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

February 25, 2014

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

Re: Permit Modification Approval for API Number 1706288 , Well #: DUKATE UNIT 2H

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

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

December 11, 2013

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 modification for an approved well on the Kirk Pad. We are requesting to change the orientation of the horizontal lateral which will change the bottom hole location of the Dukate Unit 2H (API# 47-017-06288).

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) 357-7323.

Thank you in advance for your consideration.

Sincerely,

Ashlie Mihalcin
Permit Representative
Antero Resources Corporation

Enclosures

RECEIVED
Office of Oil and Gas
DEC 18 2013
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	017-Doddridge	Greenbrier	Big Isaac
		Operator ID	County	District	Quadrangle

2) Operator's Well Number: Dukate Unit 2H Well Pad Name: Kirk Pad

3) Farm Name/Surface Owner: Homer Leroy Floyd Public Road Access: CR 48/3

4) Elevation, current ground: ~1315' Elevation, proposed post-construction: 1297'

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 Associated Pressure(s):
Marcellus Shale: 7,600' TVD, Anticipated Thickness- 50 Feet, Associated Pressure- 3200#

8) Proposed Total Vertical Depth: 7,600' TVD

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 19,200' MD

11) Proposed Horizontal Leg Length: 11,095'

12) Approximate Fresh Water Strata Depths: 246', 353'

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

14) Approximate Saltwater Depths: 1963'

15) Approximate Coal Seam Depths: 349', 633', 901'

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#	405'	405' *see #19	CTS, 563 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2480'	2480'	CTS,1010 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	19200'	19200'	4881 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7200'	
Liners							

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.

*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.

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): 25.44 acres

22) Area to be disturbed for well pad only, less access road (acres): 4.69 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:

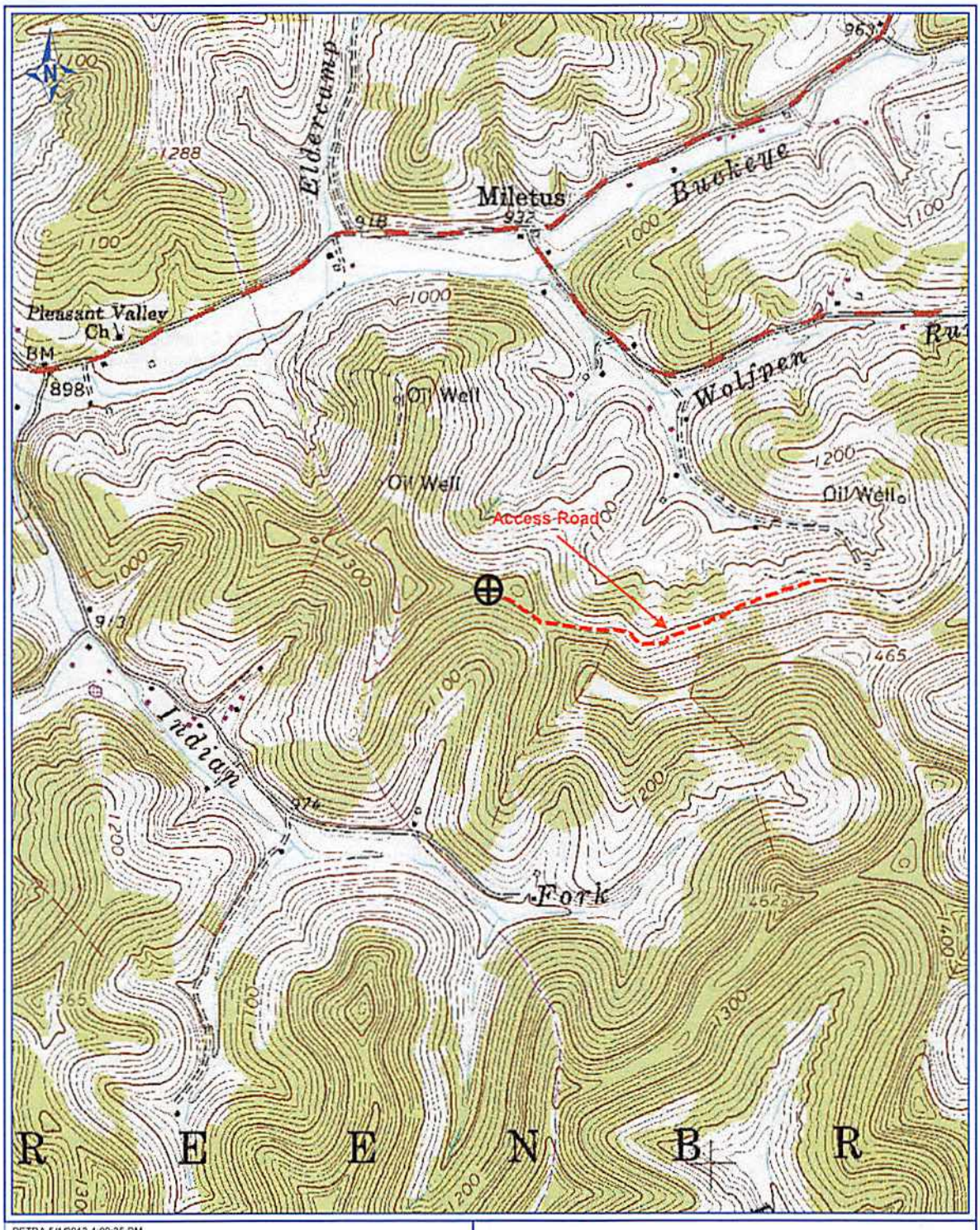
Conductor: no additives, Class A cement.
Surface: Class A cement with 2-3% calcium chloride
Intermediate: Class A cement with 1/4 lb of flake, 5 gallons of clay treat
Production: Lead cement- 50/50 Class H/Poz + 1.5% salt + 1% C-45 + 0.5% C-16a + 0.2% C-12 + 0.45% C-20 + 0.05% C-51
Production: Tail cement- 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 30 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.

