

04/26/2019



west virginia department of environmental protection

Office of Oil and Gas
601 57th Street, S.E.
Charleston, WV 25304
(304) 926-0450
fax: (304) 926-0452

Austin Caperton, Cabinet Secretary
www.dep.wv.gov

Monday, April 22, 2019
PERMIT MODIFICATION APPROVAL
Horizontal 6A / New Drill

TUG HILL OPERATING, LLC
380 SOUTHPOINTE BLVD

CANONSBURG, PA 15317

Re: Permit Modification Approval for LACKAWANNA N-5HM
47-103-03249-00-00

Lateral Extension

TUG HILL OPERATING, LLC

The Office of Oil and Gas has reviewed the attached permit modification for the above referenced permit. The attached modification has been approved and well work may begin. Please be reminded that the oil and gas inspector is to be notified twenty-four (24) hours before permitted well work is commenced.

If there are any questions, please feel free to contact me at (304) 926- 0450.

James A. Martin
Chief

A handwritten signature in blue ink, appearing to read "James A. Martin", is written over the typed name and title.

Operator's Well Number: LACKAWANNAN-5HM
Farm Name: M.B. INVESTMENTS
U.S. WELL NUMBER: 47-103-03249-00-00
Horizontal 6A New Drill
Date Modification Issued: April 22, 2019

Promoting a healthy environment.

04/26/2019



March 5, 2019

WVDEP Office of Oil & Gas
Attn: Laura Adkins
601 5th Street, SE
Charleston, WV 25304-2345

RECEIVED
Office of Oil and Gas

MAR 12 2019

WV Department of
Environmental Protection

VIA: Fed-Ex

RE: Permit Application Modification Request for Lackawanna N-5HM(API # 47-103-03249)
Lateral Extension

Dear Laura:

Tug Hill Operating, LLC would like to submit the enclosed permit modification request to our approved permit for the Lackawanna N-5HM. We recently secured leases that allow us to extend the bottom hole for this well.

Please find the following enclosed revisions for extending the bottom hole location of the well:

- Revised WW-6B with inspector signature
- Revised WW-6A1
- Revised Mylar Well Plat
- Revised Site Safety Plan
- Revised Area of Review for Communication Purposes

If you have any questions or concerns, please feel free to call me at 304-376-0111. Thank you for your consideration in this matter.

Sincerely,

A handwritten signature in blue ink that reads "Amy L. Miller".

Amy L. Miller
Permitting Specialist – Appalachia

Alm
Enclosures

04/26/2019

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
WELL WORK PERMIT APPLICATION

1) Well Operator: Tug Hill Operating, LLC 494510851 Wetzel Magnolia Porters Falls
Operator ID County District Quadrangle

2) Operator's Well Number: Lackawanna N-5HM Well Pad Name: Lackawanna

3) Farm Name/Surface Owner: Wetzel County Sanitary Landfill Public Road Access: County Route 30

4) Elevation, current ground: 1306' Elevation, proposed post-construction: 1306'

5) Well Type (a) Gas X Oil _____ Underground Storage _____
Other _____

(b) If Gas Shallow x Deep _____
Horizontal X

6) Existing Pad: Yes or No Yes

DMB
2-15-19

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):
Marcellus is the target formation at a depth of 6794 - 6739' thickness of 55' and anticipated pressure of approx. 3800 psi

8) Proposed Total Vertical Depth: 6,894'

9) Formation at Total Vertical Depth: Onondaga

10) Proposed Total Measured Depth: 17,402'

11) Proposed Horizontal Leg Length: 9,696'

12) Approximate Fresh Water Strata Depths: 70', 1116'

13) Method to Determine Fresh Water Depths: Use shallow offset wells to determine deepest freshwater. Or determine using predrill tests, testing while drilling or petrophysical evaluation of resistivity.

14) Approximate Saltwater Depths: 2,167'

15) Approximate Coal Seam Depths: Sewickly Coal - 1016' and Pittsburgh Coal - 1111'

16) Approximate Depth to Possible Void (coal mine, karst, other): None anticipated

17) Does Proposed well location contain coal seams directly overlying or adjacent to an active mine? Yes _____ No X

(a) If Yes, provide Mine Info: Name: _____
Depth: _____
Seam: _____
Owner: _____

RECEIVED
Office of Oil and Gas
MAR 12 2019
WV Department of
Environmental Protection

18) CASING AND TUBING PROGRAM

TYPE	Size (in)	New or Used	Grade	Weight per ft. (lb/ft)	FOOTAGE: For Drilling (ft)	INTERVALS: Left in Well (ft)	CEMENT: Fill-up (Cu. Ft.)/CTS
Conductor	30"	NEW	BW	BW	120'	120'	259FT^3(CTS)
Fresh Water	13 3/8"	NEW	H40	48#	1,210'	1,210'	1191ft^3(CTS)
Coal	13 3/8"	NEW	H40	48#	1,210'	1,210'	1191ft^3(CTS)
Intermediate	9 5/8"	NEW	J55	36#	3,038'	3,038'	1012ft^3(CTS)
Production	5 1/2"	NEW	P110	20#	17,402'	17,402'	4066ft^3(CTS)
Tubing	2 3/8"	NEW	N80	4.7#		7,657'	
Liners							

DMH
2-15-19

TYPE	Size (in)	Wellbore Diameter (in)	Wall Thickness (in)	Burst Pressure (psi)	Anticipated Max. Internal Pressure (psi)	Cement Type	Cement Yield (cu. ft./k)
Conductor	30"	36"	1.0	2,333	1,866	CLASS A	1.2
Fresh Water	13 3/8"	17 1/2"	.33	1,730	1,384	SEE #24	1.2
Coal	13 3/8"	17 1/2"	.33	1,730	1,384	SEE#24	1.2
Intermediate	9 5/8"	12 1/4"	.352	3,520	2,816	SEE#24	1.19
Production	5 1/2"	8 7/8_ 8 3/4	.361	12,640	9,000	SEE#24	1.17/1.19
Tubing	2 3/8"		.19	11,200	8,960		
Liners							

PACKERS

Kind:	N/A			WV Department of Environmental Protection MAR 12 2019 State of West Virginia
Sizes:	N/A			
Depths Set:	N/A			

04/26/2019

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

Drill through the Marcellus and TD Pilot Hole 100' into the Onondaga. Log vertical section and run a solid cement plug back to proposed KOP. Drill curve and lateral per proposed well plan, run and cement production casing. Perform CBL from 60 deg to surface, make cleanout run, and stimulate.

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

Well to be completed with approximately 24,240,000 lb proppant and 374,768 bbl of water. Max rate = 80 bpm; max psi = 9,000#.

D/H
2-14-19

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 26.69 acres

22) Area to be disturbed for well pad only, less access road (acres): 4.32 acres

23) Describe centralizer placement for each casing string:

Will run 3 centralizers on surface casing at equal distance. Intermediate will have 1 centralizer every other joint. Production casing will have one centralizer every other joint in lateral, one centralizer every joint through curve, one centralizer every other joint to surface.

24) Describe all cement additives associated with each cement type:

*See Attachment

RECEIVED
MAR 12 2019
WV Department of
Environmental Protection

25) Proposed borehole conditioning procedures:

Will circulate a minimum of 3 hours at TD, short trip to curve, circulate bottoms up, check for flow, POOH

*Note: Attach additional sheets as needed.

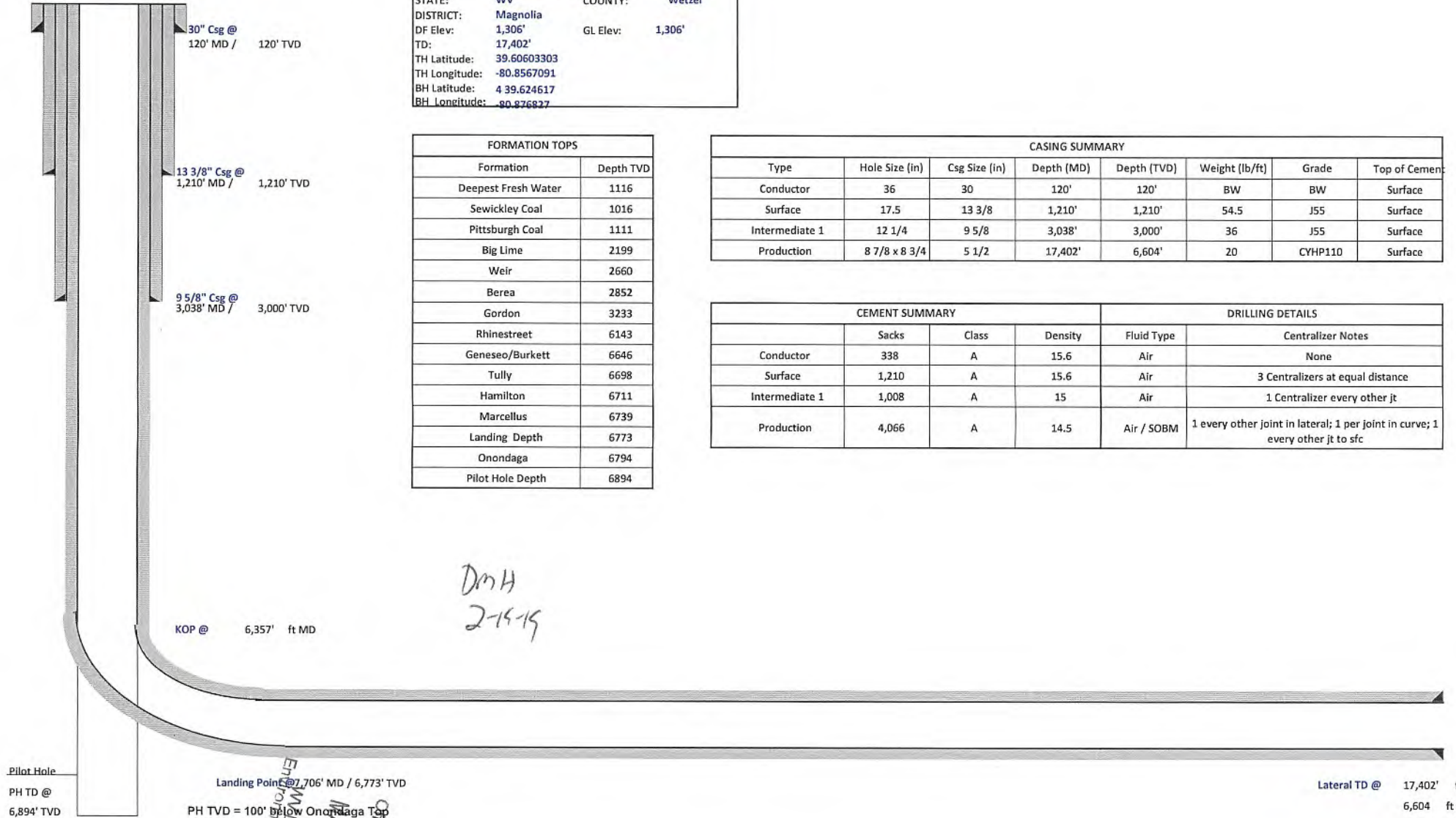


WELL NAME: Lackawanna N-5HM
STATE: WV **COUNTY:** Wetzzel
DISTRICT: Magnolia
DF Elev: 1,306' **GL Elev:** 1,305'
TD: 17,402'
TH Latitude: 39.60603303
TH Longitude: -80.8567091
BH Latitude: 4 39.624617
BH Longitude: -80.826927

