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 26, 2014

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

Re: Permit Modification Approval for API Number 1706232 ; Well #: IRONS UNIT 2H
Changed Bottom Hole

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

17- 06232 MOD

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

March 13, 2014

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

Ms. Laura Cooper:

Antero Resources Corporation (Antero) would like to submit the following permit modifications for three approved wells on the existing Leonard Pad. We are requesting to change the orientation of the horizontal laterals which will change the bottom hole locations of the Rikk Unit 1H (API# 47-017-06228), Rikk Unit 2H (API# 47-017-06231) and Irons Unit 2H (API#47-017-06232).

Attached you will find the following documents:

- REVISED Form WW-6B, which shows the revised MD and Production Casing/Cement program
- REVISED Form WW-6A1, which shows the leases we will be drilling into
- REVISED Mylar Plat, which shows the new bottom hole location

If you have any questions please feel free to contact me at (303) 357-6817.

Thank you in advance for your consideration.

Sincerely,

Lisa Bottinelli
Permit Representative
Antero Resources Corporation

Enclosures

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Office of Oil and Gas
MAR 14 2014
WV Department of
Environmental Protection

WW-6B
(9/13)

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

1) Well Operator: Antero Resources Corporation | 494488557 (Operator ID) | 017-Doddridge (County) | New Milton (District) | New Milton 7.5' (Quadrangle)

2) Operator's Well Number: Irons Unit 2H Well Pad Name: Leonard Pad (Existing)

3) Farm Name/Surface Owner: Walter V. & Leonard J. Davidson Public Road Access: CR 42

4) Elevation, current ground: 1318' Elevation, proposed post-construction: 1318'

5) Well Type (a) Gas ■ Oil ■ Underground Storage
Other
(b)If Gas Shallow ■ Deep
Horizontal ■

6) Existing Pad: Yes or No Yes

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Associated Pressure(s):
Marcellus Shale: 7650' TVD, Anticipated Thickness- 50 Feet, Associated Pressure- 3200#

8) Proposed Total Vertical Depth: 7650' TVD

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 17,400' MD

11) Proposed Horizontal Leg Length: 6986'

12) Approximate Fresh Water Strata Depths: 87', 230'

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

14) Approximate Saltwater Depths: 842', 1789', 2051'

15) Approximate Coal Seam Depths: 263', 960', 1726'

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 ☑

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

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WW-6B
(9/13)

18) **CASING AND TUBING PROGRAM**

TYPE	Size	New or Used	Grade	Weight per ft. (lb/ft)	FOOTAGE: For Drilling	INTERVALS: Left in Well	CEMENT: Fill-up (Cu. Ft.)
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#	300'	300'	CTS, 417 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2525'	2525'	CTS, 1028 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	17400'	17400'	4372 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7200'	
Liners							

LKC 3-26-14

TYPE	Size	Wellbore Diameter	Wall Thickness	Burst Pressure	Cement Type	Cement Yield (cu. ft./k)
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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WW-6B
(9/13)

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."

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 18.18 acres

22) Area to be disturbed for well pad only, less access road (acres): 4.51 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
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 + 0.05% C-51
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

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.

