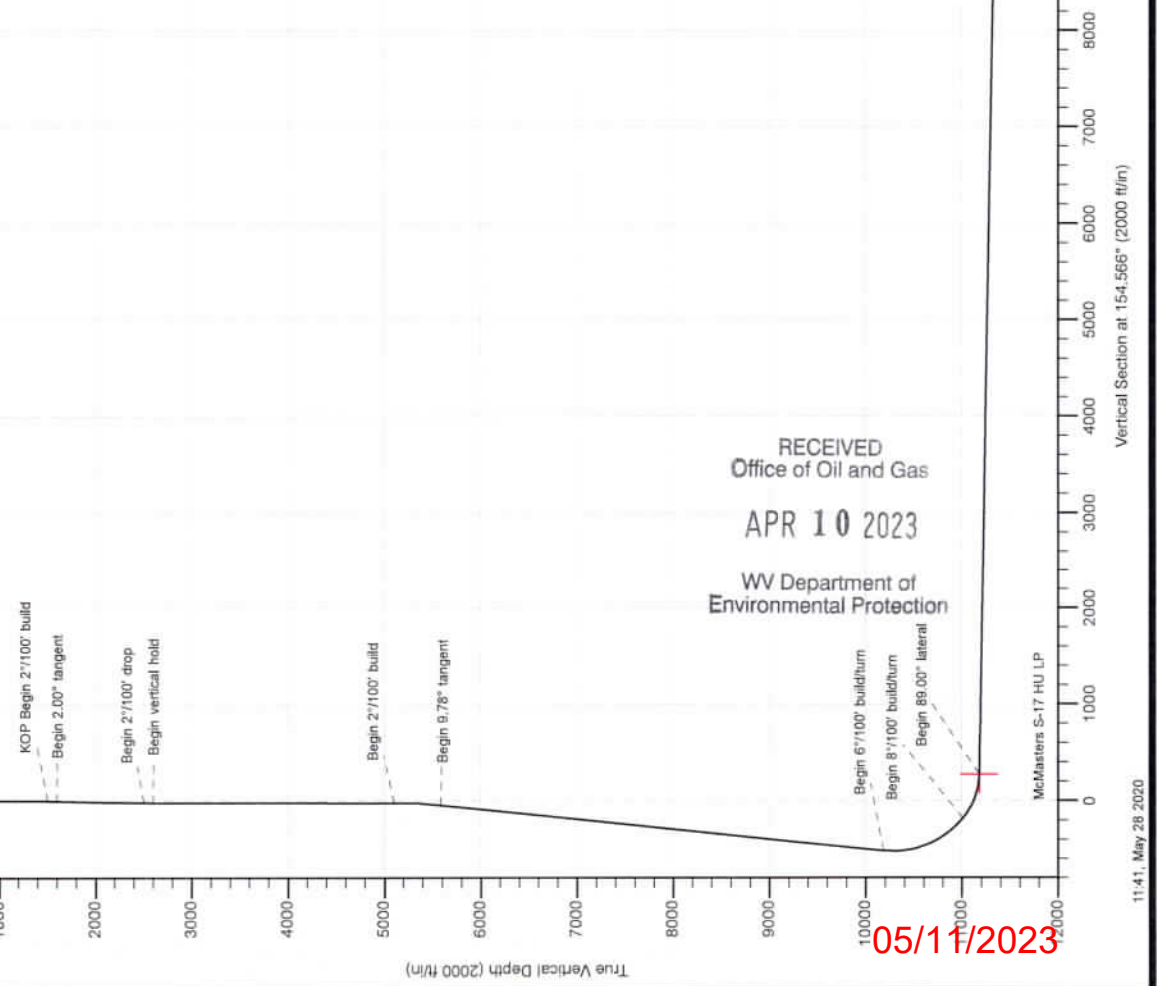


Well: **McMasters S-17 HU (slot G)**  
 Site: **McMasters Shields**  
 Project: **Marshall County, West Virginia**  
 Design: **rev2**  
 Rig:



SECTION DETAILS									
MD	Inc	Azi	TVD	+NLS	+EAW	Dleg	TFace	VSet	Annotation
0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.000	0.00	
1500.00	0.00	0.000	1500.00	0.00	0.00	0.00	0.000	0.00	KOP Begin 2'/'100' build
1600.00	2.00	280.000	1598.98	0.30	-1.77	0.00	0.000	-1.01	Begin 2'/'100' tangent
2500.57	2.00	280.000	2598.98	5.76	-32.67	0.00	0.000	-19.23	Begin 2'/'100' drop
2600.57	0.00	280.000	2598.98	6.06	-34.39	0.00	180.000	-20.25	Begin vertical hold
5000.59	0.00	280.000	5100.00	6.06	-34.39	0.00	280.000	-20.25	Begin 2'/'100' build
5589.51	9.78	281.052	5586.55	14.04	-75.24	0.00	281.052	-41.99	Begin 5.78° tangent
10758.66	50.00	158.024	10187.87	165.07	-393.93	0.00	126.032	-51.89	Begin 8'/'100' buildturn
11688.14	89.00	150.247	11181.00	-583.81	-590.94	0.00	-12.242	-273.47	Begin 89.00° lateral
11683.58	89.00	150.247	11181.00	-583.81	-590.94	0.00	-12.242	-273.47	PBHLTD 22100.25 MD/11363.00 TVD
22100.25	89.00	150.247	11363.00	-9625.88	4577.78	0.00	0.000	106568.97	



