



Well: Lackawanna 3H (slot Z)  
 Site: Lackawanna  
 Project: Wetzel County, West Virginia (UTM17 NAD83)  
 Design: rev4  
 Rig: Precision 528

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSec	Annotation
1	2873.00	3.13	182.33	2870.89	-70.52	-17.66	0.00	0.000	-51.99	Survey @ 2873.00 MD 2870.89 TVD
2	2985.00	3.13	182.33	2982.73	-76.63	-17.90	0.00	0.000	-57.14	S/T Begin 3°/100' build/turn
3	3784.19	26.50	148.00	3750.57	-252.21	77.08	3.00	-38.262	-256.65	Begin 26.50° tangent
4	5384.19	26.50	148.00	5182.47	-857.65	455.40	0.00	0.000	-970.25	Begin 3°/100' build/turn
5	5436.62	27.41	150.84	5229.21	-878.10	467.48	3.00	56.079	-894.01	
6	6023.06	27.41	150.84	5749.83	-1113.83	599.02	0.00	0.000	-1263.90	Begin 8100' build/turn
7	6990.55	50.00	329.33	6628.02	-966.40	503.52	8.00	178.817	-1088.43	Begin 10°/100' build/turn
8	7400.60	91.00	330.00	6762.00	-539.72	312.69	10.00	1.020	-710.09	Begin 91.00° lateral
9	17638.07	91.00	330.00	6583.24	8224.78	-4805.36	0.00	0.000	9525.68	PBHL/TD 17638.32 MD/6583.24 TVD

ANNOTATIONS SURVEYS

MD	Inc	Azi	TVD	+N/-S	+E/-W	VSec	Annotation
2873.00	3.13	182.33	2870.89	-70.52	-17.66	-51.98	Tie into original hole @ 2873 MD
17571.00	95.43	329.62	6608.72	8180.84	-4774.42	9472.12	Survey @ 17571.00 MD 6608.72 TVD
17622.00	95.43	329.62	6603.89	8224.64	-4800.09	9522.69	Survey Projected to 17622.00 MD 6603.89 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=1306+18 @ 1324.00ft (Precision 528)

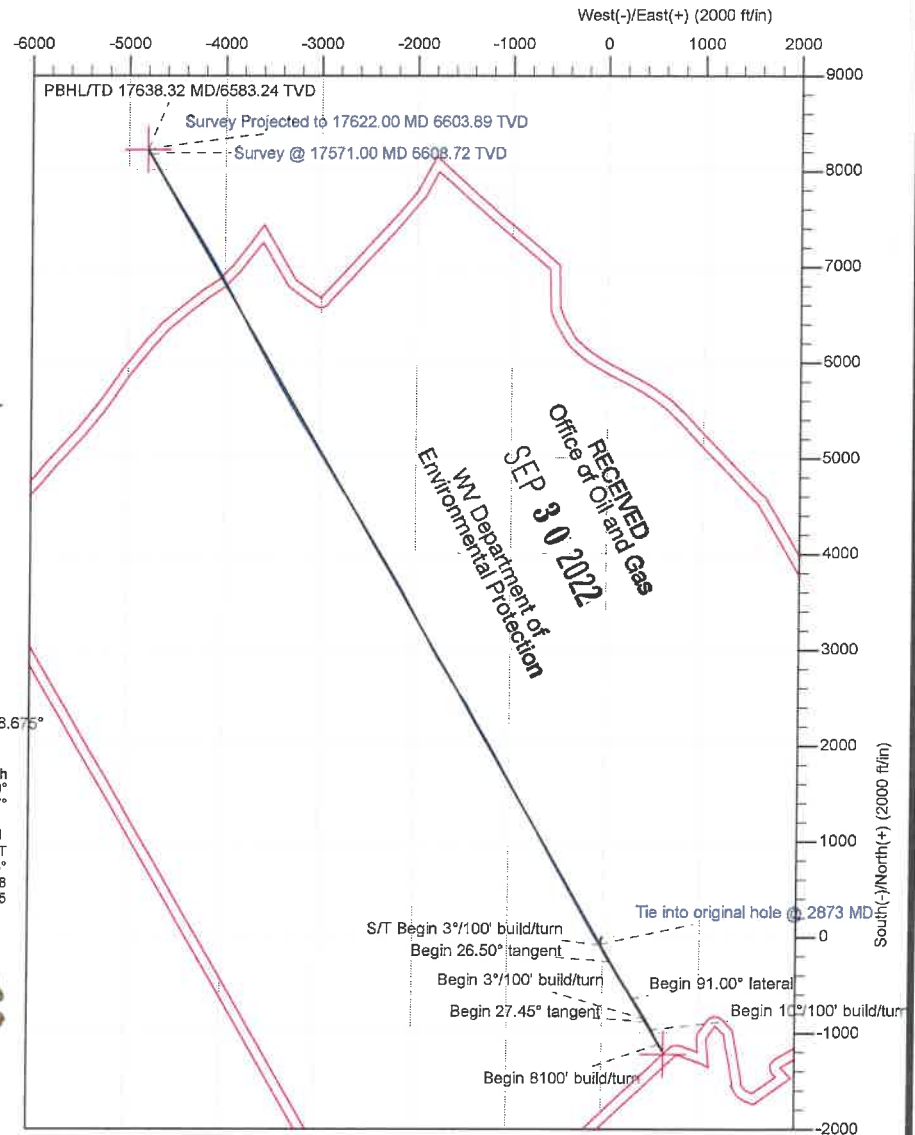
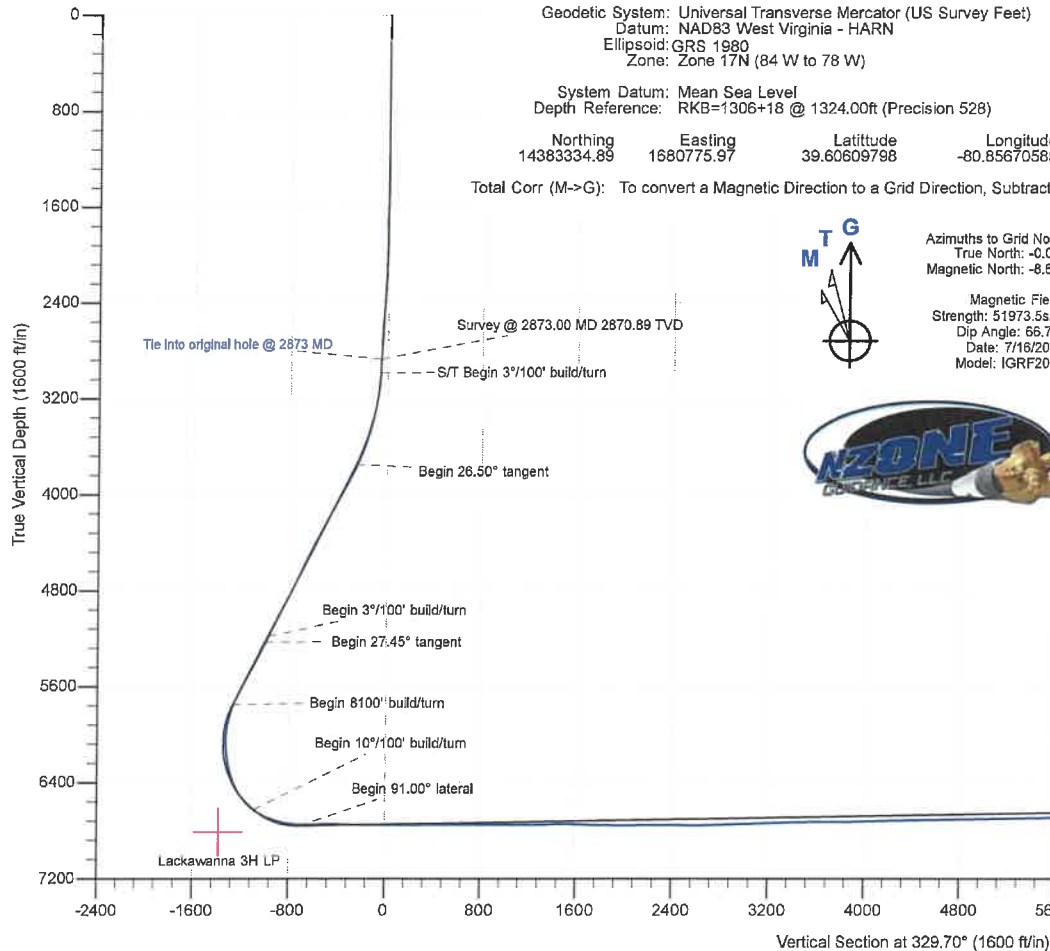
Northing: 14383334.89 Easting: 1680775.97 Latitude: 39.60609798 Longitude: -80.85670585

