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west virginia department of environmental protection

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Office of Oil and Gas  
601 57<sup>th</sup> Street, S.E.  
Charleston, WV 25304  
(304) 926-0450  
fax: (304) 926-0452

Austin Caperton, Cabinet Secretary  
[www.dep.wv.gov](http://www.dep.wv.gov)

Thursday, November 8, 2018  
PERMIT MODIFICATION APPROVAL  
Horizontal 6A / New Drill

ANTERO RESOURCES CORPORATION  
1615 WYNKOOP STREET  
DENVER, CO 80202

Re: Permit Modification Approval for WINCHESTER UNIT 1H  
47-095-02515-00-00

**Bottom hole and point of entry location change**

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: WINCHESTER UNIT 1H  
Farm Name: JAMES SINE, ET AL  
U.S. WELL NUMBER: 47-095-02515-00-00  
Horizontal 6A New Drill  
Date Modification Issued: 11/08/2018

Promoting a healthy environment.

WW-6B  
(04/15)

11/09/2018  
Permit Modification API#: 47-095-02515  
API NO. 47-095 - 02515  
OPERATOR WELL NO. Winchester Unit 1H  
Well Pad Name: Sine 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 Meade Middlebourne 7.5'  
Operator ID County District Quadrangle

2) Operator's Well Number: Winchester Unit 1H Well Pad Name: Sine Pad

3) Farm Name/Surface Owner: James Sine, et al Public Road Access: Wick Rd.

4) Elevation, current ground: 799' Elevation, proposed post-construction: \_\_\_\_\_

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: 6600' TVD, Anticipated Thickness- 55 feet, Associated Pressure- 2800#

*JES*  
*8/21/2018*  
*DMH*  
*8-21-18*

8) Proposed Total Vertical Depth: 6600' TVD

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 18500' MD

11) Proposed Horizontal Leg Length: 10412'

12) Approximate Fresh Water Strata Depths: 42'

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

14) Approximate Saltwater Depths: 1269, 1274

15) Approximate Coal Seam Depths: 154, 278

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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Environmental Protection

11/09/2018

WW-6B  
(04/15)

Permit Modification API#: 47-095-02515

API NO. 47- 095 - 02515

OPERATOR WELL NO. Winchester Unit 1H

Well Pad Name: Sine 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#	95'	95'	CTS, 91 Cu. Ft.
Fresh Water	13-3/8"	New	J-55	54.5#	330	330	CTS, 458 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#	18500	18500	CTS, 4680 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7100'	
Liners							

*Jobs 8/21/2018*

*DMH 8-21-18*

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-HPOZ & Tel - H	H/POZ~1.44 & H~1.8
Tubing	2-3/8"	4.778"	0.19"	11,200			
Liners							

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**PACKERS**

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

11/09/2018

Permit Modification API#: 47-095-02515

API NO. 47- 095 - 02515

OPERATOR WELL NO. Winchester Unit 1H

Well Pad Name: Sine Pad

WW-6B  
(10/14)

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."

Anticipated Max Pressure - 9300 lbs  
Anticipated Max Rate - 80 bpm

JCB  
8/21/2018

Dmit  
8-21-18

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 20.99 acres

22) Area to be disturbed for well pad only, less access road (acres): 5.55 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.

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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

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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.



Winchester Unit 1H

No wells exist within a 500' radius of the wellbore that are reasonably expected to penetrate a depth that could be within the range of fracture propagation; therefore no additional details (perforated formation, producing zones etc.) are required as outlined in 35CSR8-5.11



Antero Resources Corporation

Winchester Unit 1H - AOR



REMARKS  
No wells of interest

March 26, 2018

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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:

Grantor, lessor, etc.	Grantee, lessee, etc.	Royalty	Book/Page
<u>James L. Sine et ux Lease</u>			
James L. Sine et ux	Antero Resources Appalachian Corporation	1/8+	0400/0422
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>Raymond L. Moore, et ux Lease</u>			
Raymond L. Moore, et ux	Antero Resources Corporation	1/8+	0 504/0082
<u>David E. Bowyer Lease</u>			
David E. Bowyer	Antero Resources Corporation	1/8+	0538/0211 ✓
<u>Lillian Lee Eddy Lease</u>			
Lillian Lee Eddy	Antero Resources Corporation	1/8+	0564/0784 ✓
<u>Robert S. Carse et ux Lease</u>			
Robert S. Carse et ux	Antero Resources Appalachian Corporation	1/8+	0428/0021
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>TSAR-WV LLC Lease</u>			
TSAR-WV LLC	Chesapeake Appalachian LLC	1/8	0403/0419
Chesapeake Appalachian LLC	SWN Production Company	Assignment	0465/0463
SWN Production Company	Antero Resources Corporation	Assignment	0544/0242
<u>Thomas W. Moore et al Lease (TM 8 PCL 22)</u>			
Thomas W. Moore et al	Antero Resources Corporation	1/8+	0442/0588
<u>Thomas Moore et al Lease (TM 11 PCL 9)</u>			
Thomas Moore et al	Antero Resources Corporation	1/8+	0442/0590
<u>Reita J. Hall Lease</u>			
Reita J. Hall	Antero Resources Corporation	1/8	0522/0823 ✓
<u>Charles F. Mossor et ux Lease</u>			
Charles F. Mossor et ux	Antero Resources Corporation	1/8+	0562/0154
<u>The Joelynn Family Preservation Trust Lease</u>			
The Joelynn Family Preservation Trust	Antero Resources Corporation	1/8+	483/286

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\*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.

WW-6A1  
(5/13)

Operator's Well No. Winchester Unit 1H

**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>Gary A. Barnard et ux Lease Lease</u>	Gary A. Barnard, et ux	Antero Resources Corporation	1/8+	0442/0077

\*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.

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**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

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: Diana Hoff *Diana O. Hoff*  
 Its: Vice President - Operations

LATITUDE 39°25'00"

11,273'

