



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

Friday, February 28, 2020
PERMIT MODIFICATION APPROVAL
Horizontal 6A / New Drill

ANTERO RESOURCES CORPORATION
1615 WYNKOOP STREET

DENVER, CO 80202

Re: Permit Modification Approval for BRONCO UNIT 2H
47-095-02661-00-00

Point of Entry change with Measured Depth update 18500' to 21800' and lateral length update 7394' to 11345

ANTERO RESOURCES CORPORATION

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

Operator's Well Number: BRONCO UNIT 2H
Farm Name: ANTERO RESOURCES CORPORATION
U.S. WELL NUMBER: 47-095-02661-00-00
Horizontal 6A New Drill
Date Modification Issued: 02/28/2020

Promoting a healthy environment.

WW-6B
(04/15)

API NO. 47-095 - 2661
OPERATOR WELL NO. Bronco Unit 2H
Well Pad Name: Colorado West Pad

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

1) Well Operator: Antero Resources Corporation 494507062 095 - Tyler McElroy Shirley 7.5'
Operator ID County District Quadrangle

2) Operator's Well Number: Bronco Unit 2H Well Pad Name: Colorado West Pad

3) Farm Name/Surface Owner: Antero Resources Corporation Public Road Access: CR 60

4) Elevation, current ground: 754' Elevation, proposed post-construction: ~748.5'

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: 6800' TVD, Anticipated Thickness- 40 feet, Associated Pressure- 2900#

8) Proposed Total Vertical Depth: 6800' TVD

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 21800' MD ✓

11) Proposed Horizontal Leg Length: 11345' ✓

12) Approximate Fresh Water Strata Depths: 235', 241', 298'

13) Method to Determine Fresh Water Depths: 47-095-01251, 47-095-00507, 47-095-01643

14) Approximate Saltwater Depths: 970'

15) Approximate Coal Seam Depths: None Identified

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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*DMH
1-29-20*

WW-6B
(04/15)

API NO. 47- 095 - 2661
OPERATOR WELL NO. Bronco Unit 2H
Well Pad Name: Colorado West Pad

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	20"	New	H-40	94#	80	80	CTS, 77 Cu. Ft.
Fresh Water	13-3/8"	New	J-55	54.5#	348 *see # 19	348 *see # 19	CTS, 483 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2500	2500	CTS, 1018 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	23#	21800	21800 /	5587 Cu. Ft
Tubing	2-3/8"	New	N-80	4.7#			
Liners							

*Dmit
1-24-20*

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	20"	24"	0.438"	1530	50	Class A	~1.18
Fresh Water	13-3/8"	17-1/2"	0.38"	2730	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"	0.415"	12,630	2500	Lead-H/POZ & Tail - H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11,200			
Liners							

PACKERS

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

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WW-6B
(10/14)

API NO. 47-095 - 2661
OPERATOR WELL NO. Bronco Unit 2H
Well Pad Name: Colorado West Pad

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 fresh water 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."

Max Pressure - 9300 lbs
Max Rate - 80 bpm

*DMH
1-25-20*

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 18.15 acres

22) Area to be disturbed for well pad only, less access road (acres): 7.16 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 + 0.05% 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.