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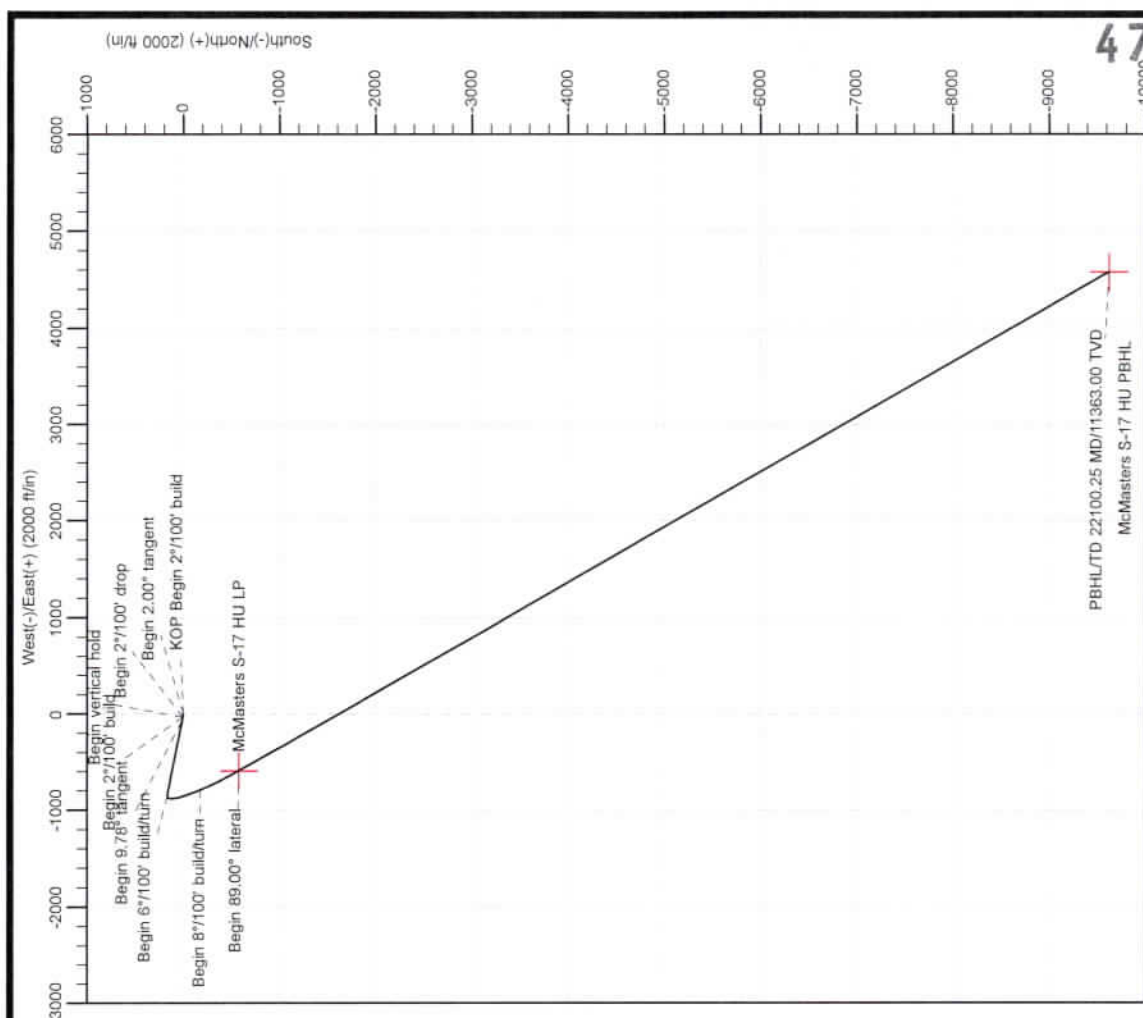


Geodetic System: Universal Transverse Mercator (US Survey Feet)  
 Datum: NAD83 West Virginia - HARN  
 Ellipsoid: GRS 1980  
 Zone: Zone 17N (84 W to 78 W)

System Datum: Mean Sea Level  
 Depth Reference: GL @ 1206.00ft

Northing: 14439522.51  
 Easting: 1700130.91  
 Latitude: 39.76030238  
 Longitude: -80.78751484

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.84°



<b>Database:</b>	DB_Aug1919_v14	<b>Local Co-ordinate Reference:</b>	Well McMasters S-17 HU (slot G)
<b>Company:</b>	Tug Hill Operating LLC	<b>TVD Reference:</b>	GL @ 1206.00ft
<b>Project:</b>	Marshall County, West Virginia	<b>MD Reference:</b>	GL @ 1206.00ft
<b>Site:</b>	McMasters Shields	<b>North Reference:</b>	Grid
<b>Well:</b>	McMasters S-17 HU (slot G)	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	rev2		

<b>Project</b>	Marshall County, West Virginia		
<b>Map System:</b>	Universal Transverse Mercator (US Survey Feet)	<b>System Datum:</b>	Mean Sea Level
<b>Geo Datum:</b>	NAD83 West Virginia - HARN		
<b>Map Zone:</b>	Zone 17N (84 W to 78 W)		

<b>Site</b>	McMasters Shields				
<b>Site Position:</b>		<b>Northing:</b>	14,439,441.76 usft	<b>Latitude:</b>	39.76008050
<b>From:</b>	Lat/Long	<b>Easting:</b>	1,700,145.18 usft	<b>Longitude:</b>	-80.78746471
<b>Position Uncertainty:</b>	0.00 ft	<b>Slot Radius:</b>	13-3/16 "	<b>Grid Convergence:</b>	0.136 °

<b>Well</b>	McMasters S-17 HU (slot G)					
<b>Well Position</b>	<b>+N/-S</b>	0.00 ft	<b>Northing:</b>	14,439,522.52 usft	<b>Latitude:</b>	39.76030238
	<b>+E/-W</b>	0.00 ft	<b>Easting:</b>	1,700,130.90 usft	<b>Longitude:</b>	-80.78751484
<b>Position Uncertainty</b>		0.00 ft	<b>Wellhead Elevation:</b>		<b>Ground Level:</b>	1,206.00 ft

<b>Wellbore</b>	Original Hole				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	IGRF2015	12/9/2019	-8.707	66.739	51,883.56008426

<b>Design</b>	rev2			
<b>Audit Notes:</b>				
<b>Version:</b>	<b>Phase:</b>	PLAN	<b>Tie On Depth:</b>	0.00
<b>Vertical Section:</b>	<b>Depth From (TVD) (ft)</b>	<b>+N/-S (ft)</b>	<b>+E/-W (ft)</b>	<b>Direction (°)</b>
	0.00	0.00	0.00	154.566

<b>Plan Survey Tool Program</b>	<b>Date</b>	5/28/2020		
<b>Depth From (ft)</b>	<b>Depth To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Remarks</b>
1	0.00	22,100.25 rev2 (Original Hole)	MWD	
			MWD - Standard	

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Planning Report - Geographic

<b>Database:</b>	DB_Aug1919_v14	<b>Local Co-ordinate Reference:</b>	Well McMasters S-17 HU (slot G)
<b>Company:</b>	Tug Hill Operating LLC	<b>TVD Reference:</b>	GL @ 1206.00ft
<b>Project:</b>	Marshall County, West Virginia	<b>MD Reference:</b>	GL @ 1206.00ft
<b>Site:</b>	McMasters Shields	<b>North Reference:</b>	Grid
<b>Well:</b>	McMasters S-17 HU (slot G)	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	rev2		