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.675°



Azimuths to Grid North  
 True North: -0.09°  
 Magnetic North: -8.67°

Magnetic Field  
 Strength: 51973.5nT  
 Dip Angle: 66.75°  
 Date: 7/16/2018  
 Model: IGRF2015





Survey Report



<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Lackawanna 3H (slot Z)
<b>Project:</b>	Wetzel County, West Virginia (UTM17 NAD83)	<b>TVD Reference:</b>	RKB=1306+18 @ 1324.00ft (Precision 528)
<b>Site:</b>	Lackawanna	<b>MD Reference:</b>	RKB=1306+18 @ 1324.00ft (Precision 528)
<b>Well:</b>	Lackawanna 3H (slot Z)	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Sidetrack 01 Lateral	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Surveys Sidetrack 01 Lateral	<b>Database:</b>	DB_Jul2216dt_v14 It

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<b>Project</b>	Wetzel County, West Virginia (UTM17 NAD83)		
<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)		

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WV Department of  
Environmental Protection

<b>Site</b>	Lackawanna				
<b>Site Position:</b>		<b>Northing:</b>	14,383,374.84 usft	<b>Latitude:</b>	39.60620769
<b>From:</b>	Lat/Long	<b>Easting:</b>	1,680,777.71 usft	<b>Longitude:</b>	-80.85669942
<b>Position Uncertainty:</b>	0.00 ft	<b>Slot Radius:</b>	13-3/16 "	<b>Grid Convergence:</b>	0.091 °

<b>Well</b>	Lackawanna 3H (slot Z)					
<b>Well Position</b>	+N/-S	0.00 ft	<b>Northing:</b>	14,383,334.89 usft	<b>Latitude:</b>	39.60609798
	+E/-W	0.00 ft	<b>Easting:</b>	1,680,775.97 usft	<b>Longitude:</b>	-80.85670585
<b>Position Uncertainty</b>		0.00 ft	<b>Wellhead Elevation:</b>	ft	<b>Ground Level:</b>	1,306.00 ft

<b>Wellbore</b>	Sidetrack 01 Lateral				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	IGRF2015	7/16/2018	-8.584	66.745	51,973.52146553

<b>Design</b>	Surveys Sidetrack 01 Lateral				
<b>Audit Notes:</b>					
<b>Version:</b>	1.0	<b>Phase:</b>	ACTUAL	<b>Tie On Depth:</b>	2,873.00
<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	329.70	

<b>Survey Program</b>	<b>Date</b>	8/5/2019			
<b>From (ft)</b>	<b>To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
100.00	2,873.00	Gyro 0-2873 MD (Original Hole)	NS-GYRO-MS	North sensing gyrocompassing m/s	
2,945.00	17,571.00	MWD ST1 (Sidetrack 01 Lateral)	MWD	MWD - Standard	
17,622.00	17,622.00	Projection (Sidetrack 01 Lateral)	MWD	MWD - Standard	

