



**Tug Hill Operating, LLC Casing and Cement Program**

**Van Winkle N-5HM**

**Casing**

	String	Grade	Bit Size	Depth (Measured)	Cement Fill Up
Conductor	30"	BW	36"	120' /	CTS
Surface	13 3/8"	J55	17 1/2"	515' /	CTS
Intermediate	9 5/8"	J55	12 1/4"	2,226' /	CTS
Production	5 1/2"	CYHP110	8 7/8 x 8 3/4	21,400' /	CTS

**Cement**

- Conductor: Premium NE-1 + 2% bwoc CaC12 + 46.5% Fresh Water – Conductor Cement mixed at 15.6 ppg, Y=1.2
- Surface: Premium NE-1 + 2% bwoc CaC12 + 46.5% Fresh Water – Surface Cement mixed at 15.6 ppg, Y=1.2
- Intermediate: Premium NE-1 + 1% bwoc CaC12 + 46.5% Fresh Water – Intermediate Cement mixed at 15.6 ppg, Y=1.19
- Kick Off Plug: Class H Cement + 1% CD-32 + .7% Sodium Metasilicate + .1% R-3 + .75 gal/100sk FP-13L - KOP Plug
- Production: 50:50 Poz: Premium NE-1 + .1% bwoc ASA-301 + 60lb/sk ASCA-1 + .35% bwoc BA-10A + .25% bwoc MPA-170, 44 lb sack + .5% bwoc R-3 + .75 gals/100sk FP-13L – Production Cement mixed at 15.2ppg, Y = 1.19

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Well: Van Winkle N-05 HIM (slot T)  
 Site: Van Winkle  
 Project: Marshall County, West Virginia NAD83 UTM 17N  
 Design: rev3  
 Rig:

DESIGN TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
Van Winkle N-05HM PBHL r2 - plan hits target center	5916.02	12726.23	-8108.30	44501.58	248.17	39.816910000	-80.755000000
Van Winkle N-05HM LP r1 - plan hits target center	6174.00	-104.35	-787.73	4447327.690	1716532.638	39.781616000	-80.729068000