Plan Sections										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	TFO (°)	Target
0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.000	
1,500.00	0.00	0.000	1,500.00	0.00	0.00	0.00	0.00	0.00	0.000	
1,600.00	2.00	280.000	1,599.98	0.30	-1.72	2.00	2.00	0.00	280.000	
2,500.57	2.00	280.000	2,500.00	5.76	-32.67	0.00	0.00	0.00	0.000	
2,600.57	0.00	280.000	2,599.98	6.06	-34.39	2.00	-2.00	0.00	180.000	
5,100.59	0.00	280.000	5,100.00	6.06	-34.39	0.00	0.00	0.00	280.000	
5,589.51	9.78	281.052	5,586.55	14.04	-75.24	2.00	2.00	0.22	281.052	
10,258.66	9.78	281.052	10,187.87	166.07	-853.53	0.00	0.00	0.00	0.000	
11,188.14	50.00	158.022	11,010.59	-176.42	-792.90	6.00	4.33	-13.24	-129.032	
11,683.59	89.00	150.247	11,181.00	-583.81	-590.84	8.00	7.87	-1.57	-12.242	
22,100.25	89.00	150.247	11,363.00	-9,625.88	4,577.78	0.00	0.00	0.00	0.000	McMasters S-17 HU F

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<b>Database:</b>	DB_Aug1919_v14	<b>Local Co-ordinate Reference:</b>	Well McMasters S-17 HU (slot G)
<b>Company:</b>	Tug Hill Operating LLC	<b>TVD Reference:</b>	GL @ 1206.00ft
<b>Project:</b>	Marshall County, West Virginia	<b>MD Reference:</b>	GL @ 1206.00ft
<b>Site:</b>	McMasters Shields	<b>North Reference:</b>	Grid
<b>Well:</b>	McMasters S-17 HU (slot G)	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	rev2		

Planned Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
0.00	0.00	0.000	0.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
100.00	0.00	0.000	100.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
200.00	0.00	0.000	200.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
300.00	0.00	0.000	300.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
400.00	0.00	0.000	400.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
500.00	0.00	0.000	500.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
600.00	0.00	0.000	600.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
700.00	0.00	0.000	700.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
800.00	0.00	0.000	800.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
900.00	0.00	0.000	900.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
1,000.00	0.00	0.000	1,000.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
1,100.00	0.00	0.000	1,100.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
1,200.00	0.00	0.000	1,200.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
1,300.00	0.00	0.000	1,300.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
1,400.00	0.00	0.000	1,400.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
1,500.00	0.00	0.000	1,500.00	0.00	0.00	14,439,522.52	1,700,130.90	39.76030238	-80.78751484	
<b>KOP Begin 2°/100' build</b>										
1,600.00	2.00	280.000	1,599.98	0.30	-1.72	14,439,522.82	1,700,129.19	39.76030323	-80.78752095	
<b>Begin 2.00° tangent</b>										
1,700.00	2.00	280.000	1,699.92	0.91	-5.16	14,439,523.43	1,700,125.75	39.76030491	-80.78753318	
1,800.00	2.00	280.000	1,799.86	1.52	-8.59	14,439,524.03	1,700,122.31	39.76030660	-80.78754540	
1,900.00	2.00	280.000	1,899.80	2.12	-12.03	14,439,524.64	1,700,118.88	39.76030829	-80.78755763	
2,000.00	2.00	280.000	1,999.74	2.73	-15.47	14,439,525.24	1,700,115.44	39.76030997	-80.78756985	
2,100.00	2.00	280.000	2,099.68	3.33	-18.90	14,439,525.85	1,700,112.00	39.76031166	-80.78758208	
2,200.00	2.00	280.000	2,199.61	3.94	-22.34	14,439,526.46	1,700,108.56	39.76031335	-80.78759430	
2,300.00	2.00	280.000	2,299.55	4.55	-25.78	14,439,527.06	1,700,105.13	39.76031503	-80.78760653	
2,400.00	2.00	280.000	2,399.49	5.15	-29.21	14,439,527.67	1,700,101.69	39.76031672	-80.78761875	
2,500.00	2.00	280.000	2,499.43	5.76	-32.65	14,439,528.27	1,700,098.25	39.76031841	-80.78763098	
2,500.57	2.00	280.000	2,500.00	5.76	-32.67	14,439,528.28	1,700,098.23	39.76031841	-80.78763105	
<b>Begin 2°/100' drop</b>										
2,600.00	0.01	280.000	2,599.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
2,600.57	0.00	280.000	2,599.98	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
<b>Begin vertical hold</b>										
2,700.00	0.00	280.000	2,699.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
2,800.00	0.00	280.000	2,799.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
2,900.00	0.00	280.000	2,899.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
3,000.00	0.00	280.000	2,999.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
3,100.00	0.00	280.000	3,099.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
3,200.00	0.00	0.000	3,199.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
3,300.00	0.00	280.000	3,299.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
3,400.00	0.00	0.000	3,399.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
3,500.00	0.00	280.000	3,499.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
3,600.00	0.00	280.000	3,599.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
3,700.00	0.00	280.000	3,699.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
3,800.00	0.00	280.000	3,799.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
3,900.00	0.00	0.000	3,899.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
4,000.00	0.00	280.000	3,999.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
4,100.00	0.00	280.000	4,099.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
4,200.00	0.00	280.000	4,199.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
4,300.00	0.00	280.000	4,299.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
4,400.00	0.00	280.000	4,399.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
4,500.00	0.00	0.000	4,499.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
4,600.00	0.00	280.000	4,599.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	
4,700.00	0.00	0.000	4,699.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716	

<b>Database:</b>	DB_Aug1919_v14	<b>Local Co-ordinate Reference:</b>	Well McMasters S-17 HU (slot G)
<b>Company:</b>	Tug Hill Operating LLC	<b>TVD Reference:</b>	GL @ 1206.00ft
<b>Project:</b>	Marshall County, West Virginia	<b>MD Reference:</b>	GL @ 1206.00ft
<b>Site:</b>	McMasters Shields	<b>North Reference:</b>	Grid
<b>Well:</b>	McMasters S-17 HU (slot G)	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	rev2		