FORMATION TOPS	
Formation	Depth TVD
Deepest Fresh Water	1116
Sewickley Coal	1016
Pittsburgh Coal	1111
Big Lime	2199
Weir	2660
Berea	2852
Gordon	3233
Rhinestreet	6143
Geneseo/Burkett	6646
Tully	6698
Hamilton	6711
Marcellus	6739
Landing Depth	6773
Onondaga	6794
Pilot Hole Depth	6894

CASING SUMMARY							
Type	Hole Size (in)	Csg Size (in)	Depth (MD)	Depth (TVD)	Weight (lb/ft)	Grade	Top of Cement
Conductor	36	30	120'	120'	BW	BW	Surface
Surface	17.5	13 3/8	1,210'	1,210'	54.5	J55	Surface
Intermediate 1	12 1/4	9 5/8	3,038'	3,000'	36	J55	Surface
Production	8 7/8 x 8 3/4	5 1/2	17,402'	6,604'	20	CYHP110	Surface

CEMENT SUMMARY				DRILLING DETAILS	
	Sacks	Class	Density	Fluid Type	Centralizer Notes
Conductor	338	A	15.6	Air	None
Surface	1,210	A	15.6	Air	3 Centralizers at equal distance
Intermediate 1	1,008	A	15	Air	1 Centralizer every other jt
Production	4,066	A	14.5	Air / SOBM	1 every other joint in lateral; 1 per joint in curve; 1 every other jt to sfc



Pilot Hole
 PH TD @
 6,894' TVD

Landing Point @ 7,706' MD / 6,773' TVD
 PH TVD = 100' below Onondaga Top

Lateral TD @ 17,402' ft MD
 6,604' ft TVD

RECEIVED
 Office of Oil and Gas
 MAR 12 2019
 WV Department of
 Environmental Protection



Tug Hill Operating, LLC Casing and Cement Program

Lackawanna 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"	1,210'	CTS
Intermediate	9 5/8"	J55	12 1/4"	3,038'	CTS
Production	5 1/2"	CYHP110	8 7/8 x 8 3/4"	17,402'	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

DMH
2/15/19

RECEIVED
Office of Oil and Gas
MAR 12 2019
WV Department of
Environmental Protection



Well: Lackawanna N-05 HM (slot BB)
 Site: Lackawanna
 Project: Wetzel County, West Virginia (UTM17 NAD83)
 Design: rev2
 Rig:

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSec	Annotation
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	1800.00	0.00	0.00	1800.00	0.00	0.00	0.00	0.00	0.00	KOP Begin 2°/100' build
3	3225.00	28.50	185.00	3166.96	-345.84	-30.26	2.00	185.00	-245.38	Begin 28.50° tangent
4	5310.80	28.50	185.00	5000.00	-1337.32	-117.00	0.00	0.00	-948.85	Begin 3°/100' build/turn
5	5524.54	34.55	189.06	5182.13	-1448.09	-131.01	3.00	21.10	-1024.67	Begin 34.55° tangent
6	6357.30	34.55	189.06	5867.99	-1914.50	-205.42	0.00	0.00	-1334.00	Begin 8°/100' build/turn
7	7249.48	50.00	307.97	6622.29	-1960.17	-562.02	8.00	134.95	-1139.64	Begin 10°/100' build/turn
8	7706.18	91.00	330.00	6773.16	-1637.55	-828.33	10.00	31.62	-721.32	Begin 91.00° lateral
9	17402.33	91.00	330.00	6604.00	6758.34	-5675.56	0.00	0.00	8825.37	PBHL/TD 17402.33 MD/6604.00 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 @ 1306.00ft

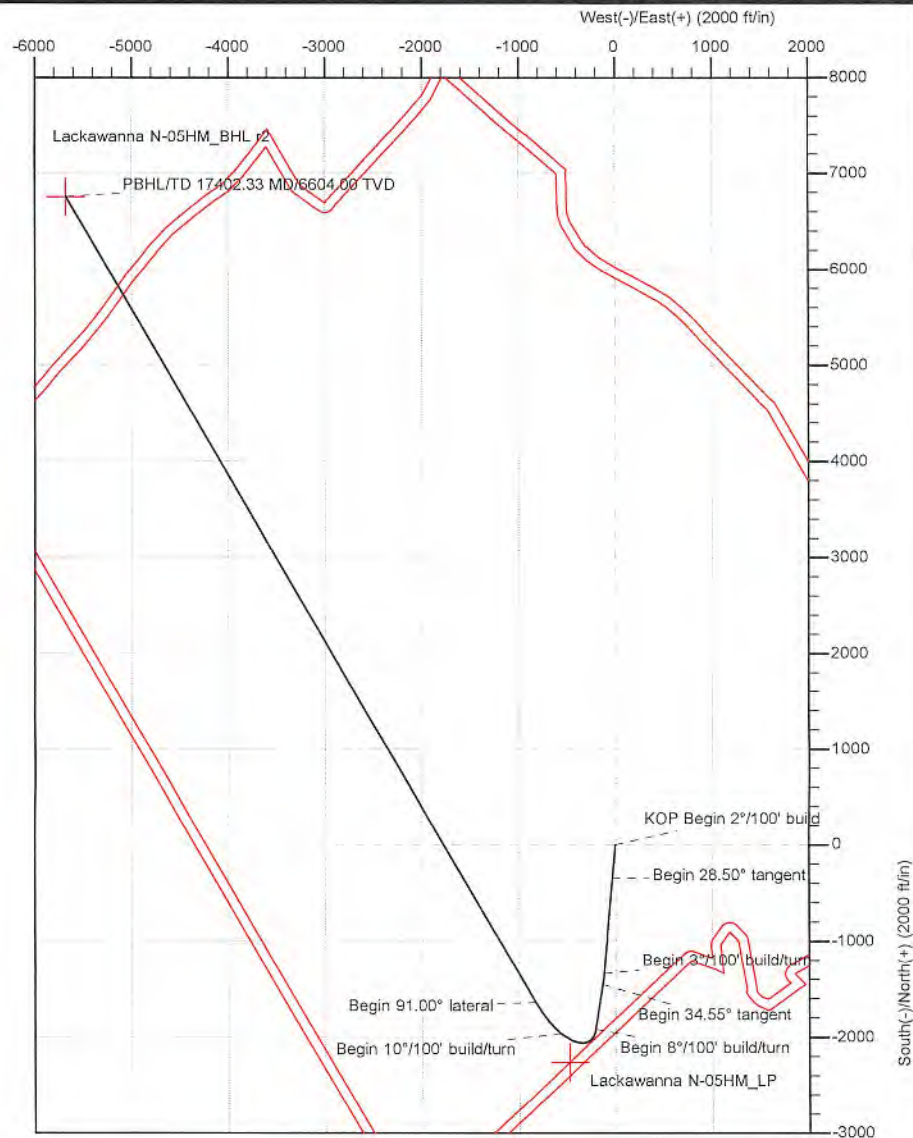
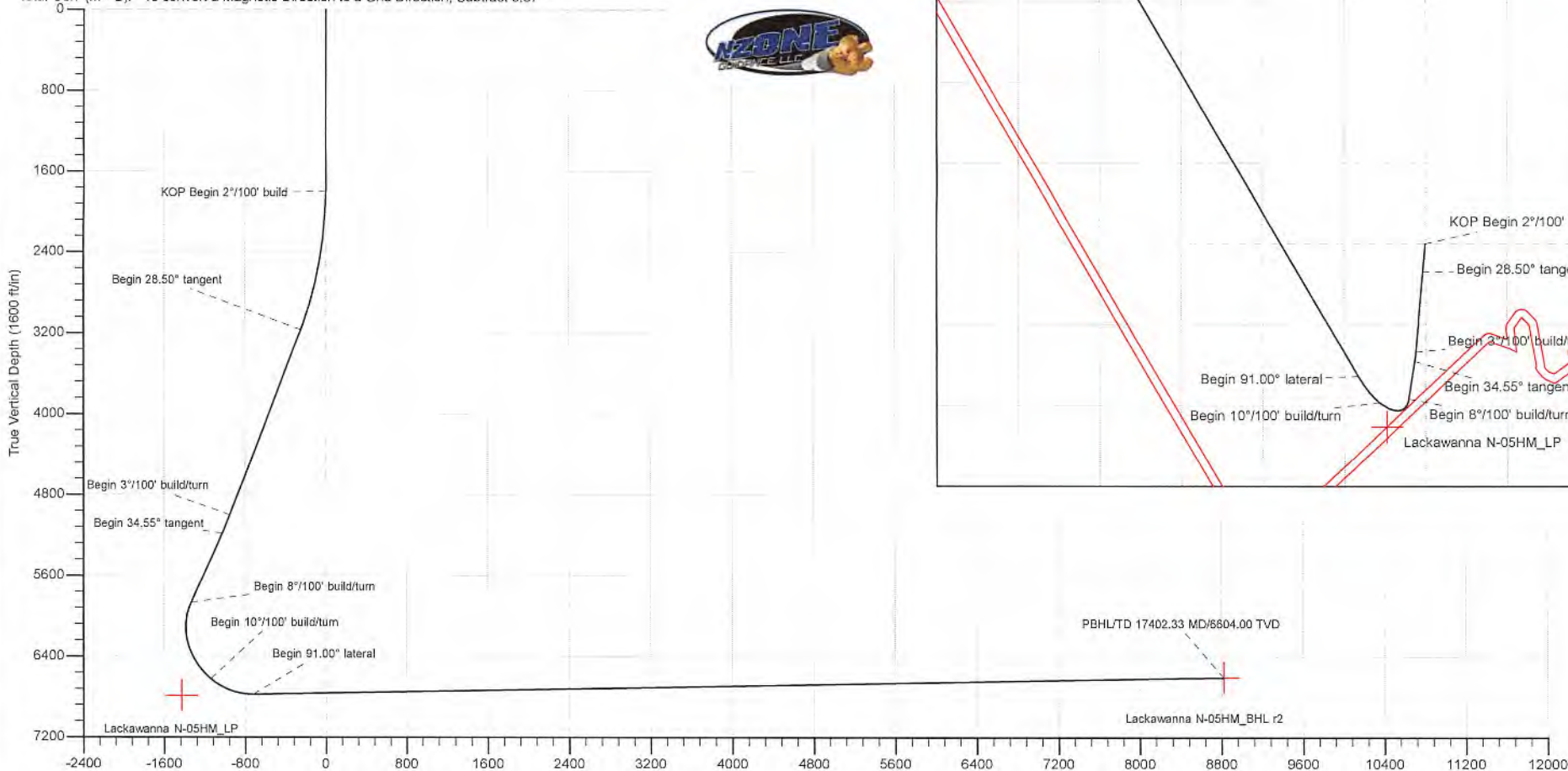
Northing 14383311.24 Easting 1680775.08 Latitude 39.60603303 Longitude -80.85670914



