



---

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

August 19, 2015

ANTERO RESOURCES CORPORATION  
1615 WYNKOOP STREET  
DENVER, CO 80202

Re: Permit Modification Approval for API Number 9502248, Well #: PLUM RUN UNIT 3H

**Move 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,

A handwritten signature in black ink that reads "Gene Smith" with a stylized flourish.

Gene Smith  
Assistant Chief of Permitting  
Office of Oil and Gas

Promoting a healthy environment.

08/21/2015



August 14, 2015

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. Melanie Hankins  
601 57<sup>th</sup> Street  
Charleston, WV 25304

Ms. Hankins:

Antero Resources Corporation (Antero) would like to submit the following permit modification for an approved well on the existing Hartley East Pad. We are requesting to slightly move the wellbore to the west for the Plum Run Unit 3H (API# 47-095-02248) which will change the bottom hole location. Please note that the revised bottom hole location 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 new lateral length and BHL

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 blue ink that reads "Ashlie Steele".

Ashlie Steele  
Permitting Supervisor  
Antero Resources Corporation

Enclosures

Received

AUG 17 2015

Office of Oil and Gas  
WV Dept. of Environmental Protection

08/21/2015

WW-6B  
(04/15)

API NO. 47-095 - 02248

OPERATOR WELL NO. Plum Run Unit 3H

Well Pad Name: Hartley East Pad

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

1) Well Operator: Antero Resources Corporal 494488557 095 - Tyler Meade Pennsboro 7.5'  
Operator ID County District Quadrangle

2) Operator's Well Number: Plum Run Unit 3H Well Pad Name: Hartley East Pad

3) Farm Name/Surface Owner: Hartley, David M. Public Road Access: CR 6/8

4) Elevation, current ground: 1021' 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 Yes

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):  
Marcellus Shale: 6500' TVD, Anticipated Thickness- 55 feet, Associated Pressure- 2800#

8) Proposed Total Vertical Depth: 6500' TVD

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 18,000' MD

11) Proposed Horizontal Leg Length: 10,770'

12) Approximate Fresh Water Strata Depths: 180'

13) Method to Determine Fresh Water Depths: Freeland Unit 2H (API# 47-095-02127) on same pad.

14) Approximate Saltwater Depths: 577', 730', 1753'

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: \_\_\_\_\_

Received  
AUG 17 2015

Office of Oil and Gas  
WV Dept. of Environmental Protection

WW-6B  
(04/15)

API# 47-095-02248 PERMIT MODIFICATION  
 API NO. 47-095 - 02248  
 OPERATOR WELL NO. Plum Run Unit 3H  
 Well Pad Name: Hartley East 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#	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#	2455'	2455'	CTS, 1000 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	18,000'	18,000'	CTS, 4556 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7100'	
Liners							

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	30"	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"	12,630	2500	Lead/HPOZ & Tel-H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11,200			
Liners							

PACKERS

Kind:	N/A				<div style="font-size: 2em; font-weight: bold; transform: rotate(-5deg);">Received</div> <div style="font-size: 1.5em; font-weight: bold; margin-top: 10px;">AUG 17 2015</div>
Sizes:	N/A				
Depths Set:	N/A				

Office of Oil and Gas  
 WV Dept. of Environmental Protection

WW-6B  
(10/14)

API NO. 47-095 - 02248

OPERATOR WELL NO. Plum Run Unit 3H

Well Pad Name: Hartley East 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.

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): 13.08 existing acres

22) Area to be disturbed for well pad only, less access road (acres): 2.68 existing 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.

Received

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

AUG 17 2015

Office of Oil and Gas  
WV Dept. of Environmental Protection

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.

