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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

## PERMIT MODIFICATION APPROVAL

February 12, 2014

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

Re: Permit Modification Approval for API Number 1706366 , Well #: FARROW UNIT 3H  
**Orientation of Lateral Changed**

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  
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 57<sup>th</sup> Street  
Charleston, WV 25304

Ms. Laura Cooper:

Antero Resources Corporation (Antero) would like to submit the following permit modifications for three approved wells on the Cline Pad. We are requesting to move the horizontal lateral which will change the bottom hole location of the Nickers Unit 2H (API# 47-017-06311), Farrow Unit 2H (API# 47-017-06362) and Farrow Unit 3H (API# 47-017-06366).

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

DEC 13 2013

Office of Oil and Gas  
WV Dept. of Environmental Protection

02/14/2014

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 New Milton New Milton 7.5'  
Operator ID County District Quadrangle

2) Operator's Well Number: Farrow Unit 3H Well Pad Name: Cline Pad

3) Farm Name/Surface Owner: Johnnie Cline et al Public Road Access: CR-18

4) Elevation, current ground: ~1105 Elevation, proposed post-construction: 1096'

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: 7200' TVD, Anticipated Thickness- 60 Feet, Associated Pressure- 3250#

8) Proposed Total Vertical Depth: 7200' TVD

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 15,800' MD

11) Proposed Horizontal Leg Length: 7,497'

12) Approximate Fresh Water Strata Depths: 203', 214'

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

14) Approximate Saltwater Depths: 612', 1595'

15) Approximate Coal Seam Depths: 258', 809'

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#	305'	305'	CTS, 424 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2460'	2460'	CTS, 1002 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	15800'	15800'	3949 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7100'	
Liners							

*OK from DN  
2/12/14*

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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DEC 15 2013  
Department of  
Environmental Protection



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.

## 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): 11.97 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

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.

WW-6A1

Operator's Well Number Farrow Unit 3H

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
<b><u>Frank Hinter et al Lease</u></b>			
Frank Hinter, et al	Bill D. Haught	1/8	0068/0306
Bill D. Haught, et ux	South Triangle Oil Company	Assignment	0068/0314
South Triangle Oil Company	Floyd A. Gearhart	Assignment	0081/0203
Randy F. Gearhart heirs of Floyd A. Gearhart, et ux	Antero Resources Appalachian Corporation	Assignment	0271/0216
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>Denver Cox et ux Lease</u></b>			
Denver Cox et ux	Swift Energy Company	1/8	0127/0473
Swift Energy Company	Peake Energy, Inc.	Assignment	0180/0036
Peak Energy Inc.	North Coast Energy Eastern, Inc.	Certificate of Amendment to the Certificate of Authority	DB 0249/0343
North Coast Energy Eastern, Inc.	EXCO - North Coast Energy Eastern, Inc.	Affidavit of Name Change	DB 0277/0068
EXCO - North Coast Energy Eastern, Inc.	EXCO Resources (WV), Inc.	Name Change	Exhibit 2
EXCO Resources (WV), Inc.	EXCO Resources (WV), LLC	Name Change	DB 0285/0083
EXCO Resources (WV), LLC	EXCO Production Company (WV), Inc.	Name Change	Exhibit 3
EXCO Production Company (WV), Inc.	Antero Resources Appalachian Corporation	Assignment	0285/0084
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>Joan R. Farrow Lease</u></b>			
Joan R. Farrow, a widow	Antero Resources Appalachian Corporation	1/8+	0297/0555
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>Joan R. Farrow Lease</u></b>			
Joan R. Farrow, a widow	Antero Resources Appalachian Corporation	1/8+	0297/0560
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>Denver Junior Cox Lease</u></b>			
Denver Junior Cox	Antero Resources Appalachian Corporation	1/8+	0294/0226
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>Grover Johnson et ux Lease</u></b>			
Grover J. Johnson, et ux	Richard C. Bachelor	1/8	0065/0421
Richard C. Bachelor	George J. Buff Jr.	Assignment	0068/0416
George J. Buff Jr.	Helen K. Buff, Ila Powell	Last Will and Testament	WB 0014/0548
Helen Buff, et al	Ila Powell	Assignment	Recital in 0162/0695-A
Ila Powell	P. & M. Oil Company, Inc.	Assignment	0162/0695-A
P. & M. Oil Company, Inc.	R & K Oil and Gas, Inc.	Assignment and Bill of Sale	0190/0371
P & M Oil Company, et al	R & K Oil and Gas, Inc.	Corrective Assignment	0233/0053
R & K Oil and Gas, Inc.	Bluestone Energy Partners	Assignment	0234/0721
Bluestone Energy Partners	Antero Resources Bluestone, LLC a wholly owned Subsidiary of Antero Resources Appalachian Corporation	Affidavit Regarding Merger	DB 0288/0001
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>Milton D. Nicholson Lease</u></b>			
M.D. Nicholson	Antero Resources Appalachian Corporation	1/8+	0327/0389
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>Ruby Gene Dicks Lease</u></b>			
Ruby Gene Dicks	Antero Resources Appalachian Corporation	1/8	0301/0021
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<b><u>Karen M. Henderson Lease</u></b>			
Karen M. Henderson	Antero Resources Appalachian Corporation	1/8+	0303/0348
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1