Planned Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
4,800.00	0.00	280.000	4,799.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716
4,900.00	0.00	280.000	4,899.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716
5,000.00	0.00	280.000	4,999.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716
5,100.00	0.00	280.000	5,099.41	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716
5,100.59	0.00	280.000	5,100.00	6.06	-34.39	14,439,528.58	1,700,096.52	39.76031926	-80.78763716
<b>Begin 2°/100' build</b>									
5,200.00	1.99	281.052	5,199.39	6.39	-36.08	14,439,528.91	1,700,094.82	39.76032018	-80.78764318
5,300.00	3.99	281.052	5,299.25	7.39	-41.20	14,439,529.91	1,700,089.71	39.76032296	-80.78766137
5,400.00	5.99	281.052	5,398.87	9.06	-49.73	14,439,531.58	1,700,081.17	39.76032759	-80.78769173
5,500.00	7.99	281.052	5,498.12	11.39	-61.67	14,439,533.91	1,700,069.23	39.76033407	-80.78773419
5,589.51	9.78	281.052	5,586.55	14.04	-75.24	14,439,536.56	1,700,055.67	39.76034144	-80.78778244
<b>Begin 9.78° tangent</b>									
5,600.00	9.78	281.052	5,596.89	14.38	-76.99	14,439,536.90	1,700,053.92	39.76034239	-80.78778866
5,700.00	9.78	281.052	5,695.44	17.64	-93.65	14,439,540.16	1,700,037.25	39.76035144	-80.78784795
5,800.00	9.78	281.052	5,793.98	20.90	-110.32	14,439,543.41	1,700,020.58	39.76036049	-80.78790723
5,900.00	9.78	281.052	5,892.53	24.15	-126.99	14,439,546.67	1,700,003.91	39.76036954	-80.78796652
6,000.00	9.78	281.052	5,991.08	27.41	-143.66	14,439,549.92	1,699,987.24	39.76037859	-80.78802581
6,100.00	9.78	281.052	6,089.62	30.66	-160.33	14,439,553.18	1,699,970.57	39.76038764	-80.78808509
6,200.00	9.78	281.052	6,188.17	33.92	-177.00	14,439,556.44	1,699,953.91	39.76039669	-80.78814438
6,300.00	9.78	281.052	6,286.72	37.18	-193.67	14,439,559.69	1,699,937.24	39.76040573	-80.78820366
6,400.00	9.78	281.052	6,385.27	40.43	-210.34	14,439,562.95	1,699,920.57	39.76041478	-80.78826295
6,500.00	9.78	281.052	6,483.81	43.69	-227.01	14,439,566.20	1,699,903.90	39.76042383	-80.78832224
6,600.00	9.78	281.052	6,582.36	46.94	-243.68	14,439,569.46	1,699,887.23	39.76043288	-80.78838152
6,700.00	9.78	281.052	6,680.91	50.20	-260.34	14,439,572.72	1,699,870.56	39.76044193	-80.78844081
6,800.00	9.78	281.052	6,779.45	53.45	-277.01	14,439,575.97	1,699,853.89	39.76045098	-80.78850010
6,900.00	9.78	281.052	6,878.00	56.71	-293.68	14,439,579.23	1,699,837.22	39.76046003	-80.78855938
7,000.00	9.78	281.052	6,976.55	59.97	-310.35	14,439,582.48	1,699,820.55	39.76046908	-80.78861867
7,100.00	9.78	281.052	7,075.10	63.22	-327.02	14,439,585.74	1,699,803.89	39.76047813	-80.78867796
7,200.00	9.78	281.052	7,173.64	66.48	-343.69	14,439,588.99	1,699,787.22	39.76048718	-80.78873724
7,300.00	9.78	281.052	7,272.19	69.73	-360.36	14,439,592.25	1,699,770.55	39.76049623	-80.78879653
7,400.00	9.78	281.052	7,370.74	72.99	-377.03	14,439,595.51	1,699,753.88	39.76050528	-80.78885582
7,500.00	9.78	281.052	7,469.28	76.25	-393.70	14,439,598.76	1,699,737.21	39.76051433	-80.78891510
7,600.00	9.78	281.052	7,567.83	79.50	-410.36	14,439,602.02	1,699,720.54	39.76052338	-80.78897439
7,700.00	9.78	281.052	7,666.38	82.76	-427.03	14,439,605.27	1,699,703.87	39.76053243	-80.78903368
7,800.00	9.78	281.052	7,764.93	86.01	-443.70	14,439,608.53	1,699,687.20	39.76054148	-80.78909296
7,900.00	9.78	281.052	7,863.47	89.27	-460.37	14,439,611.79	1,699,670.53	39.76055053	-80.78915225
8,000.00	9.78	281.052	7,962.02	92.53	-477.04	14,439,615.04	1,699,653.87	39.76055958	-80.78921154
8,100.00	9.78	281.052	8,060.57	95.78	-493.71	14,439,618.30	1,699,637.20	39.76056863	-80.78927082
8,200.00	9.78	281.052	8,159.12	99.04	-510.38	14,439,621.55	1,699,620.53	39.76057768	-80.78933011
8,300.00	9.78	281.052	8,257.66	102.29	-527.05	14,439,624.81	1,699,603.86	39.76058673	-80.78938940
8,400.00	9.78	281.052	8,356.21	105.55	-543.72	14,439,628.07	1,699,587.19	39.76059578	-80.78944868
8,500.00	9.78	281.052	8,454.76	108.81	-560.38	14,439,631.32	1,699,570.52	39.76060482	-80.78950797
8,600.00	9.78	281.052	8,553.30	112.06	-577.05	14,439,634.58	1,699,553.85	39.76061387	-80.78956726
8,700.00	9.78	281.052	8,651.85	115.32	-593.72	14,439,637.83	1,699,537.18	39.76062292	-80.78962654
8,800.00	9.78	281.052	8,750.40	118.57	-610.39	14,439,641.09	1,699,520.51	39.76063197	-80.78968583
8,900.00	9.78	281.052	8,848.95	121.83	-627.06	14,439,644.34	1,699,503.85	39.76064102	-80.78974512
9,000.00	9.78	281.052	8,947.49	125.08	-643.73	14,439,647.60	1,699,487.18	39.76065007	-80.78980440
9,100.00	9.78	281.052	9,046.04	128.34	-660.40	14,439,650.86	1,699,470.51	39.76065912	-80.78986369
9,200.00	9.78	281.052	9,144.59	131.60	-677.07	14,439,654.11	1,699,453.84	39.76066817	-80.78992298
9,300.00	9.78	281.052	9,243.13	134.85	-693.74	14,439,657.37	1,699,437.17	39.76067722	-80.78998226
9,400.00	9.78	281.052	9,341.68	138.11	-710.41	14,439,660.62	1,699,420.50	39.76068627	-80.79004155
9,500.00	9.78	281.052	9,440.23	141.36	-727.07	14,439,663.88	1,699,403.83	39.76069532	-80.79010084
9,600.00	9.78	281.052	9,538.78	144.62	-743.74	14,439,667.14	1,699,387.16	39.76070436	-80.79016012
9,700.00	9.78	281.052	9,637.32	147.88	-760.41	14,439,670.39	1,699,370.49	39.76071341	-80.79021941