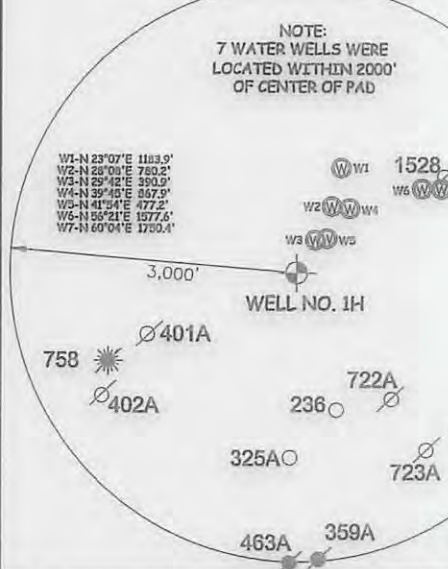
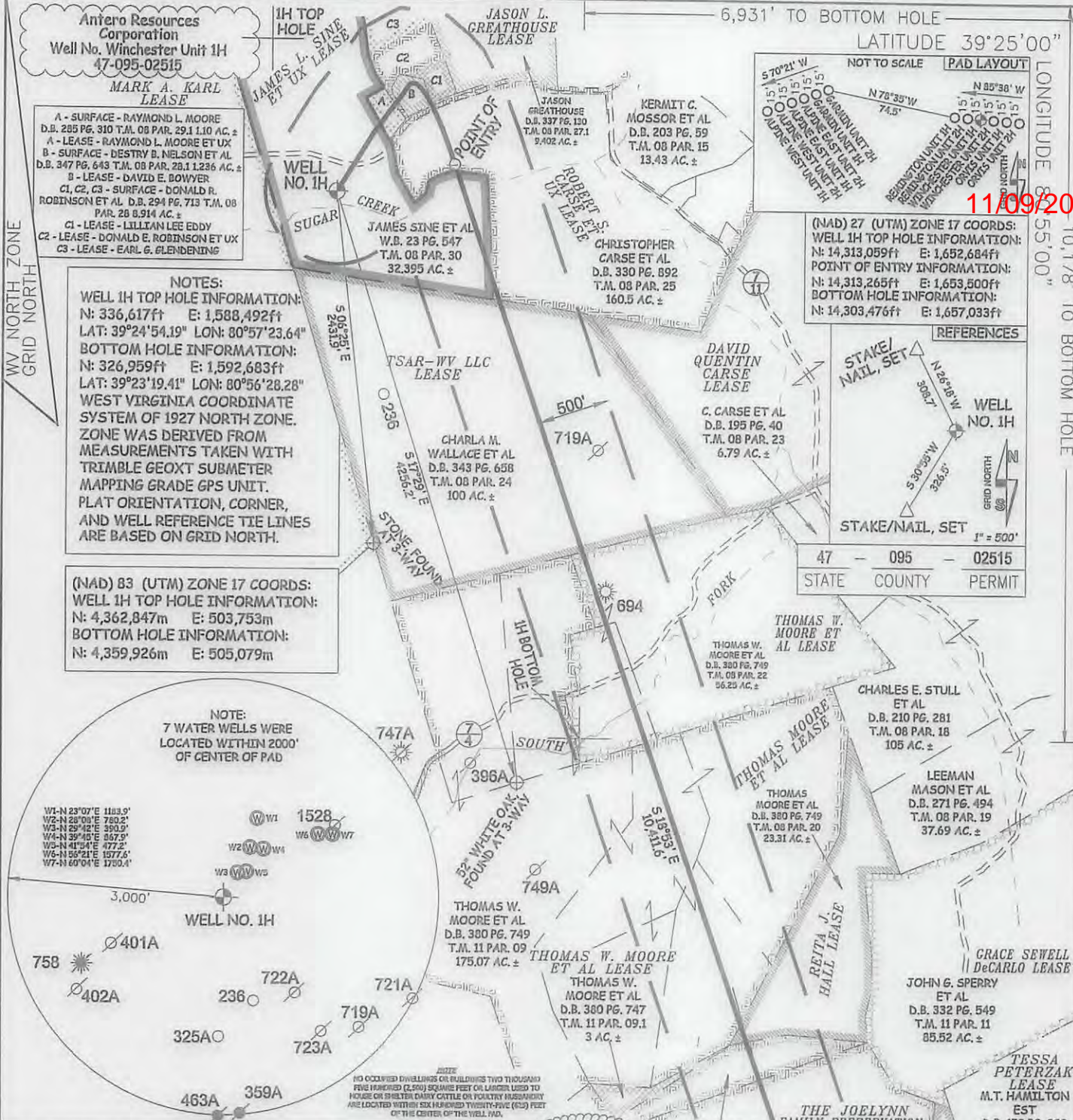
6,931' TO BOTTOM HOLE

LATITUDE 39°25'00"

LONGITUDE 80°55'00"

LONGITUDE 80°55'00"

11/09/2018

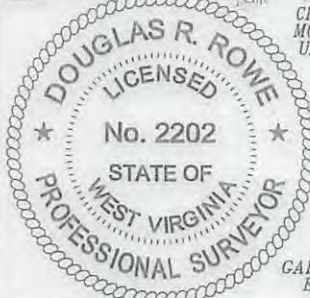


I THE UNDERSIGNED, HEREBY CERTIFY THAT THIS PLAT IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AND SHOWS ALL THE INFORMATION REQUIRED BY LAW AND THE RULES ISSUED AND PERSCRIBED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.



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 # 17-002WA  
DRAWING # WINCHESTER1H830  
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

**LEGEND**

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

DOUGLAS R. ROWE P.S. 2202  
DATE 07/26/18  
OPERATOR'S WELL# WINCHESTER UNIT #1H

WELL TYPE: OIL \_\_\_ GAS  LIQUID INJECTION \_\_\_ WASTE DISPOSAL \_\_\_  
(IF "GAS") PRODUCTION  STORAGE \_\_\_ DEEP \_\_\_ SHALLOW   
LOCATION: ELEVATION 799' - AS-BUILT WATERSHED OUTLET MIDDLE ISLAND CREEK  
QUADRANGLE MIDDLEBOURNE 7.5' DISTRICT MEADE COUNTY TYLER