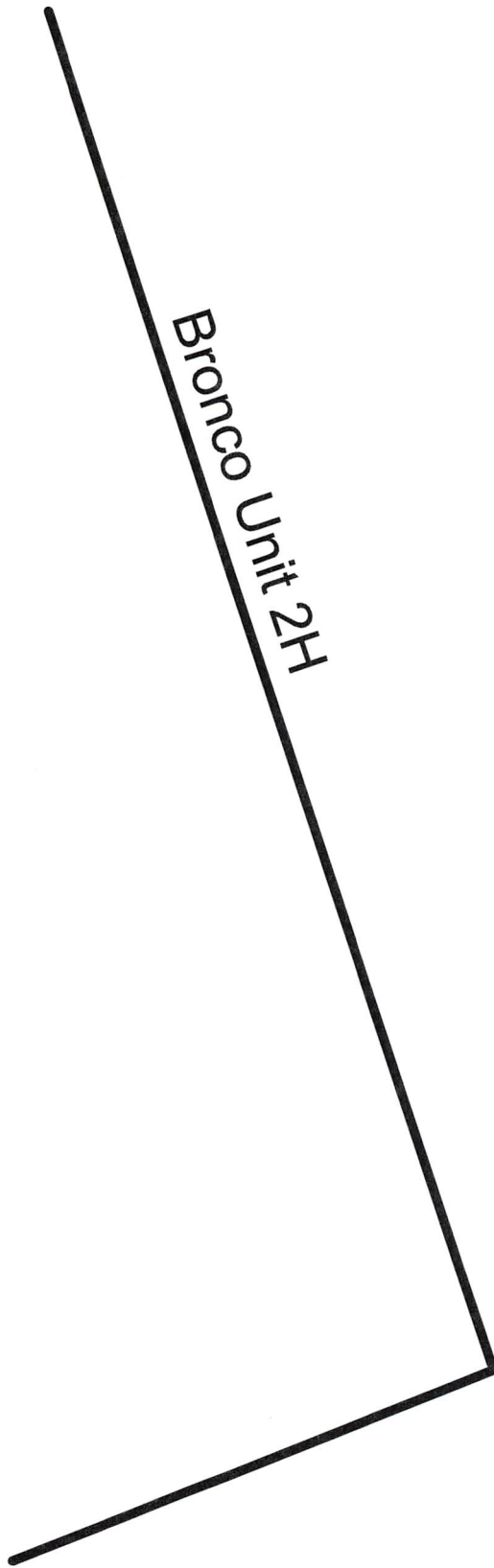
Production: circulate with 14 lb/gal NaCl mud, trip to middle of lateral, circulate, pump high viscosity sweep, trip to base of curve, pump high viscosity sweep, trip to top of curve, trip to bottom, circulate, pump high viscosity sweep, trip out, run casing, circulate 10 bbls fresh water, pump 48 bbls barite pill, pump 10 bbls fresh water followed by 48 bbls mud flush and 10 bbls water.

*Note: Attach additional sheets as needed.

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Antero Resources Corporation

Bronco Unit 2H - AOR



REMARKS
No Wells of Interest

April 10, 2019

LATITUDE 39°25'00"

11,170'

211' TO BOTTOM HOLE
LATITUDE 39°27'30"

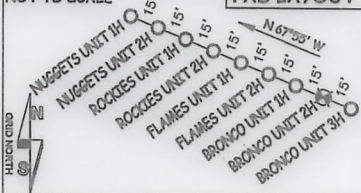
Antero Resources Corporation
Well No. Bronco Unit 2H

NOTES:
WELL 2H TOP HOLE INFORMATION:
N: 331,232ft E: 1,635,614ft
LAT: 39°24'08.09" LON: 80°47'22.30"
BOTTOM HOLE INFORMATION:
N: 343,144ft E: 1,634,969ft
LAT: 39°26'05.72" LON: 80°47'32.69"
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.

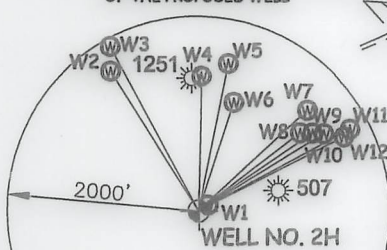
(NAD) 83 (UTM) ZONE 17 COORDS:
WELL 2H TOP HOLE INFORMATION:
N: 4,361,446m E: 518,136m
BOTTOM HOLE INFORMATION:
N: 4,365,072m E: 517,879m

