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west virginia department of environmental protection

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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](http://www.dep.wv.gov)

## PERMIT MODIFICATION APPROVAL

February 06, 2015

ANTERO RESOURCES CORPORATION  
1615 WYNKOOP STREET  
DENVER, CO 80202

Re: Permit Modification Approval for API Number 9502188 , Well #: BERRY UNIT 1H  
**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,

Gene Smith  
Assistant Chief of Permitting  
Office of Oil and Gas

Promoting a healthy environment.



January 30, 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 modifications for two approved wells on the existing Coastal 1 Pad. We are requesting to move the horizontal laterals which will change the bottom hole locations of the James Gray Unit 1H (API# 47-095-02187) and Berry Unit 1H (API# 47-095-02188).

Attached you will find the following documents:

- REVISED Form WW-6B, which shows the revised lateral length and updated measured depth
- REVISED Form WW-6A1, which shows additional leases from original permit (James Gray Unit 1H only – the Berry Unit 1H did NOT drill into any new leases)
- 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 Steele  
Permitting Supervisor  
Antero Resources Corporation

Enclosures

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

1) Well Operator: Antero Resources Corporation

|                  |                   |                |                         |
|------------------|-------------------|----------------|-------------------------|
| <u>494488557</u> | <u>095- Tyler</u> | <u>McElroy</u> | <u>Centerpoint 7.5'</u> |
|------------------|-------------------|----------------|-------------------------|

  
Operator ID County District Quadrangle

2) Operator's Well Number: Berry Unit 1H Well Pad Name: Coastal 1 Pad

3) Farm Name/Surface Owner: Coastal Lumber Co. Public Road Access: CR 64

4) Elevation, current ground: 1164' Elevation, proposed post-construction: 1164'

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: 7400' TVD, Anticipated Thickness- 55 feet, Associated Pressure- 2950#

8) Proposed Total Vertical Depth: 7400' TVD

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 18,200' MD

11) Proposed Horizontal Leg Length: 8591'

12) Approximate Fresh Water Strata Depths: 154', 264'

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

14) Approximate Saltwater Depths: 1,679'

15) Approximate Coal Seam Depths: 879', 899', 909'

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: \_\_\_\_\_

18)

**CASING AND TUBING PROGRAM**

| <u>TYPE</u>  | <u>Size</u> | <u>New or Used</u> | <u>Grade</u> | <u>Weight per ft. (lb/ft)</u> | <u>FOOTAGE: For Drilling</u> | <u>INTERVALS: Left in Well</u> | <u>CEMENT: Fill-up (Cu. Ft.)</u> |
|--------------|-------------|--------------------|--------------|-------------------------------|------------------------------|--------------------------------|----------------------------------|
| 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#                    | 340'                         | 340'                           | CTS, 472 Cu. Ft.                 |
| Coal         | 9-5/8"      | New                | J-55         | 36#                           | 2450'                        | 2450'                          | CTS, 998 Cu. Ft.                 |
| Intermediate |             |                    |              |                               |                              |                                |                                  |
| Production   | 5-1/2"      | New                | P-110        | 20#                           | 18200'                       | 18200'                         | 4612 Cu. Ft.                     |
| Tubing       | 2-3/8"      | New                | N-80         | 4.7#                          |                              | 7100'                          |                                  |
| Liners       |             |                    |              |                               |                              |                                |                                  |

| <u>TYPE</u>  | <u>Size</u> | <u>Wellbore Diameter</u> | <u>Wall Thickness</u> | <u>Burst Pressure</u> | <u>Cement Type</u>    | <u>Cement Yield (cu. ft./k)</u> |
|--------------|-------------|--------------------------|-----------------------|-----------------------|-----------------------|---------------------------------|
| 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 |  |  |  |

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): 29.37 acres

22) Area to be disturbed for well pad only, less access road (acres): 3.19 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% calcium and 1/4 lb flake, 5 gallons of clay treat

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.