SURFACE OWNER JAMES SINE ET AL ACREAGE 32.395 ACRES +/-  
OIL & GAS ROYALTY OWNER JAMES L. SINE ET UX; RAYMOND L. MOORE ET UX; DONALD E. ROBINSON ET UX; LILLIAN LEE EDDY; DAVID E. BOWYER; ROBERT S. CARSE ET UX; TSAR-WV LLC; THOMAS W. MOORE ET AL; 5.84 AC±; 1.236 AC±; 140 AC±; 105 AC±; 56.25 AC±;  
THOMAS MOORE ET AL; REITA J. HALL; CHARLES F. MOSSOR ET UX; THE JOE LYNN FAMILY PRESERVATION TRUST; GARY A. BARNARD ET UX 175.07 AC±; 23.31 AC±; 18.25 AC±; 200 AC±; 91.55 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  
TARGET FORMATION MARCELLUS ESTIMATED DEPTH 6,600' TVD 18,500' MD  
WELL OPERATOR ANTERO RESOURCES CORP. DESIGNATED AGENT DIANNA STAMPER - CT CORPORATION SYSTEM  
ADDRESS 1615 WYNKOOP STREET ADDRESS 5400 D BIG TYLER ROAD  
FORM WW-6 DENVER, CO 80202 CHARLESTON, WV 25313

COUNTY NAME PERMIT



LATITUDE 39°25'00"

11.273'

6,931' TO BOTTOM HOLE

LATITUDE 39°25'00"

LONGITUDE 80°55'00"

587' LONGITUDE 80°55'00"

11/09/2018

Antero Resources Corporation  
Well No. Winchester Unit 1H  
47-095-02515

MARK A. KARL  
LEASE

A - SURFACE - RAYMOND L. MOORE  
D.B. 285 PG. 310 T.M. 08 PAR. 29.1 1.10 AC. ±  
A - LEASE - RAYMOND L. MOORE ET UX  
B - SURFACE - DESTROY B. NELSON ET AL  
D.B. 347 PG. 643 T.M. 08 PAR. 28.1 1.236 AC. ±  
B - LEASE - DAVID E. BOWYER  
C1, C2, C3 - SURFACE - DONALD R.  
ROBINSON ET AL D.B. 294 PG. 713 T.M. 08  
PAR. 28 8.914 AC. ±  
C1 - LEASE - LILLIAN LEE EDDY  
C2 - LEASE - DONALD E. ROBINSON ET UX  
C3 - LEASE - EARL E. GLENDENING

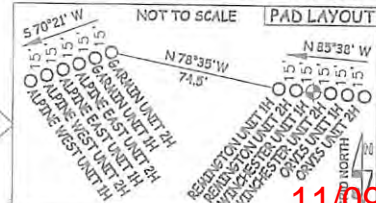
JASON L. GREATHOUSE  
LEASE

JASON  
GREATHOUSE  
D.B. 337 PG. 130  
T.M. 08 PAR. 27.1  
9.402 AC. ±

KERMIT C.  
MOSSOR ET AL  
D.B. 203 PG. 59  
T.M. 08 PAR. 15  
13.43 AC. ±

ROBERT S.  
CARSE  
LEASE

CHRISTOPHER  
CARSE ET AL  
D.B. 330 PG. 892  
T.M. 08 PAR. 25  
160.5 AC. ±



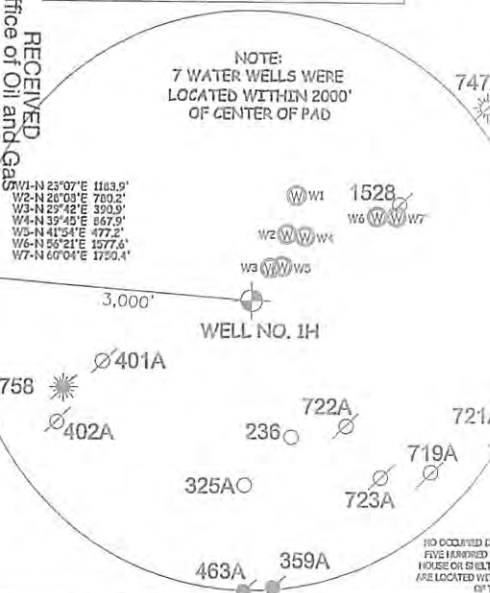
(NAD) 27 (UTM) ZONE 17 COORDS:  
WELL 1H TOP HOLE INFORMATION:  
N: 14,313,059ft E: 1,652,684ft  
POINT OF ENTRY INFORMATION:  
N: 14,313,265ft E: 1,653,500ft  
BOTTOM HOLE INFORMATION:  
N: 14,303,476ft E: 1,657,033ft

