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west virginia department of environmental protection

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

Earl Ray Tomblin, Governor  
Randy C. Huffman, Cabinet Secretary  
[www.dep.wv.gov](http://www.dep.wv.gov)

## PERMIT MODIFICATION APPROVAL

October 07, 2013

ANTERO RESOURCES APPALACHIAN CORPORATION  
1625 17TH STREET, SUITE 300  
DENVER, CO 80202

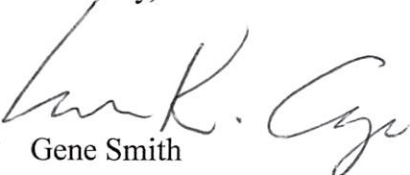
Re: Permit Modification Approval for API Number 8509985 , Well #: LEFT FORK UNIT #1H  
**extended lateral**

Oil and Gas Operator:

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.

Please call James Martin at 304-926-0499, extension 1654 if you have any questions.

Sincerely,

*for*   
Gene Smith  
Regulatory/Compliance Manager  
Office of Oil and Gas



Antero Resources  
1625 17th Street  
Denver, Colorado 80202  
Office 303.357.7310  
Fax 303.357.7315

May 3, 2013

West Virginia Department of Environmental Protection  
Office of Oil and Gas  
Attn: Ms. Laura Cooper  
601 57<sup>th</sup> Street  
Charleston, WV 25304

Ms. Laura Cooper:

Antero Resources Appalachian Corporation (Antero) would like to submit the following permit modifications for three approved wells on the Lockhart Heirs West Pad. We are requesting to extend the horizontal lateral which will change the bottom hole locations of the Left Fork Unit 1H (API# 47-085-09985), Left Fork Unit 2H (API# 47-085-09986) and Left Fork Unit 3H (API# 47-085-09987).

Attached you will find the following documents:

- REVISED Forms WW-6B, which show the revised MDs and Production Casing/Cement programs
- REVISED Forms WW-6A1, which show the additional leases we will be drilling into
- REVISED Mylar Plats, which show the new bottom hole locations

If you have any questions please feel free to contact me at (303) 357-7323.

Thank you in advance for your consideration.

Sincerely,

Ashlie Mihalcin  
Permit Representative  
Antero Resources Appalachian Corporation

Enclosures

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Office of Oil & Gas

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10/11/2013

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

1) Well Operator: Antero Resources Appalachian Corporation 494488557 085-Ritchie Union Pullman 7.5'  
Operator ID County District Quadrangle

2) Operator's Well Number: Left Fork Unit 1H Well Pad Name: Lockhart Heirs West Pad

3 Elevation, current ground: 1022' Elevation, proposed post-construction: 1022'

4) Well Type: (a) Gas  Oil  Underground Storage   
Other \_\_\_\_\_  
(b) If Gas: Shallow  Deep   
Horizontal

5) Existing Pad? Yes or No: Yes

6) Proposed Target Formation(s), Depth(s), Anticipated Thicknesses and Associated Pressure(s):  
Marcellus Shale: 66700' TVD, Anticipated Thickness- 50 Feet, Associated Pressure- 3,000#

7) Proposed Total Vertical Depth: 6700' TVD

8) Formation at Total Vertical Depth: Marcellus

9) Proposed Total Measured Depth: 14,600' MD

10) Approximate Fresh Water Strata Depths: 190', 258'

11) Method to Determine Fresh Water Depth: Offset well records. Depths have been adjusted according to surface elevations.

12) Approximate Saltwater Depths: 1712', 2040'

13) Approximate Coal Seam Depths: None available

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

15) Does proposed well location contain coal seams directly overlying or adjacent to an active mine? If so, indicate name and depth of mine: No

16) Describe proposed well work: Drill, perforate, fracture a new horizontal shallow well and complete Marcellus Shale

\*Antero will be air drilling the fresh water string which makes it difficult to determine when freshwater is encountered, therefore we have built in a buffer for the casing setting depth which helps to ensure that all fresh water zones are covered.

17) Describe fracturing/stimulating methods in detail:  
Antero plans to pump Slickwater into the Marcellus Shale formation in order to ready the well for production. The fluid will be comprised of approximately 99 percent water and sand, with less than 1 percent special-purpose additives as shown in the attached "List of Anticipated Additives Used for Fracturing or Stimulating Well."