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

Magnetic Field
 Strength: 51976.0nT
 Dip Angle: 66.75°
 Date: 7/8/2018
 Model: IGRF2015

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.67°



Vertical Section at 319.98° (1600 ft/in)

Database:	DB_Jul2216dt_v14	Local Co-ordinate Reference:	Well Lackawanna N-05 HM (slot BB)
Company:	Tug Hill Operating LLC	TVD Reference:	GL @ 1306.00ft
Project:	Wetzel County, West Virginia (UTM17 NAD83)	MD Reference:	GL @ 1306.00ft
Site:	Lackawanna	North Reference:	Grid
Well:	Lackawanna N-05 HM (slot BB)	Survey Calculation Method:	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev2		

Project	Wetzel County, West Virginia (UTM17 NAD83)		
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	Lackawanna				
Site Position:		Northing:	14,383,374.84 usft	Latitude:	39.60620769
From:	Lat/Long	Easting:	1,680,777.71 usft	Longitude:	-80.85669942
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "	Grid Convergence:	0.09 °

Well	Lackawanna N-05 HM (slot BB)					
Well Position	+N/-S	0.00 ft	Northing:	14,383,311.24 usft	Latitude:	39.60603303
	+E/-W	0.00 ft	Easting:	1,680,775.08 usft	Longitude:	-80.85670914
Position Uncertainty		0.00 ft	Wellhead Elevation:		Ground Level:	1,306.00 ft

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	7/8/2018	-8.58	66.75	51,976.02325707

Design	rev2			
Audit Notes:				
Version:	Phase:	PLAN	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)
	0.00	0.00	0.00	319.98

Plan Survey Tool Program	Date	2/11/2019		
Depth From (ft)	Depth To (ft)	Survey (Wellbore)	Tool Name	Remarks
1	0.00	17,402.33 rev2 (Original Hole)	MWD MWD - Standard	

RECEIVED
 Office of Oil and Gas
MAR 12 2019
 WV Department of
 Environmental Protection

Database:	DB_Jul2216dt_v14	Local Co-ordinate Reference:	Well Lackawanna N-05 HM (slot BB)
Company:	Tug Hill Operating LLC	TVD Reference:	GL @ 1306.00ft
Project:	Wetzel County, West Virginia (UTM17 NAD83)	MD Reference:	GL @ 1306.00ft
Site:	Lackawanna	North Reference:	Grid
Well:	Lackawanna N-05 HM (slot BB)	Survey Calculation Method:	Minimum Curvature
Wellbore:	Original Hole		
Design:	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1,800.00	0.00	0.00	1,800.00	0.00	0.00	0.00	0.00	0.00	0.00	
3,225.00	28.50	185.00	3,166.96	-345.84	-30.26	2.00	2.00	0.00	185.00	
5,310.80	28.50	185.00	5,000.00	-1,337.32	-117.00	0.00	0.00	0.00	0.00	
5,524.54	34.55	189.06	5,182.13	-1,448.09	-131.01	3.00	2.83	1.90	21.10	
6,357.30	34.55	189.06	5,867.99	-1,914.50	-205.42	0.00	0.00	0.00	0.00	
7,249.48	50.00	307.97	6,622.29	-1,960.17	-562.02	8.00	1.73	13.33	134.95	
7,706.18	91.00	330.00	6,773.16	-1,637.55	-828.33	10.00	8.98	4.82	31.62	
17,402.33	91.00	330.00	6,604.00	6,758.34	-5,675.56	0.00	0.00	0.00	0.00	Lackawanna N-05HM

RECEIVED
 Office of Oil and Gas
MAR 12 2019
 WV Department of
 Environmental Protection

Database: DB_Jul2216dt_v14
 Company: Tug Hill Operating LLC
 Project: Wetzel County, West Virginia (UTM17 NAD83)
 Site: Lackawanna
 Well: Lackawanna N-05 HM (slot BB)
 Wellbore: Original Hole
 Design: rev2

Local Co-ordinate Reference: Well Lackawanna N-05 HM (slot BB)
 TVD Reference: GL @ 1306.00ft
 MD Reference: GL @ 1306.00ft
 North Reference: Grid
 Survey Calculation Method: Minimum Curvature

RECEIVED
 APR 12 2019

Planned Survey

WV Department of Environmental Protection

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	0.00	0.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
100.00	0.00	0.00	100.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
200.00	0.00	0.00	200.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
300.00	0.00	0.00	300.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
400.00	0.00	0.00	400.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
500.00	0.00	0.00	500.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
600.00	0.00	0.00	600.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
700.00	0.00	0.00	700.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
800.00	0.00	0.00	800.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
900.00	0.00	0.00	900.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
1,000.00	0.00	0.00	1,000.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
1,100.00	0.00	0.00	1,100.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
1,200.00	0.00	0.00	1,200.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
1,300.00	0.00	0.00	1,300.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
1,400.00	0.00	0.00	1,400.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
1,500.00	0.00	0.00	1,500.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
1,600.00	0.00	0.00	1,600.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
1,700.00	0.00	0.00	1,700.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
1,800.00	0.00	0.00	1,800.00	0.00	0.00	14,383,311.24	1,680,775.08	39.60603303	-80.85670914
KOP Begin 2°/100' build									
1,900.00	2.00	185.00	1,899.98	-1.74	-0.15	14,383,309.50	1,680,774.92	39.60602826	-80.85670969
2,000.00	4.00	185.00	1,999.84	-6.95	-0.61	14,383,304.29	1,680,774.47	39.60601394	-80.85671134
2,100.00	6.00	185.00	2,099.45	-15.63	-1.37	14,383,295.61	1,680,773.71	39.60599010	-80.85671409
2,200.00	8.00	185.00	2,198.70	-27.77	-2.43	14,383,283.47	1,680,772.65	39.60595676	-80.85671793
2,300.00	10.00	185.00	2,297.47	-43.36	-3.79	14,383,267.88	1,680,771.28	39.60591397	-80.85672285
2,400.00	12.00	185.00	2,395.62	-62.36	-5.46	14,383,248.88	1,680,769.62	39.60586178	-80.85672887
2,500.00	14.00	185.00	2,493.06	-84.77	-7.42	14,383,226.47	1,680,767.66	39.60580025	-80.85673595
2,600.00	16.00	185.00	2,589.64	-110.55	-9.67	14,383,200.69	1,680,765.40	39.60572945	-80.85674411
2,700.00	18.00	185.00	2,685.27	-139.68	-12.22	14,383,171.56	1,680,762.86	39.60564947	-80.85675332
2,800.00	20.00	185.00	2,779.82	-172.11	-15.06	14,383,139.13	1,680,760.02	39.60556042	-80.85676358
2,900.00	22.00	185.00	2,873.17	-207.81	-18.18	14,383,103.43	1,680,756.90	39.60546239	-80.85677487
3,000.00	24.00	185.00	2,965.21	-246.73	-21.59	14,383,064.51	1,680,753.49	39.60535551	-80.85678718
3,100.00	26.00	185.00	3,055.84	-288.83	-25.27	14,383,022.41	1,680,749.81	39.60523991	-80.85680049
3,200.00	28.00	185.00	3,144.94	-334.05	-29.23	14,382,977.19	1,680,745.85	39.60511572	-80.85681480
3,225.00	28.50	185.00	3,166.96	-345.84	-30.26	14,382,965.40	1,680,744.82	39.60508335	-80.85681852
Begin 28.50° tangent									
3,300.00	28.50	185.00	3,232.87	-381.49	-33.38	14,382,929.75	1,680,741.70	39.60498546	-80.85682980
3,400.00	28.50	185.00	3,320.75	-429.03	-37.54	14,382,882.22	1,680,737.54	39.60485493	-80.85684483
3,500.00	28.50	185.00	3,408.63	-476.56	-41.69	14,382,834.68	1,680,733.38	39.60472440	-80.85685987
3,600.00	28.50	185.00	3,496.52	-524.10	-45.85	14,382,787.15	1,680,729.22	39.60459387	-80.85687490
3,700.00	28.50	185.00	3,584.40	-571.63	-50.01	14,382,739.61	1,680,725.06	39.60446334	-80.85688993
3,800.00	28.50	185.00	3,672.28	-619.16	-54.17	14,382,692.08	1,680,720.91	39.60433281	-80.85690497
3,900.00	28.50	185.00	3,760.16	-666.70	-58.33	14,382,644.54	1,680,716.75	39.60420229	-80.85692000
4,000.00	28.50	185.00	3,848.04	-714.23	-62.49	14,382,597.01	1,680,712.59	39.60407176	-80.85693504
4,100.00	28.50	185.00	3,935.92	-761.77	-66.65	14,382,549.48	1,680,708.43	39.60394123	-80.85695007
4,200.00	28.50	185.00	4,023.81	-809.30	-70.80	14,382,501.94	1,680,704.27	39.60381070	-80.85696510
4,300.00	28.50	185.00	4,111.69	-856.84	-74.96	14,382,454.41	1,680,700.11	39.60368017	-80.85698014
4,400.00	28.50	185.00	4,199.57	-904.37	-79.12	14,382,406.87	1,680,695.95	39.60354964	-80.85699517
4,500.00	28.50	185.00	4,287.45	-951.90	-83.28	14,382,359.34	1,680,691.80	39.60341912	-80.85701020
4,600.00	28.50	185.00	4,375.33	-999.44	-87.44	14,382,311.80	1,680,687.64	39.60328859	-80.85702524
4,700.00	28.50	185.00	4,463.21	-1,046.97	-91.60	14,382,264.27	1,680,683.48	39.60315806	-80.85704027
4,800.00	28.50	185.00	4,551.10	-1,094.51	-95.76	14,382,216.74	1,680,679.32	39.60302753	-80.85705530
4,900.00	28.50	185.00	4,638.98	-1,142.04	-99.92	14,382,169.20	1,680,675.16	39.60289700	-80.85707033