LATITUDE 39°27'30"

7,380'

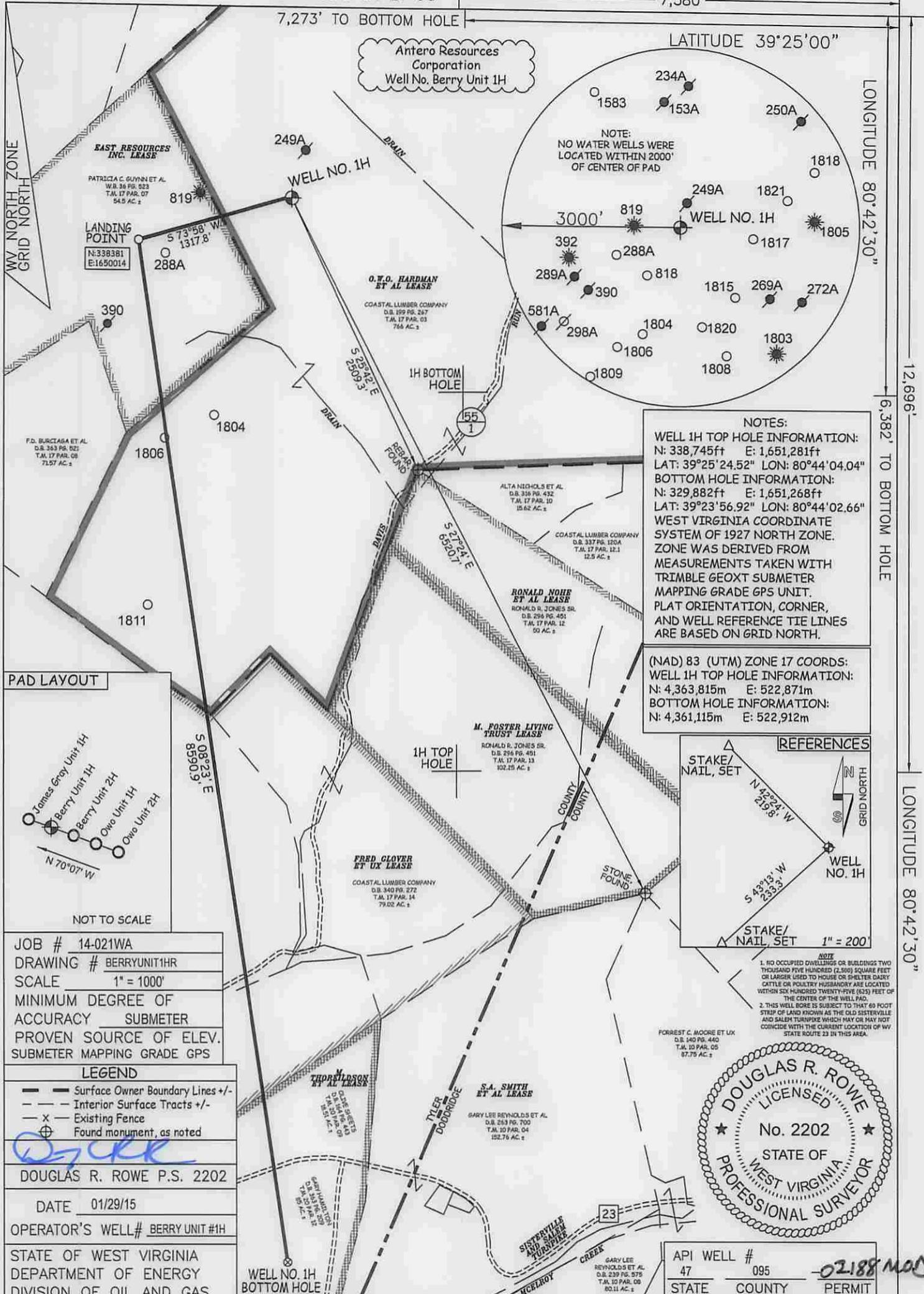
7,273' TO BOTTOM HOLE

LATITUDE 39°25'00"