NOT TO SCALE

PAD LAYOUT



NOTE:
12 WATER WELLS WERE LOCATED WITHIN 2000' OF THE PROPOSED WELL

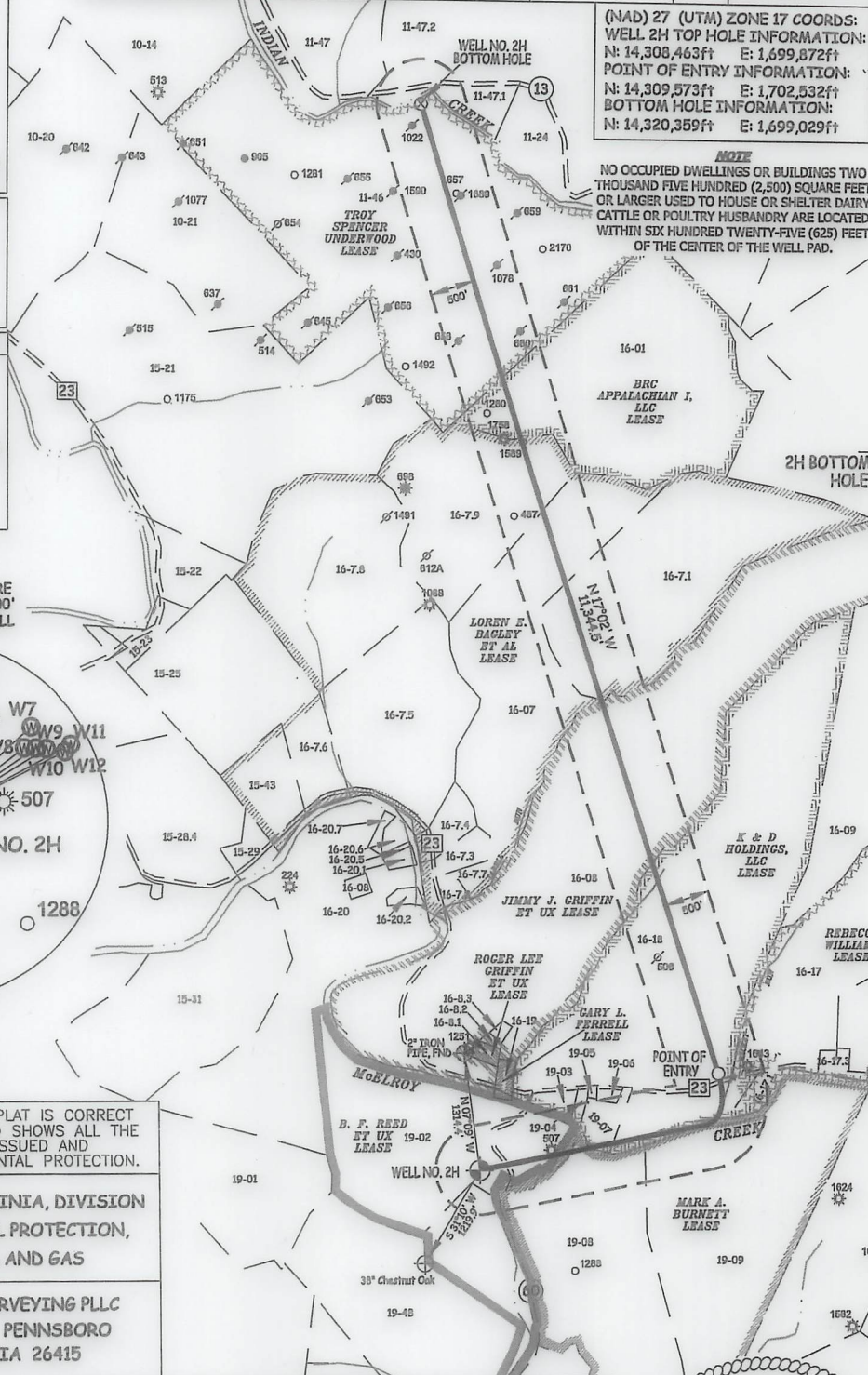


W1	N 50°50' E	116.8'
W2	N 32°31' W	1699.8'
W3	N 28°31' W	1919.4'
W4	N 01°31' E	1393.8'
W5	N 11°55' E	1546.2'
W6	N 10°37' E	1174.6'
W7	N 47°54' E	1539.6'
W8	N 53°04' E	1332.1'
W9	N 56°16' E	1437.9'
W10	N 59°55' E	1531.8'
W11	N 62°11' E	1798.0'
W12	N 63°28' E	1703.7'

TM-Par	Surface Owner	15-29	Mitchell Herrick	16-08	June Griffin	16-20.5	Susan Spencer
10-14	Charles Garrison	15-31	Roger Weese	16-8.1	Roger Griffin	16-20.6	Timothy Spencer
10-20	Kenneth Mason	15-43	Robert Kocher	16-8.2	Roger Griffin	16-20.7	Timothy Spencer
10-21	Kenneth Mason	16-01	Donald VanDine Jr.	16-8.3	Brian Eddy	19-01	Susan Spencer
11-24	Bobby Thomas	16-07	Robert Kocher	16-09	Jamie Straight	19-02	Antero Resources Corp.
11-46	Alva Spencer Est.	16-7.3	Donald Moore	16-17	Charles Straight	19-03	Larry Stevens
11-47	Jay Bee Oil & Gas Inc.	16-7.2	Donna Brumbaugh	16-17.1	Charles Straight	19-04	John Owens
11-47.1	James Canter Sr.	16-7.3	Mary Blattner	16-17.2	Rodney Tippins	19-05	Paul Weekley
11-47.2	Everett Stanley	16-7.4	Donald Moore	16-17.3	Charles Kimball	19-06	Paul Weekley
15-21	Robert Jennings	16-7.5	Robert Kocher	16-20	Susan Spencer	19-07	Patricia Montgomery
15-22	Joe Kimball	16-7.6	Robert Kocher	16-20.1	Susan Spencer	19-08	John Lewis Jr.
15-23	Kenneth Kline	16-7.7	Robert Kocher	16-20.2	Gary Nichols	19-09	Robert Welsh
15-25	Willam Roberts	16-7.8	Blattner & Howard LLC	16-20.3	Gary Nichols	19-48	Lloyd Talkington
15-28.4	George Hamilton	16-7.9	Mary Blattner				