Database:	DB_Jul2216dt_v14	Local Co-ordinate Reference:	Well Lackawanna N-05 HM (slot BB)
Company:	Tug Hill Operating LLC	TVD Reference:	GL @ 1306.00ft
Project:	Wetzel County, West Virginia (UTM17 NAD83)	MD Reference:	GL @ 1306.00ft
Site:	Lackawanna	North Reference:	Grid
Well:	Lackawanna N-05 HM (slot BB)	Survey Calculation Method:	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev2		

RECEIVED
Office of Oil and Gas
MAR 12 2019

Planned Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
5,000.00	28.50	185.00	4,726.86	-1,189.58	-104.07	14,382,121.67	1,680,671.00	39.60276647	-80.85708537
5,100.00	28.50	185.00	4,814.74	-1,237.11	-108.23	14,382,074.13	1,680,666.84	39.60263594	-80.85710040
5,200.00	28.50	185.00	4,902.62	-1,284.64	-112.39	14,382,026.60	1,680,662.68	39.60250542	-80.85711543
5,300.00	28.50	185.00	4,990.50	-1,332.18	-116.55	14,381,979.07	1,680,658.53	39.60237489	-80.85713047
5,310.80	28.50	185.00	5,000.00	-1,337.32	-117.00	14,381,973.93	1,680,658.08	39.60236078	-80.85713209
Begin 3°/100' build/turn									
5,400.00	31.01	186.87	5,077.43	-1,381.33	-121.60	14,381,929.91	1,680,653.47	39.60223991	-80.85714868
5,500.00	33.85	188.66	5,161.83	-1,434.46	-128.88	14,381,876.79	1,680,646.19	39.60209405	-80.85717482
5,524.54	34.55	189.06	5,182.13	-1,448.09	-131.01	14,381,863.16	1,680,644.07	39.60205662	-80.85718245
Begin 34.55° tangent									
5,600.00	34.55	189.06	5,244.27	-1,490.35	-137.75	14,381,820.90	1,680,637.33	39.60194059	-80.85720662
5,700.00	34.55	189.06	5,326.63	-1,546.36	-146.69	14,381,764.89	1,680,628.39	39.60178681	-80.85723866
5,800.00	34.55	189.06	5,408.99	-1,602.37	-155.62	14,381,708.88	1,680,619.46	39.60163303	-80.85727070
5,900.00	34.55	189.06	5,491.35	-1,658.37	-164.56	14,381,652.87	1,680,610.52	39.60147924	-80.85730273
6,000.00	34.55	189.06	5,573.71	-1,714.38	-173.49	14,381,596.86	1,680,601.59	39.60132546	-80.85733477
6,100.00	34.55	189.06	5,656.07	-1,770.39	-182.43	14,381,540.85	1,680,592.65	39.60117168	-80.85736681
6,200.00	34.55	189.06	5,738.43	-1,826.40	-191.36	14,381,484.84	1,680,583.72	39.60101790	-80.85739884
6,300.00	34.55	189.06	5,820.79	-1,882.41	-200.30	14,381,428.84	1,680,574.78	39.60086412	-80.85743088
6,357.30	34.55	189.06	5,867.99	-1,914.50	-205.42	14,381,396.74	1,680,569.66	39.60077600	-80.85744924
Begin 8°/100' build/turn									
6,400.00	32.22	193.60	5,903.64	-1,937.53	-210.00	14,381,373.71	1,680,565.08	39.60071278	-80.85746565
6,500.00	27.55	206.69	5,990.42	-1,984.18	-226.68	14,381,327.07	1,680,548.39	39.60058474	-80.85752514
6,600.00	24.50	223.63	6,080.39	-2,019.90	-251.42	14,381,291.34	1,680,523.66	39.60048673	-80.85761315
6,700.00	23.71	243.20	6,171.82	-2,044.01	-283.72	14,381,267.23	1,680,491.36	39.60042066	-80.85772796
6,800.00	25.39	262.11	6,262.92	-2,056.04	-322.96	14,381,255.21	1,680,452.12	39.60038781	-80.85786734
6,900.00	29.11	277.65	6,351.92	-2,055.74	-368.38	14,381,255.50	1,680,406.70	39.60038882	-80.85802858
7,000.00	34.22	289.43	6,437.09	-2,043.13	-419.09	14,381,268.11	1,680,355.99	39.60042366	-80.85820853
7,100.00	40.18	298.28	6,516.76	-2,018.45	-474.10	14,381,292.79	1,680,300.97	39.60049168	-80.85840370
7,200.00	46.66	305.12	6,589.40	-1,982.19	-532.35	14,381,329.06	1,680,242.73	39.60059152	-80.85861029
7,249.48	50.00	307.97	6,622.29	-1,960.17	-562.02	14,381,351.08	1,680,213.06	39.60065213	-80.85871550
Begin 10°/100' build/turn									
7,300.00	54.35	311.23	6,653.27	-1,934.72	-592.73	14,381,376.53	1,680,182.34	39.60072216	-80.85882439
7,400.00	63.17	316.75	6,705.11	-1,875.30	-654.02	14,381,435.95	1,680,121.06	39.60088562	-80.85904164
7,500.00	72.18	321.46	6,743.08	-1,805.39	-714.41	14,381,505.85	1,680,060.67	39.60107786	-80.85925564
7,600.00	81.28	325.71	6,766.02	-1,727.13	-772.06	14,381,584.11	1,680,003.02	39.60129304	-80.85945988
7,700.00	90.43	329.75	6,773.24	-1,642.90	-825.23	14,381,668.35	1,679,949.85	39.60152461	-80.85964817
7,706.18	91.00	330.00	6,773.16	-1,637.55	-828.33	14,381,673.70	1,679,946.75	39.60153931	-80.85965916
Begin 91.00° lateral									
7,800.00	91.00	330.00	6,771.52	-1,556.31	-875.23	14,381,754.93	1,679,899.85	39.60176261	-80.85982521
7,900.00	91.00	330.00	6,769.78	-1,469.72	-925.22	14,381,841.52	1,679,849.86	39.60200064	-80.86000221
8,000.00	91.00	330.00	6,768.04	-1,383.13	-975.21	14,381,928.11	1,679,799.87	39.60223866	-80.86017922
8,100.00	91.00	330.00	6,766.29	-1,296.54	-1,025.20	14,382,014.70	1,679,749.87	39.60247668	-80.86035622
8,200.00	91.00	330.00	6,764.55	-1,209.95	-1,075.20	14,382,101.29	1,679,699.88	39.60271470	-80.86053323
8,300.00	91.00	330.00	6,762.80	-1,123.36	-1,125.19	14,382,187.88	1,679,649.89	39.60295272	-80.86071023
8,400.00	91.00	330.00	6,761.06	-1,036.77	-1,175.18	14,382,274.47	1,679,599.90	39.60319074	-80.86088724
8,500.00	91.00	330.00	6,759.31	-950.18	-1,225.17	14,382,361.06	1,679,549.91	39.60342876	-80.86106425
8,600.00	91.00	330.00	6,757.57	-863.59	-1,275.16	14,382,447.65	1,679,499.92	39.60366678	-80.86124126
8,700.00	91.00	330.00	6,755.82	-777.00	-1,325.15	14,382,534.24	1,679,449.93	39.60390480	-80.86141827
8,800.00	91.00	330.00	6,754.08	-690.41	-1,375.14	14,382,620.83	1,679,399.94	39.60414282	-80.86159528
8,900.00	91.00	330.00	6,752.33	-603.82	-1,425.13	14,382,707.42	1,679,349.94	39.60438084	-80.86177229
9,000.00	91.00	330.00	6,750.59	-517.23	-1,475.13	14,382,794.01	1,679,299.95	39.60461886	-80.86194931
9,100.00	91.00	330.00	6,748.84	-430.64	-1,525.12	14,382,880.60	1,679,249.96	39.60485688	-80.86212633
9,200.00	91.00	330.00	6,747.10	-344.05	-1,575.11	14,382,967.19	1,679,199.97	39.60509490	-80.86230334

WV Department of Environmental Protection



Database: DB_Jul2216dt_v14
 Company: Tug Hill Operating LLC
 Project: Wetzel County, West Virginia (UTM17 NAD83)
 Site: Lackawanna
 Well: Lackawanna N-05 HM (slot BB)
 Wellbore: Original Hole
 Design: rev2

Local Co-ordinate Reference:
 TVD Reference:
 MD Reference:
 North Reference:
 Survey Calculation Method:

Well Lackawanna N-05 HM (slot BB)
 GL @ 1306.00ft
 GL @ 1306.00ft
 Grid
 Minimum Curvature
MAR 12 2019
 WV Department of Environmental Protection