<b>Survey</b>										
<b>Measured Depth (ft)</b>	<b>Inclination (°)</b>	<b>Azimuth (°)</b>	<b>Vertical Depth (ft)</b>	<b>+N/-S (ft)</b>	<b>+E/-W (ft)</b>	<b>Vertical Section (ft)</b>	<b>Dogleg Rate (°/100ft)</b>	<b>Build Rate (°/100ft)</b>	<b>Turn Rate (°/100ft)</b>	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.13	125.55	100.00	-0.07	0.09	-0.10	0.13	0.13	0.00	
200.00	0.28	254.80	200.00	-0.20	-0.05	-0.14	0.38	0.15	129.25	
300.00	0.27	272.55	300.00	-0.25	-0.52	0.05	0.09	-0.01	17.75	
400.00	0.29	242.80	400.00	-0.35	-0.98	0.19	0.15	0.02	-29.75	
500.00	0.29	260.92	500.00	-0.51	-1.46	0.29	0.09	0.00	18.12	
600.00	0.10	257.77	600.00	-0.57	-1.79	0.41	0.19	-0.19	-3.15	
700.00	0.29	214.14	699.99	-0.80	-2.02	0.33	0.23	0.19	-43.63	
800.00	0.09	196.78	799.99	-1.08	-2.19	0.17	0.21	-0.20	-17.36	

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<b>Well:</b>	Lackawanna 3H (slot Z)	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Sidetrack 01 Lateral	<b>Survey Calculation Method:</b>	Minimum Curvature
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Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	WV Department of Environmental Protection	
900.00	0.05	217.92	899.99	-1.19	-2.23	0.10	0.05	-0.04	21.14	
1,000.00	0.14	317.24	999.99	-1.14	-2.34	0.20	0.16	0.09	99.32	
1,100.00	0.12	198.00	1,099.99	-1.15	-2.46	0.25	0.22	-0.02	-119.24	
1,200.00	0.07	275.01	1,199.99	-1.24	-2.55	0.22	0.12	-0.05	77.01	
1,300.00	0.15	243.10	1,299.99	-1.29	-2.73	0.26	0.10	0.08	-31.91	
1,400.00	0.66	211.41	1,399.99	-1.84	-3.15	0.00	0.54	0.51	-31.69	
1,500.00	1.13	202.75	1,499.98	-3.25	-3.83	-0.87	0.49	0.47	-8.66	
1,600.00	1.24	213.34	1,599.96	-5.06	-4.80	-1.94	0.24	0.11	10.59	
1,700.00	1.77	207.09	1,699.92	-7.34	-6.10	-3.26	0.55	0.53	-6.25	
1,800.00	1.48	206.59	1,799.88	-9.87	-7.38	-4.79	0.29	-0.29	-0.50	
1,900.00	2.18	212.39	1,899.83	-12.63	-8.98	-6.37	0.72	0.70	5.80	
2,000.00	2.02	204.51	1,999.76	-15.84	-10.73	-8.26	0.33	-0.16	-7.88	
2,100.00	2.38	207.56	2,099.69	-19.28	-12.42	-10.38	0.38	0.36	3.05	
2,200.00	3.13	185.87	2,199.58	-23.84	-13.66	-13.69	1.27	0.75	-21.69	
2,300.00	4.12	183.78	2,299.37	-30.14	-14.18	-18.87	1.00	0.99	-2.09	
2,400.00	4.74	182.51	2,399.08	-37.85	-14.60	-25.32	0.63	0.62	-1.27	
2,500.00	4.79	180.97	2,498.73	-46.15	-14.85	-32.36	0.14	0.05	-1.54	
2,600.00	4.28	186.50	2,598.42	-54.04	-15.34	-38.91	0.67	-0.51	5.53	
2,700.00	3.73	199.00	2,698.17	-60.82	-16.82	-44.02	1.03	-0.55	12.50	
2,800.00	3.08	176.21	2,798.00	-66.58	-17.70	-48.55	1.49	-0.65	-22.79	
2,873.00	3.13	182.33	2,870.89	-70.52	-17.66	-51.98	0.46	0.07	8.38	
<b>Tie into original hole @ 2873 MD</b>										
2,945.00	2.49	188.12	2,942.81	-74.04	-17.96	-54.86	0.97	-0.89	8.04	
2,977.00	2.48	185.99	2,974.78	-75.41	-18.13	-55.97	0.29	-0.03	-6.66	
3,034.00	3.80	165.18	3,031.69	-78.47	-17.77	-58.78	3.02	2.32	-36.51	
3,072.00	4.54	161.50	3,069.59	-81.11	-16.97	-61.47	2.07	1.95	-9.68	
3,167.00	8.96	151.21	3,163.91	-91.16	-12.21	-72.55	4.81	4.65	-10.83	
3,260.00	11.16	148.36	3,255.48	-105.17	-4.00	-88.79	2.42	2.37	-3.06	
3,355.00	12.91	146.11	3,348.39	-121.81	6.74	-108.57	1.91	1.84	-2.37	
3,450.00	15.36	148.32	3,440.50	-141.33	19.26	-131.75	2.64	2.58	2.33	
3,545.00	18.47	152.90	3,531.39	-165.44	32.73	-159.36	3.56	3.27	4.82	
3,636.00	21.46	152.23	3,616.91	-193.01	47.06	-190.39	3.30	3.29	-0.74	
3,730.00	23.55	150.46	3,703.75	-224.57	64.33	-226.35	2.34	2.22	-1.88	
3,825.00	26.21	149.52	3,789.92	-259.16	84.33	-266.31	2.83	2.80	-0.99	
3,919.00	28.22	150.53	3,873.51	-296.41	105.80	-309.29	2.19	2.14	1.07	
4,013.00	27.97	149.31	3,956.44	-334.71	127.98	-353.56	0.67	-0.27	-1.30	
4,108.00	27.77	149.71	4,040.42	-372.98	150.51	-397.97	0.29	-0.21	0.42	
4,203.00	27.64	149.72	4,124.53	-411.12	172.79	-442.13	0.14	-0.14	0.01	
4,298.00	27.73	148.43	4,208.65	-448.98	195.47	-486.27	0.64	0.09	-1.36	
4,391.00	27.23	147.06	4,291.16	-485.27	218.37	-529.15	0.87	-0.54	-1.47	
4,486.00	26.74	147.99	4,375.82	-521.64	241.51	-572.23	0.68	-0.52	0.98	
4,580.00	26.70	146.92	4,459.78	-557.26	264.25	-614.46	0.51	-0.04	-1.14	
4,675.00	25.64	149.37	4,545.04	-592.83	286.37	-656.33	1.59	-1.12	2.58	

