



west virginia department of environmental protection

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

PERMIT MODIFICATION APPROVAL

March 21, 2016

ANTERO RESOURCES CORPORATION
1615 WYNKOOP STREET
DENVER, CO 80202

Re: Permit Modification Approval for API Number 8510206, Well #: LEFT FORK UNIT 4H

Shift Tangent

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,

A handwritten signature in black ink, appearing to read 'Gene Smith', written over a horizontal line.

For

Gene Smith
Assistant Chief of Permitting
Office of Oil and Gas

Promoting a healthy environment.

03/25/2016



February 5, 2016

Antero Resources
1615 Wynkoop Street
Denver, CO 80202
Office 303.357.7310
Fax 303.357.7315

West Virginia Department of Environmental Protection
Office of Oil and Gas
Attn: Ms. Laura Adkins
601 57th Street
Charleston, WV 25304

Ms. Adkins:

Antero Resources Corporation (Antero) would like to submit the following permit modifications for two approved wells on the existing Lockhart Heirs West Pad. We are requesting to slightly shift the tangent points to accommodate appropriate spacing between the Left Fork Unit 3H (API# 47-085-10205) and **Left Fork Unit 4H (API# 47-085-10206)**. Please note that the bottom hole locations have not changed and we will not be drilling through any new leases; therefore, a revised Form WW-6A1 has not been included.

Attached you will find the following documents:

- REVISED Form WW-6B, which shows the updated lateral length
- REVISED Mylar Plat, which shows the updated tangent point

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

Thank you in advance for your consideration.

Sincerely,

A handwritten signature in cursive script that reads "Ashlie Steele".

Ashlie Steele
Permitting Supervisor
Antero Resources Corporation

Enclosures

4708510200 MOP

03/25/2016

API # 47-085-10206 PERMIT MODIFICATION

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

1) Well Operator: Antero Resources Corp.

<u>494488557</u>	<u>085 - Ritchie</u>	<u>Union</u>	<u>Pullman 7.5'</u>
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Operator ID County District Quadrangle

2) Operator's Well Number: Left Fork Unit 4H Well Pad Name: Lockhart Heirs West Pad

3) Farm Name/Surface Owner: O'Neill Family Trust, et al Public Road Access: CR 9

4) Elevation, current ground: 1039' Elevation, proposed post-construction: 1021'

5) Well Type (a) Gas Oil Underground Storage

Other

(b) If Gas Shallow Deep

Horizontal

6) Existing Pad: Yes or No No

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):
Marcellus Shale: 6700' TVD, Anticipated Thickness- 50 feet, Associated Pressure- 3,000#

8) Proposed Total Vertical Depth: 6700'

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 19200'

11) Proposed Horizontal Leg Length: 10971'

12) Approximate Fresh Water Strata Depths: 12', 52', 124', 258'

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

14) Approximate Saltwater Depths: 1712', 2040'

15) Approximate Coal Seam Depths: None Identified

16) Approximate Depth to Possible Void (coal mine, karst, other): None Anticipated 6700540206 MOP

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

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

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API # 47-085-10206 PERMIT MODIFICATION

18)

CASING AND TUBING PROGRAM

TYPE	<u>Size (in)</u>	<u>New or Used</u>	<u>Grade</u>	<u>Weight per ft. (lb/ft)</u>	<u>FOOTAGE: For Drilling (ft)</u>	<u>INTERVALS: Left in Well (ft)</u>	<u>CEMENT: Fill-up (Cu. Ft.)/CTS</u>
Conductor	20"	New	H-40	94#	105'	105'	CTS, 101 Cu. Ft.
Fresh Water	13-3/8"	New	J-55/H-40	54.5#/48#	310'	310'	CTS, 431 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2405'	2405'	CTS, 979 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	19200'	19200'	4901 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7200'	
Liners							

TYPE	<u>Size (in)</u>	<u>Wellbore Diameter (in)</u>	<u>Wall Thickness (in)</u>	<u>Burst Pressure (psi)</u>	<u>Anticipated Max. Internal Pressure (psi)</u>	<u>Cement Type</u>	<u>Cement Yield (cu. ft./k)</u>
Conductor	20"	24"	0.438"	1530	50	Class A	1.18
Fresh Water	13-3/8"	17-1/2"	0.38"/0.33"	2730/1730	1000	Class A	1.18
Coal	9-5/8"	12-1/4"	0.352"	3520	1500	Class A	1.18
Intermediate							
Production	5-1/2"	8-3/4" & 8-1/2"	0.361"	12630	2500	Lead-H/POZ & Tail - H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11200			
Liners							

4708510206 *MoA*

PACKERS

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

API # 47-085-10206 PERMIT MODIFICATION

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

Drill, perforate, fracture a new horizontal shallow well and complete Marcellus Shale.

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

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."