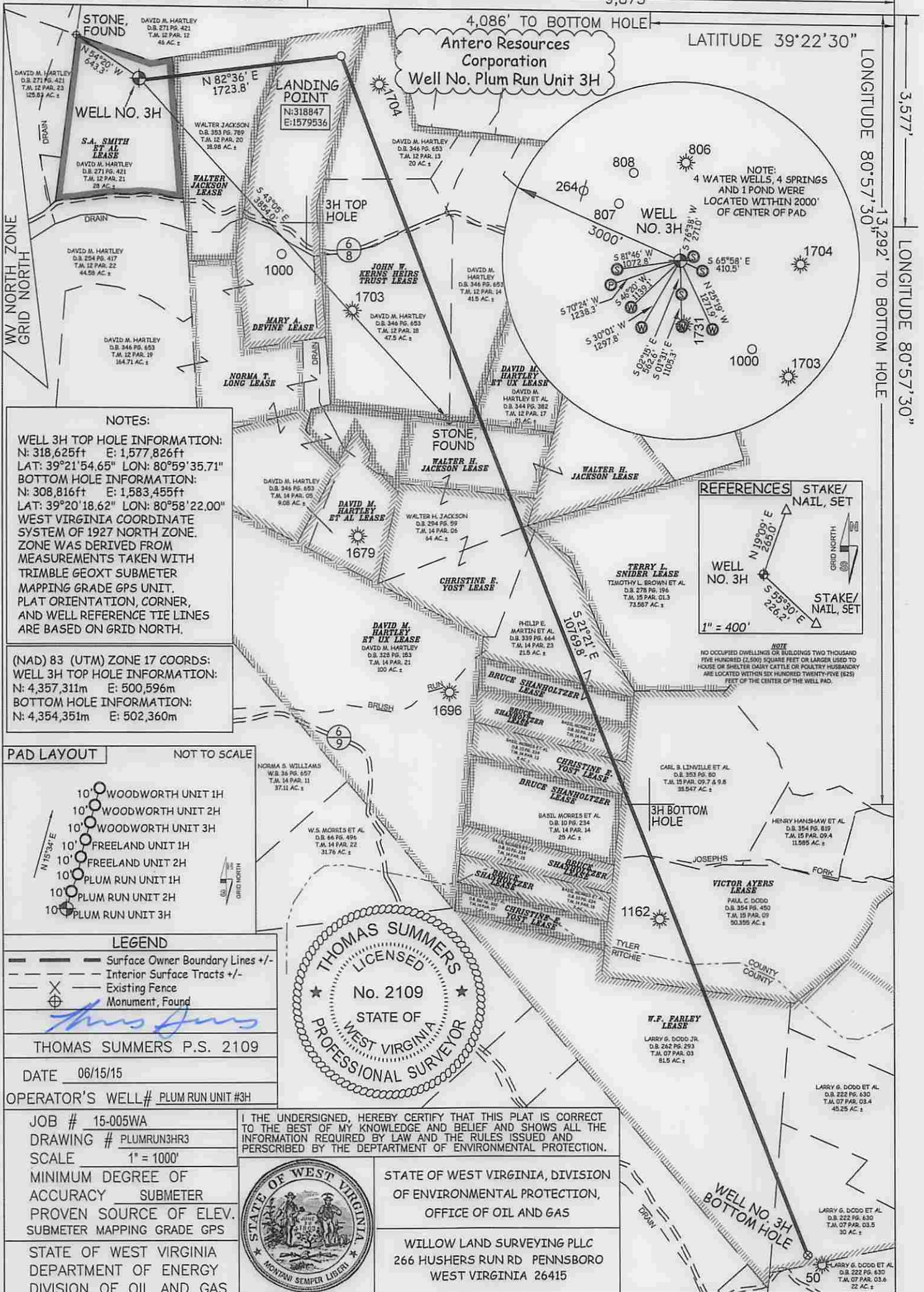
LATITUDE 39°22'30"

9,873'

LATITUDE 39°22'30"

LONGITUDE 80°57'30"

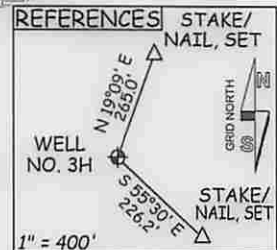
LONGITUDE 80°57'30"



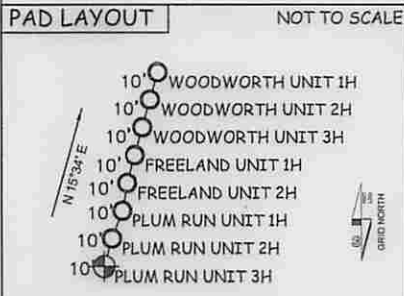
NOTES:

WELL 3H TOP HOLE INFORMATION:  
 N: 318,625ft E: 1,577,826ft  
 LAT: 39°21'54.65" LON: 80°59'35.71"  
 BOTTOM HOLE INFORMATION:  
 N: 308,816ft E: 1,583,455ft  
 LAT: 39°20'18.62" LON: 80°58'22.00"  
 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 3H TOP HOLE INFORMATION:  
 N: 4,357,311m E: 500,596m  
 BOTTOM HOLE INFORMATION:  
 N: 4,354,351m E: 502,360m



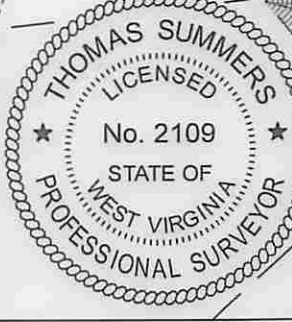
NOTE:  
 NO OCCUPIED DWELLINGS OR BUILDINGS TWO THOUSAND FIVE HUNDRED (2,500) SQUARE FEET OR LARGER USED TO HOUSE OR SHELTER OASIS CATTLE OR POULTRY HUSBANDRY ARE LOCATED WITHIN SIX HUNDRED TWENTY-FIVE (625) FEET OF THE CENTER OF THE WELL PAD.



LEGEND  
 - - - Surface Owner Boundary Lines +/-  
 - - - Interior Surface Tracts +/-  
 - - - Existing Fence  
 ⊕ Monument, Found

THOMAS SUMMERS P.S. 2109

DATE 06/15/15  
 OPERATOR'S WELL# PLUM RUN UNIT #3H



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

JOB # 15-005WA	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.
DRAWING # PLUMRUN3HR3	
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	
WELL TYPE: OIL ___ GAS <input checked="" type="checkbox"/> LIQUID INJECTION ___ WASTE DISPOSAL ___	API WELL # 47 - 095 - 02248 MOD
(IF "GAS") PRODUCTION <input checked="" type="checkbox"/> STORAGE ___ DEEP ___ SHALLOW <input checked="" type="checkbox"/>	
LOCATION: ELEVATION ORIGINAL 1,031' - PROPOSED 1,021'	WATERSHED OUTLET MIDDLE ISLAND CREEK
QUADRANGLE PENNSBORO 7.5'	DISTRICT MEADE COUNTY TYLER
SURFACE OWNER DAVID M. HARTLEY	ACREAGE 28 ACRES +/-
OIL & GAS ROYALTY OWNER S.A. SMITH ET AL; WALTER JACKSON; MARY A. DEVINE; JOHN W. KERNS HEIRS TRUST; LEASE ACREAGE 28 AC+; 24.0125 AC+; 40 AC+; 109 AC+;	
DAVID M. HARTLEY ET UX; WALTER H. JACKSON; CHRISTINE E. YOST; BRUCE SHANHOLTZER; BRUCE SHANHOLTZER; CHRISTINE E. YOST; VICTOR AYERS; W.F. FARLEY	21 AC+; 14.5 AC+; 52.125 AC+; 8 AC+; 8 AC+; 8 AC+; 167.5 AC+; 192 AC+
PROPOSED WORK: DRILL <input checked="" type="checkbox"/> CONVERT ___ DRILL DEEPER ___ REDRILL ___ FRACTURE OR STIMULATE <input checked="" type="checkbox"/>	
PLUG OFF OLD FORMATION ___ PERFORATE NEW FORMATION <input checked="" type="checkbox"/> OTHER PHYSICAL CHANGE IN WELL (SPECIFY) Permit Modification - BTL	PLUG & ABANDON CLEAN OUT & REPLUG
TARGET FORMATION MARCELLUS	ESTIMATED DEPTH 6,500' TVD 18,000' MD
WELL OPERATOR ANTERO RESOURCES CORP.	DESIGNATED AGENT DIANNA STAMPER
ADDRESS 1615 WYNKOOP STREET	ADDRESS 5400 D BIG TYLER ROAD
DENVER, CO 80202	CHARLESTON, WV 25313

08/21/2015