18) Total area to be disturbed, including roads, stockpile area, pits, etc. (acres): 18.21 acres

19) Area to be disturbed for well pad only, less access road (acres): 6.14 acres

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20)

**CASING AND TUBING PROGRAM**

<b>TYPE</b>	<b>Size</b>	<b>New or Used</b>	<b>Grade</b>	<b>Weight per ft.</b>	<b>FOOTAGE: For Drilling</b>	<b>INTERVALS: Left in Well</b>	<b>CEMENT: Fill -up (Cu. Ft.)</b>
Conductor	20"	New	H-40	94#	40'	40'	CTS, 38 Cu. Ft.
Fresh Water	13-3/8"	New	J-55/H-40	54.5#/48#	395'	395'	CTS, 549 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2495'	2495'	CTS, 1016 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	14600'	14600'	3615 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7200'	
Liners							

<b>TYPE</b>	<b>Size</b>	<b>Wellbore Diameter</b>	<b>Wall Thickness</b>	<b>Burst Pressure</b>	<b>Cement Type</b>	<b>Cement Yield</b>
Conductor	20"	24"	0.438"	1530	Class A	1.18
Fresh Water	13-3/8"	17-1/2"	0.38"/0.33"	2730/1730	Class A	1.18
Coal	9-5/8"	12-1/4"	0.352"	3520	Class A	1.18
Intermediate						
Production	5-1/2"	8-3/4" & 8-1/2"	0.361"	12630	Lead-H/POZ & Tail - H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11200		
Liners						