<b>Database:</b>	DB_Aug1919_v14	<b>Local Co-ordinate Reference:</b>	Well McMasters S-17 HU (slot G)
<b>Company:</b>	Tug Hill Operating LLC	<b>TVD Reference:</b>	GL @ 1206.00ft
<b>Project:</b>	Marshall County, West Virginia	<b>MD Reference:</b>	GL @ 1206.00ft
<b>Site:</b>	McMasters Shields	<b>North Reference:</b>	Grid
<b>Well:</b>	McMasters S-17 HU (slot G)	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	rev2		

Planned Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
9,800.00	9.78	281.052	9,735.87	151.13	-777.08	14,439,673.65	1,699,353.83	39.76072246	-80.79027870	
9,900.00	9.78	281.052	9,834.42	154.39	-793.75	14,439,676.90	1,699,337.16	39.76073151	-80.79033799	
10,000.00	9.78	281.052	9,932.96	157.64	-810.42	14,439,680.16	1,699,320.49	39.76074056	-80.79039727	
10,100.00	9.78	281.052	10,031.51	160.90	-827.09	14,439,683.42	1,699,303.82	39.76074961	-80.79045656	
10,200.00	9.78	281.052	10,130.06	164.16	-843.76	14,439,686.67	1,699,287.15	39.76075866	-80.79051585	
10,258.66	9.78	281.052	10,187.87	166.07	-853.53	14,439,688.58	1,699,277.37	39.76076396	-80.79055062	
<b>Begin 6°/100' build/turn</b>										
10,300.00	8.44	267.807	10,228.69	166.62	-860.01	14,439,689.14	1,699,270.89	39.76076554	-80.79057367	
10,400.00	7.92	224.774	10,327.76	161.45	-872.20	14,439,683.96	1,699,258.70	39.76075140	-80.79061710	
10,500.00	11.21	193.783	10,426.42	147.10	-879.38	14,439,669.62	1,699,251.53	39.76071206	-80.79064274	
10,600.00	16.14	178.999	10,523.59	123.75	-881.45	14,439,646.26	1,699,249.45	39.76064792	-80.79065032	
10,700.00	21.60	171.252	10,618.19	91.63	-878.41	14,439,614.15	1,699,252.50	39.76055970	-80.79063975	
10,800.00	27.28	166.565	10,709.20	51.11	-870.28	14,439,573.62	1,699,260.63	39.76044837	-80.79061115	
10,900.00	33.07	163.404	10,795.62	2.63	-857.15	14,439,525.14	1,699,273.76	39.76031514	-80.79056484	
11,000.00	38.92	161.098	10,876.49	-53.29	-839.16	14,439,469.23	1,699,291.74	39.76016147	-80.79050131	
11,100.00	44.80	159.313	10,950.95	-116.02	-816.52	14,439,406.50	1,699,314.39	39.75998904	-80.79042127	
11,188.14	50.00	158.022	11,010.59	-176.42	-792.90	14,439,346.10	1,699,338.01	39.75982301	-80.79033772	
<b>Begin 8°/100' build/turn</b>										
11,200.00	50.93	157.763	11,018.14	-184.89	-789.46	14,439,337.62	1,699,341.45	39.75979972	-80.79032554	
11,300.00	58.77	155.811	11,075.67	-259.94	-757.20	14,439,262.57	1,699,373.71	39.75959340	-80.79021137	
11,400.00	66.63	154.161	11,121.50	-340.38	-719.61	14,439,182.13	1,699,411.29	39.75937225	-80.79007831	
11,500.00	74.51	152.697	11,154.74	-424.65	-677.44	14,439,097.87	1,699,453.47	39.75914057	-80.78992894	
11,600.00	82.40	151.340	11,174.74	-511.09	-631.49	14,439,011.42	1,699,499.41	39.75890287	-80.78976617	
11,683.59	89.00	150.247	11,181.00	-583.81	-590.84	14,438,938.71	1,699,540.07	39.75870291	-80.78962213	
<b>Begin 89.00° lateral</b>										
11,700.00	89.00	150.247	11,181.29	-598.05	-582.70	14,438,924.47	1,699,548.21	39.75866374	-80.78959327	
11,800.00	89.00	150.247	11,183.04	-684.86	-533.08	14,438,837.66	1,699,597.83	39.75842503	-80.78941744	
11,900.00	89.00	150.247	11,184.78	-771.66	-483.46	14,438,750.86	1,699,647.45	39.75818632	-80.78924161	
12,000.00	89.00	150.247	11,186.53	-858.46	-433.84	14,438,664.05	1,699,697.07	39.75794761	-80.78906578	
12,100.00	89.00	150.247	11,188.28	-945.27	-384.22	14,438,577.25	1,699,746.68	39.75770890	-80.78888996	
12,200.00	89.00	150.247	11,190.02	-1,032.07	-334.60	14,438,490.45	1,699,796.30	39.75747019	-80.78871413	
12,300.00	89.00	150.247	11,191.77	-1,118.88	-284.98	14,438,403.64	1,699,845.92	39.75723148	-80.78853831	
12,400.00	89.00	150.247	11,193.52	-1,205.68	-235.37	14,438,316.84	1,699,895.54	39.75699277	-80.78836249	
12,500.00	89.00	150.247	11,195.27	-1,292.48	-185.75	14,438,230.03	1,699,945.16	39.75675406	-80.78818666	
12,600.00	89.00	150.247	11,197.01	-1,379.29	-136.13	14,438,143.23	1,699,994.78	39.75651535	-80.78801084	
12,700.00	89.00	150.247	11,198.76	-1,466.09	-86.51	14,438,056.43	1,700,044.40	39.75627664	-80.78783502	
12,800.00	89.00	150.247	11,200.51	-1,552.90	-36.89	14,437,969.62	1,700,094.01	39.75603793	-80.78765921	
12,900.00	89.00	150.247	11,202.26	-1,639.70	12.73	14,437,882.82	1,700,143.63	39.75579922	-80.78748339	
13,000.00	89.00	150.247	11,204.00	-1,726.50	62.35	14,437,796.02	1,700,193.25	39.75556051	-80.78730757	
13,100.00	89.00	150.247	11,205.75	-1,813.31	111.97	14,437,709.21	1,700,242.87	39.75532179	-80.78713176	
13,200.00	89.00	150.247	11,207.50	-1,900.11	161.58	14,437,622.41	1,700,292.49	39.75508308	-80.78695595	
13,300.00	89.00	150.247	11,209.24	-1,986.92	211.20	14,437,535.60	1,700,342.11	39.75484437	-80.78678013	
13,400.00	89.00	150.247	11,210.99	-2,073.72	260.82	14,437,448.80	1,700,391.73	39.75460566	-80.78660432	
13,500.00	89.00	150.247	11,212.74	-2,160.52	310.44	14,437,362.00	1,700,441.35	39.75436694	-80.78642851	
13,600.00	89.00	150.247	11,214.49	-2,247.33	360.06	14,437,275.19	1,700,490.96	39.75412823	-80.78625271	
13,700.00	89.00	150.247	11,216.23	-2,334.13	409.68	14,437,188.39	1,700,540.58	39.75388952	-80.78607690	
13,800.00	89.00	150.247	11,217.98	-2,420.94	459.30	14,437,101.59	1,700,590.20	39.75365080	-80.78590109	
13,900.00	89.00	150.247	11,219.73	-2,507.74	508.92	14,437,014.78	1,700,639.82	39.75341209	-80.78572529	
14,000.00	89.00	150.247	11,221.47	-2,594.54	558.53	14,436,927.98	1,700,689.44	39.75317337	-80.78554949	
14,100.00	89.00	150.247	11,223.22	-2,681.35	608.15	14,436,841.17	1,700,739.06	39.75293466	-80.78537368	
14,200.00	89.00	150.247	11,224.97	-2,768.15	657.77	14,436,754.37	1,700,788.68	39.75269594	-80.78519788	
14,300.00	89.00	150.247	11,226.72	-2,854.96	707.39	14,436,667.57	1,700,838.29	39.75245723	-80.78502208	
14,400.00	89.00	150.247	11,228.46	-2,941.76	757.01	14,436,580.76	1,700,887.91	39.75221851	-80.78484628	
14,500.00	89.00	150.247	11,230.21	-3,028.56	806.63	14,436,493.96	1,700,937.53	39.75197980	-80.78467049	