SECTION DETAILS

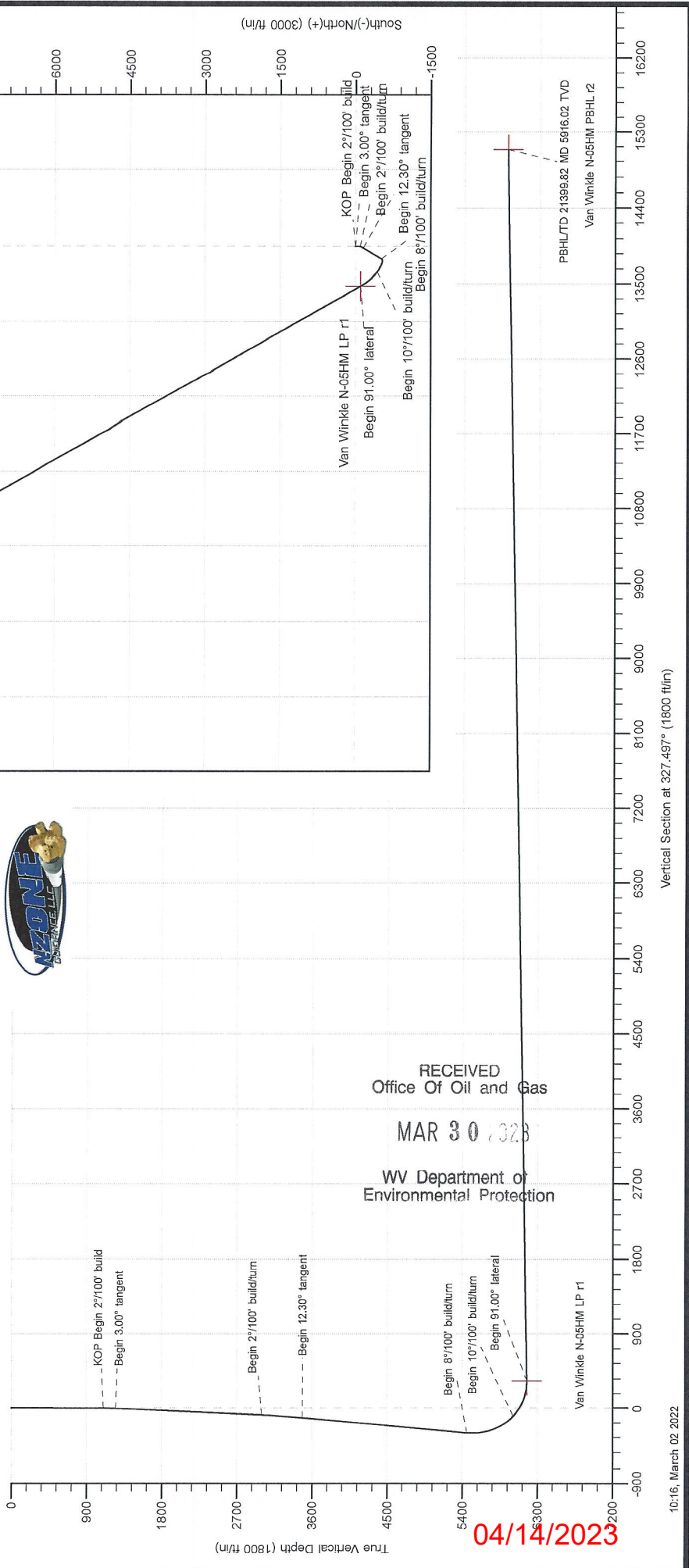
Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSEct	Annotation
1	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	
2	1100.00	0.00	0.000	1100.00	0.00	0.00	0.00	0.00	0.00	KOP Begin 2°/100' build
3	1250.00	3.00	180.000	1249.93	-3.93	0.00	-3.31	180.00	-3.31	Begin 3.00° tangent
4	3002.47	3.00	180.000	3000.00	-95.64	0.00	-80.66	0.00	-80.66	Begin 2°/100' build/turn
5	3495.74	12.30	211.500	3488.48	-153.49	2.00	-114.66	40.52	-114.66	Begin 12.30° tangent
6	5508.97	12.30	211.500	5455.50	-519.17	0.00	-302.65	0.00	-302.65	Begin 8°/100' build/turn
7	6146.02	49.20	304.497	6011.99	-434.83	8.00	-502.68	103.24	-96.68	Begin 10°/100' build/turn
8	6625.48	91.00	330.293	6174.00	-104.35	10.00	-355.27	35.88	-335.27	Begin 91.00° lateral
9	21399.82	91.00	330.293	5916.02	12726.23	-8108.30	0.00	0.00	0.00	PBHL/TD 21399.82 MD 5916.02 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: GL @ 753.00ft

Northing 14447432.042 Easting 1717320.367 Latitude 39.781896000 Longitude -80.726263000

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.82°



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Planning Report - Geographic

<b>Database:</b>	DB_Feb2822	<b>Local Co-ordinate Reference:</b>	Well Van Winkle N-05 HM (slot T)
<b>Company:</b>	Tug Hill Operating LLC	<b>TVD Reference:</b>	GL @ 753.00ft
<b>Project:</b>	Marshall County, West Virginia NAD83 UTM 17N	<b>MD Reference:</b>	GL @ 753.00ft
<b>Site:</b>	Van Winkle	<b>North Reference:</b>	Grid
<b>Well:</b>	Van Winkle N-05 HM (slot T)	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	rev3		

<b>Project</b>	Marshall County, West Virginia NAD83 UTM 17N		
<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>	Van Winkle				
<b>Site Position:</b>		<b>Northing:</b>	14,447,369.493 usft	<b>Latitude:</b>	39.781725330
<b>From:</b>	Lat/Long	<b>Easting:</b>	1,717,188.440 usft	<b>Longitude:</b>	-80.726733270
<b>Position Uncertainty:</b>	0.00 ft	<b>Slot Radius:</b>	13-3/16 "		