(NAD) 27 (UTM) ZONE 17 COORDS:
WELL 2H TOP HOLE INFORMATION:
N: 14,308,463ft E: 1,699,872ft
POINT OF ENTRY INFORMATION:
N: 14,309,573ft E: 1,702,532ft
BOTTOM HOLE INFORMATION:
N: 14,320,359ft E: 1,699,029ft

NOTE:
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.



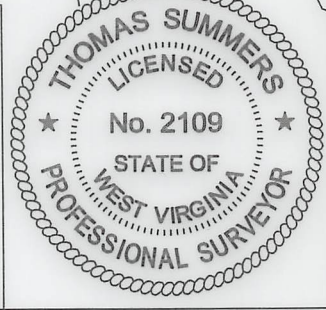
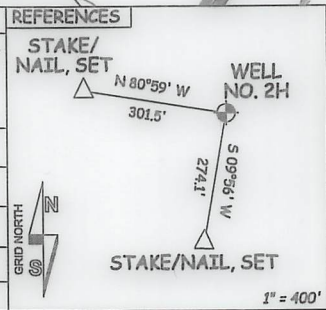
I THE UNDERSIGNED, HEREBY CERTIFY THAT THIS PLAT IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AND SHOWS ALL THE INFORMATION REQUIRED BY LAW AND THE RULES ISSUED AND PERSCRIBED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.



STATE OF WEST VIRGINIA, DIVISION OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
WILLOW LAND SURVEYING PLLC
220 MASONIC AVE. PENNSBORO WEST VIRGINIA 26415

JOB # 19-006WA
DRAWING # BRONCO 2HR
SCALE 1" = 2000'
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
--- Surface Owner Boundary Lines +/-
--- Interior Surface Tracts +/-
X Existing Fence
⊕ Found monument, as noted
THOMAS SUMMERS P.S. 2109
DATE 01/20/20
OPERATOR'S WELL# BRONCO UNIT #2H



WELL TYPE: OIL GAS LIQUID INJECTION WASTE DISPOSAL 47 - 095 - 02661 MOD
(IF "GAS") PRODUCTION STORAGE DEEP SHALLOW STATE COUNTY PERMIT
LOCATION: ELEVATION 754' - ORIGINAL 748.5' - PROPOSED WATERSHED McELROY CREEK
QUADRANGLE SHIRLEY 7.5' DISTRICT McELROY COUNTY TYLER
SURFACE OWNER ANTERO RESOURCES CORPORATION ACREAGE 127.86 ACRES +/-
OIL & GAS ROYALTY OWNER B.F. REED ET UX; MARK A. BURNETT; K & D HOLDINGS, LLC; LEASE ACREAGE 130 AC.±; 256 AC.±; 219.39 AC.±;
JIMMY J. GRIFFIN ET UX; LOREN E. BAGLEY ET AL; BRC APPALACHIAN I, LLC; TROY SPENCER UNDERWOOD 236 AC.±; 502.8 AC.±; 70 AC.±; 257 AC.±;
PROPOSED WORK: DRILL CONVERT DRILL DEEPER REDRILL FRACTURE OR STIMULATE
PLUG OFF OLD FORMATION PERFORATE NEW FORMATION OTHER PHYSICAL CHANGE IN WELL
(SPECIFY) MOD - BHL PLUG & ABANDON CLEAN OUT & REPLUG
TARGET FORMATION MARCELLUS ESTIMATED DEPTH 6,800' TVD 21,800' MD
WELL OPERATOR ANTERO RESOURCES CORP. DESIGNATED AGENT DIANNA STAMPER - CT CORPORATION SYSTEM
ADDRESS 1615 WYNKOOP ST. ADDRESS 5400 D BIG TYLER ROAD
FORM WW-6 DENVER, CO 80202 CHARLESTON, WV 25313

WV NORTH ZONE
GRID NORTH

8,526' TO BOTTOM HOLE
LONGITUDE 80°45'00"
LONGITUDE 80°47'30"

COUNTY NAME
PERMIT

WW-6A1
(5/13)

Operator's Well No. Bronco Unit 2H

**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
<u>Troy Spencer Underwood Lease</u>	Troy Spencer Underwood	Antero Resources Corporation	1/8+	0427/0095

*Partial Assignments to Antero Resources Corporation include 100% rights to extract, produce and market the oil and gas from the Marcellus and any other formations completed with this well.