<b>Database:</b>	DB_Aug1919_v14	<b>Local Co-ordinate Reference:</b>	Well McMasters S-17 HU (slot G)
<b>Company:</b>	Tug Hill Operating LLC	<b>TVD Reference:</b>	GL @ 1206.00ft
<b>Project:</b>	Marshall County, West Virginia	<b>MD Reference:</b>	GL @ 1206.00ft
<b>Site:</b>	McMasters Shields	<b>North Reference:</b>	Grid
<b>Well:</b>	McMasters S-17 HU (slot G)	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	rev2		

Planned Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
14,600.00	89.00	150.247	11,231.96	-3,115.37	856.25	14,436,407.16	1,700,987.15	39.75174108	-80.78449469
14,700.00	89.00	150.247	11,233.70	-3,202.17	905.87	14,436,320.35	1,701,036.77	39.75150236	-80.78431890
14,800.00	89.00	150.247	11,235.45	-3,288.98	955.48	14,436,233.55	1,701,086.39	39.75126365	-80.78414310
14,900.00	89.00	150.247	11,237.20	-3,375.78	1,005.10	14,436,146.74	1,701,136.01	39.75102493	-80.78396731
15,000.00	89.00	150.247	11,238.95	-3,462.58	1,054.72	14,436,059.94	1,701,185.62	39.75078621	-80.78379152
15,100.00	89.00	150.247	11,240.69	-3,549.39	1,104.34	14,435,973.14	1,701,235.24	39.75054750	-80.78361573
15,200.00	89.00	150.247	11,242.44	-3,636.19	1,153.96	14,435,886.33	1,701,284.86	39.75030878	-80.78343994
15,300.00	89.00	150.247	11,244.19	-3,722.99	1,203.58	14,435,799.53	1,701,334.48	39.75007006	-80.78326415
15,400.00	89.00	150.247	11,245.93	-3,809.80	1,253.20	14,435,712.73	1,701,384.10	39.74983134	-80.78308837
15,500.00	89.00	150.247	11,247.68	-3,896.60	1,302.82	14,435,625.92	1,701,433.72	39.74959262	-80.78291258
15,600.00	89.00	150.247	11,249.43	-3,983.41	1,352.43	14,435,539.12	1,701,483.34	39.74935390	-80.78273680
15,700.00	89.00	150.247	11,251.18	-4,070.21	1,402.05	14,435,452.31	1,701,532.96	39.74911518	-80.78256101
15,800.00	89.00	150.247	11,252.92	-4,157.01	1,451.67	14,435,365.51	1,701,582.57	39.74887646	-80.78238523
15,900.00	89.00	150.247	11,254.67	-4,243.82	1,501.29	14,435,278.71	1,701,632.19	39.74863775	-80.78220945
16,000.00	89.00	150.247	11,256.42	-4,330.62	1,550.91	14,435,191.90	1,701,681.81	39.74839903	-80.78203367
16,100.00	89.00	150.247	11,258.16	-4,417.43	1,600.53	14,435,105.10	1,701,731.43	39.74816031	-80.78185790
16,200.00	89.00	150.247	11,259.91	-4,504.23	1,650.15	14,435,018.29	1,701,781.05	39.74792158	-80.78168212
16,300.00	89.00	150.247	11,261.66	-4,591.03	1,699.77	14,434,931.49	1,701,830.67	39.74768286	-80.78150634
16,400.00	89.00	150.247	11,263.41	-4,677.84	1,749.38	14,434,844.69	1,701,880.29	39.74744414	-80.78133057
16,500.00	89.00	150.247	11,265.15	-4,764.64	1,799.00	14,434,757.88	1,701,929.90	39.74720542	-80.78115480
16,600.00	89.00	150.247	11,266.90	-4,851.45	1,848.62	14,434,671.08	1,701,979.52	39.74696670	-80.78097902
16,700.00	89.00	150.247	11,268.65	-4,938.25	1,898.24	14,434,584.28	1,702,029.14	39.74672798	-80.78080325
16,800.00	89.00	150.247	11,270.40	-5,025.05	1,947.86	14,434,497.47	1,702,078.76	39.74648926	-80.78062748
16,900.00	89.00	150.247	11,272.14	-5,111.86	1,997.48	14,434,410.67	1,702,128.38	39.74625053	-80.78045172
17,000.00	89.00	150.247	11,273.89	-5,198.66	2,047.10	14,434,323.86	1,702,178.00	39.74601181	-80.78027595
17,100.00	89.00	150.247	11,275.64	-5,285.47	2,096.72	14,434,237.06	1,702,227.62	39.74577309	-80.78010018
17,200.00	89.00	150.247	11,277.38	-5,372.27	2,146.33	14,434,150.26	1,702,277.24	39.74553436	-80.77992442