Planned Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
9,300.00	91.00	330.00	6,745.36	-257.46	-1,625.10	14,383,053.78	1,679,149.98	39.60533291	-80.86248036
9,400.00	91.00	330.00	6,743.61	-170.87	-1,675.09	14,383,140.37	1,679,099.99	39.60557093	-80.86265738
9,500.00	91.00	330.00	6,741.87	-84.28	-1,725.08	14,383,226.96	1,679,050.00	39.60580895	-80.86283440
9,600.00	91.00	330.00	6,740.12	2.31	-1,775.07	14,383,313.55	1,679,000.01	39.60604697	-80.86301142
9,700.00	91.00	330.00	6,738.38	88.90	-1,825.06	14,383,400.14	1,678,950.01	39.60628498	-80.86318845
9,800.00	91.00	330.00	6,736.63	175.49	-1,875.06	14,383,486.73	1,678,900.02	39.60652300	-80.86336547
9,900.00	91.00	330.00	6,734.89	262.08	-1,925.05	14,383,573.32	1,678,850.03	39.60676102	-80.86354250
10,000.00	91.00	330.00	6,733.14	348.67	-1,975.04	14,383,659.91	1,678,800.04	39.60699903	-80.86371952
10,100.00	91.00	330.00	6,731.40	435.26	-2,025.03	14,383,746.50	1,678,750.05	39.60723705	-80.86389655
10,200.00	91.00	330.00	6,729.65	521.85	-2,075.02	14,383,833.09	1,678,700.06	39.60747506	-80.86407358
10,300.00	91.00	330.00	6,727.91	608.44	-2,125.01	14,383,919.68	1,678,650.07	39.60771308	-80.86425061
10,400.00	91.00	330.00	6,726.16	695.03	-2,175.00	14,384,006.27	1,678,600.08	39.60795109	-80.86442764
10,500.00	91.00	330.00	6,724.42	781.62	-2,225.00	14,384,092.86	1,678,550.09	39.60818911	-80.86460468
10,600.00	91.00	330.00	6,722.68	868.21	-2,274.99	14,384,179.45	1,678,500.09	39.60842712	-80.86478171
10,700.00	91.00	330.00	6,720.93	954.80	-2,324.98	14,384,266.04	1,678,450.10	39.60866514	-80.86495875
10,800.00	91.00	330.00	6,719.19	1,041.39	-2,374.97	14,384,352.63	1,678,400.11	39.60890315	-80.86513578
10,900.00	91.00	330.00	6,717.44	1,127.98	-2,424.96	14,384,439.22	1,678,350.12	39.60914117	-80.86531282
11,000.00	91.00	330.00	6,715.70	1,214.57	-2,474.95	14,384,525.81	1,678,300.13	39.60937918	-80.86548986
11,100.00	91.00	330.00	6,713.95	1,301.16	-2,524.94	14,384,612.40	1,678,250.14	39.60961719	-80.86566690
11,200.00	91.00	330.00	6,712.21	1,387.75	-2,574.93	14,384,698.99	1,678,200.15	39.60985521	-80.86584394
11,300.00	91.00	330.00	6,710.46	1,474.34	-2,624.93	14,384,785.57	1,678,150.16	39.61009322	-80.86602098
11,400.00	91.00	330.00	6,708.72	1,560.93	-2,674.92	14,384,872.16	1,678,100.16	39.61033123	-80.86619803
11,500.00	91.00	330.00	6,706.97	1,647.52	-2,724.91	14,384,958.75	1,678,050.17	39.61056924	-80.86637507
11,600.00	91.00	330.00	6,705.23	1,734.11	-2,774.90	14,385,045.34	1,678,000.18	39.61080725	-80.86655212
11,700.00	91.00	330.00	6,703.48	1,820.70	-2,824.89	14,385,131.93	1,677,950.19	39.61104527	-80.86672917
11,800.00	91.00	330.00	6,701.74	1,907.29	-2,874.88	14,385,218.52	1,677,900.20	39.61128328	-80.86690622
11,900.00	91.00	330.00	6,700.00	1,993.88	-2,924.87	14,385,305.11	1,677,850.21	39.61152129	-80.86708327
12,000.00	91.00	330.00	6,698.25	2,080.47	-2,974.87	14,385,391.70	1,677,800.22	39.61175930	-80.86726032
12,100.00	91.00	330.00	6,696.51	2,167.06	-3,024.86	14,385,478.29	1,677,750.23	39.61199731	-80.86743737
12,200.00	91.00	330.00	6,694.76	2,253.65	-3,074.85	14,385,564.88	1,677,700.23	39.61223532	-80.86761442
12,300.00	91.00	330.00	6,693.02	2,340.24	-3,124.84	14,385,651.47	1,677,650.24	39.61247333	-80.86779148
12,400.00	91.00	330.00	6,691.27	2,426.83	-3,174.83	14,385,738.06	1,677,600.25	39.61271134	-80.86796853
12,500.00	91.00	330.00	6,689.53	2,513.42	-3,224.82	14,385,824.65	1,677,550.26	39.61294935	-80.86814559
12,600.00	91.00	330.00	6,687.78	2,600.01	-3,274.81	14,385,911.24	1,677,500.27	39.61318736	-80.86832265
12,700.00	91.00	330.00	6,686.04	2,686.60	-3,324.80	14,385,997.83	1,677,450.28	39.61342536	-80.86849971
12,800.00	91.00	330.00	6,684.29	2,773.19	-3,374.80	14,386,084.42	1,677,400.29	39.61366337	-80.86867677
12,900.00	91.00	330.00	6,682.55	2,859.78	-3,424.79	14,386,171.01	1,677,350.30	39.61390138	-80.86885383
13,000.00	91.00	330.00	6,680.80	2,946.37	-3,474.78	14,386,257.60	1,677,300.30	39.61413939	-80.86903090
13,100.00	91.00	330.00	6,679.06	3,032.96	-3,524.77	14,386,344.19	1,677,250.31	39.61437740	-80.86920796
13,200.00	91.00	330.00	6,677.31	3,119.55	-3,574.76	14,386,430.78	1,677,200.32	39.61461540	-80.86938503
13,300.00	91.00	330.00	6,675.57	3,206.14	-3,624.75	14,386,517.37	1,677,150.33	39.61485341	-80.86956209
13,400.00	91.00	330.00	6,673.83	3,292.73	-3,674.74	14,386,603.96	1,677,100.34	39.61509142	-80.86973916
13,500.00	91.00	330.00	6,672.08	3,379.32	-3,724.73	14,386,690.55	1,677,050.35	39.61532942	-80.86991623
13,600.00	91.00	330.00	6,670.34	3,465.91	-3,774.73	14,386,777.14	1,677,000.36	39.61556743	-80.87009330
13,700.00	91.00	330.00	6,668.59	3,552.50	-3,824.72	14,386,863.73	1,676,950.37	39.61580544	-80.87027037
13,800.00	91.00	330.00	6,666.85	3,639.09	-3,874.71	14,386,950.32	1,676,900.37	39.61604344	-80.87044744
13,900.00	91.00	330.00	6,665.10	3,725.68	-3,924.70	14,387,036.91	1,676,850.38	39.61628145	-80.87062452
14,000.00	91.00	330.00	6,663.36	3,812.27	-3,974.69	14,387,123.50	1,676,800.39	39.61651945	-80.87080159
14,100.00	91.00	330.00	6,661.61	3,898.86	-4,024.68	14,387,210.09	1,676,750.40	39.61675746	-80.87097867
14,200.00	91.00	330.00	6,659.87	3,985.45	-4,074.67	14,387,296.68	1,676,700.41	39.61699546	-80.87115575
14,300.00	91.00	330.00	6,658.12	4,072.04	-4,124.67	14,387,383.27	1,676,650.42	39.61723347	-80.87133283
14,400.00	91.00	330.00	6,656.38	4,158.63	-4,174.66	14,387,469.86	1,676,600.43	39.61747147	-80.87150991
14,500.00	91.00	330.00	6,654.63	4,245.22	-4,224.65	14,387,556.45	1,676,550.44	39.61770947	-80.87168699
14,600.00	91.00	330.00	6,652.89	4,331.81	-4,274.64	14,387,643.04	1,676,500.45	39.61794748	-80.87186407

Database:	DB_Jul2216dt_v14	Local Co-ordinate Reference:	Well Lackawanna N-05 HM (slot BB)
Company:	Tug Hill Operating LLC	TVD Reference:	GL @ 1306.00ft
Project:	Wetzel County, West Virginia (UTM17 NAD83)	MD Reference:	GL @ 1306.00ft
Site:	Lackawanna	North Reference:	Grid
Well:	Lackawanna N-05 HM (slot BB)	Survey Calculation Method:	Minimum Curvature
Wellbore:	Original Hole		
Design:	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	
14,700.00	91.00	330.00	6,651.15	4,418.40	-4,324.63	14,387,729.63	1,676,450.45	39.61818548	-80.87204116	
14,800.00	91.00	330.00	6,649.40	4,504.99	-4,374.62	14,387,816.22	1,676,400.46	39.61842348	-80.87221824	
14,900.00	91.00	330.00	6,647.66	4,591.58	-4,424.61	14,387,902.81	1,676,350.47	39.61866149	-80.87239533	
15,000.00	91.00	330.00	6,645.91	4,678.17	-4,474.60	14,387,989.40	1,676,300.48	39.61889949	-80.87257241	
15,100.00	91.00	330.00	6,644.17	4,764.76	-4,524.60	14,388,075.99	1,676,250.49	39.61913749	-80.87274950	
15,200.00	91.00	330.00	6,642.42	4,851.35	-4,574.59	14,388,162.58	1,676,200.50	39.61937549	-80.87292659	
15,300.00	91.00	330.00	6,640.68	4,937.94	-4,624.58	14,388,249.17	1,676,150.51	39.61961349	-80.87310368	
15,400.00	91.00	330.00	6,638.93	5,024.53	-4,674.57	14,388,335.76	1,676,100.52	39.61985149	-80.87328078	
15,500.00	91.00	330.00	6,637.19	5,111.12	-4,724.56	14,388,422.35	1,676,050.52	39.62008950	-80.87345787	
15,600.00	91.00	330.00	6,635.44	5,197.71	-4,774.55	14,388,508.94	1,676,000.53	39.62032750	-80.87363496	
15,700.00	91.00	330.00	6,633.70	5,284.30	-4,824.54	14,388,595.53	1,675,950.54	39.62056550	-80.87381206	
15,800.00	91.00	330.00	6,631.95	5,370.89	-4,874.54	14,388,682.12	1,675,900.55	39.62080350	-80.87398916	
15,900.00	91.00	330.00	6,630.21	5,457.48	-4,924.53	14,388,768.71	1,675,850.56	39.62104150	-80.87416626	
16,000.00	91.00	330.00	6,628.47	5,544.07	-4,974.52	14,388,855.30	1,675,800.57	39.62127950	-80.87434336	
16,100.00	91.00	330.00	6,626.72	5,630.66	-5,024.51	14,388,941.89	1,675,750.58	39.62151749	-80.87452046	
16,200.00	91.00	330.00	6,624.98	5,717.25	-5,074.50	14,389,028.48	1,675,700.59	39.62175549	-80.87469756	
16,300.00	91.00	330.00	6,623.23	5,803.84	-5,124.49	14,389,115.07	1,675,650.59	39.62199349	-80.87487466	
16,400.00	91.00	330.00	6,621.49	5,890.43	-5,174.48	14,389,201.66	1,675,600.60	39.62223149	-80.87505177	
16,500.00	91.00	330.00	6,619.74	5,977.02	-5,224.47	14,389,288.25	1,675,550.61	39.62246949	-80.87522887	
16,600.00	91.00	330.00	6,618.00	6,063.61	-5,274.47	14,389,374.83	1,675,500.62	39.62270749	-80.87540598	
16,700.00	91.00	330.00	6,616.25	6,150.20	-5,324.46	14,389,461.42	1,675,450.63	39.62294548	-80.87558309	
16,800.00	91.00	330.00	6,614.51	6,236.79	-5,374.45	14,389,548.01	1,675,400.64	39.62318348	-80.87576020	
16,900.00	91.00	330.00	6,612.76	6,323.38	-5,424.44	14,389,634.60	1,675,350.65	39.62342148	-80.87593731	
17,000.00	91.00	330.00	6,611.02	6,409.97	-5,474.43	14,389,721.19	1,675,300.66	39.62365948	-80.87611442	
17,100.00	91.00	330.00	6,609.27	6,496.56	-5,524.42	14,389,807.78	1,675,250.66	39.62389747	-80.87629153	
17,200.00	91.00	330.00	6,607.53	6,583.15	-5,574.41	14,389,894.37	1,675,200.67	39.62413547	-80.87646865	
17,300.00	91.00	330.00	6,605.79	6,669.74	-5,624.40	14,389,980.96	1,675,150.68	39.62437346	-80.87664576	
17,400.00	91.00	330.00	6,604.04	6,756.33	-5,674.40	14,390,067.55	1,675,100.69	39.62461146	-80.87682288	
17,402.33	91.00	330.00	6,604.00	6,758.34	-5,675.56	14,390,069.57	1,675,099.53	39.62461700	-80.87682700	