<b>Well</b>	Van Winkle N-05 HM (slot T)					
<b>Well Position</b>	<b>+N/-S</b>	0.00 ft	<b>Northing:</b>	14,447,432.042 usft	<b>Latitude:</b>	39.781896000
	<b>+E/-W</b>	0.00 ft	<b>Easting:</b>	1,717,320.368 usft	<b>Longitude:</b>	-80.726263000
<b>Position Uncertainty</b>		0.00 ft	<b>Wellhead Elevation:</b>	ft	<b>Ground Level:</b>	753.00 ft
<b>Grid Convergence:</b>	0.18 °					

<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>
	IGRF2020	2/25/2022	-8.65	66.47	51,679.14387345

<b>Design</b>	rev3			
<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	327.497

<b>Plan Survey Tool Program</b>	Date 3/2/2022			
<b>Depth From (ft)</b>	<b>Depth To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Remarks</b>
1	0.00	21,399.81 rev3 (Original Hole)	MWD MWD - Standard	

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<b>Company:</b>	Tug Hill Operating LLC	<b>TVD Reference:</b>	GL @ 753.00ft
<b>Project:</b>	Marshall County, West Virginia NAD83 UTM 17N	<b>MD Reference:</b>	GL @ 753.00ft
<b>Site:</b>	Van Winkle	<b>North Reference:</b>	Grid
<b>Well:</b>	Van Winkle N-05 HM (slot T)	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	rev3		

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	0.00	
1,100.00	0.00	0.000	1,100.00	0.00	0.00	0.00	0.00	0.00	0.00	
1,250.00	3.00	180.000	1,249.93	-3.93	0.00	2.00	2.00	0.00	180.00	
3,002.47	3.00	180.000	3,000.00	-95.64	0.00	0.00	0.00	0.00	0.00	
3,495.74	12.30	211.500	3,488.48	-153.49	-27.52	2.00	1.89	6.39	40.52	
5,508.97	12.30	211.500	5,455.50	-519.17	-251.61	0.00	0.00	0.00	0.00	
6,146.02	49.20	304.497	6,011.99	-434.83	-502.55	8.00	5.79	14.60	103.24	
6,625.48	91.00	330.293	6,174.00	-104.35	-787.73	10.00	8.72	5.38	35.88	Van Winkle N-05HM L
21,399.82	91.00	330.293	5,916.02	12,726.23	-8,108.30	0.00	0.00	0.00	0.00	Van Winkle N-05HM F



## Planning Report - Geographic

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<b>Project:</b>	Marshall County, West Virginia NAD83 UTM 17N	<b>MD Reference:</b>	GL @ 753.00ft
<b>Site:</b>	Van Winkle	<b>North Reference:</b>	Grid
<b>Well:</b>	Van Winkle N-05 HM (slot T)	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	rev3		