LONGITUDE 80°42'30"

12,696'

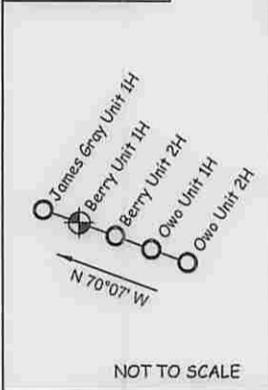
LONGITUDE 80°42'30"



NOTES:  
 WELL 1H TOP HOLE INFORMATION:  
 N: 338,745ft E: 1,651,281ft  
 LAT: 39°25'24.52" LON: 80°44'04.04"  
 BOTTOM HOLE INFORMATION:  
 N: 329,882ft E: 1,651,268ft  
 LAT: 39°23'56.92" LON: 80°44'02.66"  
 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 1H TOP HOLE INFORMATION:  
 N: 4,363,815m E: 522,871m  
 BOTTOM HOLE INFORMATION:  
 N: 4,361,115m E: 522,912m

PAD LAYOUT



JOB # 14-021WA  
 DRAWING # BERRYUNIT1HR  
 SCALE 1" = 1000'  
 MINIMUM DEGREE OF ACCURACY SUBMETER  
 PROVEN SOURCE OF ELEV. SUBMETER MAPPING GRADE GPS

LEGEND  
 - - - Surface Owner Boundary Lines +/-  
 - - - Interior Surface Tracts +/-  
 - x - Existing Fence  
 ⊕ Found monument, as noted

DOUGLAS R. ROWE P.S. 2202

DATE 01/29/15

OPERATOR'S WELL# BERRY UNIT #1H

STATE OF WEST VIRGINIA  
 DEPARTMENT OF ENERGY  
 DIVISION OF OIL AND GAS

WELL TYPE: OIL  GAS  LIQUID INJECTION  WASTE DISPOSAL   
 (IF "GAS") PRODUCTION  STORAGE  DEEP  SHALLOW

LOCATION: ELEVATION 1,164' WATERSHED DAVIS RUN

QUADRANGLE CENTERPOINT 7.5' DISTRICT MCELROY COUNTY TYLER

SURFACE OWNER COASTAL LUMBER COMPANY ACREAGE 766 ACRES +/-

OIL & GAS ROYALTY OWNER O.W.O. HARDMAN ET AL; EAST RESOURCES INC.; FRED GLOVER ET UX; M. THORKILDSON ET AL

LEASE ACREAGE 952.3 AC±; 100 AC±; 263.67 AC±; 125.91 AC±

PROPOSED WORK: DRILL  CONVERT  DRILL DEEPER  REDRILL  FRACTURE OR STIMULATE   
 PLUG OFF OLD FORMATION  PERFORATE NEW FORMATION  OTHER PHYSICAL CHANGE IN WELL (SPECIFY) \_\_\_\_\_ PLUG & ABANDON  CLEAN OUT & REPLUG

TARGET FORMATION MARCELLUS ESTIMATED DEPTH 7,400' TVD 18,200' MD

WELL OPERATOR ANTERO RESOURCES CORP. DESIGNATED AGENT CT CORPORATION SYSTEM-DIANNA STAMPER

ADDRESS 1615 WYNKOOP STREET ADDRESS 5400 D BIG TYLER ROAD

FORM WW-6 DENVER, CO 80202 CHARLESTON, WV 25313

API WELL # 47 095 02188 MOD  
 STATE COUNTY PERMIT



STATE OF WEST VIRGINIA,  
 DIVISION OF ENVIRONMENTAL PROTECTION,  
 OFFICE OF OIL AND GAS

WILLOW LAND SURVEYING PLLC  
 220 MASONIC AVE. PENNSBORO  
 WEST VIRGINIA 26415

COUNTY NAME

PERMIT