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<b>Well:</b>	Lackawanna 3H (slot Z)	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Sidetrack 01 Lateral	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Surveys Sidetrack 01 Lateral	<b>Database:</b>	DB_Jul2216dt_v14 lt

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Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	WV Department of Environmental Protection Build Rate (°/100ft)	Turn Rate (°/100ft)
4,770.00	25.52	147.51	4,630.73	-627.78	307.84	-697.34	0.85	-0.13	-1.96
4,865.00	25.72	147.62	4,716.39	-662.45	329.87	-738.39	0.22	0.21	0.12
4,960.00	26.72	147.68	4,801.61	-697.91	352.33	-780.33	1.05	1.05	0.06
5,055.00	27.12	149.47	4,886.32	-734.61	374.75	-823.33	0.95	0.42	1.88
5,149.00	27.11	149.47	4,969.99	-771.51	396.51	-866.17	0.01	-0.01	0.00
5,244.00	27.14	151.73	5,054.54	-809.24	417.77	-909.47	1.09	0.03	2.38
5,337.00	27.38	150.92	5,137.22	-846.61	438.21	-952.05	0.48	0.26	-0.87
5,432.00	28.09	149.91	5,221.30	-885.06	460.04	-996.26	0.90	0.75	-1.06
5,527.00	27.34	149.15	5,305.40	-923.14	482.44	-1,040.44	0.87	-0.79	-0.80
5,621.00	26.28	147.80	5,389.30	-959.28	504.60	-1,082.82	1.30	-1.13	-1.44
5,717.00	25.72	150.49	5,475.58	-995.39	526.19	-1,124.90	1.36	-0.58	2.80
5,812.00	26.60	149.66	5,560.85	-1,031.69	547.08	-1,166.78	1.00	0.93	-0.87
5,906.00	27.18	148.12	5,644.69	-1,068.08	569.05	-1,209.28	0.96	0.62	-1.64
5,943.00	27.03	148.04	5,677.63	-1,082.39	577.97	-1,226.13	0.42	-0.41	-0.22
6,038.00	20.88	147.86	5,764.40	-1,115.07	598.42	-1,264.67	6.47	-6.47	-0.19
6,133.00	15.16	152.70	5,854.71	-1,140.47	613.14	-1,294.02	6.22	-6.02	5.09
6,228.00	7.96	148.74	5,947.72	-1,157.15	622.26	-1,313.03	7.62	-7.58	-4.17
6,322.00	2.55	182.14	6,041.31	-1,164.81	625.56	-1,321.31	6.38	-5.76	35.53
6,417.00	5.10	310.02	6,136.19	-1,164.21	622.25	-1,319.11	7.33	2.68	134.61
6,513.00	10.51	327.25	6,231.28	-1,154.09	614.23	-1,306.34	6.08	5.64	17.95
6,607.00	15.16	336.74	6,322.91	-1,135.58	604.74	-1,285.56	5.42	4.95	10.10
6,702.00	22.90	334.02	6,412.65	-1,107.51	591.71	-1,254.75	8.20	8.15	-2.86
6,797.00	32.13	331.12	6,496.82	-1,068.69	571.37	-1,210.97	9.81	9.72	-3.05
6,892.00	42.42	330.32	6,572.31	-1,018.59	543.23	-1,153.52	10.84	10.83	-0.84
6,987.00	53.36	330.85	6,635.92	-957.28	508.69	-1,083.16	11.52	11.52	0.56
7,082.00	66.02	329.97	6,683.77	-886.13	468.24	-1,001.32	13.35	13.33	-0.93
7,178.00	72.35	328.92	6,717.87	-808.90	422.63	-911.63	6.67	6.59	-1.09
7,273.00	81.32	329.18	6,739.48	-729.65	375.11	-819.23	9.45	9.44	0.27
7,368.00	84.22	329.53	6,751.44	-648.58	327.08	-725.00	3.07	3.05	0.37
7,461.00	93.63	328.04	6,753.18	-569.15	278.94	-632.13	10.24	10.12	-1.60
7,529.00	92.40	328.65	6,749.60	-511.35	243.31	-564.25	2.02	-1.81	0.90
7,556.00	92.48	328.74	6,748.45	-488.30	229.29	-537.28	0.45	0.30	0.33
7,651.00	89.58	325.40	6,746.74	-408.59	177.67	-442.42	4.66	-3.05	-3.52
7,747.00	87.91	328.92	6,748.85	-327.97	125.63	-346.55	4.06	-1.74	3.67
7,842.00	88.00	329.36	6,752.24	-246.47	76.93	-251.62	0.47	0.09	0.46
7,937.00	89.54	329.80	6,754.28	-164.57	28.84	-156.64	1.69	1.62	0.46
8,032.00	89.85	329.53	6,754.78	-82.58	-19.14	-61.64	0.43	0.33	-0.28
8,127.00	90.73	329.53	6,754.30	-0.70	-67.31	33.35	0.93	0.93	0.00
8,222.00	91.30	329.62	6,752.62	81.20	-115.41	128.34	0.61	0.60	0.09
8,317.00	89.41	330.50	6,752.03	163.52	-162.82	223.33	2.19	-1.99	0.93
8,410.00	89.41	329.88	6,752.99	244.21	-209.05	316.32	0.67	0.00	-0.67
8,505.00	89.89	329.71	6,753.57	326.31	-256.84	411.32	0.54	0.51	-0.18
8,599.00	90.37	330.32	6,753.36	407.73	-303.82	505.31	0.83	0.51	0.65
8,694.00	91.08	330.15	6,752.15	490.18	-350.98	600.30	0.77	0.75	-0.18