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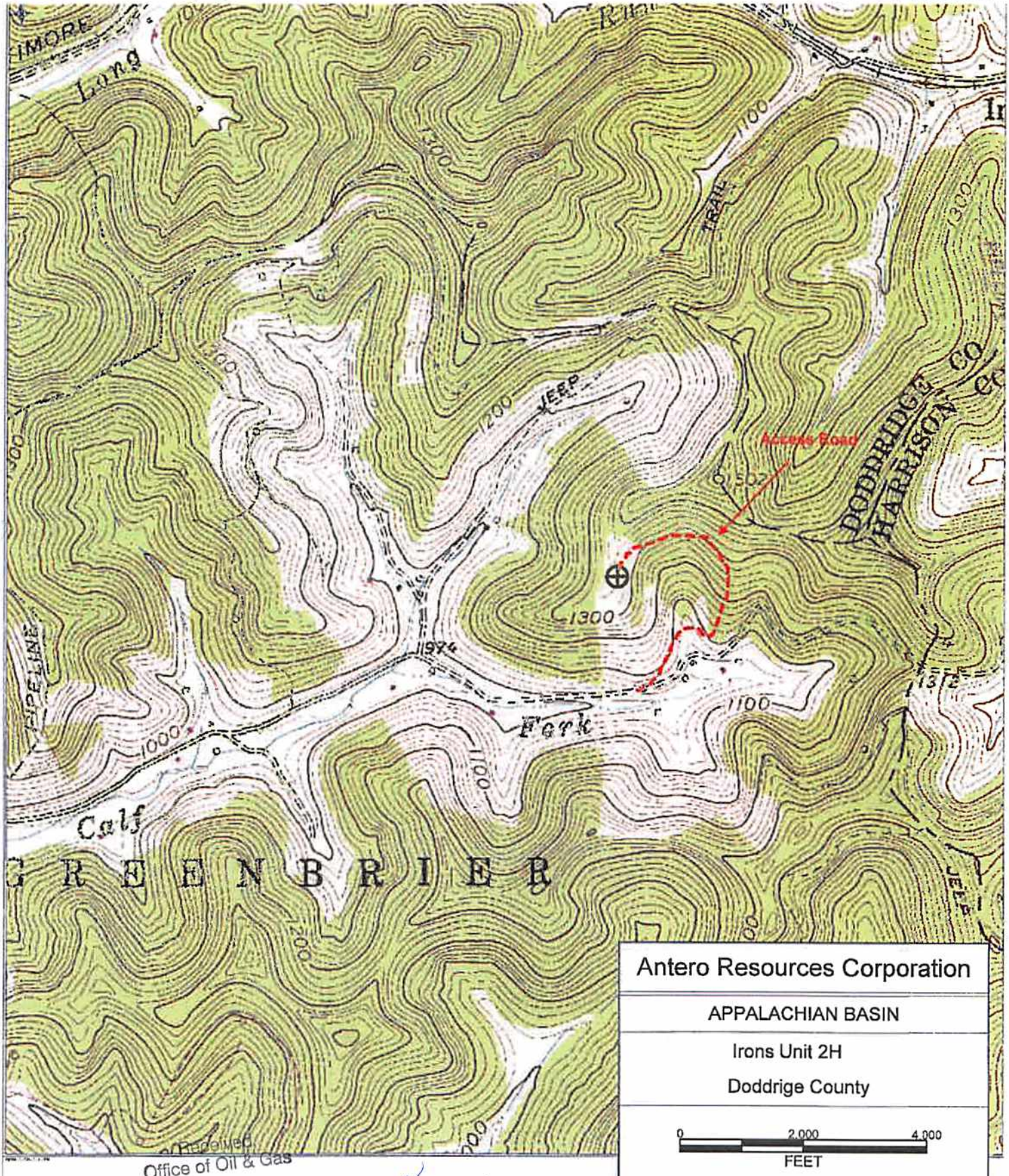
*Note: Attach additional sheets as needed.