Anticipated Max Pressure - 9300 lbs
Anticipated Max Rate - 80 bpm

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 19.30 Acres

22) Area to be disturbed for well pad only, less access road (acres): 6.54 Acres

23) Describe centralizer placement for each casing string:

Conductor: no centralizers
Surface Casing: one centralizer 10' above the float shoe, one on the insert float collar and one every 4th joint spaced up the hole to surface.
Intermediate Casing: one centralizer above float joint, one centralizer 5' above float collar and one every 4th collar to surface.
Production Casing: one centralizer at shoe joint and one every 3 joints to top of cement in intermediate casing.

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

Conductor: no additives, Class A cement.
Surface: Class A cement with 2-3% calcium chloride and 1/4 lb of flake.
Intermediate: Class A Cement with 1/4 lb of flake, 5 gallons of clay treat.
Production: Lead cement - 50/50 Class H/Poz + 1/5% salt + 1% C-45 + 0.5% C-16a + 0.2% C-12 + 0.45% C-20 + 0.5% C51.
Production: Tail cement - Class H + 45 PPS Calcium Carbonate + 1.0% FL-160 + 0.2% ACGB-47 + 0.05% ACSA-51 + 0.2% ACR-20

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4708510206 MOP

25) Proposed borehole conditioning procedures:

Conductor: blowhole clean with air, run casing, 10 bbls fresh water.
Surface: blowhole clean with air, trip to conductor shoe, trip to bottom, blowhole clean with air, trip out, run casing, circulate pipe capacity + 40 bbls fresh water followed by 25 bbls bentonite mud, 10 bbls fresh water spacer.
Intermediate: blowhole clean with air, trip to surface casing shoe, trip to bottom, blowhole clean with air, trip out, run casing, circulate 40 bbls brine water followed by 10 bbls fresh water and 25 bbls bentonite mud, pump 10 bbls fresh water.
Production: circulate with 14 lb/gal NaCl mud, trip to middle of lateral, circulate, pump high viscosity sweep, trip to base of curve, pump high viscosity sweep, trip to top of curve, trip to bottom, circulate, pump high viscosity sweep, trip out, run casing, circulate 10 bbls fresh water, pump 48 bbls barite pill, pump 10 bbls fresh water followed by 48 bbls mud flush and 10 bbls water.

*Note: Attach additional sheets as needed.

LATITUDE 39°12'30" 3,261'

LATITUDE 39°15'00"

LONGITUDE 80°55'00"

6,862'

10,936' TO BOTTOM HOLE

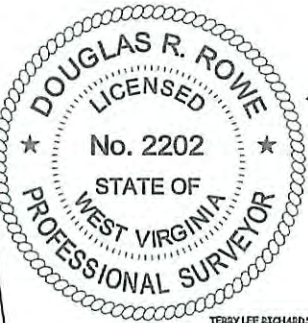
Antero Resources Corporation
Well No. Left Fork Unit 4H

WELL NO. 4H
BOTTOM HOLE

NO OCCUPIED DWELLINGS OR BUILDINGS TWO THOUSAND FIVE HUNDRED (2,500) SQUARE FEET OR LARGER USED TO HOUSE OR SHELTER DAIRY CATTLE OR POULTRY HUSBANDRY ARE LOCATED WITHIN SIX HUNDRED TWENTY-FIVE (625) FEET OF THE CENTER OF THE WELL PAD.

NOTES:
WELL 4H TOP HOLE INFORMATION:
N: 254,346ft E: 1,595,208ft
LAT: 39°11'22.18" LON: 80°55'41.42"
BOTTOM HOLE INFORMATION:
N: 265,475ft E: 1,593,566ft
LAT: 39°13'11.91" LON: 80°56'04.52"
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 4H TOP HOLE INFORMATION:
N: 4,337,817m E: 506,218m
BOTTOM HOLE INFORMATION:
N: 4,341,199m E: 505,661m