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 SEP 30 2022

## Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	WV Department of Environmental Protection Rate (°/100ft)	Rate (°/100ft)
8,788.00	88.92	330.68	6,752.15	571.92	-397.39	694.29	2.37	-2.30	0.56
8,883.00	89.14	330.32	6,753.76	654.60	-444.16	789.27	0.44	0.23	-0.38
8,977.00	90.07	330.06	6,754.41	736.16	-490.89	883.26	1.03	0.99	-0.28
9,072.00	90.95	330.32	6,753.56	818.58	-538.11	978.25	0.97	0.93	0.27
9,168.00	89.71	330.76	6,753.01	902.16	-585.32	1,074.24	1.37	-1.29	0.46
9,263.00	90.33	330.94	6,752.98	985.13	-631.60	1,169.22	0.68	0.65	0.19
9,358.00	91.25	331.03	6,751.67	1,068.20	-677.67	1,264.18	0.97	0.97	0.09
9,453.00	92.00	331.21	6,748.97	1,151.35	-723.54	1,359.12	0.81	0.79	0.19
9,548.00	90.77	330.32	6,746.68	1,234.22	-769.92	1,454.07	1.60	-1.29	-0.94
9,643.00	87.74	330.32	6,747.91	1,316.74	-816.95	1,549.04	3.19	-3.19	0.00
9,738.00	87.56	330.24	6,751.81	1,399.18	-864.01	1,643.96	0.21	-0.19	-0.08
9,832.00	88.44	330.41	6,755.09	1,480.80	-910.52	1,737.90	0.95	0.94	0.18
9,926.00	89.01	330.68	6,757.18	1,562.63	-956.73	1,831.86	0.67	0.61	0.29
10,021.00	89.71	331.12	6,758.24	1,645.63	-1,002.93	1,926.83	0.87	0.74	0.46
10,115.00	90.37	331.03	6,758.18	1,727.90	-1,048.39	2,020.81	0.71	0.70	-0.10
10,211.00	90.73	331.29	6,757.25	1,811.99	-1,094.69	2,116.77	0.46	0.38	0.27
10,306.00	90.95	330.41	6,755.86	1,894.95	-1,140.96	2,211.74	0.95	0.23	-0.93
10,399.00	91.60	330.59	6,753.79	1,975.87	-1,186.75	2,304.71	0.73	0.70	0.19
10,494.00	88.44	330.41	6,753.76	2,058.55	-1,233.52	2,399.69	3.33	-3.33	-0.19
10,589.00	89.14	330.24	6,755.77	2,141.07	-1,280.54	2,494.66	0.76	0.74	-0.18
10,684.00	89.45	328.48	6,756.93	2,222.80	-1,328.95	2,589.65	1.88	0.33	-1.85
10,779.00	91.47	331.20	6,756.17	2,304.92	-1,376.68	2,684.63	3.57	2.13	2.86
10,874.00	91.16	329.88	6,753.99	2,387.61	-1,423.38	2,779.59	1.43	-0.33	-1.39
10,969.00	91.43	326.54	6,751.84	2,468.33	-1,473.41	2,874.52	3.53	0.28	-3.52
11,064.00	92.18	325.93	6,748.85	2,547.26	-1,526.18	2,969.30	1.02	0.79	-0.64
11,159.00	92.88	329.09	6,744.66	2,627.31	-1,577.16	3,064.12	3.40	0.74	3.33
11,253.00	93.45	329.09	6,739.47	2,707.83	-1,625.37	3,157.98	0.61	0.61	0.00
11,348.00	91.12	329.53	6,735.68	2,789.46	-1,673.82	3,252.89	2.50	-2.45	0.46
11,443.00	91.74	329.36	6,733.31	2,871.24	-1,722.10	3,347.86	0.68	0.65	-0.18
11,538.00	90.59	330.32	6,731.38	2,953.36	-1,769.81	3,442.84	1.58	-1.21	1.01
11,633.00	91.38	330.85	6,729.74	3,036.10	-1,816.46	3,537.81	1.00	0.83	0.56
11,727.00	92.09	331.55	6,726.90	3,118.43	-1,861.73	3,631.73	1.06	0.76	0.74
11,822.00	89.76	331.03	6,725.36	3,201.74	-1,907.35	3,726.68	2.51	-2.45	-0.55
11,917.00	89.98	331.29	6,725.58	3,284.95	-1,953.18	3,821.65	0.36	0.23	0.27
12,012.00	90.37	330.85	6,725.29	3,368.10	-1,999.13	3,916.62	0.62	0.41	-0.46
12,106.00	90.90	331.38	6,724.25	3,450.40	-2,044.54	4,010.58	0.80	0.56	0.56
12,201.00	91.82	331.91	6,721.99	3,533.98	-2,089.64	4,105.50	1.12	0.97	0.56
12,296.00	90.42	330.94	6,720.14	3,617.39	-2,135.07	4,200.44	1.79	-1.47	-1.02
12,390.00	90.73	330.15	6,719.19	3,699.23	-2,181.29	4,294.42	0.90	0.33	-0.84
12,485.00	91.34	329.53	6,717.48	3,781.36	-2,229.01	4,389.40	0.92	0.64	-0.65
12,578.00	91.52	329.27	6,715.16	3,861.38	-2,276.34	4,482.37	0.34	0.19	-0.28
12,673.00	92.22	329.53	6,712.06	3,943.11	-2,324.67	4,577.32	0.79	0.74	0.27
12,767.00	90.20	329.18	6,710.07	4,023.96	-2,372.57	4,671.29	2.18	-2.15	-0.37