REFERENCES

NOTES:  
WELL 1H TOP HOLE INFORMATION:  
N: 336,617ft E: 1,588,492ft  
LAT: 39°24'54.19" LON: 80°57'23.64"  
BOTTOM HOLE INFORMATION:  
N: 326,959ft E: 1,592,683ft  
LAT: 39°23'19.41" LON: 80°56'28.28"  
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: 4,362,847m E: 503,753m  
BOTTOM HOLE INFORMATION:  
N: 4,359,926m E: 505,079m

NOTE:  
7 WATER WELLS WERE  
LOCATED WITHIN 2000'  
OF CENTER OF PAD



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

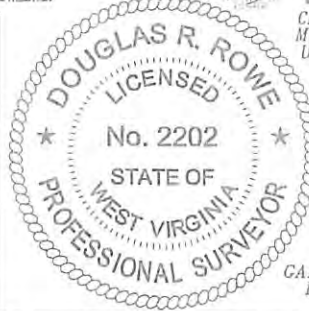
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TO THE BEST OF MY KNOWLEDGE AND BELIEF AND SHOWS ALL THE  
INFORMATION REQUIRED BY LAW AND THE RULES ISSUED AND  
PERSCRIBED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.



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 # 17-002WA  
DRAWING # WINCHESTER1H030  
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

LEGEND  
— Surface Owner Boundary Lines +/-  
- - Interior Surface Tracts +/-  
- - Existing Fence  
⊕ Found monument, as noted  
  
DOUGLAS R. ROWE P.S. 2202  
DATE 07/26/18  
OPERATOR'S WELL# WINCHESTER UNIT #1H

WELL TYPE: OIL \_\_\_ GAS X LIQUID INJECTION \_\_\_ WASTE DISPOSAL \_\_\_  
(IF "GAS") PRODUCTION X STORAGE \_\_\_ DEEP \_\_\_ SHALLOW X  
LOCATION: ELEVATION 799' - AS-BUILT WATERSHED OUTLET MIDDLE ISLAND CREEK  
QUADRANGLE MIDDLEBOURNE 7.5' DISTRICT MEADE COUNTY TYLER  
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OIL & GAS ROYALTY OWNER JAMES L. SINE ET UX; RAYMOND L. MOORE ET UX; DONALD E. ROBINSON ET UX; LEASE ACREAGE 54.74 AC±; 1.1 AC±; 2.59 AC±;  
LILLIAN LEE EDDY; DAVID E. BOWYER; ROBERT S. CARSE ET UX; TSAR-WV LLC; THOMAS W. MOORE ET AL; 5.84 AC±; 1.236 AC±; 140 AC±; 105 AC±; 56.25 AC±;  
THOMAS MOORE ET AL; REITA J. HALL; CHARLES F. MOSSOR ET UX; THE JOELYNN FAMILY PRESERVATION TRUST; GARY A. BARNARD ET UX 175.07 AC±; 23.31 AC±; 10.25 AC±; 200 AC±; 91.55 AC±  
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PLUG OFF OLD FORMATION \_\_\_ PERFORATE NEW FORMATION X OTHER PHYSICAL CHANGE IN WELL \_\_\_  
(SPECIFY) MOD BHL PLUG & ABANDON CLEAN OUT & REPLUG  
TARGET FORMATION MARCELLUS ESTIMATED DEPTH 6,600' TVD 18,500' MD  
WELL OPERATOR ANTERO RESOURCES CORP. DESIGNATED AGENT DIANNA STAMPER - CT CORPORATION SYSTEM  
ADDRESS 1615 WYNKOOP STREET ADDRESS 5400 D BIG TYLER ROAD  
DENVER, CO 80202 CHARLESTON, WV 25313