17,300.00	89.00	150.247	11,279.13	-5,459.07	2,195.95	14,434,063.45	1,702,326.85	39.74529564	-80.77974865
17,400.00	89.00	150.247	11,280.88	-5,545.88	2,245.57	14,433,976.65	1,702,376.47	39.74505692	-80.77957289
17,500.00	89.00	150.247	11,282.63	-5,632.68	2,295.19	14,433,889.85	1,702,426.09	39.74481819	-80.77939713
17,600.00	89.00	150.247	11,284.37	-5,719.49	2,344.81	14,433,803.04	1,702,475.71	39.74457947	-80.77922137
17,700.00	89.00	150.247	11,286.12	-5,806.29	2,394.43	14,433,716.24	1,702,525.33	39.74434074	-80.77904561
17,800.00	89.00	150.247	11,287.87	-5,893.09	2,444.05	14,433,629.43	1,702,574.95	39.74410202	-80.77886986
17,900.00	89.00	150.247	11,289.61	-5,979.90	2,493.67	14,433,542.63	1,702,624.57	39.74386329	-80.77869410
18,000.00	89.00	150.247	11,291.36	-6,066.70	2,543.28	14,433,455.83	1,702,674.18	39.74362457	-80.77851835
18,100.00	89.00	150.247	11,293.11	-6,153.51	2,592.90	14,433,369.02	1,702,723.80	39.74338584	-80.77834259
18,200.00	89.00	150.247	11,294.86	-6,240.31	2,642.52	14,433,282.22	1,702,773.42	39.74314712	-80.77816684
18,300.00	89.00	150.247	11,296.60	-6,327.11	2,692.14	14,433,195.42	1,702,823.04	39.74290839	-80.77799109
18,400.00	89.00	150.247	11,298.35	-6,413.92	2,741.76	14,433,108.61	1,702,872.66	39.74266966	-80.77781534
18,500.00	89.00	150.247	11,300.10	-6,500.72	2,791.38	14,433,021.81	1,702,922.28	39.74243094	-80.77763959
18,600.00	89.00	150.247	11,301.84	-6,587.53	2,841.00	14,432,935.00	1,702,971.90	39.74219221	-80.77746384
18,700.00	89.00	150.247	11,303.59	-6,674.33	2,890.62	14,432,848.20	1,703,021.51	39.74195348	-80.77728809
18,800.00	89.00	150.247	11,305.34	-6,761.13	2,940.23	14,432,761.40	1,703,071.13	39.74171476	-80.77711235
18,900.00	89.00	150.247	11,307.09	-6,847.94	2,989.85	14,432,674.59	1,703,120.75	39.74147603	-80.77693661
19,000.00	89.00	150.247	11,308.83	-6,934.74	3,039.47	14,432,587.79	1,703,170.37	39.74123730	-80.77676086
19,100.00	89.00	150.247	11,310.58	-7,021.55	3,089.09	14,432,500.98	1,703,219.99	39.74099857	-80.77658512
19,200.00	89.00	150.247	11,312.33	-7,108.35	3,138.71	14,432,414.18	1,703,269.61	39.74075984	-80.77640938
19,300.00	89.00	150.247	11,314.07	-7,195.15	3,188.33	14,432,327.38	1,703,319.23	39.74052111	-80.77623364
19,400.00	89.00	150.247	11,315.82	-7,281.96	3,237.95	14,432,240.57	1,703,368.85	39.74028238	-80.77605790
19,500.00	89.00	150.247	11,317.57	-7,368.76	3,287.57	14,432,153.77	1,703,418.46	39.74004365	-80.77588217
19,600.00	89.00	150.247	11,319.32	-7,455.57	3,337.18	14,432,066.97	1,703,468.08	39.73980492	-80.77570643
19,700.00	89.00	150.247	11,321.06	-7,542.37	3,386.80	14,431,980.16	1,703,517.70	39.73956619	-80.77553070
19,800.00	89.00	150.247	11,322.81	-7,629.17	3,436.42	14,431,893.36	1,703,567.32	39.73932746	-80.77535496
19,900.00	89.00	150.247	11,324.56	-7,715.98	3,486.04	14,431,806.55	1,703,616.94	39.73908873	-80.77517923
20,000.00	89.00	150.247	11,326.31	-7,802.78	3,535.66	14,431,719.75	1,703,666.56	39.73885000	-80.77500350

<b>Database:</b>	DB_Aug1919_v14	<b>Local Co-ordinate Reference:</b>	Well McMasters S-17 HU (slot G)
<b>Company:</b>	Tug Hill Operating LLC	<b>TVD Reference:</b>	GL @ 1206.00ft
<b>Project:</b>	Marshall County, West Virginia	<b>MD Reference:</b>	GL @ 1206.00ft
<b>Site:</b>	McMasters Shields	<b>North Reference:</b>	Grid
<b>Well:</b>	McMasters S-17 HU (slot G)	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	rev2		