\*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. 02/14/2014

\*\*CONTINUED ON NEXT PAGE\*\*

WW-6A1  
(5/13)

Operator's Well No. Farrow Unit 3H

**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>James F. Bonnell et ux Lease</u>	James F. Bonnell Antero Resources Appalachian Corporation	Antero Resources Appalachian Corporation Antero Resources Corporation	1/8+ Name Change	0311/0067 Exhibit 1

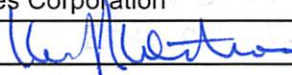
\*Partial Assignments to Antero Resources Corporation include 100% rights to extract, produce and market the oil and gas from the Marcellus and any other formations completed with this well.

**Acknowledgement of Possible Permitting/Approval  
In Addition to the Office of Oil and Gas**

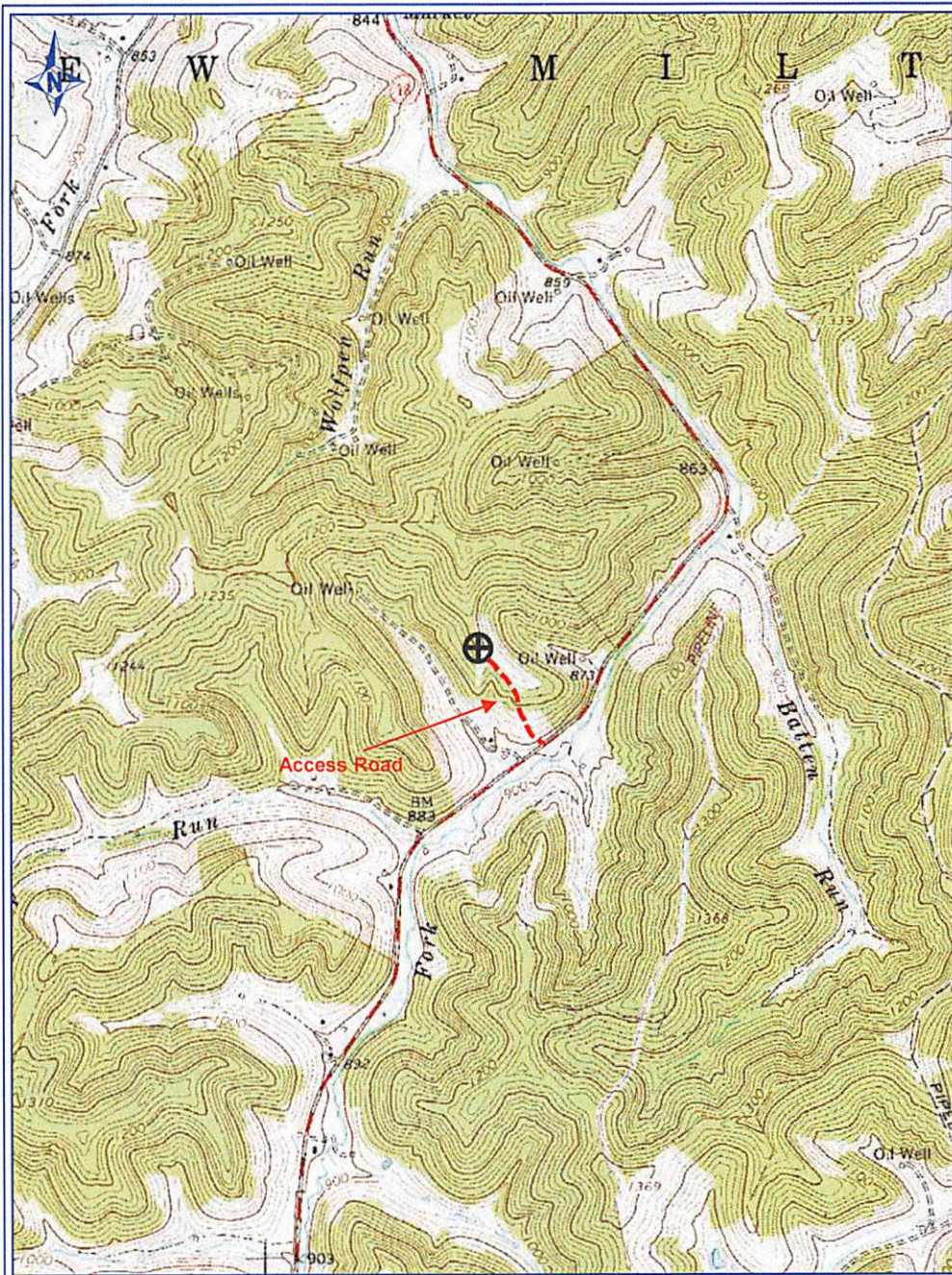
The permit applicant for the proposed well work addressed in this application hereby acknowledges the possibility of the need for permits and/or approvals from local, state, or federal entities in addition to the DEP, Office of Oil and Gas, including but not limited to the following:

- 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

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: Kevin Kilstrom   
 Its: Vice President of Production





PETRA 6/3/2013 2:37:31 PM

Received

AUG 30 2013

Office of Oil and Gas  
WV Dept. of Environmental Protection

**Antero Resources Corp**

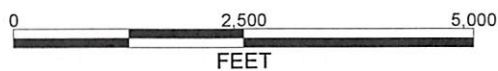
APPALACHIAN BASIN

Farrow Unit 3H

**REMARKS**

QUADRANGLE: NEW MILTON  
WATERSHED: TOM'S FORK  
DISTRICT: NEW MILTON

By: ECM





LATITUDE 39°12'30"

9,379'