WV NORTH ZONE
GRID NORTH

TERRY LEE RICHARDS
D.B. 104 PG. 507
T.J.L. 40 PAR. 05
50 AC. ±

TERRY LEE RICHARDS
D.B. 104 PG. 507
T.J.L. 40 PAR. 05
50 AC. ±

CHERYL HUNTING ET UX LEASE
ROBERT F. PUGH ET AL
D.B. 237 PG. 455
T.J.L. 40 PAR. 05
36.5 AC. ±

BERNARD W. RICHARDS ET AL LEASE
ROGER B. RICHARDS
D.B. 242 PG. 319
T.J.L. 40 PAR. 10
103.56 AC. ±

TERRY LEE RICHARDS
D.B. 104 PG. 507
T.J.L. 40 PAR. 09
50 AC. ±

DUANE RIGGS
D.B. 274 PG. 39
T.J.L. 40 PAR. 20
19.9 AC. ±

W. G. BURGAN ET AL LEASE
JOHN CAMPBELL
D.B. 171 PG. 662
T.J.L. 8 PAR. 3
126.23 AC. ±

KEVIN H. WRIGHT
W.B. 35 PG. 535
T.J.L. 8 PAR. 4
71 AC. ±

J.B. ELLIOTT ET UX LEASE
THOMAS ELLIOTT
W.B. 22 PG. 69
T.J.L. 40 PAR. 21
69.35 AC. ±

JULIE SATRE
D.B. 242 PG. 152
T.J.L. 40 PAR. 22
119.5 AC. ±

I.S. HALL ET AL LEASE

FRED HICKNEY ET AL
D.B. 230 PG. 579
T.J.L. 08 PAR. 05
91415 AC. ±

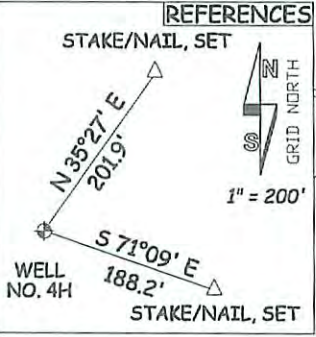
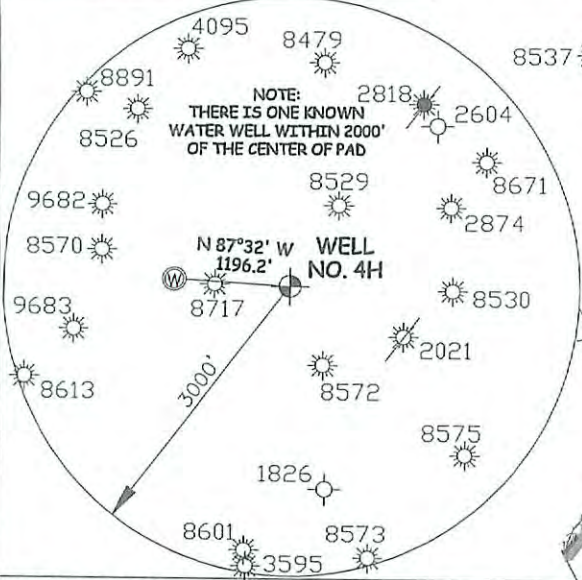
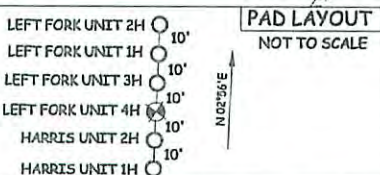


Table with job information: JOB # 12-045, DRAWING # LEFTFORKUNIT4HR2, SCALE 1" = 1000', MINIMUM DEGREE OF ACCURACY SUBMETER, PROVEN SOURCE OF ELEV. SUBMETER MAPPING GRADE GPS, STATE OF WEST VIRGINIA DEPARTMENT OF ENERGY DIVISION OF OIL AND GAS, LEGEND, DOUGLAS R. ROWE P.S. 2202



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 PERSCRIBED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.



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 02/04/16

OPERATOR'S WELL# LEFT FORK UNIT #4H

WELL TYPE: OIL GAS X LIQUID INJECTION WASTE DISPOSAL (IF "GAS") PRODUCTION X STORAGE DEEP SHALLOW X LOCATION: ORIGINAL GROUND ELEV. 1,039' PROPOSED ELEV. 1021' WATERSHED SOUTH FORK HUGHES RIVER

QUADRANGLE PULLMAN 7.5' DISTRICT UNION COUNTY RITCHIE SURFACE OWNER O'NEILL FAMILY TRUST ET AL ACREAGE 300.45 ACRES +/- OIL & GAS ROYALTY OWNER O'NEILL FAMILY TRUST ET AL; DENNIS HADDOX ET AL; MICHAEL P. HEASTER ET AL; BERNARD RICHARDS ET AL; J.B. ELLIOTT ET UX; BERNARD W. RICHARDS ET AL; CHERYL HUNTING ET UX LEASE ACREAGE 517.83 ACRES ±; 41.75 ACRES ±; 234.5 ACRES ±; 214 ACRES ±; 70 ACRES ±; 114 ACRES ±; 141.29 ACRES ±

PROPOSED WORK: DRILL X CONVERT DRILL DEEPER REDRILL FRACTURE OR STIMULATE X PLUG OFF OLD FORMATION PERFORATE NEW FORMATION X OTHER PHYSICAL CHANGE IN WELL (SPECIFY) Modification - Spacing PLUG & ABANDON CLEAN OUT & REPLUG TARGET FORMATION MARCELLUS ESTIMATED DEPTH 6,700' TVD 19,200' MD

