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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)

Friday, August 31, 2018  
PERMIT MODIFICATION APPROVAL  
Horizontal 6A / New Drill

ANTERO RESOURCES CORPORATION  
1615 WYNKOOP STREET

DENVER, CO 80202

Re: Permit Modification Approval for SPOCK UNIT 3H  
47-095-02428-00-00

**Bottom Hole Adjustment**

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

A handwritten signature in blue ink, appearing to read "James A. Martin", is positioned to the right of the typed name and title.

Operator's Well Number: SPOCK UNIT 3H  
Farm Name: TYRONE L. BEEM  
U.S. WELL NUMBER: 47-095-02428-00-00  
Horizontal 6A New Drill  
Date Modification Issued: August 31, 2018

Promoting a healthy environment.

WW-6B  
(04/15)

Permit Modification API# 47-095-02428 **7/16**  
API NO. 47-095 - 02428  
OPERATOR WELL NO. Spock Unit 3H  
Well Pad Name: Pyle Run Pad

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

1) Well Operator: Antero Resources Corpora 494507062 095 - Tyler Centerville Middlebourne 7.5'  
Operator ID County District Quadrangle

2) Operator's Well Number: Spock Unit 3H Well Pad Name: Pyle Run Pad

3) Farm Name/Surface Owner: Tyrone L Beem et al Public Road Access: Bearsville-Mole Hole

4) Elevation, current ground: 1115' Elevation, proposed post-construction: \_\_\_\_\_

5) Well Type (a) Gas X Oil \_\_\_\_\_ Underground Storage \_\_\_\_\_  
Other \_\_\_\_\_

(b) If Gas Shallow X Deep \_\_\_\_\_  
Horizontal X \_\_\_\_\_

6) Existing Pad: Yes or No Yes

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):  
Marcellus Shale: 6800' TVD, Anticipated Thickness- 55 feet, Associated Pressure- 2800#

*DMH  
7-25-18  
JOB  
7/25/2018*

8) Proposed Total Vertical Depth: 6800' TVD

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 18300' MD ✓

11) Proposed Horizontal Leg Length: 10530' ✓ *w/plate*

12) Approximate Fresh Water Strata Depths: 301'; 332' ✓

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

14) Approximate Saltwater Depths: 674', 1584' ✓

15) Approximate Coal Seam Depths: 811' ✓

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 X

(a) If Yes, provide Mine Info: Name: \_\_\_\_\_  
Depth: \_\_\_\_\_  
Seam: \_\_\_\_\_  
Owner: \_\_\_\_\_

Received

JUL 26 2018

WW-6B  
(04/15)

Permit Modification API# 47-095-02428  
 API NO. 47- 095 - 02428  
 OPERATOR WELL NO. Spock Unit 3H  
 Well Pad Name: Pylo Run 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#	80'	80' ✓	CTS, 77 Cu. Ft.
Fresh Water	13-3/8"	New	J-55/H-40	54.5#/48#	385' *see #19	385' *see #19 ✓	CTS, 535 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2500'	2500' ✓	CTS, 1018 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	18300'	18300' ✓	4625 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7100'	
Liners							

*DmH 7-25-18* *QEB 7/25/2018*

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			
Sizes:	N/A			
Depths Set:	N/A			

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JUL 26 2018

WW-6B  
(10/14)

API NO. 47- 095 - 02428  
OPERATOR WELL NO. Spock Unit 3H  
Well Pad Name: Pyle Run 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.

\*Antero will be air drilling the fresh water string which makes it difficult to determine when freshwater 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.

DMH  
7-25-18 JCS  
7/25/2018

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): 29.70 acres

22) Area to be disturbed for well pad only, less access road (acres): 10.67 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