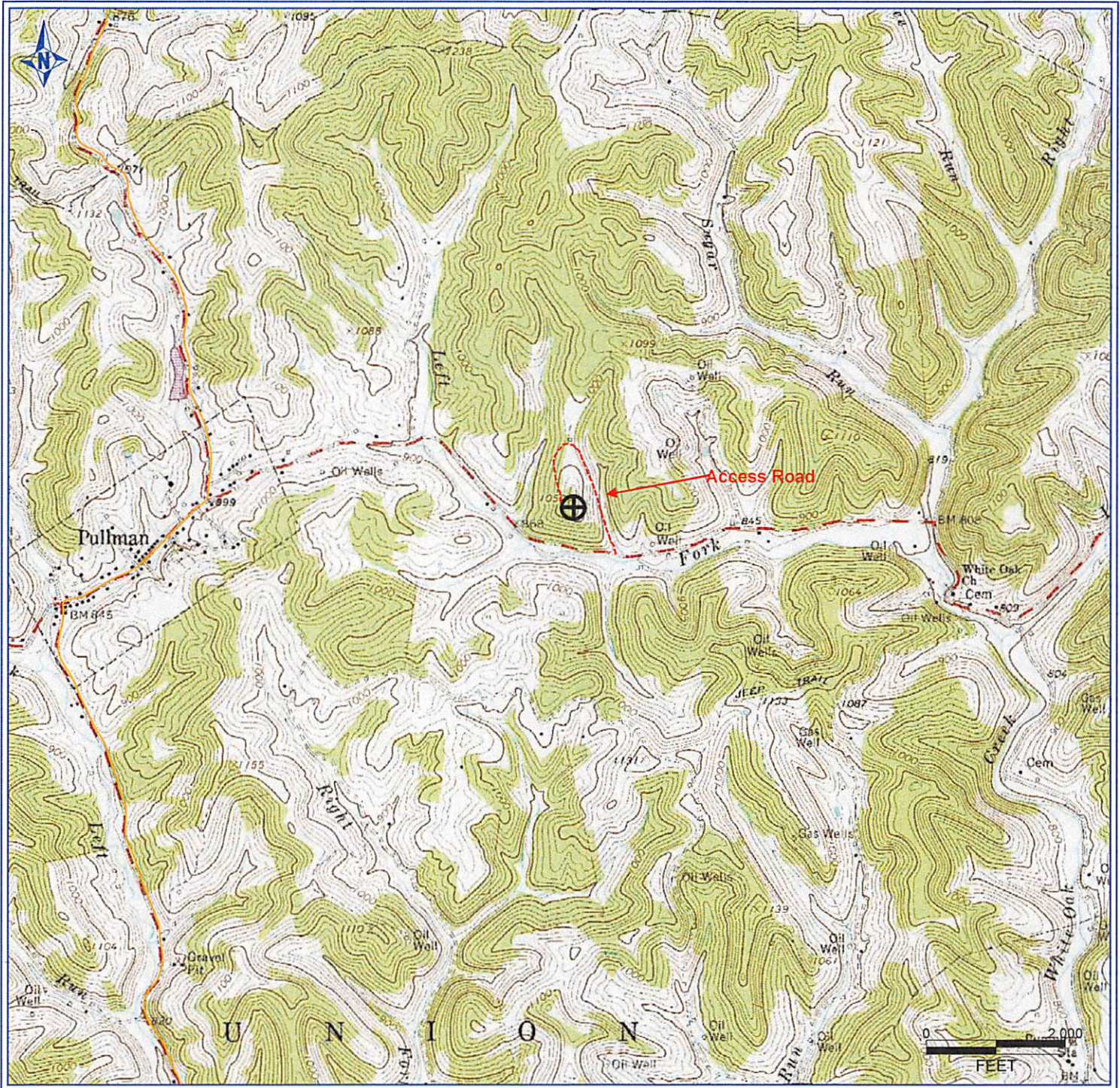
**PACKERS**

Kind:	N/A			
Sizes:	N/A			
Depths Set:	N/A			

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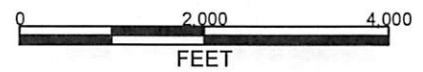