17-06288



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Antero Resources Corp

APPALACHIAN BASIN

Dukate Unit 2H

Doddridge County

REMARKS

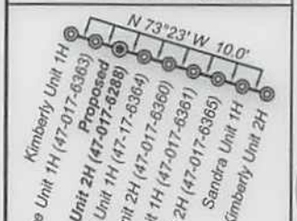
QUADRANGLE: BIG ISAAC
WATERSHED: BIG ISAAC CREEK
DISTRICT: GREENBRIER

By: ECM

0 2,500

FEET

Antero Resources
Well No. Dukate Unit 2H
Antero Resources Corporation



Detail Not to Scale

SEAL

6,531' to Bottom Hole

1,880' to Top Hole

BTM HOLE LATITUDE 39 - 17 - 30

TOP HOLE LATITUDE 39 - 15 - 00

LONGITUDE 80 - 35 - 00

14,933' to Bottom Hole

10,077' to Top Hole

Legend
- Proposed gas well
- Found corner, as noted
- Found Well, as noted
- Surface boundary (approx.)
- Interior surface tracts (approx.)
- Existing Road
- Creek or Drain

Dukate Unit 2H Bottom Hole

Stump

47-017 -1371

4 / 15.1 — 273/290 — 5 Acres

Mary Maxine Welch Lease 22163

Mary Maxine Welch Lease 22161

Richard E. & Wilma J. Marsden 229/54 386 Ac.

4 / 16

47-017-2278

17

Fence Cor.

Greenbrier Creek

N 18°26' W 11,094.7'

Loretta Marsh, et vir, et al Lease

Rodney & Crystal Clark (Rosalie Clark LE) 287/593 57.34 Ac.