**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

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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: Antero Resources Corporation
By: Tim Rady
Its: VP of Land

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Grantor, lessor, etc.	Grantee, lessee, etc.	Royalty	Book/Page
Loren E. Bagley et al Lease			
Loren E. Bagley et al	Sancho Oil & Gas Corporation	1/8	0361/0752
Sancho Oil & Gas Corporation	Republic Energy Ventures LLC	Assignment	0404/0761
Republic Energy Ventures LLC	Antero Resources Corporation	Assignment	0436/0316
BRC Appalachian I LLC Lease			
BRC Appalachian I LLC	BRC Working Interest Company LLC	1/8	0369/0648
BRC Working Interest Company LLC	Chesapeake Appalachian LLC	Assignment	0369/0784
Chesapeake Appalachian LLC	SWN Production Company LLC	Agreement	0465/0463
SWN Production Company LLC	Statoil USA Onshore Properties Inc	Assignment	0470/0658
Statoil USA Onshore Properties Inc	EQT Production Company	Assignment	0539/0239
EQT Production Company	Antero Resources Corporation	Assignment	0663/0001

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Operator's Well Number Bronco Unit 2H

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Grantor, lessor, etc.	Grantee, lessee, etc.	Royalty	Book/Page
<u>BF Reed et ux Lease</u>			
BF Reed et ux	FH Morse	1/8	0069/0004
FH Morse	The Philadelphia Company of WV	Assignment	0101/0036
The Philadelphia Company of WV	Pittsburgh & West Virginia Gas Company	Assignment	0101/0031
Pittsburgh & West Virginia Gas Company	Equitable Gas Company LLC	Assignment	0132/0445
Equitable Gas Company LLC	Equitrans Inc	Assignment	0274/0471
Equitrans Inc	EQT Capital Corporation	Merger	0433/0738
EQT Capital Corporation	Equitable Resources Inc	Merger	0433/0738
Equitable Resources Inc	Equitable Gas Company LLC	Merger	0433/0755
Equitable Gas Company LLC	Equitrans LP	Assignment	0433/0777
Equitrans LP	EQT Production Company	Agreement	0440/0107
EQT Production Company	Antero Resources Corporation	Assignment	0654/0172
<u>Mark A. Burnette Lease</u>			
Mark A. Burnette	Antero Resources Corporation	1/8+	0501/0539
<u>K & D Holdings LLC Lease</u>			
K & D Holdings LLC	Equitrans Inc	1/8	0283/0338
Equitrans Inc	EQT Capital Corporation	Merger	0433/0738
EQT Capital Corporation	Equitable Resources Inc	Merger	0433/0738
Equitable Resources Inc	Equitable Gas Company LLC	Merger	0433/0755
Equitable Gas Company LLC	Equitrans LP	Assignment	0433/0777
Equitrans LP	EQT Production Company	Agreement	0396/0640
EQT Production Company	Antero Resources Corporation	Assignment	0654/0172
<u>Jimmy J. Griffin et ux Lease</u>			
Jimmy J. Griffin et ux	Kepeco Inc	1/8	0258/0046
Kepeco Inc	Eastern Kentucky Production Company	Name Change	0006/0015
Eastern Kentucky Production Company	Kepeco Resources Inc	Assignment	0261/0392
Kepeco Resources Inc	Union Drilling Inc	Merger	0006/0124
Union Drilling Inc	Equitable Resources Exploration Inc	Assignment	0274/0070
Equitable Resources Exploration Inc	Equitable Resources Energy Company	Assignment	0280/0186
Equitable Resources Energy Company	Enervest East Limited Partnership	Assignment	0313/0145
Enervest East Limited Partnership	The Houston Exploration Company	Assignment	0342/0160
The Houston Exploration Company	Seneca Upshur Petroleum Inc	Assignment	0346/0553
Seneca Upshur Petroleum Inc	Seneca Upshur Petroleum LLC	Incorporation	0009/0198
Seneca Upshur Petroleum LLC	Antero Resources Corporation	Assignment	0555/0190

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CONTINUED ON NEXT PAGE