PBHL/TD 17402.33 MD/6604.00 TVD

Design Targets										
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (usft)	Easting (usft)	Latitude	Longitude	
- hit/miss target										
- Shape										
Lackawanna N-05HM_B	0.00	0.00	6,604.00	6,758.34	-5,675.56	14,390,069.57	1,675,099.53	39.62461700	-80.87682700	
- plan hits target center										
- Point										
Lackawanna N-05HM_L	0.00	0.01	6,786.00	-2,256.56	-471.22	14,381,054.69	1,680,303.86	39.59983775	-80.85839480	
- plan misses target center by 343.03ft at 7200.00ft MD (6589.40 TVD, -1982.19 N, -532.35 E)										
- Point										

 RECEIVED
 Office of Oil and Gas

MAR 12 2019

 WV Department of
 Environmental Protection

Database:	DB_Jul2216dt_v14	Local Co-ordinate Reference:	Well Lackawanna N-05 HM (slot BB)
Company:	Tug Hill Operating LLC	TVD Reference:	GL @ 1306.00ft
Project:	Wetzel County, West Virginia (UTM17 NAD83)	MD Reference:	GL @ 1306.00ft
Site:	Lackawanna	North Reference:	Grid
Well:	Lackawanna N-05 HM (slot BB)	Survey Calculation Method:	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev2		

Plan Annotations				
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
1,800.00	1,800.00	0.00	0.00	KOP Begin 2°/100' build
3,225.00	3,166.96	-345.84	-30.26	Begin 28.50° tangent
5,310.80	5,000.00	-1,337.32	-117.00	Begin 3°/100' build/turn
5,524.54	5,182.13	-1,448.09	-131.01	Begin 34.55° tangent
6,357.30	5,867.99	-1,914.50	-205.42	Begin 8°/100' build/turn
7,249.48	6,622.29	-1,960.17	-562.02	Begin 10°/100' build/turn
7,706.18	6,773.16	-1,637.55	-828.33	Begin 91.00° lateral
17,402.33	6,604.00	6,758.34	-5,675.56	PBHL/TD 17402.33 MD/6604.00 TVD

WW-6A1
(5/13)

Operator's Well No. Lackawanna N-5HM

**INFORMATION SUPPLIED UNDER WEST VIRGINIA CODE
Chapter 22, Article 6A, Section 5(a)(5)
IN LIEU OF FILING LEASE(S) AND OTHER CONTINUING CONTRACT(S)**

Under the oath required to make the verification on page 1 of this Notice and Application, I depose and say that I am the person who signed the Notice and Application for the Applicant, and that –

(1) the tract of land is the same tract described in this Application, partly or wholly depicted in the accompanying plat, and described in the Construction and Reclamation Plan;

(2) the parties and recordation data (if recorded) for lease(s) or other continuing contract(s) by which the Applicant claims the right to extract, produce or market the oil or gas are as follows:

Lease Name or Number	Grantor, Lessor, etc.	Grantee, Lessee, etc.	Royalty	Book/Page
----------------------	-----------------------	-----------------------	---------	-----------

*See attachment

**Acknowledgement of Possible Permitting/Approval
In Addition to the Office of Oil and Gas**

The permit applicant for the proposed well work addressed in this application hereby acknowledges the possibility of the need for permits and/or approvals from local, state, or federal entities in addition to the DEP, Office of Oil and Gas, including but not limited to the following:

- WV Division of Water and Waste Management
- WV Division of Natural Resources WV Division of Highways
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- County Floodplain Coordinator

The applicant further acknowledges that any Office of Oil and Gas permit in no way overrides, replaces, or nullifies the need for other permits/approvals that may be necessary and further affirms that all needed permits/approvals should be acquired from the appropriate authority before the affected activity is initiated.

Well Operator: Tug Hill Operating, LLC
By: Amy L. Miller *Amy L. Miller*
Its: Permitting Specialist - Appalachia Region

RECEIVED
Office of Oil and Gas
MAR 12 2019

WW-6A1 Supplement

Operator's Well No. Lackawanna N - 5HM

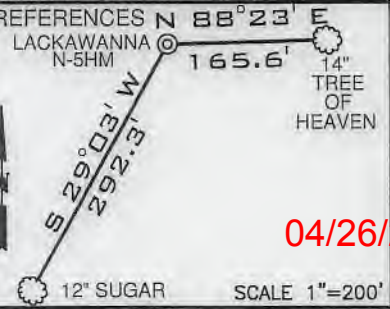
Lease ID	Parcel	Tags	Grantor, Lessor, Etc.	Grantee, Lessee, Etc.	Royalty	Deed Book/Page		Assignments
10*47103.061.2	8-12-134	A	M B INVESTMENTS	TH EXPLORATION LLC	1/8+	179A	475	N/A
10*47103.060.6	8-12-122	B	WILLIAM JOSEPH GAMBLE AND LINDA ELAINE GAMBLE	TH EXPLORATION LLC	1/8+	179A	466	N/A
10*47103.060.7	8-12-122	B	JOHN BRENT GAMBLE	TH EXPLORATION LLC	1/8+	179A	469	N/A
10*47103.060.8	8-12-122	B	JANE ANN GAMBLE	TH EXPLORATION LLC	1/8+	179A	472	N/A
10*47103.061.2	8-17-4	C	M B INVESTMENTS	TH EXPLORATION LLC	1/8+	179A	475	N/A
10*47103.061.2	8-12-109.1	D	M B INVESTMENTS	TH EXPLORATION LLC	1/8+	179A	475	N/A
10*47103.061.2	8-12-109	E	M B INVESTMENTS	TH EXPLORATION LLC	1/8+	179A	475	N/A
10*47103.061.2	8-12-108	F	M B INVESTMENTS	TH EXPLORATION LLC	1/8+	179A	475	N/A
10*47103.061.2	8-12-70	G	M B INVESTMENTS	TH EXPLORATION LLC	1/8+	179A	475	N/A
10*47103.061.2	8-12-69	H	M B INVESTMENTS	TH EXPLORATION LLC	1/8+	179A	475	N/A
10*47103.061.2	8-12-39	I	M B INVESTMENTS	TH EXPLORATION LLC	1/8+	179A	475	N/A
10*47103.061.2	8-12-13	J	M B INVESTMENTS	TH EXPLORATION LLC	1/8+	179A	475	N/A
10*19710	8-12-11	K	ROBERT J WITTMAN FIVE STAR RESOURCES	TH EXPLORATION LLC	1/8+	196A	712	N/A
PENDING	8-12-11.2	L	TRIBUNE RESOURCES MINERALS LLC	TH EXPLORATION LLC	FEE	470	618	N/A
10*24142	8-12-1	M	CSX TRANSPORTATION INC DIRECTOR - CONTRACT MANAGEMENT	TH EXPLORATION LLC	1/8+	220A	809	N/A
10*24142	8-12-1	N	CSX TRANSPORTATION INC DIRECTOR - CONTRACT MANAGEMENT	TH EXPLORATION LLC	1/8+	220A	809	N/A
PENDING	Ohio River	O	WEST VIRGINIA DIVISION OF NATURAL RESOURCES	TH EXPLORATION LLC	1/8+	221A	850	N/A

RECEIVED
 Office of Oil and Gas
 MAR 12 2019
 WV Dept. of Environmental Protection

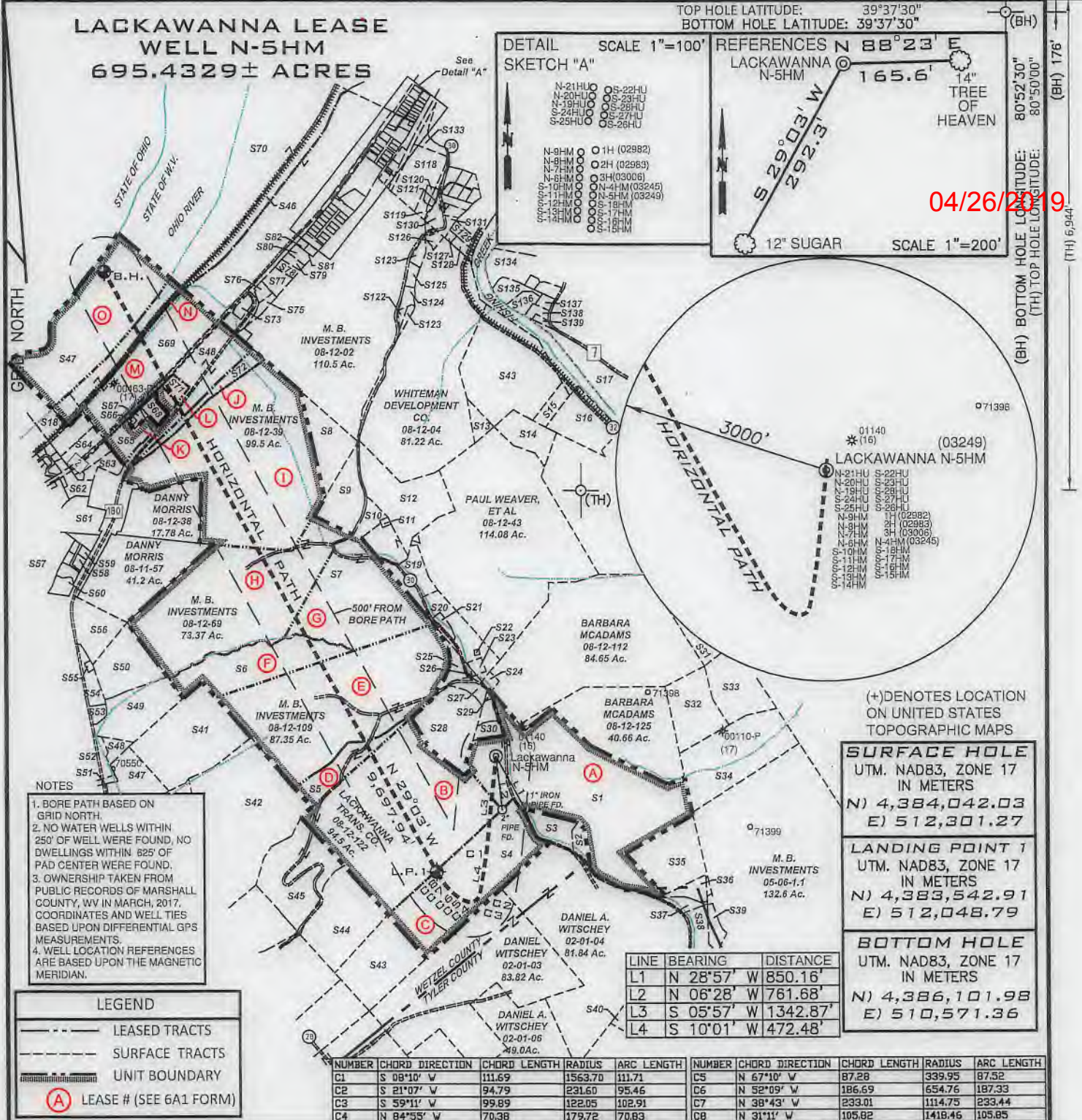
**LACKAWANNA LEASE
WELL N-5HM
695.4329± ACRES**

DETAIL SCALE 1"=100'
SKETCH "A"

TOP HOLE LATITUDE: 39°37'30"
BOTTOM HOLE LATITUDE: 39°37'30"



04/26/2019



- NOTES**
1. BORE PATH BASED ON GRID NORTH.
 2. NO WATER WELLS WITHIN 250' OF WELL WERE FOUND, NO DWELLINGS WITHIN 825' OF PAD CENTER WERE FOUND.
 3. OWNERSHIP TAKEN FROM PUBLIC RECORDS OF MARSHALL COUNTY, WV IN MARCH, 2017. COORDINATES AND WELL TIES BASED UPON DIFFERENTIAL GPS MEASUREMENTS.
 4. WELL LOCATION REFERENCES ARE BASED UPON THE MAGNETIC MERIDIAN.