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	14,447,432.042	1,717,320.368	39.781896000	-80.726263000
100.00	0.00	0.000	100.00	0.00	0.00	14,447,432.042	1,717,320.368	39.781896000	-80.726263000
200.00	0.00	0.000	200.00	0.00	0.00	14,447,432.042	1,717,320.368	39.781896000	-80.726263000
300.00	0.00	0.000	300.00	0.00	0.00	14,447,432.042	1,717,320.368	39.781896000	-80.726263000
400.00	0.00	0.000	400.00	0.00	0.00	14,447,432.042	1,717,320.368	39.781896000	-80.726263000
500.00	0.00	0.000	500.00	0.00	0.00	14,447,432.042	1,717,320.368	39.781896000	-80.726263000
600.00	0.00	0.000	600.00	0.00	0.00	14,447,432.042	1,717,320.368	39.781896000	-80.726263000
700.00	0.00	0.000	700.00	0.00	0.00	14,447,432.042	1,717,320.368	39.781896000	-80.726263000
800.00	0.00	0.000	800.00	0.00	0.00	14,447,432.042	1,717,320.368	39.781896000	-80.726263000
900.00	0.00	0.000	900.00	0.00	0.00	14,447,432.042	1,717,320.368	39.781896000	-80.726263000
1,000.00	0.00	0.000	1,000.00	0.00	0.00	14,447,432.042	1,717,320.368	39.781896000	-80.726263000
1,100.00	0.00	0.000	1,100.00	0.00	0.00	14,447,432.042	1,717,320.368	39.781896000	-80.726263000
<b>KOP Begin 2°/100' build</b>									
1,200.00	2.00	180.000	1,199.98	-1.75	0.00	14,447,430.297	1,717,320.368	39.781891207	-80.726263019
1,250.00	3.00	180.000	1,249.93	-3.93	0.00	14,447,428.116	1,717,320.368	39.781885218	-80.726263043
<b>Begin 3.00° tangent</b>									
1,300.00	3.00	180.000	1,299.86	-6.54	0.00	14,447,425.499	1,717,320.368	39.781878032	-80.726263071
1,400.00	3.00	180.000	1,399.73	-11.78	0.00	14,447,420.266	1,717,320.368	39.781863659	-80.726263128
1,500.00	3.00	180.000	1,499.59	-17.01	0.00	14,447,415.032	1,717,320.368	39.781849286	-80.726263185
1,600.00	3.00	180.000	1,599.45	-22.24	0.00	14,447,409.799	1,717,320.368	39.781834913	-80.726263242
1,700.00	3.00	180.000	1,699.31	-27.48	0.00	14,447,404.565	1,717,320.368	39.781820540	-80.726263299
1,800.00	3.00	180.000	1,799.18	-32.71	0.00	14,447,399.331	1,717,320.368	39.781806168	-80.726263356
1,900.00	3.00	180.000	1,899.04	-37.94	0.00	14,447,394.098	1,717,320.368	39.781791795	-80.726263413
2,000.00	3.00	180.000	1,998.90	-43.18	0.00	14,447,388.864	1,717,320.368	39.781777422	-80.726263470
2,100.00	3.00	180.000	2,098.77	-48.41	0.00	14,447,383.631	1,717,320.368	39.781763049	-80.726263527
2,200.00	3.00	180.000	2,198.63	-53.65	0.00	14,447,378.397	1,717,320.368	39.781748676	-80.726263584
2,300.00	3.00	180.000	2,298.49	-58.88	0.00	14,447,373.163	1,717,320.368	39.781734303	-80.726263641