<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Lackawanna 3H (slot Z)
<b>Project:</b>	Wetzel County, West Virginia (UTM17 NAD83)	<b>TVD Reference:</b>	RKB=1306+18 @ 1324.00ft (Precision 528)
<b>Site:</b>	Lackawanna	<b>MD Reference:</b>	RKB=1306+18 @ 1324.00ft (Precision 528)
<b>Well:</b>	Lackawanna 3H (slot Z)	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Sidetrack 01 Lateral	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Surveys Sidetrack 01 Lateral	<b>Database:</b>	DB_Jul2216dt_v14.lt

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 Office of Oil and Gas  
 SEP 30 2022

**Survey**

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	WV Department of Environmental Protection Rate (°/100ft)	Rate (°/100ft)
12,861.00	90.51	329.62	6,709.49	4,104.86	-2,420.42	4,765.29	0.57	0.33	0.47
12,956.00	91.38	329.45	6,707.92	4,186.74	-2,468.58	4,860.28	0.93	0.92	-0.18
13,051.00	91.78	329.27	6,705.30	4,268.44	-2,516.98	4,955.24	0.46	0.42	-0.19
13,146.00	91.03	329.88	6,702.97	4,350.33	-2,565.07	5,050.21	1.02	-0.79	0.64
13,241.00	91.12	328.74	6,701.19	4,432.01	-2,613.55	5,145.19	1.20	0.09	-1.20
13,336.00	91.03	328.30	6,699.41	4,513.02	-2,663.15	5,240.15	0.47	-0.09	-0.46
13,430.00	90.73	328.30	6,697.96	4,592.98	-2,712.54	5,334.11	0.32	-0.32	0.00
13,525.00	90.81	328.48	6,696.69	4,673.88	-2,762.33	5,429.08	0.21	0.08	0.19
13,620.00	90.81	329.09	6,695.35	4,755.12	-2,811.56	5,524.06	0.64	0.00	0.64
13,714.00	90.64	329.36	6,694.16	4,835.88	-2,859.65	5,618.04	0.34	-0.18	0.29
13,809.00	91.21	329.80	6,692.62	4,917.79	-2,907.74	5,713.03	0.76	0.60	0.46
13,903.00	91.08	330.32	6,690.74	4,999.22	-2,954.65	5,807.01	0.57	-0.14	0.55
13,999.00	91.03	329.97	6,688.98	5,082.47	-3,002.43	5,902.99	0.37	-0.05	-0.36
14,093.00	91.08	328.13	6,687.25	5,163.07	-3,050.76	5,996.97	1.96	0.05	-1.96
14,188.00	91.43	328.04	6,685.16	5,243.69	-3,100.97	6,091.90	0.38	0.37	-0.09
14,282.00	90.55	328.65	6,683.54	5,323.69	-3,150.30	6,185.86	1.14	-0.94	0.65
14,377.00	91.30	328.39	6,682.01	5,404.70	-3,199.90	6,280.83	0.84	0.79	-0.27
14,472.00	90.37	329.45	6,680.62	5,486.05	-3,248.94	6,375.81	1.48	-0.98	1.12
14,567.00	89.41	330.41	6,680.80	5,568.26	-3,296.53	6,470.81	1.43	-1.01	1.01
14,662.00	89.76	330.41	6,681.49	5,650.87	-3,343.44	6,565.80	0.37	0.37	0.00
14,757.00	90.15	330.59	6,681.57	5,733.55	-3,390.22	6,660.79	0.45	0.41	0.19
14,852.00	90.90	330.85	6,680.70	5,816.41	-3,436.68	6,755.77	0.84	0.79	0.27
14,947.00	91.47	330.76	6,678.73	5,899.33	-3,483.01	6,850.73	0.61	0.60	-0.09
15,041.00	91.96	331.12	6,675.92	5,981.45	-3,528.65	6,944.66	0.65	0.52	0.38
15,137.00	90.46	330.76	6,673.89	6,065.35	-3,575.27	7,040.62	1.61	-1.56	-0.38
15,231.00	90.37	330.94	6,673.21	6,147.44	-3,621.05	7,134.59	0.21	-0.10	0.19
15,325.00	90.77	331.38	6,672.28	6,229.78	-3,666.39	7,228.56	0.63	0.43	0.47
15,419.00	90.99	331.64	6,670.83	6,312.38	-3,711.23	7,322.50	0.36	0.23	0.28
15,514.00	91.34	332.61	6,668.90	6,396.34	-3,755.63	7,417.40	1.09	0.37	1.02
15,608.00	91.52	332.26	6,666.55	6,479.65	-3,799.12	7,511.26	0.42	0.19	-0.37
15,703.00	89.41	331.47	6,665.78	6,563.41	-3,843.91	7,606.18	2.37	-2.22	-0.83
15,797.00	89.67	331.64	6,666.54	6,646.06	-3,888.68	7,700.13	0.33	0.28	0.18
15,892.00	90.24	331.99	6,666.61	6,729.80	-3,933.55	7,795.06	0.70	0.60	0.37
15,987.00	90.55	332.35	6,665.96	6,813.81	-3,977.90	7,889.97	0.50	0.33	0.38
16,081.00	90.51	332.26	6,665.09	6,897.03	-4,021.59	7,983.87	0.10	-0.04	-0.10
16,175.00	92.53	330.50	6,662.60	6,979.51	-4,066.60	8,077.79	2.85	2.15	-1.87
16,269.00	93.01	330.24	6,658.05	7,061.13	-4,113.01	8,171.67	0.58	0.51	-0.28
16,364.00	93.76	330.24	6,652.44	7,143.45	-4,160.09	8,266.50	0.79	0.79	0.00
16,460.00	92.75	329.62	6,646.99	7,226.40	-4,208.11	8,362.35	1.23	-1.05	-0.65
16,554.00	91.12	329.45	6,643.82	7,307.37	-4,255.74	8,456.29	1.74	-1.73	-0.18
16,649.00	89.41	328.65	6,643.38	7,388.84	-4,304.60	8,551.28	1.99	-1.80	-0.84
16,745.00	89.98	328.65	6,643.89	7,470.82	-4,354.54	8,647.26	0.59	0.59	0.00
16,841.00	90.42	328.83	6,643.56	7,552.88	-4,404.36	8,743.24	0.50	0.46	0.19