4 / 26

4 / 23 — 273/290

4 / 24.1

4 / 25 — 273/290 — 16 Acres

M.T. Williams, et al Lease 003636

287/595 98.13 Ac.

4 / 9

GRID NORTH

James Edward II & Michelle Lea Stout 273/290 10 Acres

Tree w/ old fence

47-017 -3566

Okey Clark et ux Lease

Chad W. Johnson Lease

7 / 7.3 — 253/105 — 0.72 Ac.

Alastair B. & Edith Park Martin Lease 21574

Ed Broome, Inc. Lease

7 / 7

11

47-017-3316

7 / 6 — Jeffrey A. & Penelope B. Mills 260/558 69.75 Ac.

Robert W. and Loretta C. Kelly 156/387 116.57 Ac.

7 / 7.1

7 / 8.1

7 / 7.2

7 / 8 — 174/157 — 31.5 Ac.

Rosa Nicholson Lease

47-033-3664

47 -033 -3546

Iron Pipe (3)

Ora Virginia White Lease DAD61820/002

47-033-3509

Top Hole 7.5' Spot

7 / 13 — Stephen W. & Barbara S. Dolly 263/326 83.746 Ac.

7 / 14.1 — Shawn & Penny Dahlheimer 249/217 30.38 Acres

Jeffrey & Penelope Mills (Tract 1) 166/378 94.61 Ac.

7 / 12

4

Ora Virginia White Lease

DAD37957/002

Chrystal Dawn Keplinger 293/238 29.568 Ac.

47-033 -3510

3/4" Rebar

Charles V. Hammond, et ux Lease

1" Rebar

Painted Stone

47-033 -3520

7 / 20.3

3

5/8" Rebar w/cap

2

3/4" Rebar

5

1

Denver Jack Cork Lease 21235

15 / 11

Well Location References

30" Dbl. Red Oak

AZ92° 214'

186'

AZ235°

40" Oak

Well No. Dukate Unit 2H

Kirk Drill Pad

Detail Not to Scale

(⊕) Denotes Location of Well on United States Topographical Maps

47-017-3352

8

6

7

Buckeye Creek

47-017-3351

Bottom Hole 7.5' Spot

Tree w/ Fencepost Cor.

7 / 36

47-017-3424

Homer Leroy Ford WB 11/556 33 Acres

Homer L. Ford Lease DV019229

47-017 -2205

14

47-017 -2206

7 / 36.1 — Homer Leroy Ford WB 11/556, 54.25 Ac.

Dukate Unit 2H Top Hole

8 / 25.2

7 / 18.1

7 / 18.2 — 256/598 — 1 Acre

47-017-3511

15

Isaac Eddy, et ux Lease L012454 James Romine Lease DV011162

189/3 — 4.01 Ac. — 7 / 25.1

10

Indian Fork

Darrell Ford, et ux, et al Lease

Scott Edward & Petra Paul 253/466 14.25 Ac.

7 / 25

W. V. Ross Lease

47-017 -3567

Beverly A. Frye WB 30/550 70 Ac.

7 / 33

Fencepost Cor.

L2

L1

13

12

9

L5

L3

L4

Kenneth Kirk 267/652 21 Ac.

8 / 25.3

John & Mary Davis 200/338 66.17 Acres

Blaine W. Devericks, et ux Lease

Tangent Point
N: 264,731.58'
E: 1,690,366.74'

A

47-017-3438

Kenneth Kirk 267/652 20.02 Ac.

7 / 44

10 / 9.1

47-017-3430

47-017-3352 — Capped Well No # — 47-017-5807 — Scale: 1" - 2000'

47-017-2205 — Water Well — 47-017 -3461

47-017-3424

47-017-3351

47-017-2206 — Spring — Spring — Water Well — 47-017-0062 — Water Well

3000'

Proposed Well No. Dukate Unit 2H

47-017-3567 — 47-017-2594

47-017-3438 — 47-017-5942

47-017-3430

47-017 -3448 — 47-017-3449 — 47-017-1940

Water Well

Note:
It appears 4 water wells and 2 springs were found within 2000' of proposed well.
No occupied dwellings or buildings 2,500 square feet or larger used to house or shelter dairy cattle or poultry husbandry are located within 625' of the center of the well pad.