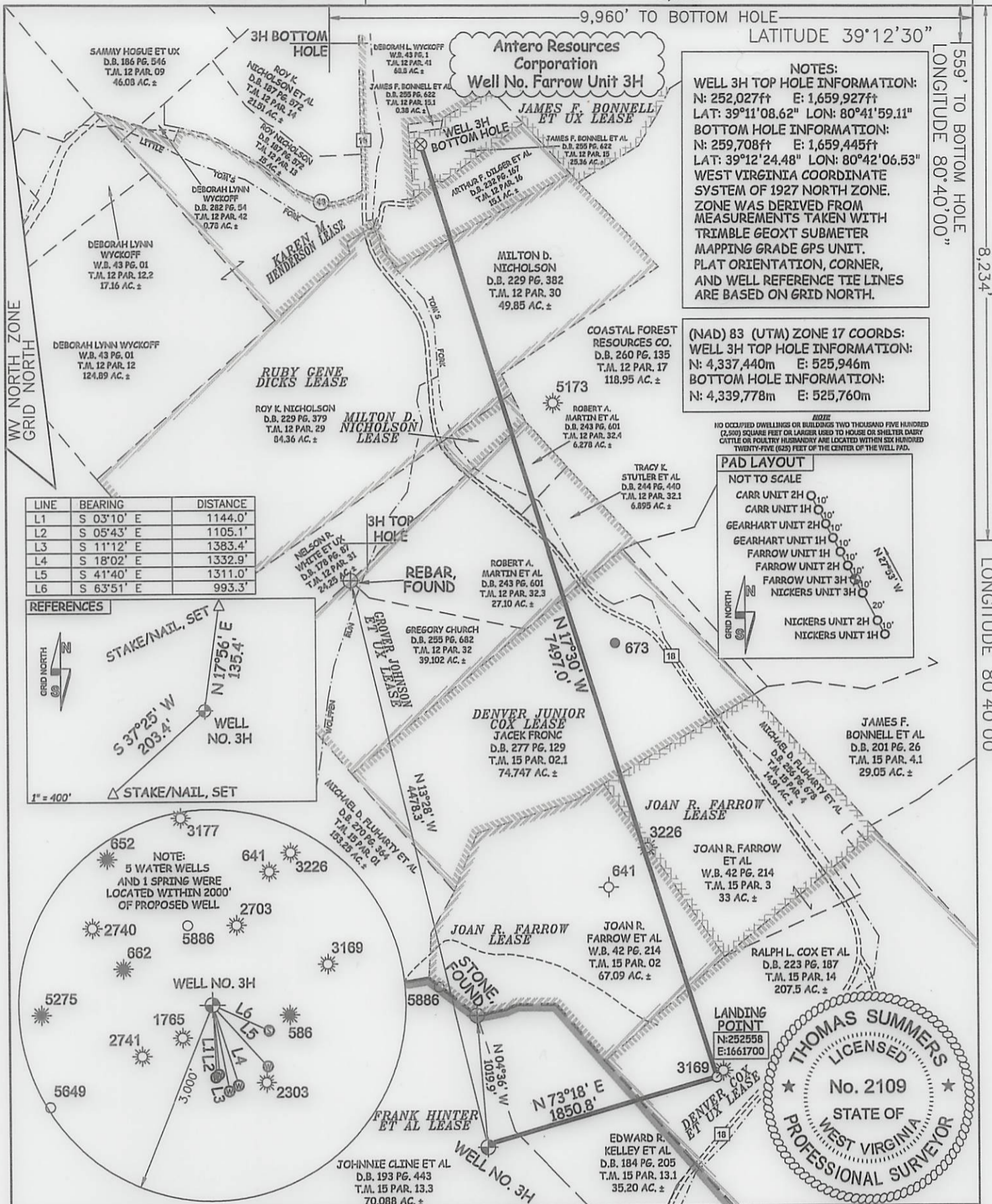
9,960' TO BOTTOM HOLE

LATITUDE 39°12'30"

LONGITUDE 80°40'00"

8,234'

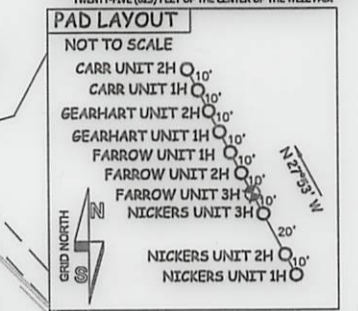
LONGITUDE 80°40'00"