PETRA 6/26/2012 2:36 01 PM

**Antero Resources Corporation**

APPALACHIAN BASIN

Left Fork Unit 1H  
Ritchie County



REMARKS  
QUADRANGLE: PULLMAN  
WATERSHED: LEFT FORK  
DISTRICT: UNION

10/11/2013

Date: 7/05/2012

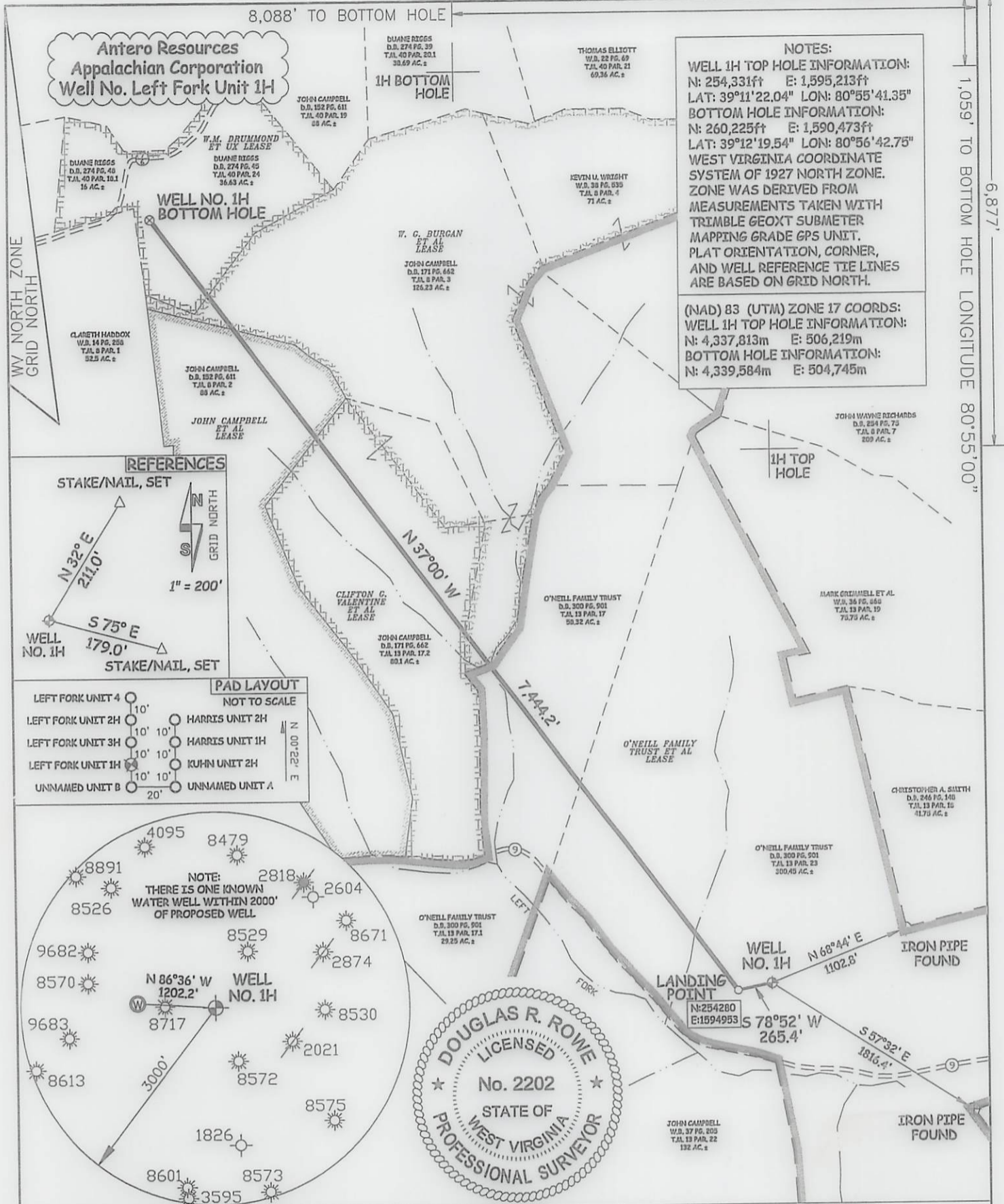


LATITUDE 39°12'30"

3,256'

1,059' TO BOTTOM HOLE LONGITUDE 80°55'00"

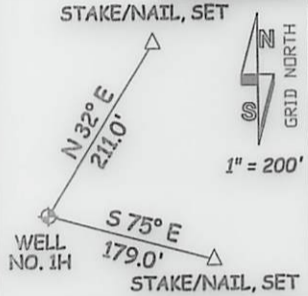
6,877'



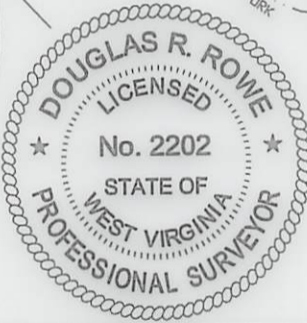
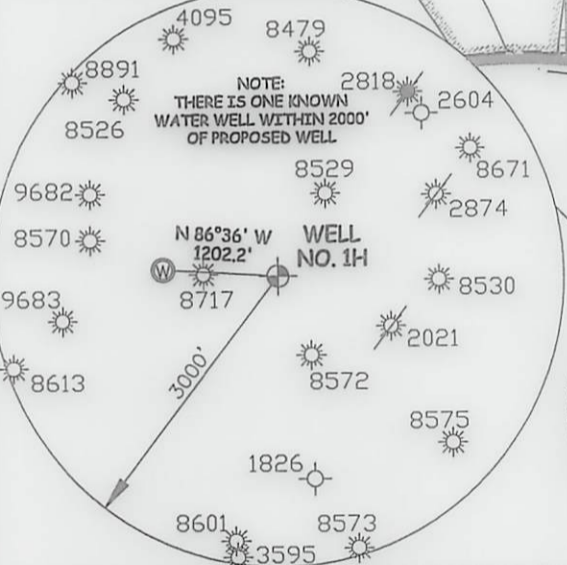
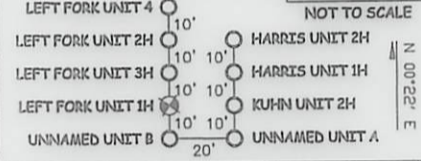
**NOTES:**  
**WELL 1H TOP HOLE INFORMATION:**  
 N: 254,331ft E: 1,595,213ft  
 LAT: 39°11'22.04" LON: 80°55'41.35"  
**BOTTOM HOLE INFORMATION:**  
 N: 260,225ft E: 1,590,473ft  
 LAT: 39°12'19.54" LON: 80°56'42.75"  
 WEST VIRGINIA COORDINATE SYSTEM OF 1927 NORTH ZONE. ZONE WAS DERIVED FROM MEASUREMENTS TAKEN WITH TRIMBLE GEOXT SUBMETER MAPPING GRADE GPS UNIT. PLAT ORIENTATION, CORNER, AND WELL REFERENCE TIE LINES ARE BASED ON GRID NORTH.