2,400.00	3.00	180.000	2,398.36	-64.11	0.00	14,447,367.930	1,717,320.368	39.781719931	-80.726263698
2,500.00	3.00	180.000	2,498.22	-69.35	0.00	14,447,362.696	1,717,320.368	39.781705558	-80.726263755
2,600.00	3.00	180.000	2,598.08	-74.58	0.00	14,447,357.463	1,717,320.368	39.781691185	-80.726263812
2,700.00	3.00	180.000	2,697.94	-79.81	0.00	14,447,352.229	1,717,320.368	39.781676812	-80.726263869
2,800.00	3.00	180.000	2,797.81	-85.05	0.00	14,447,346.996	1,717,320.368	39.781662439	-80.726263926
2,900.00	3.00	180.000	2,897.67	-90.28	0.00	14,447,341.762	1,717,320.368	39.781648067	-80.726263982
3,002.47	3.00	180.000	3,000.00	-95.64	0.00	14,447,336.399	1,717,320.368	39.781633339	-80.726264041
<b>Begin 2°/100' build/turn</b>									
3,100.00	4.66	195.800	3,097.31	-102.01	-1.08	14,447,330.036	1,717,319.289	39.781615872	-80.726267949
3,200.00	6.53	203.183	3,196.83	-111.14	-4.42	14,447,320.901	1,717,315.946	39.781590815	-80.726279950
3,300.00	8.46	207.251	3,295.97	-122.91	-10.03	14,447,309.136	1,717,310.340	39.781558552	-80.726300032
3,400.00	10.41	209.809	3,394.62	-137.29	-17.89	14,447,294.755	1,717,302.478	39.781519123	-80.726328170
3,495.74	12.30	211.500	3,488.48	-153.49	-27.52	14,447,278.550	1,717,292.847	39.781474700	-80.726362628
<b>Begin 12.30° tangent</b>									
3,500.00	12.30	211.500	3,492.64	-154.27	-27.99	14,447,277.776	1,717,292.374	39.781472580	-80.726364322
3,600.00	12.30	211.500	3,590.34	-172.43	-39.13	14,447,259.613	1,717,281.243	39.781422791	-80.726404139
3,700.00	12.30	211.500	3,688.05	-190.59	-50.26	14,447,241.449	1,717,270.112	39.781373002	-80.726443956
3,800.00	12.30	211.500	3,785.75	-208.76	-61.39	14,447,223.285	1,717,258.981	39.781323213	-80.726483772
3,900.00	12.30	211.500	3,883.46	-226.92	-72.52	14,447,205.121	1,717,247.850	39.781273423	-80.726523589
4,000.00	12.30	211.500	3,981.16	-245.09	-83.65	14,447,186.958	1,717,236.720	39.781223634	-80.726563405
4,100.00	12.30	211.500	4,078.87	-263.25	-94.78	14,447,168.794	1,717,225.589	39.781173845	-80.726603222
4,200.00	12.30	211.500	4,176.57	-281.41	-105.91	14,447,150.630	1,717,214.458	39.781124056	-80.726643038
4,300.00	12.30	211.500	4,274.28	-299.58	-117.04	14,447,132.466	1,717,203.327	39.781074266	-80.726682854
4,400.00	12.30	211.500	4,371.98	-317.74	-128.17	14,447,114.302	1,717,192.196	39.781024477	-80.726722670
4,500.00	12.30	211.500	4,469.69	-335.90	-139.30	14,447,096.139	1,717,181.066	39.780974688	-80.726762486
4,600.00	12.30	211.500	4,567.39	-354.07	-150.43	14,447,077.975	1,717,169.935	39.780924898	-80.726802303