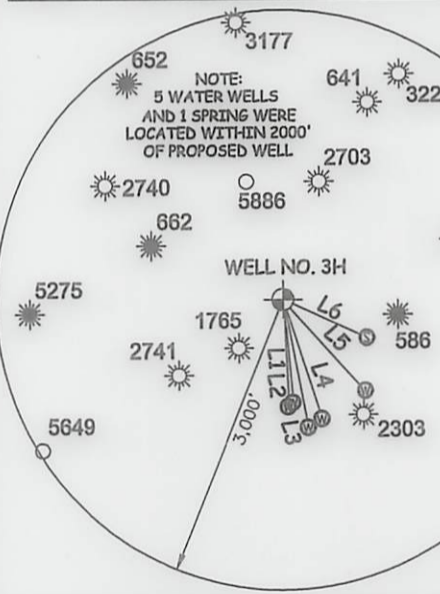
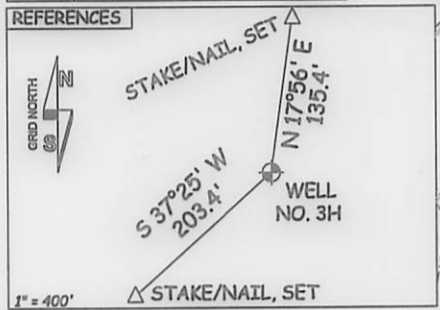
**NOTES:**  
**WELL 3H TOP HOLE INFORMATION:**  
 N: 252,027ft E: 1,659,927ft  
 LAT: 39°11'08.62" LON: 80°41'59.11"  
**BOTTOM HOLE INFORMATION:**  
 N: 259,708ft E: 1,659,445ft  
 LAT: 39°12'24.48" LON: 80°42'06.53"  
 WEST VIRGINIA COORDINATE SYSTEM OF 1927 NORTH ZONE. ZONE WAS DERIVED FROM MEASUREMENTS 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: 4,337,440m E: 525,946m  
**BOTTOM HOLE INFORMATION:**  
 N: 4,339,778m E: 525,760m

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



LINE	BEARING	DISTANCE
L1	S 03°10' E	1144.0'
L2	S 05°43' E	1105.1'
L3	S 11°12' E	1383.4'
L4	S 18°02' E	1332.9'
L5	S 41°40' E	1311.0'
L6	S 63°51' E	993.3'



JOB # 13-067WA  
 DRAWING # FARROW3HR1  
 SCALE 1" = 1000'  
 MINIMUM DEGREE OF ACCURACY SUBMETER  
 PROVEN SOURCE OF ELEV. SUBMETER MAPPING GRADE GPS

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

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

THOMAS SUMMERS P.S. 2109

DATE 11/18/13

OPERATOR'S WELL # FARROW UNIT #3H

API WELL # 47 - 017 - 06366 H6A

STATE WV COUNTY DODD PERMIT 02714/2014

STATE OF WEST VIRGINIA DEPARTMENT OF ENERGY DIVISION OF OIL AND GAS  
 WELL TYPE: OIL    GAS X LIQUID INJECTION    WASTE DISPOSAL     
 (IF "GAS") PRODUCTION X STORAGE    DEEP    SHALLOW X  
 LOCATION: ELEVATION 1,096' WATERSHED TOMS FORK QUADRANGLE NEW MILTON 7.5' DISTRICT NEW MILTON COUNTY DODD  
 SURFACE OWNER JOHNNIE CLINE ET AL ACREAGE 70.088 ACRES +/-  
 OIL & GAS ROYALTY OWNER FRANK HINTER ET AL; DENVER COX ET UX; JOAN R. FARROW; JOAN R. FARROW; DENVER JUNIOR COX; GROVER JOHNSON ET UX; MILTON D. NICHOLSON; RUBY GENE DICKS; KAREN M. HENDERSON; JAMES F. BONNELL ET UX LEASE ACREAGE 329.73 AC±; 206 AC±; 67 AC±; 52.4033 AC±; 80 AC±; 81 AC±; 5.9 AC±; 117.197 AC±; 84.96 AC±; 27.153 AC±  
 PROPOSED WORK: DRILL X CONVERT    DRILL DEEPER    REDRILL    FRACTURE OR STIMULATE X  
 PLUG OFF OLD FORMATION    PERFORATE NEW FORMATION X OTHER PHYSICAL CHANGE IN WELL (SPECIFY)    PLUG & ABANDON    CLEAN OUT & REPLUG     
 TARGET FORMATION MARCELLUS ESTIMATED DEPTH 7,200' TVD 15,800' MD  
 WELL OPERATOR ANTERO RESOURCES CORP. DESIGNATED AGENT DIANNA STAMPER  
 ADDRESS 1625 17TH STREET ADDRESS 5400 D BIG TYLER ROAD  
DENVER, CO 80202 CHARLESTON, WV 25313