WELL OPERATOR ANTERO RESOURCES CORP. ADDRESS 1615 WYNKOOP STREET DENVER, CO 80202 DESIGNATED AGENT DIANNA STAMPER CT CORPORATION SYSTEM 5400 D BIG TYLER ROAD CHARLESTON, WV 25313

IRON PIPE FOUND

N 08°32' E 2155.7'

N 65°12' E 1201.5'

N 69°32' E 1102.6'

LANDING POINT
N: 254849
E: 1596298

Received Office of Oil & Gas FEB 08 2016

03/25/2016

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LATITUDE 39°15'00"

LONGITUDE 80°55'00"

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10,936' TO BOTTOM HOLE

COUNTY NAME PERMIT

Antero Resources Corporation
Well No. Left Fork Unit 4H

WELL NO. 4H
BOTTOM HOLE

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D.B. 237 PG. 426
T.J.L. 40 PAR. 05
66.5 AC. ±

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T.J.L. 40 PAR. 10
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D.B. 194 PG. 907
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40 AC. ±

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D.B. 274 PG. 39
T.J.L. 40 PAR. 20
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69.36 AC. ±

JULIE SATRE
D.B. 242 PG. 182
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119.5 AC. ±

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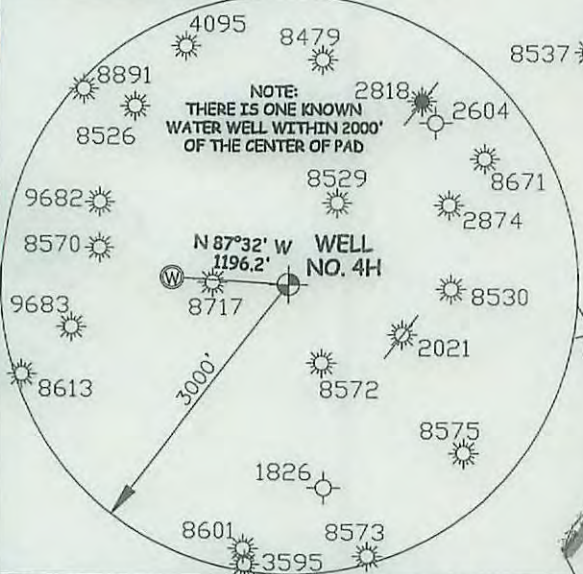
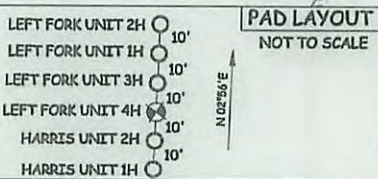
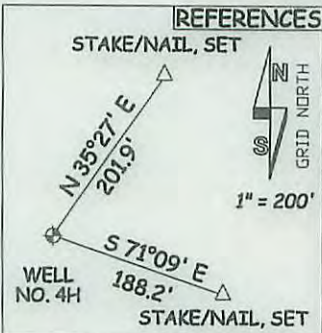
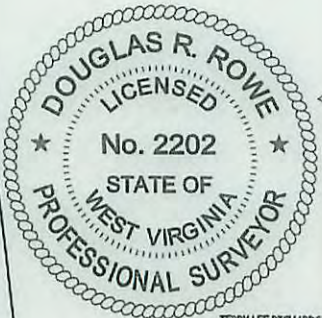
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4H TOP HOLE

4H BOTTOM HOLE

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PROVEN SOURCE OF ELEV.	SUBMETER MAPPING GRADE GPS
STATE OF WEST VIRGINIA DEPARTMENT OF ENERGY DIVISION OF OIL AND GAS	
LEGEND	
---	Surface Owner Boundary Lines +/-
---	Inferior Surface Tracts +/-
---	Existing Fence
---	Found monument, as noted
DOUGLAS R. ROWE P.S. 2202	

WV NORTH ZONE
GRID NORTH



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WILLOW LAND SURVEYING PLLC
266 HUSHERS RUN RD PENNSBORO WEST VIRGINIA 26415

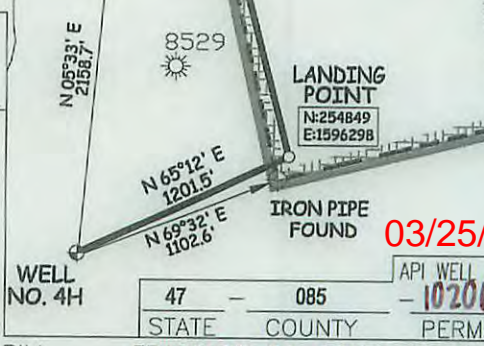
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WELL OPERATOR ANTERO RESOURCES CORP.
ADDRESS 1615 WYNKOOP STREET DENVER, CO 80202
DESIGNATED AGENT DIANNA STAMPER
ADDRESS 5400 D BIG TYLER ROAD CHARLESTON, WV 25313



03/25/2016