.70	8,522.35	-2,420.56	14,454,670.67	1,704,554.23	39.80187350	-80.77163769
14,282.00	90.73	328.38	6,547.47	8,602.83	-2,469.10	14,454,751.15	1,704,505.69	39.80209487	-80.77180979
14,375.00	89.76	329.61	6,547.07	8,682.54	-2,517.00	14,454,830.86	1,704,457.78	39.80231411	-80.77197963
14,469.00	89.63	329.70	6,547.57	8,763.66	-2,564.49	14,454,911.98	1,704,410.29	39.80253722	-80.77214797
14,564.00	89.93	329.43	6,547.94	8,845.57	-2,612.61	14,454,993.89	1,704,362.17	39.80276250	-80.77231857
14,658.00	91.96	330.40	6,546.39	8,926.89	-2,659.72	14,455,075.21	1,704,315.06	39.80298615	-80.77248558
14,750.00	91.69	329.78	6,543.46	9,006.60	-2,705.58	14,455,154.92	1,704,269.21	39.80320537	-80.77264811
14,845.00	91.03	328.91	6,541.20	9,088.30	-2,754.00	14,455,236.62	1,704,220.78	39.80343007	-80.77281979
14,939.00	90.42	329.96	6,540.01	9,169.23	-2,801.79	14,455,317.55	1,704,172.99	39.80365267	-80.77298924
15,033.00	90.42	330.49	6,539.33	9,250.82	-2,848.47	14,455,399.14	1,704,126.31	39.80387705	-80.77315470
15,127.00	89.63	330.22	6,539.28	9,332.51	-2,894.97	14,455,480.83	1,704,079.82	39.80410173	-80.77331951
15,221.00	90.86	331.02	6,538.88	9,414.42	-2,941.08	14,455,562.74	1,704,033.70	39.80432699	-80.77348297
15,315.00	91.91	331.72	6,536.61	9,496.90	-2,986.11	14,455,645.22	1,703,988.67	39.80455382	-80.77364255
15,408.00	91.65	331.10	6,533.72	9,578.52	-3,030.59	14,455,726.84	1,703,944.19	39.80477828	-80.77380020
15,501.00	91.08	330.84	6,531.51	9,659.81	-3,075.71	14,455,808.13	1,703,899.08	39.80500184	-80.77396011
15,595.00	90.29	329.43	6,530.38	9,741.32	-3,122.51	14,455,889.64	1,703,852.27	39.80522601	-80.77412603
15,689.00	91.03	329.70	6,529.30	9,822.36	-3,170.12	14,455,970.68	1,703,804.66	39.80544890	-80.77429484
15,782.00	90.46	328.99	6,528.09	9,902.36	-3,217.54	14,456,050.68	1,703,757.25	39.80566892	-80.77446294
15,877.00	91.38	329.08	6,526.57	9,983.81	-3,266.41	14,456,132.13	1,703,708.37	39.80589294	-80.77463623
15,971.00	91.25	328.82	6,524.41	10,064.32	-3,314.88	14,456,212.64	1,703,659.90	39.80611438	-80.77480810
16,064.00	90.55	328.82	6,522.95	10,143.87	-3,363.02	14,456,292.19	1,703,611.76	39.80633319	-80.77497881
16,156.00	90.02	328.64	6,522.49	10,222.51	-3,410.78	14,456,370.83	1,703,564.01	39.80654947	-80.77514814
16,251.00	91.08	329.43	6,521.58	10,303.96	-3,459.65	14,456,452.28	1,703,515.13	39.80677350	-80.77532145
16,366.00	91.21	330.93	6,519.28	10,403.71	-3,516.83	14,456,552.03	1,703,457.96	39.80704784	-80.77552414
16,459.00	90.99	330.66	6,517.49	10,484.87	-3,562.20	14,456,633.19	1,703,412.59	39.80727104	-80.77568496
16,553.00	90.20	330.31	6,516.52	10,566.67	-3,608.50	14,456,714.99	1,703,366.28	39.80749600	-80.77584912
16,647.00	90.11	330.49	6,516.26	10,648.40	-3,654.93	14,456,796.72	1,703,319.85	39.80772077	-80.77601372
16,741.00	89.54	330.93	6,516.55	10,730.38	-3,700.92	14,456,878.70	1,703,273.86	39.80794623	-80.77617674
16,836.00	90.15	330.49	6,516.81	10,813.24	-3,747.40	14,456,961.56	1,703,227.39	39.80817409	-80.77634149
16,930.00	89.67	330.31	6,516.96	10,894.97	-3,793.83	14,457,043.29	1,703,180.96	39.80839887	-80.77650610
17,024.00	90.24	329.78	6,517.03	10,976.41	-3,840.76	14,457,124.73	1,703,134.02	39.80862285	-80.77667250
17,118.00	89.76	329.52	6,517.03	11,057.53	-3,888.26	14,457,205.85	1,703,086.53	39.80884595	-80.77684091
17,213.00	90.90	329.70	6,516.48	11,139.48	-3,936.31	14,457,287.79	1,703,038.47	39.80907132	-80.77701130
17,306.00	90.46	329.43	6,515.38	11,219.65	-3,983.42	14,457,367.97	1,702,991.36	39.80929183	-80.77717833

Company:	Tug Hill Operating LLC	Local Co-ordinate Reference:	Well Old Crow N-04 HM (slot N)
Project:	Marshall County, West Virginia.	TVD Reference:	RKB=1265+32.5 @ 1297.50usft
Site:	Old Crow Pad	MD Reference:	RKB=1265+32.5 @ 1297.50usft
Well:	Old Crow N-04 HM (slot N)	North Reference:	Grid
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original Hole	Database:	DB_Dec2220_v16

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
17,400.00	91.30	329.43	6,513.93	11,300.58	-4,031.22	14,457,448.90	1,702,943.56	39.80951440	-80.77734783	
17,494.00	91.08	328.91	6,511.98	11,381.28	-4,079.39	14,457,529.60	1,702,895.40	39.80973635	-80.77751862	
17,597.00	91.25	328.82	6,509.89	11,469.42	-4,132.63	14,457,617.74	1,702,842.15	39.80997878	-80.77770744	
Survey @ 17597.00 MD 6509.89 TVD										
17,655.00	91.25	328.82	6,508.62	11,519.03	-4,162.65	14,457,667.35	1,702,812.13	39.81011523	-80.77781391	
Survey Proj. to 17655.00 MD 6508.62 TVD										

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
186.00	186.00	-0.01	-0.65	MWD surveys	
17,597.00	6,509.89	11,469.42	-4,132.63	Survey @ 17597.00 MD 6509.89 TVD	
17,655.00	6,508.62	11,519.03	-4,162.65	Survey Proj. to 17655.00 MD 6508.62 TVD	