Planned Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
20,100.00	89.00	150.247	11,328.05	-7,889.59	3,585.28	14,431,632.95	1,703,716.18	39.73861127	-80.77482777
20,200.00	89.00	150.247	11,329.80	-7,976.39	3,634.90	14,431,546.14	1,703,765.79	39.73837254	-80.77465204
20,300.00	89.00	150.247	11,331.55	-8,063.19	3,684.52	14,431,459.34	1,703,815.41	39.73813381	-80.77447632
20,400.00	89.00	150.247	11,333.29	-8,150.00	3,734.13	14,431,372.54	1,703,865.03	39.73789508	-80.77430059
20,500.00	89.00	150.247	11,335.04	-8,236.80	3,783.75	14,431,285.73	1,703,914.65	39.73765634	-80.77412487
20,600.00	89.00	150.247	11,336.79	-8,323.60	3,833.37	14,431,198.93	1,703,964.27	39.73741761	-80.77394914
20,700.00	89.00	150.247	11,338.54	-8,410.41	3,882.99	14,431,112.12	1,704,013.89	39.73717888	-80.77377342
20,800.00	89.00	150.247	11,340.28	-8,497.21	3,932.61	14,431,025.32	1,704,063.51	39.73694015	-80.77359770
20,900.00	89.00	150.247	11,342.03	-8,584.02	3,982.23	14,430,938.52	1,704,113.13	39.73670141	-80.77342198
21,000.00	89.00	150.247	11,343.78	-8,670.82	4,031.85	14,430,851.71	1,704,162.74	39.73646268	-80.77324626
21,100.00	89.00	150.247	11,345.52	-8,757.62	4,081.47	14,430,764.91	1,704,212.36	39.73622395	-80.77307054
21,200.00	89.00	150.247	11,347.27	-8,844.43	4,131.08	14,430,678.11	1,704,261.98	39.73598521	-80.77289483
21,300.00	89.00	150.247	11,349.02	-8,931.23	4,180.70	14,430,591.30	1,704,311.60	39.73574648	-80.77271911
21,400.00	89.00	150.247	11,350.77	-9,018.04	4,230.32	14,430,504.50	1,704,361.22	39.73550774	-80.77254340
21,500.00	89.00	150.247	11,352.51	-9,104.84	4,279.94	14,430,417.69	1,704,410.84	39.73526901	-80.77236769
21,600.00	89.00	150.247	11,354.26	-9,191.64	4,329.56	14,430,330.89	1,704,460.46	39.73503027	-80.77219197
21,700.00	89.00	150.247	11,356.01	-9,278.45	4,379.18	14,430,244.09	1,704,510.07	39.73479154	-80.77201626
21,800.00	89.00	150.247	11,357.75	-9,365.25	4,428.80	14,430,157.28	1,704,559.69	39.73455280	-80.77184055
21,900.00	89.00	150.247	11,359.50	-9,452.06	4,478.42	14,430,070.48	1,704,609.31	39.73431406	-80.77166485
22,000.00	89.00	150.247	11,361.25	-9,538.86	4,528.03	14,429,983.68	1,704,658.93	39.73407533	-80.77148914
22,100.00	89.00	150.247	11,363.00	-9,625.66	4,577.65	14,429,896.87	1,704,708.55	39.73383659	-80.77131344
22,100.25	89.00	150.247	11,363.00	-9,625.88	4,577.78	14,429,896.66	1,704,708.67	39.73383600	-80.77131300

**PBHL/TD 22100.25 MD/11363.00 TVD**

Design Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (usft)	Easting (usft)	Latitude	Longitude
McMasters S-17 HU LP - hit/miss target - Shape - Point	0.00	0.000	11,181.00	-583.77	-590.80	14,438,938.74	1,699,540.10	39.75870300	-80.78962200
- plan misses target center by 0.05ft at 11683.58ft MD (11181.00 TVD, -583.80 N, -590.85 E)									
McMasters S-17 HU PBI - plan hits target center - Point	0.00	0.000	11,363.00	-9,625.88	4,577.78	14,429,896.66	1,704,708.67	39.73383600	-80.77131300

Plan Annotations					
Measured Depth (ft)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Comment	
1,500.00	1,500.00	0.00	0.00	KOP Begin 2°/100' build	
1,600.00	1,599.98	0.30	-1.72	Begin 2.00° tangent	
2,500.57	2,500.00	5.76	-32.67	Begin 2°/100' drop	
2,600.57	2,599.98	6.06	-34.39	Begin vertical hold	
5,100.59	5,100.00	6.06	-34.39	Begin 2°/100' build	
5,589.51	5,586.55	14.04	-75.24	Begin 9.78° tangent	
10,258.66	10,187.87	166.07	-853.53	Begin 6°/100' build/turn	
11,188.14	11,010.59	-176.42	-792.90	Begin 8°/100' build/turn	
11,683.59	11,181.00	-583.81	-590.84	Begin 89.00° lateral	
22,100.25	11,363.00	-9,625.88	4,577.78	PBHL/TD 22100.25 MD/11363.00 TVD	

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**Area of Review****Sources of information to Support 35CSR8 - 5.11: 9.3 et seq.**

Description of process to identify potential pathways for well communication during hydraulic fracturing activities.

## Data Sources Reviewed:

1. IHS Well Data service: Public nationwide data service that pulls directly from State agency Oil and Gas databases
2. Farm Maps
3. Topo Maps: Recent and older (contact WVGES)
4. Check with DPS

Contacted Devin Ducoeur 724-705-0444, [dducoeur@dpslandservices.com](mailto:dducoeur@dpslandservices.com) DPS GIS (06/02/2020) to have him make maps of the wellbores with his information. DPS utilizes WVGES maps for their mapping seems it as the best publicly available. See attached map he provided.

## Request maps for:

1. Wellbore with IHS All Wells Layer
2. Map with Farm lines overlain and any well spots identified on Farm Maps
3. More recent (1970s vintage) topos and older topos

## Discussion with Phil Dinterman WVGES GIS Department (7/15/2016)

- WVGES has plotted every well spot they have access to and are aware of with that contains a coordinate. 30000, 70000, and 90000 series wells are available via the WVGES online map. Some locations aren't great due to vintage and manipulation of maps through time
- 30000 series – any well drilled prior to 1929 – APIs were not assigned to original wells
- 70000 series – Well spots pulled from old Farm line maps that the WVGES has access to
- 90000 series – Any sources that the WVGES has access that shows a well spot but has no additional supporting information. DEP does not have 90000 series on their maps.
- There can be duplication between wells in the 3 series
- Phil indicated that other Operators are providing a screenshot of the WVGES map with their planned well and using that for permits

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