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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

May 30, 2014

ANTERO RESOURCES CORPORATION  
1615 WYNKOOP STREET  
DENVER, CO 80202

Re: Permit Modification Approval for API Number 9502127 , Well #: FREELAND UNIT 2H  
**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



May 1, 2014

Antero Resources  
1625 17th Street  
Denver, Colorado 80202  
Office 303.357.7310  
Fax 303.357.7315

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 modification for an approved well on the Hartley East Pad. We are requesting to change the orientation of the horizontal lateral which will change the bottom hole location of the Freeland Unit 2H (API# 47-095-02127).

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,

A handwritten signature in blue ink that reads "Ashlie Mihalcin".

Ashlie Mihalcin  
Permit Representative  
Antero Resources Corporation

Enclosures

RECEIVED  
Office of Oil and Gas  
MAY 02 2014  
WV Department of  
Environmental Protection

05/30/2014

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 095-Tyler Meade Pennsboro 7.5'  
Operator ID County District Quadrangle

2) Operator's Well Number: Freeland Unit 2H Well Pad Name: Hartley East Pad

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

4) Elevation, current ground: ~1030' 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 No

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Associated Pressure(s):  
Marcellus Shale: 6500' TVD, Anticipated Thickness- 75 Feet, Associated Pressure- 2800#

8) Proposed Total Vertical Depth: 6500' TVD

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 13,500' MD

11) Proposed Horizontal Leg Length: 6563'

12) Approximate Fresh Water Strata Depths: 90', 181'

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

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

15) Approximate Coal Seam Depths: None reported

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**

<b>TYPE</b>	<b>Size</b>	<b>New or Used</b>	<b>Grade</b>	<b>Weight per ft. (lb/ft)</b>	<b>FOOTAGE: For Drilling</b>	<b>INTERVALS: Left in Well</b>	<b>CEMENT: Fill-up (Cu. Ft.)</b>
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#	2475'	2475'	CTS, 1008 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	13,500'	13,500'	3313 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7100'	
Liners							

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

APPROVED  
and Gas  
2014  
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): 13.08 acres

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

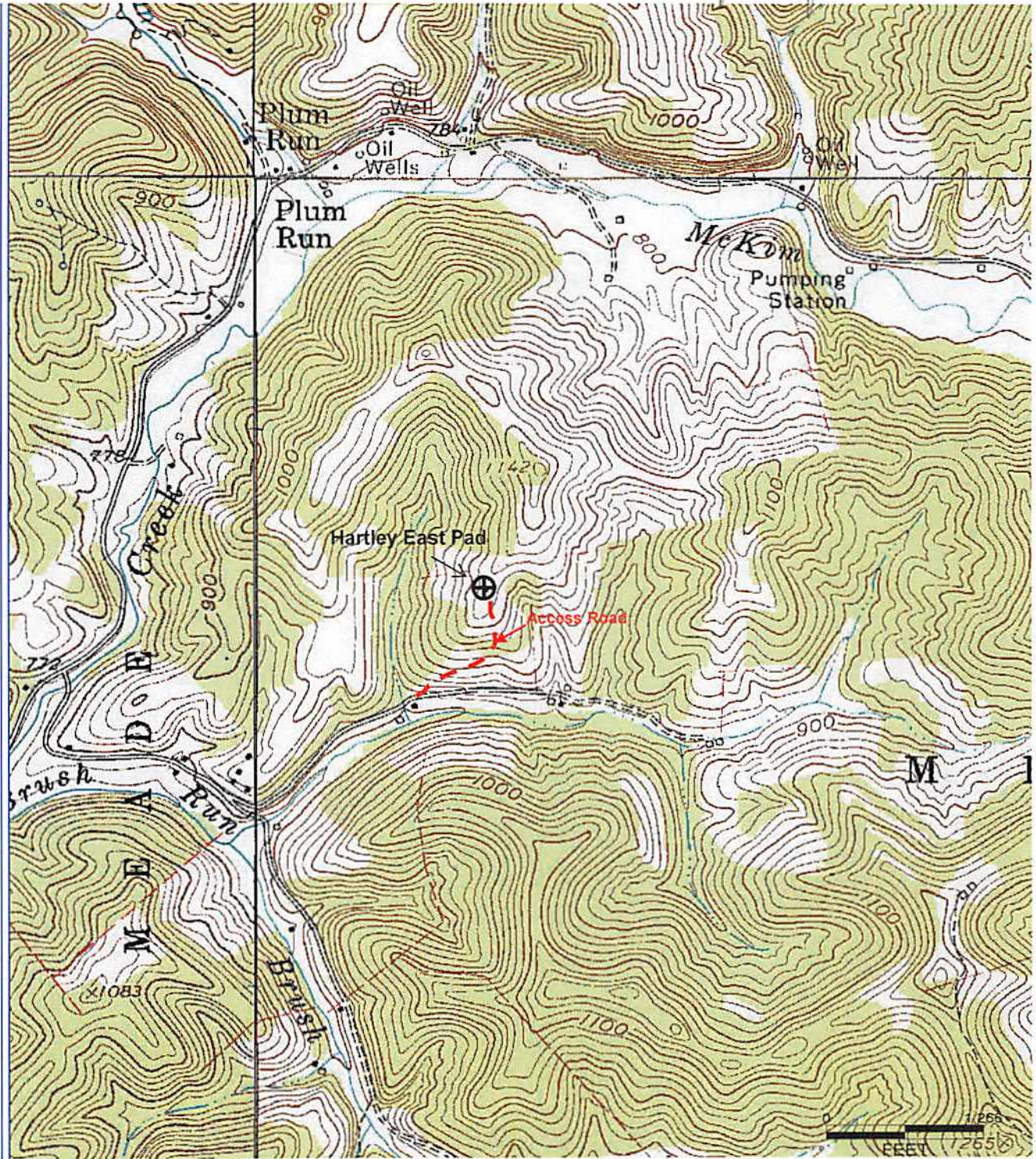
25) Proposed borehole conditioning procedures:

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.



Plat spotted 95-02127



RECEIVED  
Office of Oil and Gas

AUG 9 2013

WV Department of  
Environmental Protection

**Antero Resources Corporation**  
Appalachian Basin  
Freeland Unit 2H  
Tyler County

Quadrangle: Ellenboro & Pennsboro  
Watershed: Middle Island Creek  
District: Meade  
Date: 7-26-2013

05/30/2014



LATITUDE 39°22'30"

9,875'

1,660' TO BOTTOM HOLE

LATITUDE 39°25'00"

LONGITUDE 81°00'00"

3,575'

LONGITUDE 80°57'30"

12,753' TO BOTTOM HOLE

Antero Resources Corporation  
Well No. Freeland Unit 2H

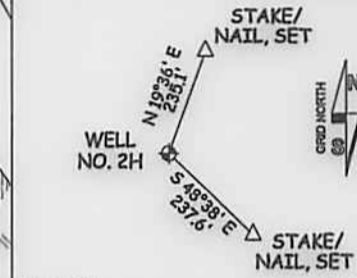
WELL NO. 2H  
BOTTOM HOLE

NOTES:

WELL 2H TOP HOLE INFORMATION:  
N: 318,654ft E: 1,577,835ft  
LAT: 39°21'54.93" LON: 80°59'35.62"  
BOTTOM HOLE INFORMATION:  
N: 324,660ft E: 1,574,413ft  
LAT: 39°22'53.73" LON: 81°00'20.46"  
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: 4,357,320m E: 500,598  
BOTTOM HOLE INFORMATION:  
N: 4,359,132m E: 499,525m

REFERENCES



1" = 400'