Planning Report - Geographic

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<b>Company:</b>	Tug Hill Operating LLC	<b>TVD Reference:</b>	GL @ 753.00ft
<b>Project:</b>	Marshall County, West Virginia NAD83 UTM 17N	<b>MD Reference:</b>	GL @ 753.00ft
<b>Site:</b>	Van Winkle	<b>North Reference:</b>	Grid
<b>Well:</b>	Van Winkle N-05 HM (slot T)	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	rev3		

Planned Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
19,200.00	91.00	330.293	5,954.43	10,815.83	-7,018.31	14,458,247.850	1,710,302.074	39.811655296	-80.751137194	
19,300.00	91.00	330.293	5,952.69	10,902.67	-7,067.86	14,458,334.694	1,710,252.525	39.811894169	-80.751312778	
19,400.00	91.00	330.293	5,950.94	10,989.52	-7,117.41	14,458,421.537	1,710,202.976	39.812133042	-80.751488363	
19,500.00	91.00	330.293	5,949.19	11,076.36	-7,166.95	14,458,508.381	1,710,153.427	39.812371914	-80.751663950	
19,600.00	91.00	330.293	5,947.45	11,163.20	-7,216.50	14,458,595.224	1,710,103.878	39.812610787	-80.751839537	
19,700.00	91.00	330.293	5,945.70	11,250.05	-7,266.05	14,458,682.068	1,710,054.329	39.812849658	-80.752015126	
19,800.00	91.00	330.293	5,943.96	11,336.89	-7,315.60	14,458,768.911	1,710,004.779	39.813088530	-80.752190716	
19,900.00	91.00	330.293	5,942.21	11,423.74	-7,365.15	14,458,855.755	1,709,955.230	39.813327401	-80.752366307	
20,000.00	91.00	330.293	5,940.46	11,510.58	-7,414.70	14,458,942.598	1,709,905.681	39.813566272	-80.752541900	
20,100.00	91.00	330.293	5,938.72	11,597.42	-7,464.25	14,459,029.442	1,709,856.132	39.813805143	-80.752717494	
20,200.00	91.00	330.293	5,936.97	11,684.27	-7,513.80	14,459,116.285	1,709,806.583	39.814044013	-80.752893088	
20,300.00	91.00	330.293	5,935.22	11,771.11	-7,563.35	14,459,203.129	1,709,757.034	39.814282884	-80.753066885	
20,400.00	91.00	330.293	5,933.48	11,857.95	-7,612.90	14,459,289.973	1,709,707.485	39.814521754	-80.753244282	
20,500.00	91.00	330.293	5,931.73	11,944.80	-7,662.45	14,459,376.816	1,709,657.936	39.814760623	-80.753419880	
20,600.00	91.00	330.293	5,929.99	12,031.64	-7,712.00	14,459,463.660	1,709,608.387	39.814999493	-80.753595480	
20,700.00	91.00	330.293	5,928.24	12,118.48	-7,761.55	14,459,550.503	1,709,558.838	39.815238362	-80.753771081	
20,800.00	91.00	330.293	5,926.49	12,205.33	-7,811.09	14,459,637.347	1,709,509.288	39.815477231	-80.753946683	
20,900.00	91.00	330.293	5,924.75	12,292.17	-7,860.64	14,459,724.190	1,709,459.739	39.815716099	-80.754122287	
21,000.00	91.00	330.293	5,923.00	12,379.02	-7,910.19	14,459,811.034	1,709,410.190	39.815954968	-80.754297891	
21,100.00	91.00	330.293	5,921.26	12,465.86	-7,959.74	14,459,897.877	1,709,360.641	39.816193836	-80.754473497	
21,200.00	91.00	330.293	5,919.51	12,552.70	-8,009.29	14,459,984.721	1,709,311.092	39.816432703	-80.754649104	
21,300.00	91.00	330.293	5,917.76	12,639.55	-8,058.84	14,460,071.564	1,709,261.543	39.816671571	-80.754824712	
21,399.82	91.00	330.293	5,916.02	12,726.23	-8,108.30	14,460,158.249	1,709,212.085	39.816910000	-80.755000000	

PBHL/TD 21399.82 MD 5916.02 TVD

Design Targets										
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (usft)	Easting (usft)	Latitude	Longitude	
Van Winkle N-05HM PBI - hit/miss target - Shape - Point	0.00	0.000	5,916.02	12,726.23	-8,108.30	14,460,158.249	1,709,212.085	39.816910000	-80.755000000	
Van Winkle N-05HM LP - plan hits target center - Point	0.00	0.000	6,174.00	-104.35	-787.73	14,447,327.690	1,716,532.638	39.781616000	-80.729068000	

Plan Annotations					
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment	
		+N/-S (ft)	+E/-W (ft)		
1,100.00	1,100.00	0.00	0.00	KOP Begin 2°/100' build	
1,250.00	1,249.93	-3.93	0.00	Begin 3.00° tangent	
3,002.47	3,000.00	-95.64	0.00	Begin 2°/100' build/turn	
3,495.74	3,488.48	-153.49	-27.52	Begin 12.30° tangent	
5,508.97	5,455.50	-519.17	-251.61	Begin 8°/100' build/turn	
6,146.02	6,011.99	-434.83	-502.55	Begin 10°/100' build/turn	
6,625.48	6,174.00	-104.35	-787.73	Begin 91.00° lateral	
21,399.82	5,916.02	12,726.23	-8,108.30	PBHL/TD 21399.82 MD 5916.02 TVD	