LEGEND

- LEASED TRACTS
- SURFACE TRACTS
- UNIT BOUNDARY
- (A) LEASE # (SEE 6A1 FORM)

(+) DENOTES LOCATION ON UNITED STATES TOPOGRAPHIC MAPS

SURFACE HOLE UTM. NAD83, ZONE 17 IN METERS
N) 4,384,042.03
E) 512,301.27
LANDING POINT 1 UTM. NAD83, ZONE 17 IN METERS
N) 4,383,542.91
E) 512,048.79
BOTTOM HOLE UTM. NAD83, ZONE 17 IN METERS
N) 4,386,101.98
E) 510,571.36

LINE	BEARING	DISTANCE
L1	N 28°57' W	850.16'
L2	N 06°28' W	761.68'
L3	S 05°57' W	1342.87'
L4	S 10°01' W	472.48'

NUMBER	CHORD DIRECTION	CHORD LENGTH	RADIUS	ARC LENGTH	NUMBER	CHORD DIRECTION	CHORD LENGTH	RADIUS	ARC LENGTH
C1	S 08°10' W	111.69	1563.70	111.71	C5	N 67°10' W	87.28	339.95	87.52
C2	S 21°07' W	94.79	231.60	95.46	C6	N 52°09' W	186.69	654.76	187.33
C3	S 59°11' W	99.89	122.05	102.91	C7	N 38°43' W	233.01	1114.75	233.44
C4	N 84°55' W	70.38	179.72	70.83	C8	N 31°11' W	105.82	1418.46	105.85

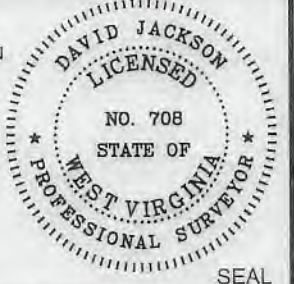
FILE NUMBER _____
 DRAWING NUMBER:
 LACKAWANNA N-5HM_REV 1
 SCALE 1" = 2000'
 MINIMUM DEGREE OF ACCURACY 1/200
 PROVEN SOURCE OF ELEVATION SUBMETER MAPPING
 GRADE GPS

I, THE UNDERSIGNED, HEREBY CERTIFY THAT THIS PLAT IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AND SHOWS ALL THE INFORMATION REQUIRED BY LAW AND THE RULES ISSUED AND PRESCRIBED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION



David L. Jackson

JACKSON SURVEYING INC.
 P.O. Box 1460
 Clarksburg, WV 26302
 304-823-5851



WVDEP
 OFFICE OF OIL & GAS
 601 57TH STREET, SE
 CHARLESTON, WV 25304

DATE: AUGUST 7, 2018
 REVISED DATE: FEBRUARY 18, 2019
 OPERATORS WELL NO. LACKAWANNA N-5HM

WELL TYPE: OIL ___ GAS LIQUID INJECTION ___ WASTE DISPOSAL ___
 (IF "GAS") PRODUCTION STORAGE ___ DEEP ___ SHALLOW
 STATE COUNTY PERMIT 47-103-03249

LOCATION ELEVATION 1306.26' WATERSHED (HUC 10) OUTLET MIDDLE ISLAND CREEK
 DISTRICT MAGNOLIA COUNTY WETZEL
 QUADRANGLE PORTER FALL 7.5' LEASE NUMBER SEE WW-6A1 Form

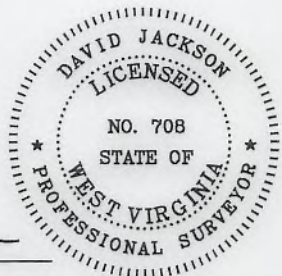
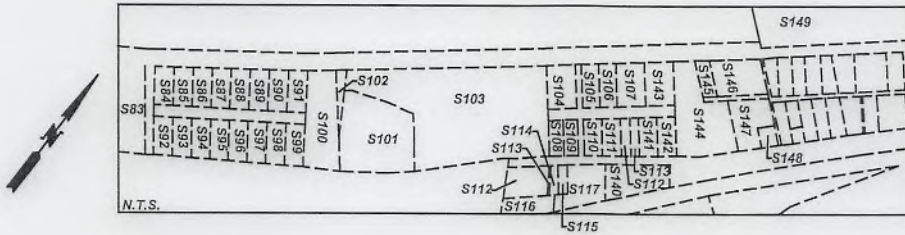
SURFACE OWNER M. B. INVESTMENTS ACREAGE 88.09
 OIL & GAS ROYALTY OWNER M. B. INVESTMENTS, ET AL LEASE ACREAGE 88.09
 PROPOSED WORK: DRILL CONVERT ___ DRILL DEEPER ___ REDRILL ___ FRACTURE OR STIMULATE PLUG OFF OLD FORMATION ___
 PERFORATE NEW FORMATION ___ OTHER PHYSICAL CHANGE (SPECIFY) ___
 PLUG & ABANDON ___ CLEAN OUT & REPLUG ___

TARGET FORMATION MARCELLUS ESTIMATED DEPTH TVD: 6,894' TMD: 17,402'
 WELL OPERATOR TUG HILL OPERATING, LLC DESIGNATED AGENT DIANNA STAMPER
 CT CORPORATION SYSTEM
 ADDRESS 1320 SOUTH UNIVERSITY DRIVE, SUITE 500 FORT WORTH, TX 76107 ADDRESS 5400 D BIG TYLER ROAD CHARLESTON, WV 25313

COUNTY NAME
 PERMIT

LACKAWANNA LEASE
WELL N-5HM
695.4329± ACRES

04/26/2019



P.S.
708

David L Jackson



TUG HILL
OPERATING

OPERATOR'S
WELL #: LACKAWANNA N-5HM
DISTRICT: Magnolia
COUNTY: Wetzel
STATE: WV
API #: 47-103-03249

WELL PLAT
PAGE 2 OF 3
DATE: 08/07/2018
REVISED DATE:
02/18/2019

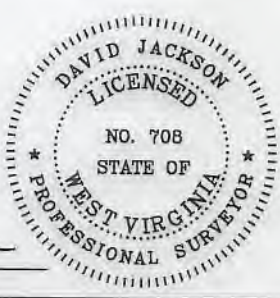
form wv6

**LACKAWANNA LEASE
WELL N-5HM
695.4329± ACRES**

Number	TAX MAP-PARCEL	SURFACE OWNER	ACRES
S1	08-12-134	M. B. Investments	88.09
S2	08-12-134.1	Raymond L. & Elizabeth Pibble	2.14
S3	08-12-134.3	M. B. Investments	5.55
S4	08-17-04	M. B. Investments	46.75
S5	08-12-109.1	M. B. Investments	10.0019
S6	08-12-108	M. B. Investments	24.0
S7	08-12-70	M. B. Investments	50.37
S8	08-12-14	Thomas & Helena McLaughlin	10.5
S9	08-12-40	Timothy Doty & Helena McLaughlin	8.83
S10	08-12-41	Michael A. & Annabelle Corbin & Paul E. & Christine Weaver	3.39
S11	08-12-42	Shriver Cemetery	1.0
S12	08-12-43.1	Michael A. & Annabelle Corbin & Paul E. & Christine Weaver	22.25
S13	08-12-15	Michael A. & Annabelle Corbin & Paul E. & Christine Weaver	2.6
S14	08-12-44	Richard L. Armstrong	8.0
S15	08-12-5.1	Michael & Joyce Durig	4.0
S16	08-12-16	Russell Dalrymple, et al	11.87
S17	08-12-08	Calvin Dean Cross	14.96
S18	08-12-17	Virgie E. Kuhns	1.25
S19	08-12-43.2	Michael A. & Annabelle Corbin & Paul E. & Christine Weaver	7.25
S20	08-12-43.5	M. B. Investments	8.774
S21	08-12-43.4	Michael A. & Annabelle Corbin & Paul E. & Christine Weaver	0.996
S22	08-12-43.3	Geraldine C. Cross	0.13
S23	08-12-111	WV Conservation Comm.	1.0
S24	08-12-112.1	M. B. Investments	0.82
S25	08-12-110	Lackawanna Transport Company	3.59
S26	08-12-72	Paul E. & Christine Weaver	0.50
S27	08-12-124	M. B. Investments	2.23
S28	08-12-123	Lackawanna Transport Company	18.55
S29	08-12-134.2	M. B. Investments	0.23
S30	08-12-134.4	M. B. Investments	3.51
S31	08-12-113	Jacob Presley Morgan III	16.30
S32	08-12-126	Jacob Presley Morgan III	16.06
S33	08-12-127	Jacob Presley Morgan III	10.0
S34	08-12-136	Jacob Presley Morgan III	28.25
S35	08-12-135	Timothy J. Haynes & Gary W. Wofter	21.0
S36	02-01-5.2	Mark K. & Teresa J. Loy	2,945
S37	02-01-5.3	Mark K. & Teresa J. Loy	1,939
S38	02-01-5.1	Mark K. & Teresa J. Loy	4.56
S39	05-06-01	Mark K. & Teresa J. Loy	2.37
S40	02-01-05	Daniel A. Witschey	21.5
S41	08-12-121	Charles E. & Mary Elizabeth Clegg	31.94
S42	08-12-129	Charles E. & Mary Elizabeth Clegg	20.0
S43	08-12-05	Michael Lloyd & Joyce Diana Durig	30.5
S44	08-17-07	Lackawanna Transport Company	21.37
S45	08-17-7.1	Lackawanna Transport Company	25.64
S46		CSX Railroad	
S47	Ohio River	State of WV, Department of Commerce, Division of Natural Resources	
S48	Rt 180	State Road Commission	15.96
S49	08-12-106	Thomas C. Pennell	15.96
S50	08-12-106.1	Thomas R. & Tamara D. Pennell	14.04
S56	08-11-61	Hunter B. McAdams & Doug McAdams	7.61
S61	08-11-19	Lisa Straight & Edwin Rial	6.3
S62	08-11-39.1	William L. & Beulah Talkington	1.83
S63	08-11-41	A+A Supply, LLC	1.63
S64	08-11-35	Lisa Straight & Edwin Rial	5.9
S65	08-12-11	Calvin T. Hedrick	6.64
S66	08-12-11.1	Larry D. McCaman	0.25
S67	08-12-11.3	Larry McCaman	0.807
S68	08-12-11.4	Paul Andrew James Simmons, Jr.	1.94
S69	08-12-01	Mount Clare Properties, Inc	50.71
S70	08-07-105	Mount Clare Properties, Inc	116.08
S71	08-12-11.2	Ascent Resources Marcellus Minerals, LLC	1.811
S72	08-12-13	M. B. Investments	8.18
S73	08-12-139	Department of Public Safety	1.37
S75	08-07-87.2	H. Lee Scott Jr.	1.110
S76	08-07-87.1	H. Lee Scott Jr.	0.95
S77	08-07-87	H. Lee Scott Jr. & Stephen A. & Betty A. Davis	2.221