**(NAD) 83 (UTM) ZONE 17 COORDS:**  
**WELL 1H TOP HOLE INFORMATION:**  
 N: 4,337,813m E: 506,219m  
**BOTTOM HOLE INFORMATION:**  
 N: 4,339,584m E: 504,745m

**REFERENCES**



**PAD LAYOUT**



JOB # <b>12-045</b> DRAWING # <b>LEFTFORKUNIT1HR1</b> SCALE <b>1" = 1000'</b> MINIMUM DEGREE OF ACCURACY <b>SUBMETER</b> PROVEN SOURCE OF ELEV. <b>SUBMETER MAPPING GRADE GPS</b>		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 REGULATIONS ISSUED AND PERSCRIBED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.		<b>LEGEND</b> --- Surface Owner Boundary Lines +/- - - - Interior Surface Tracts +/- - - - Existing Fence X Found monument, as noted	
STATE OF WEST VIRGINIA DEPARTMENT OF ENERGY DIVISION OF OIL AND GAS WELL TYPE: OIL ___ GAS <b>X</b> LIQUID INJECTION ___ WASTE DISPOSAL ___ (IF "GAS") PRODUCTION <b>X</b> STORAGE ___ DEEP ___ SHALLOW <b>X</b> LOCATION: ELEVATION <b>1,022'</b> WATERSHED <b>LEFT FORK</b> QUADRANGLE <b>PULLMAN 7.5'</b> DISTRICT <b>UNION</b> COUNTY <b>RITCHIE</b>		STATE OF WEST VIRGINIA, DIVISION OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS WILLow LAND SURVEYING PLLC 266 HUSHERS RUN RD PENNSBORO WEST VIRGINIA 26415		DATE <b>04/29/13</b> OPERATOR'S WELL# <b>LEFT FORK UNIT #1H</b> API WELL # <b>MOD 47 - 085 - 09985 H6A</b> STATE COUNTY PERMIT	
SURFACE OWNER <b>O'NEILL FAMILY TRUST ET AL</b> ACREAGE <b>300.45 ACRES +/-</b> OIL & GAS ROYALTY OWNER <b>O'NEILL FAMILY TRUST ET AL;</b> LEASE ACREAGE <b>517.83 ACRES±;</b> <b>W. G. BURGAN ET AL; CLIFTON G. VALENTINE ET AL; JOHN CAMPBELL; W.M. DRUMMOND ET UX</b> <b>126.23 ACRES±; 80.1 ACRES±; 88 ACRES±; 58 ACRES±;</b>		PROPOSED WORK: DRILL <b>X</b> CONVERT ___ DRILL DEEPER ___ REDRILL ___ FRACTURE OR STIMULATE <b>X</b> PLUG OFF OLD FORMATION ___ PERFORATE NEW FORMATION <b>X</b> OTHER PHYSICAL CHANGE IN WELL (SPECIFY) <b>BTL - Permit Modification</b> PLUG & ABANDON ___ CLEAN OUT & REPLUG ___ TARGET FORMATION <b>MARCELLUS</b> ESTIMATED DEPTH <b>6,700' TVD 14,600' MD</b>		DOUGLAS R. ROWE P.S. 2202 DATE <b>04/29/13</b> OPERATOR'S WELL# <b>LEFT FORK UNIT #1H</b> API WELL # <b>MOD 47 - 085 - 09985 H6A</b> STATE COUNTY PERMIT	
WELL OPERATOR <b>ANTERO RESOURCES APPALACHIAN CORP.</b> DESIGNATED AGENT <b>DIANNA STAMPER</b> ADDRESS <b>1625 17TH STREET</b> ADDRESS <b>CT CORPORATION SYSTEM</b> <b>DENVER, CO 80202</b> ADDRESS <b>5400 D BIG TYLER ROAD</b> <b>FORM WW-6</b> <b>CHARLESTON, WV 25313</b>					