RODGER B. KING LEASE  
PAUL W. MCGRAHAM ET AL  
D.B. 330 PG. 127  
T.J. 12 PAR. 31  
49,039 AC.±

ANDREW Z. WILLIAMSON ET AL  
D.B. 336 PG. 469  
T.J. 12 PAR. 32  
47,763 AC.±

DAVID H. HARTLEY  
D.B. 271 PG. 421  
T.J. 12 PAR. 12  
45 AC.±

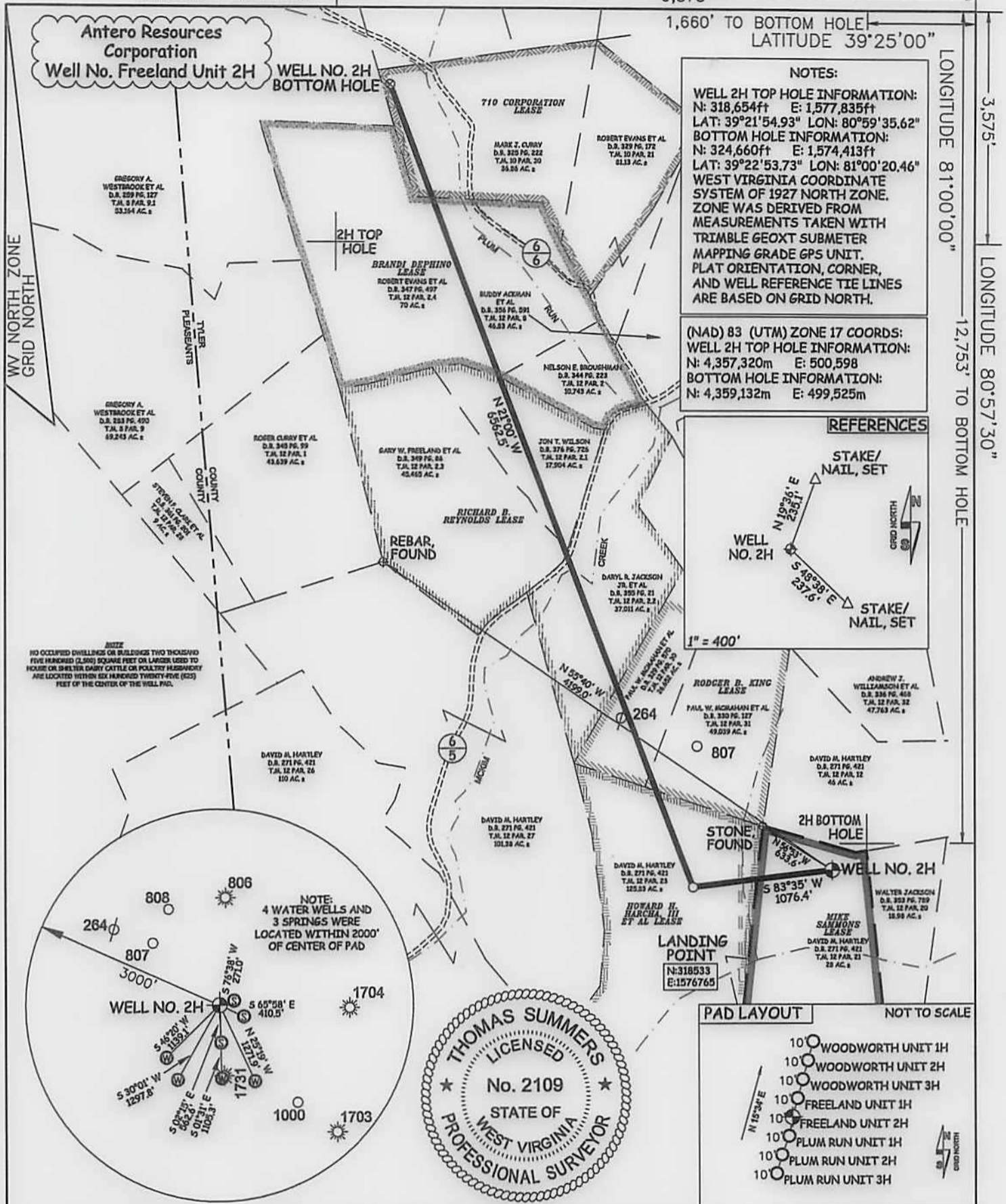
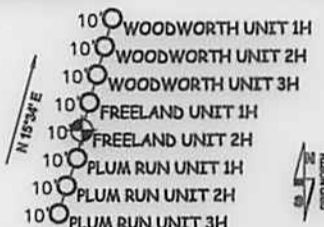
WALTER JACKSON  
D.B. 393 PG. 789  
T.J. 12 PAR. 20  
18.98 AC.±