Number	TAX MAP-PARCEL	SURFACE OWNER	ACRES
S78	08-07-88	Living Quarters, LLC	1.08
S79	08-07-89.3	Living Quarters, LLC	0.94
S80	08-07-89.2	Barbara S. Nice	0.89
S81	08-07-89	Barbara S. Nice	0.40
S82	08-07-89.1	Barbara S. Nice	0.40
S83	08-07-90	Barbara Shank	0.70
S84	08-07-91	Dennis Phillips	0.20
S85	08-07-92	Karen D. Pugh	0.20
S86	08-07-93	Darrell S. & Diana Lynn Hartwig	0.20
S87	08-07-94	Ronald D. & Carole Dawson	0.21
S88	08-07-95	Debra Barrile, (Leslie L. Deboit, land contract)	0.21
S89	08-07-96	Rita E. Barrick	0.21
S90	08-07-102	Michael Vaughn Skeen & Patricia Ann Sawyer	0.22
S91	08-07-103.1	Charlotte M. Adams	0.22
S92	08-07-97	David Ray Christian	0.20
S93	08-07-98	David Ray Christian	0.20
S94	08-07-98.1	Lionel Kent, Helen A. Potts & Deloris Potts (Life)	0.20
S95	08-07-99	Lionel Kent, Helen A. Potts & Deloris Potts (Life)	0.20
S96	08-07-100	James J. & Carol Clark	0.21
S97	08-07-101	Doris A. Fannin & Richard S. Williamson	0.21
S98	08-07-102.1	Ronald E. Jr. & Lori J McCoy	0.21
S99	08-07-103	Michael L. & Joyce D. Durig	0.21
S100	08-07-104	Lisa Denise Bridge	0.12
S101	08-07-105.1	Tiona Henthorn	1.49
S102	08-07-104.1	Lisa Denise Bridge	0.06
S103	08-07-106	Route 2 South, LLC	4.33
S104	08-07-107	Route 2 South, LLC	0.36
S105	08-07-108	Donald W. Owens, Jr.	0.21
S106	08-07-109	Douglas E. & Amber L. Straight	0.21
S107	08-07-110	Allen R. & Malinda J. Laugh	0.34
S108	08-07-114	William & Ruth Leek	0.14
S109	08-07-115	William J. Leek	0.14
S110	08-07-116	Betty J. Yoho (Life), Sandra M. Hardman	0.20
S111	08-07-117	Jerry W. & Elizabeth Southerly	0.21
S112	08-07-123.1	William & Ruth Ann Leek	0.23
S113	08-07-123.2	William & Ruth Ann Leek	0.01
S114	08-07-124	William & Ruth Ann Leek	0.08
S115	08-07-125	William & Ruth Ann Leek	0.07
S116	08-07-129	Mary Burton, et al	1.10
S117	08-07-127	William Sherman & Ruth Ann Leek	0.49
S118	08-07-131.3	Nancy J. Todd	9.726
S119	08-07-131.1	Edgar W. Whitman, Jr.	1.25
S120	08-07-131.4	Nancy J. Todd	0.989
S121			
S122	08-12-03	O. Terrell Coffield Family Trust	0.98
S123	08-12-4.1	Whiteman Development Co., LLC & PRN, LLC	2.59
S124	08-07-142	Pamela E. Weisenbarger	1.35
S125	08-07-142.1	Thomas W, II & Teena B. Emch	1.35
S126	08-07-160	Frank L. Price, Jr.	1.28
S127	08-07-144	Roger Hall, et al	5.58
S128	08-07-143	Dominic D. Yost	1.0
S129	08-07-144.1	Donald J. & Debby J. Powell	2.25
S130	08-07-137	462 Properties, LLC	1.836
S131	08-07-137.1	Anna E. McPeak	0.94
S134	08-07-145	Lois J. Day	8.008
S135	08-07-145.5	Jodi Forni	3.65
S136	08-07-145.3	Jodi Forni	2.641
S137	08-07-145.2	David J. Jackson, (Life), James & Ruth Jackson	0.813
S138	08-12-06	David J. Jackson, (Life), James & Ruth Jackson	1.74
S139	08-12-07	David J. Jackson, (Life), James & Ruth Jackson	0.35
S140	08-07-126	William Sherman & Ruth Ann Leek	0.30
S141	08-07-117.1	Donald L. Larsen, Jr.	0.21
S142	08-07-119	Joshua D. Larsen, Jr.	0.22
S143	08-07-111	Allen R. & Malinda J. Laugh	0.34
S144	08-07-120	William D. Lawrence	1.51
S145	08-07-112	Charles D. & Shirley L. White	0.17
S146	08-07-113	Joe's Tire III, LLC	0.60
S147	08-07-122	Moser & Moser Associates, Inc.	0.50
S148	08-07-121	Moser & Moser Associates, Inc.	0.10
S149	08-07-123	M.B. Investments	8.50

04/26/2019



P.S. 708 *David L Jackson*



TUG HILL
OPERATING

OPERATOR'S WELL #1 LACKAWANNA N-5HM
DISTRICT: Magnolia
COUNTY: Wetzel
STATE: WV
API #: 47-103-03249

WELL PLAT
PAGE 3 OF 3
DATE: 08/07/2018
REVISED DATE:
02/18/2019



Well Site Safety Plan

Tug Hill Operating, LLC

Well Name: Lackawanna N-5HM

Pad Location: Lackawanna Pad
Wetzel County, West Virginia

UTM (meters), NAD83, Zone 17:

Northing: 4,384,042.03

Easting: 512,301.27

*DMH
2-15-19*

Updated February 2019

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 DPS GIS (7/27/2018) 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

Permit well - Lackawanna N-5HM

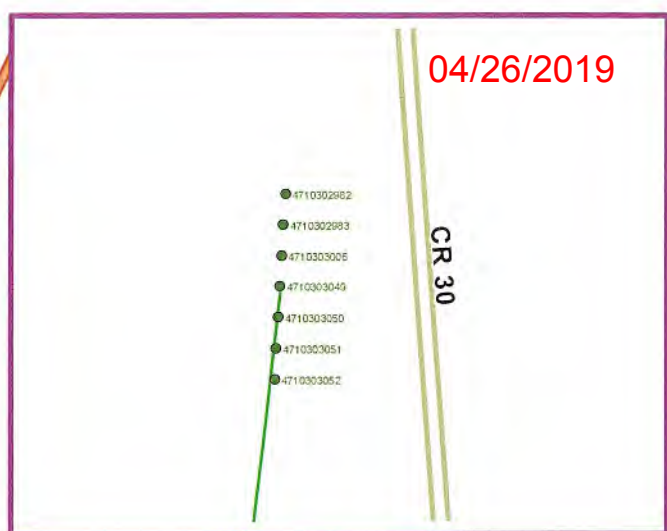
Wells within 500' Buffer

Note: Well spots depicted on Area of Review map (page 3) are derived from State held coordinates. The spots may differ from those depicted on the Well Plat because the Plat locations represent actual field surveyed locations. Please refer to the Plat for surveyed well spots

API Number	Operator Name	Total Depth	Perforated Fms	Producing zones not perforated	Is this well "known or reasonably expected to penetrate a depth that could be within the range of Fracture propagation"? 1000' is max limit I would assign to wells that might be within in range of fracture propagation	Comments
4710302982	Tug Hill Operating	5685' MD 5616' TVD	None	None	Yes, existing Marcellus top hole wellbore. Proper casing and cement should prevent migration of fluids from new wellbore to existing wellbore	This is a shallow top hole wellbore for an undrilled lateral Marcellus well.
4710302983	Tug Hill Operating	5530' MD	None	None	Yes, existing Marcellus top hole wellbore. Proper casing and cement should prevent migration of fluids from new wellbore to existing wellbore	This is a shallow top hole wellbore for an undrilled lateral Marcellus well.
4710303006	Tug Hill Operating	2480' MD	None	None	No, existing shallow top hole well bore. Proper casing and cement should prevent migration of fluids from new wellbore to existing wellbore.	This is a shallow top hole wellbore for an undrilled lateral Utica well
4710303049	Gastar Exploration	n/a	None	None	No	Permit
4710303050	Gastar Exploration	n/a	None	None	No	Permit
4710303051	Gastar Exploration	n/a	None	None	No	Permit
4710303052	Gastar Exploration	n/a	None	None	No	Permit

04/26/2019

MONROE LEE



WETZEL

MAGNOLIA

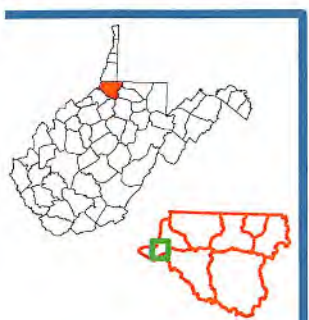
Legend

- Well Locations (ims.wvgs.wvnet.edu)
- Major Highways
- Major Roads
- Marcellus Drilled Laterals
- Utica Drilled Laterals
- Lackawanna N-5HM
- 500 Ft. Buffer
- Counties
- Districts

TYLER

ELLSWORTH

GREEN



Lackawanna N - 5HM
Magnolia District
Wetzel County, WV



Map Created: February 13, 2019

Notes: All locations are approximate and are for visualization purposes only.