RICHARD R.  
BARNARD ET AL  
D.B. 270 PG. 231  
T.M. 11 PAR. 13  
91.55 AC. ±  
  
JOE-DOM  
INC.  
LEASE  
KEVIN GRIM  
D.B. 326 PG. 52  
T.M. 11 PAR. 14  
90.5 AC. ±  
  
WELL 1H  
BOTTOM HOLE

COUNTY NAME  
PERMIT

11/09/2018



August 8, 2018

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. Laura Adkins  
601 57<sup>th</sup> Street  
Charleston, WV 25304

Ms. Adkins:

Antero Resources Corporation (Antero) would like to submit the following permit modification for one approved well on the Sine Pad. We are requesting to change the bottom hole location of the Winchester Unit 1H (API# 47-095-02515).

Attached you will find the following documents:

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

If you have any questions please feel free to contact me at (303) 357-6820.

Thank you in advance for your consideration.

Sincerely,

A handwritten signature in black ink, appearing to read "Karin Cox", written over a light blue horizontal line.

Karin Cox  
Permitting Agent  
Antero Resources Corporation

Enclosures

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Environmental Protection

WW-6B  
(04/15)

Permit Modification API#: 47-095-02515  
API NO. 47-095 - 02515 11/09/2018  
OPERATOR WELL NO. Winchester Unit 1H  
Well Pad Name: Sine 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 Meade Middlebourne 7.5'  
Operator ID County District Quadrangle

2) Operator's Well Number: Winchester Unit 1H Well Pad Name: Sine Pad

3) Farm Name/Surface Owner: James Sine, et al Public Road Access: Wick Rd.

4) Elevation, current ground: 799' Elevation, proposed post-construction: \_\_\_\_\_

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: 6600' TVD, Anticipated Thickness- 55 feet, Associated Pressure- 2800#

8) Proposed Total Vertical Depth: 6600' TVD

9) Formation at Total Vertical Depth: Marcellus

**VOID**

10) Proposed Total Measured Depth: 18500' MD

11) Proposed Horizontal Leg Length: 10412'

12) Approximate Fresh Water Strata Depths: 42'

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

14) Approximate Saltwater Depths: 1269, 1274

15) Approximate Coal Seam Depths: 154, 278

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  
(04/15)

Permit Modification API#: 47-095-02515  
 API NO. 47- 095 - 02515 **11/09/2018**  
 OPERATOR WELL NO. Winchester Unit 1H  
 Well Pad Name: Sine Pad

18)

**CASING AND TUBING PROGRAM**

<b>TYPE</b>	<u>Size (in)</u>	<u>New or Used</u>	<u>Grade</u>	<u>Weight per ft. (lb/ft)</u>	<u>FOOTAGE: For Drilling (ft)</u>	<u>INTERVALS: Left in Well (ft)</u>	<u>CEMENT: Fill-up (Cu. Ft.)/CTS</u>
Conductor	20"	New	H-40	94#	95'	95'	CTS, 91 Cu. Ft.
Fresh Water	13-3/8"	New	J-55	54.5#	330	330	CTS, 458 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#	18500	18500	CTS, 4680 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7100'	
Liners							

<b>TYPE</b>	<u>Size (in)</u>	<u>Wellbore Diameter (in)</u>	<u>Wall Thickness (in)</u>	<u>Burst Pressure (psi)</u>	<u>Anticipated Max. Internal Pressure (psi)</u>	<u>Cement Type</u>	<u>Cement Yield (cu. ft./k)</u>
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							

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**PACKERS**

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

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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."

Anticipated Max Pressure - 9300 lbs  
Anticipated Max Rate - 80 bpm

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 20.99 acres

22) Area to be disturbed for well pad only, less access road (acres): 5.55 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

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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.

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