<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Lackawanna 3H (slot Z)
<b>Project:</b>	Wetzel County, West Virginia (UTM17 NAD83)	<b>TVD Reference:</b>	RKB=1306+18 @ 1324.00ft (Precision 528)
<b>Site:</b>	Lackawanna	<b>MD Reference:</b>	RKB=1306+18 @ 1324.00ft (Precision 528)
<b>Well:</b>	Lackawanna 3H (slot Z)	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Sidetrack 01 Lateral	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Surveys Sidetrack 01 Lateral	<b>Database:</b>	DB_Jul2216dt_v14

SEP 30 2022

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	VAAD Department of Environmental Protection (°/100ft)	From Protection (°/100ft)	
16,935.00	90.90	328.74	6,642.47	7,633.27	-4,453.07	8,837.23	0.52	0.51	-0.10	
17,030.00	90.51	328.74	6,641.30	7,714.47	-4,502.36	8,932.21	0.41	-0.41	0.00	
17,124.00	93.01	329.71	6,638.42	7,795.19	-4,550.43	9,026.15	2.85	2.66	1.03	
17,219.00	92.92	329.71	6,633.50	7,877.11	-4,598.28	9,121.02	0.09	-0.09	0.00	
17,314.00	93.54	329.88	6,628.15	7,959.08	-4,646.00	9,215.87	0.68	0.65	0.18	
17,409.00	94.20	330.24	6,621.74	8,041.21	-4,693.31	9,310.65	0.79	0.69	0.38	
17,504.00	94.51	329.71	6,614.52	8,123.23	-4,740.71	9,405.38	0.64	0.33	-0.56	
17,571.00	95.43	329.62	6,608.72	8,180.84	-4,774.42	9,472.12	1.38	1.37	-0.13	
<b>Survey @ 17571.00 MD 6608.72 TVD</b>										
17,622.00	95.43	329.62	6,603.89	8,224.64	-4,800.09	9,522.89	0.00	0.00	0.00	
<b>Survey Projected to 17622.00 MD 6603.89 TVD</b>										

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
2,873.00	2,870.89	-70.52	-17.66	Tie into original hole @ 2873 MD
17,571.00	6,608.72	8,180.84	-4,774.42	Survey @ 17571.00 MD 6608.72 TVD
17,622.00	6,603.89	8,224.64	-4,800.09	Survey Projected to 17622.00 MD 6603.89 TVD

<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Lackawanna 3H (slot Z)
<b>Project:</b>	Wetzel County, West Virginia (UTM17 NAD83)	<b>TVD Reference:</b>	RKB=1306+18 @ 1324.00ft (Precision 528)
<b>Site:</b>	Lackawanna	<b>MD Reference:</b>	RKB=1306+18 @ 1324.00ft (Precision 528)
<b>Well:</b>	Lackawanna 3H (slot Z)	<b>North Reference:</b>	Grid <b>RECEIVED</b>
<b>Wellbore:</b>	Sidetrack 01 Lateral	<b>Survey Calculation Method:</b>	Minimum Curvature <b>Office of Oil and Gas</b>
<b>Design:</b>	Surveys Sidetrack 01 Lateral	<b>Database:</b>	DB_Jul2216dt_v14 lt <b>SEP 30 2022</b>

<b>Project</b>	Wetzel County, West Virginia (UTM17 NAD83)		
<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>WV Department of Environmental Protection</b>	
<b>Map Zone:</b>	Zone 17N (84 W to 78 W)		

<b>Site</b>	Lackawanna			
<b>Site Position:</b>	<b>Northing:</b>	14,383,374.84 usft	<b>Latitude:</b>	39.60620769
<b>From:</b> Lat/Long	<b>Easting:</b>	1,680,777.71 usft	<b>Longitude:</b>	-80.85669942
<b>Position Uncertainty:</b> 0.00 ft	<b>Slot Radius:</b>	13-3/16 "	<b>Grid Convergence:</b>	0.091 °

<b>Well</b>	Lackawanna 3H (slot Z)			
<b>Well Position</b>	<b>+N/-S</b>	0.00 ft	<b>Northing:</b>	14,383,334.89 usft
	<b>+E/-W</b>	0.00 ft	<b>Easting:</b>	1,680,775.97 usft
<b>Position Uncertainty</b>		0.00 ft	<b>Wellhead Elevation:</b>	ft
			<b>Latitude:</b>	39.60609798
			<b>Longitude:</b>	-80.85670585
			<b>Ground Level:</b>	1,306.00 ft

<b>Wellbore</b>	Sidetrack 01 Lateral				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	IGRF2015	7/16/2018	-8.584	66.745	51,973.52146553

<b>Design</b>	Surveys Sidetrack 01 Lateral				
<b>Audit Notes:</b>					
<b>Version:</b>	1.0	<b>Phase:</b>	ACTUAL	<b>Tie On Depth:</b>	2,873.00
<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	329.70	