ALLEGHENY SURVEYS, INC.

Notes:

West Virginia Coordinate System of 1927, North Zone based upon Differential GPS Measurements.

Well No. Dukate Unit 2H Top Hole coordinates are
N: 264,937.83' Latitude: 39°13'20.18"
E: 1,691,326.56' Longitude: 80°35'22.35"
Bottom Hole coordinates are
N: 275,257.01' Latitude: 39°15'01.63"
E: 1,686,858.60' Longitude: 80°36'20.73"

UTM Zone 17, NAD 1983

Top Hole Coordinates	Bottom Hole Coordinates
N: 4,341,532.882m	N: 4,344,653.917m
E: 535,446.473m	E: 534,032.865m

Plat orientation and corner and well references are based upon the grid north meridian.
Well location references are based upon the magnetic meridian.

		Tax Map 7 Owner	Bk/Pg	Acres
1	28.2	David J. Dukate	262/536	1.02
2	20.4	Quanita M. Crabbe	264/228	7.71
3	20.2	William F. & Inge Rogers	276/703	9.07
4	12-2	Jeffrey A. & Penelope B. Mills	166/378	1.66
5	20.1	Pleasant Valley UM Church	256/598	0.62
6	19	Missionary Regular Baptist Chuch of Jesus Christ	4/368	0.62
7	28.1	Kenneth L. & Debora S. Ash	213/127	1.00
8	26	William H. Swiger	271/152	0.88
9	43	Martha & Blaine Devericks	163/590	10.0
10	28	James L. Dukate	211/292	53.9
11	7.4	Robert W. & Loretta C. Kelly	279/590	0.96
12	42	William W. Nicholas	152/719	13.0
13	41	Richard L. & Donna Campbell	222/634	16.4
14	29	James L. Dukate	211/292	80.5
15	27	James L. & Carol S. Dukate	258/399	0.90

	Lease Table
A	Pauline M. Cottrill & Margaret H. Vincent Lease DAD35254

	Bearing	Dist.
L1	S 73°20' E	1232.4'
L2	N 83°17' E	1003.0'
L3	S 77°52' W	981.7'
L4	N 44°10' W	924.6'
L5	N 73°38' E	798.6'

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.

Bradley D. Miller, P.S. 2167

FILE NO: 230-30-G-12
DRAWING NO: 230-12 Dukate Unit 2H
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: November 15 2013
OPERATOR'S WELL NO. Dukate Unit 2H
API WELL NO MOD
47 - 017 - 06288
STATE COUNTY PERMIT

H6A

WELL TYPE: ☐ OIL ☒ GAS ☐ LIQUID INJECTION ☐ WASTE DISPOSAL
(IF GAS) PRODUCTION : ☐ STORAGE ☐ DEEP ☒ SHALLOW
LOCATION: ELEVATION: 1297' WATERSHED: Big Isaac Creek QUADRANGLE: Big Isaac
DISTRICT: Greenbier COUNTY: Doddridge
SURFACE OWNER: Homer Leroy Floyd
OIL & GAS ROYALTY OWNER: Pauline M. Cottrill & Margaret H. Vincent; Homer L. Ford LEASE #: L012454; DVO19229 ACREAGE: 221; 46; 93.3709
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: 19,200' MD 7,600' TVD

Alastair B. & Edith Park Martin; Ora Virginia White; M.T. Williams, et al; Loretta Marsh, et vir, et al; Blaine W. Devericks, et ux; Isaac Eddy, et ux; James Romine
DAD37957/002; DV011162; 21574; DAD35254; 003636
ACREAGE: 54.25 — 350; 92; 85; 57; 67

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