17-06232



Antero Resources Corporation

APPALACHIAN BASIN

Irons Unit 2H

Doddrige County

0 2,000 4,000

FEET

REMARKS

QUADRANGLE: SALEM & BIG ISAAC
WATERSHED: BUFFALO CALF FORK
DISTRICT: GREENBRIER

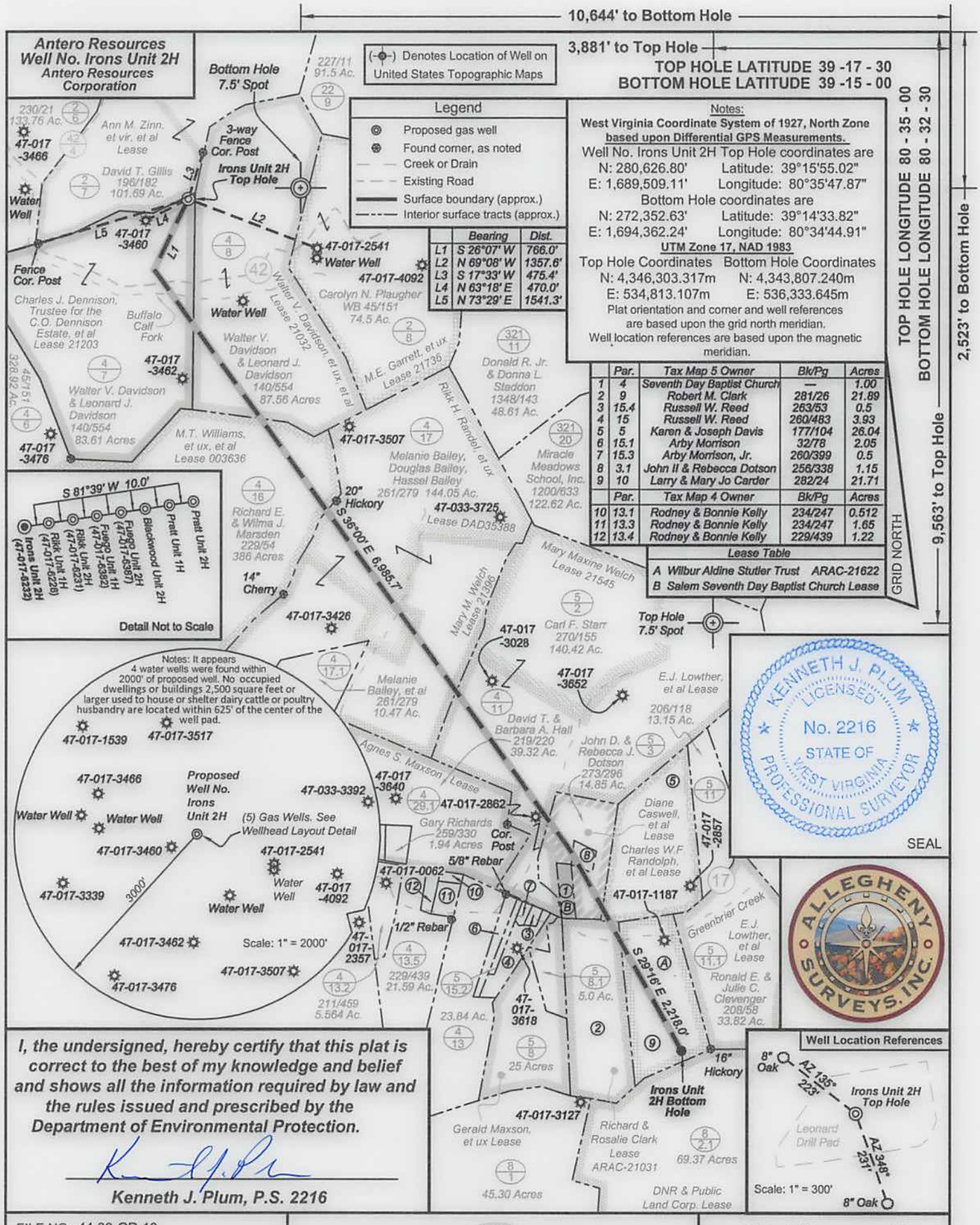
January 9, 2009

Received
Office of Oil & Gas

MAY 16 2013

DCN
5-14-2013

17-06232 H6A IRONS UNIT 2H
ANTERO RESOURCES



	Bearing	Dist.
L1	S 26°07' W	766.0'
L2	N 69°08' W	1357.6'
L3	S 17°33' W	475.4'
L4	N 63°18' E	470.0'
L5	N 73°29' E	1541.3'

	Par.	Tax Map 5 Owner	Bk/Pg	Acres
1	4	Seventh Day Baptist Church	—	1.00
2	9	Robert M. Clark	281/26	21.89
3	15.4	Russell W. Reed	263/53	0.5
4	15	Russell W. Reed	260/483	3.93
5	5	Karen & Joseph Davis	177/104	26.04
6	15.1	Arby Morrison	32/78	2.05
7	15.3	Arby Morrison, Jr.	260/399	0.5
8	3.1	John II & Rebecca Dotson	256/338	1.15
9	10	Larry & Mary Jo Carder	282/24	21.71
	Par.	Tax Map 4 Owner	Bk/Pg	Acres
10	13.1	Rodney & Bonnie Kelly	234/247	0.512
11	13.3	Rodney & Bonnie Kelly	234/247	1.65
12	13.4	Rodney & Bonnie Kelly	229/439	1.22

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.

Kenneth J. Plum, P.S. 2216

FILE NO: 44-30-GR-13
DRAWING NO: 44-13 Irons 2H Well Plat-Mod
SCALE: 1" = 1200'
MINIMUM DEGREE OF ACCURACY: Submeter
PROVEN SOURCE OF ELEVATION: WVDOT, Bridgeport, WV

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
OIL AND GAS DIVISION

DATE: March 10 2014
OPERATOR'S WELL NO. Irons Unit 2H
API WELL NO MOD
47 - 017 - 06232 HSA
STATE COUNTY PERMIT

WELL TYPE: ☐ OIL ☒ GAS ☐ LIQUID INJECTION ☐ WASTE DISPOSAL
(IF GAS) PRODUCTION : ☐ STORAGE ☐ DEEP ☒ SHALLOW
LOCATION: ELEVATION: 1318' WATERSHED: Buffalo Calf Fork QUADRANGLE: Salem & Big Isaac
DISTRICT: Greenbrier COUNTY: Doddridge
SURFACE OWNER: Walter V. Davidson & Leonard J. Davidson
ROYALTY OWNER: Charles J. Dennison, Trustee for the C.O. Dennison Estate, et al
Diane Caswell, et al; Wilbur Aldine Stutler Trust Under Will; Richard & Rosalie Clark; E.J. Lowther, et al; Charles W.F. Randolph, et al; M.T. Williams, et ux, et al; Rikk H. Randel, et ux; Walter V. Davidson, et ux, et al; Mary M. Welch
ARAC-21031 ARAC-21622 21203; 21032; 21396
LEASE NO: 003636; DAD35388
ACREAGE: 83.61 24; 21 9.37; 90; 92
ACREAGE: 84; 87; 350; 27; 65
PROPOSED WORK: ☒ DRILL ☐ CONVERT ☐ DRILL DEEPER ☒ FRACTURE OR STIMULATE ☐ PLUG OFF OLD FORMATION
☒ PERFORATE NEW FORMATION ☒ OTHER PHYSICAL CHANGE IN WELL (SPECIFY) Modification - BHL
☐ PLUG AND ABANDON ☐ CLEAN OUT AND REPLUG TARGET FORMATION: Marcellus Shale ESTIMATED DEPTH: 7,650' TVD 17,400' MD

WELL OPERATOR: Antero Resources Corporation
ADDRESS: 1625 17th Street, Denver, CO 80202
DESIGNATED AGENT: Dianna Stamper - CT Corporation System
ADDRESS: 5400 D Big Tyler Road, Charleston, WV 25313