<b>Survey Program</b>	<b>Date</b>	8/5/2019			
<b>From (ft)</b>	<b>To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
100.00	2,873.00	Gyro 0-2873 MD (Original Hole)	NS-GYRO-MS	North sensing gyrocompassing m/s	
2,945.00	17,571.00	MWD ST1 (Sidetrack 01 Lateral)	MWD	MWD - Standard	
17,622.00	17,622.00	Projection (Sidetrack 01 Lateral)	MWD	MWD - Standard	

<b>Survey</b>										
<b>Measured Depth (ft)</b>	<b>Inclination (°)</b>	<b>Azimuth (°)</b>	<b>Vertical Depth (ft)</b>	<b>+N/-S (ft)</b>	<b>+E/-W (ft)</b>	<b>Map Northing (usft)</b>	<b>Map Easting (usft)</b>	<b>Latitude</b>	<b>Longitude</b>	
0.00	0.00	0.00	0.00	0.00	0.00	14,383,334.89	1,680,775.97	39.60609798	-80.85670585	
100.00	0.13	125.55	100.00	-0.07	0.09	14,383,334.83	1,680,776.06	39.60609780	-80.85670552	
200.00	0.28	254.80	200.00	-0.20	-0.05	14,383,334.70	1,680,775.91	39.60609744	-80.85670603	
300.00	0.27	272.55	300.00	-0.25	-0.52	14,383,334.64	1,680,775.44	39.60609730	-80.85670771	
400.00	0.29	242.80	400.00	-0.35	-0.98	14,383,334.54	1,680,774.98	39.60609701	-80.85670934	
500.00	0.29	260.92	500.00	-0.51	-1.46	14,383,334.38	1,680,774.51	39.60609659	-80.85671103	
600.00	0.10	257.77	600.00	-0.57	-1.79	14,383,334.32	1,680,774.17	39.60609643	-80.85671222	
700.00	0.29	214.14	699.99	-0.80	-2.02	14,383,334.10	1,680,773.94	39.60609580	-80.85671303	
800.00	0.09	196.78	799.99	-1.08	-2.19	14,383,333.81	1,680,773.78	39.60609502	-80.85671362	
900.00	0.05	217.92	899.99	-1.19	-2.23	14,383,333.70	1,680,773.73	39.60609472	-80.85671379	









<b>Company:</b>	Tug Hill Operating LLC	<b>Local Co-ordinate Reference:</b>	Well Lackawanna 3H (slot Z)
<b>Project:</b>	Wetzel County, West Virginia (UTM17 NAD83)	<b>TVD Reference:</b>	RKB=1306+18 @ 1324.00ft (Precision 528)
<b>Site:</b>	Lackawanna	<b>MD Reference:</b>	RKB=1306+18 @ 1324.00ft (Precision 528)
<b>Well:</b>	Lackawanna 3H (slot Z)	<b>North Reference:</b>	Grid
<b>Wellbore:</b>	Sidetrack 01 Lateral	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	Surveys Sidetrack 01 Lateral	<b>Database:</b>	DB_Jul2216dt_v14 It

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
16,269.00	93.01	330.24	6,658.05	7,061.13	-4,113.01	14,390,396.00	1,676,662.96	39.62550749	-80.87127297
16,364.00	93.76	330.24	6,652.44	7,143.45	-4,160.09	14,390,478.33	1,676,615.89	39.62573377	-80.87143973
16,460.00	92.75	329.62	6,646.99	7,226.40	-4,208.11	14,390,561.27	1,676,567.86	39.62596175	-80.87160986
16,554.00	91.12	329.45	6,643.82	7,307.37	-4,255.74	14,390,642.25	1,676,520.23	39.62618432	-80.87177861
16,649.00	89.41	328.65	6,643.38	7,388.84	-4,304.60	14,390,723.72	1,676,471.38	39.62640826	-80.87195170
16,745.00	89.98	328.65	6,643.89	7,470.82	-4,354.54	14,390,805.70	1,676,421.43	39.62663361	-80.87212866
16,841.00	90.42	328.83	6,643.56	7,552.88	-4,404.36	14,390,887.76	1,676,371.62	39.62685917	-80.87230517
16,935.00	90.90	328.74	6,642.47	7,633.27	-4,453.07	14,390,968.15	1,676,322.91	39.62708013	-80.87247777
17,030.00	90.51	328.74	6,641.30	7,714.47	-4,502.36	14,391,049.35	1,676,273.61	39.62730333	-80.87265242
17,124.00	93.01	329.71	6,638.42	7,795.19	-4,550.43	14,391,130.06	1,676,225.54	39.62752520	-80.87282274
17,219.00	92.92	329.71	6,633.50	7,877.11	-4,598.28	14,391,211.99	1,676,177.69	39.62775037	-80.87299228
17,314.00	93.54	329.88	6,628.15	7,959.08	-4,646.00	14,391,293.96	1,676,129.97	39.62797568	-80.87316134
17,409.00	94.20	330.24	6,621.74	8,041.21	-4,693.31	14,391,376.09	1,676,082.67	39.62820143	-80.87332894
17,504.00	94.51	329.71	6,614.52	8,123.23	-4,740.71	14,391,458.10	1,676,035.27	39.62842685	-80.87349686
17,571.00	95.43	329.62	6,608.72	8,180.84	-4,774.42	14,391,515.71	1,676,001.56	39.62858520	-80.87361630
<b>Survey @ 17571.00 MD 6608.72 TVD</b>									
17,622.00	95.43	329.62	6,603.89	8,224.64	-4,800.09	14,391,559.51	1,675,975.88	39.62870558	-80.87370728
<b>Survey Projected to 17622.00 MD 6603.89 TVD</b>									

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
2,873.00	2,870.89	-70.52	-17.66	Tie into original hole @ 2873 MD
17,571.00	6,608.72	8,180.84	-4,774.42	Survey @ 17571.00 MD 6608.72 TVD
17,622.00	6,603.89	8,224.64	-4,800.09	Survey Projected to 17622.00 MD 6603.89 TVD

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