MIKE SAMMONS LEASE  
DAVID H. HARTLEY  
D.B. 271 PG. 421  
T.J. 12 PAR. 21  
23 AC.±

LANDING POINT  
N: 318533  
E: 1576765

PAD LAYOUT

NOT TO SCALE



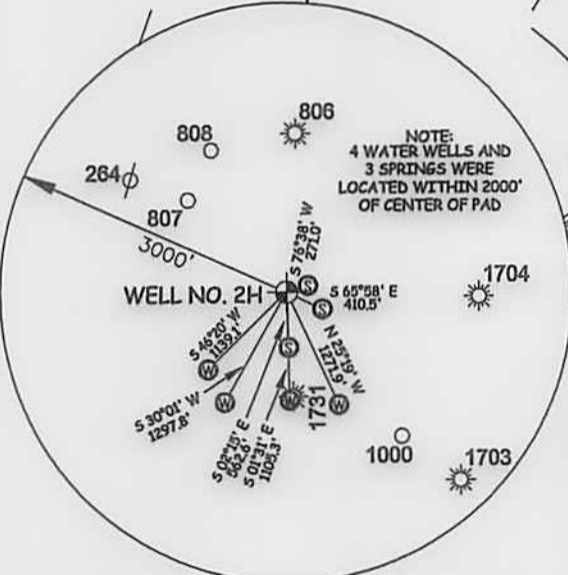
NOTE:  
NO OCCUPIED DWELLINGS OR BUILDINGS TWO THOUSAND FIVE HUNDRED (2,500) SQUARE FEET OR LARGER USED TO HOUSE OR SHED FOR CHAIRY CATTLE OR POLYTRY HUSBANDRY ARE LOCATED WITHIN SIX HUNDRED TWENTY-FIVE (625) FEET OF THE CENTER OF THE WELL PAD.

DAVID H. HARTLEY  
D.B. 271 PG. 421  
T.J. 12 PAR. 26  
110 AC.±

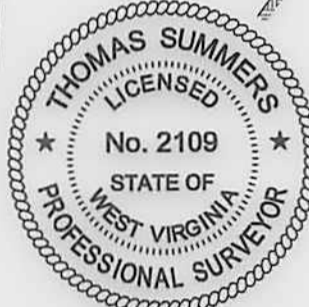
DAVID H. HARTLEY  
D.B. 271 PG. 421  
T.J. 12 PAR. 27  
101.28 AC.±

DAVID H. HARTLEY  
D.B. 271 PG. 421  
T.J. 12 PAR. 23  
125.23 AC.±

HOWARD H. HARCHA, III ET AL LEASE



NOTE:  
4 WATER WELLS AND 3 SPRINGS WERE LOCATED WITHIN 2000' OF CENTER OF PAD



JOB # 13-042WA

DRAWING # FREELAND2HR

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 X LIQUID INJECTION WASTE DISPOSAL

(IF "GAS") PRODUCTION X STORAGE DEEP SHALLOW X

LOCATION: ELEVATION 1,021' WATERSHED TRIBUTARY OF BRUSH RUN

QUADRANGLE PENNSBORO 7.5 (TOP HOLE) BENS RUN 7.5 (BOTTOM HOLE) DISTRICT MEADE COUNTY TYLER

SURFACE OWNER DAVID M. HARTLEY

OIL & GAS ROYALTY OWNER MIKE SAMMONS; HOWARD H. HARCHA, III ET AL; RODGER B. KING

RICHARD B. REYNOLDS; BRANDI DEPHINO; 710 CORPORATION

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)

TARGET FORMATION MARCELLUS ESTIMATED DEPTH 6,500' TVD 13,500' 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

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 REGULATIONS 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

LEGEND

- Surface Owner Boundary Lines +/-
- Interior Surface Tracts +/-
- Existing Fence
- Rebar, Found

THOMAS SUMMERS P.S. 2109

DATE 4/29/14

OPERATOR'S WELL # FREELAND UNIT #2H

API WELL # 47 - 095 - 02/27H 6A

STATE COUNTY PERMIT

05/30/2014

ACREAGE 21 ACRES +/-

LEASE ACREAGE 28 AC.±; 115 AC.±; 43 AC.±

100.38 AC.±; 122 ACRES±; 57 AC.±

CLEAN OUT & REPLUG

PERMIT