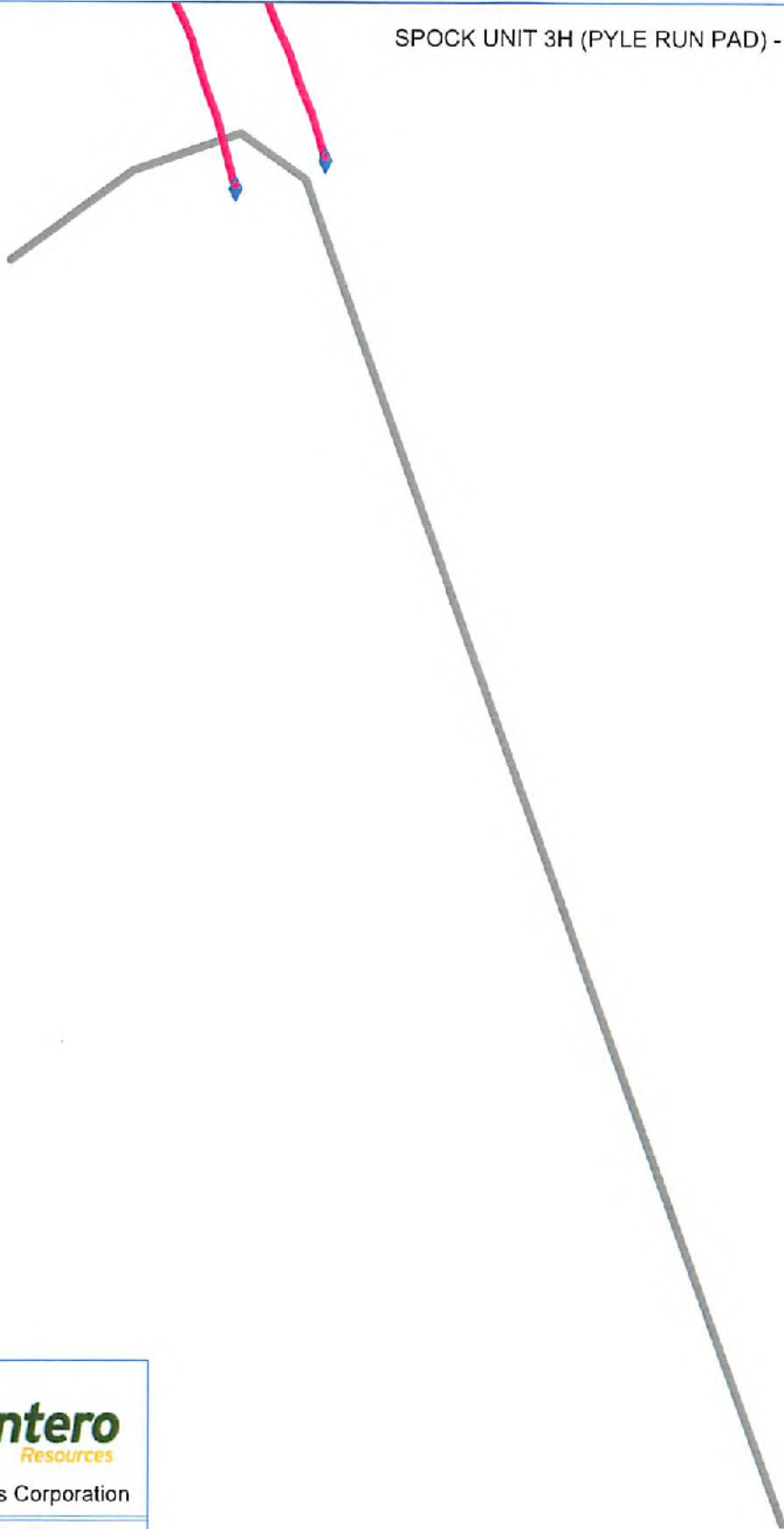
25) Proposed borehole conditioning procedures:

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.

Received

JUL 26 2018



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Office of Oil and Gas

JUL 17 2018

WV Department of  
Environmental Protection



Antero Resources Corporation

Spock Unit 3H - AOR



WELL SYMBOLS  
Waiting on Completion

Permit Modification API# 47-095-02428

UWI (API Num)	Well Name	Well Number	Operator	Historical Operator	TD	Perforated Interval (shallowest, deepest)	Perforated Formation(s)	Productible Formation(s) not perf'd
47095024010000	Ant Unit	2H	ANTERO RESOURCES CORPORATION	ANTERO RESOURCES CORPORATION	15555	N/A	Marcellus Fm	N/A
47095024003000	Ant Unit	1H	ANTERO RESOURCES CORPORATION	ANTERO RESOURCES CORPORATION	15869	N/A	Marcellus Fm	N/A

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Office of Oil and Gas

JUL 17 2018

WV Department of  
Environmental Protection

LATITUDE 39°25'00"

8,165'

2,487' TO BOTTOM HOLE

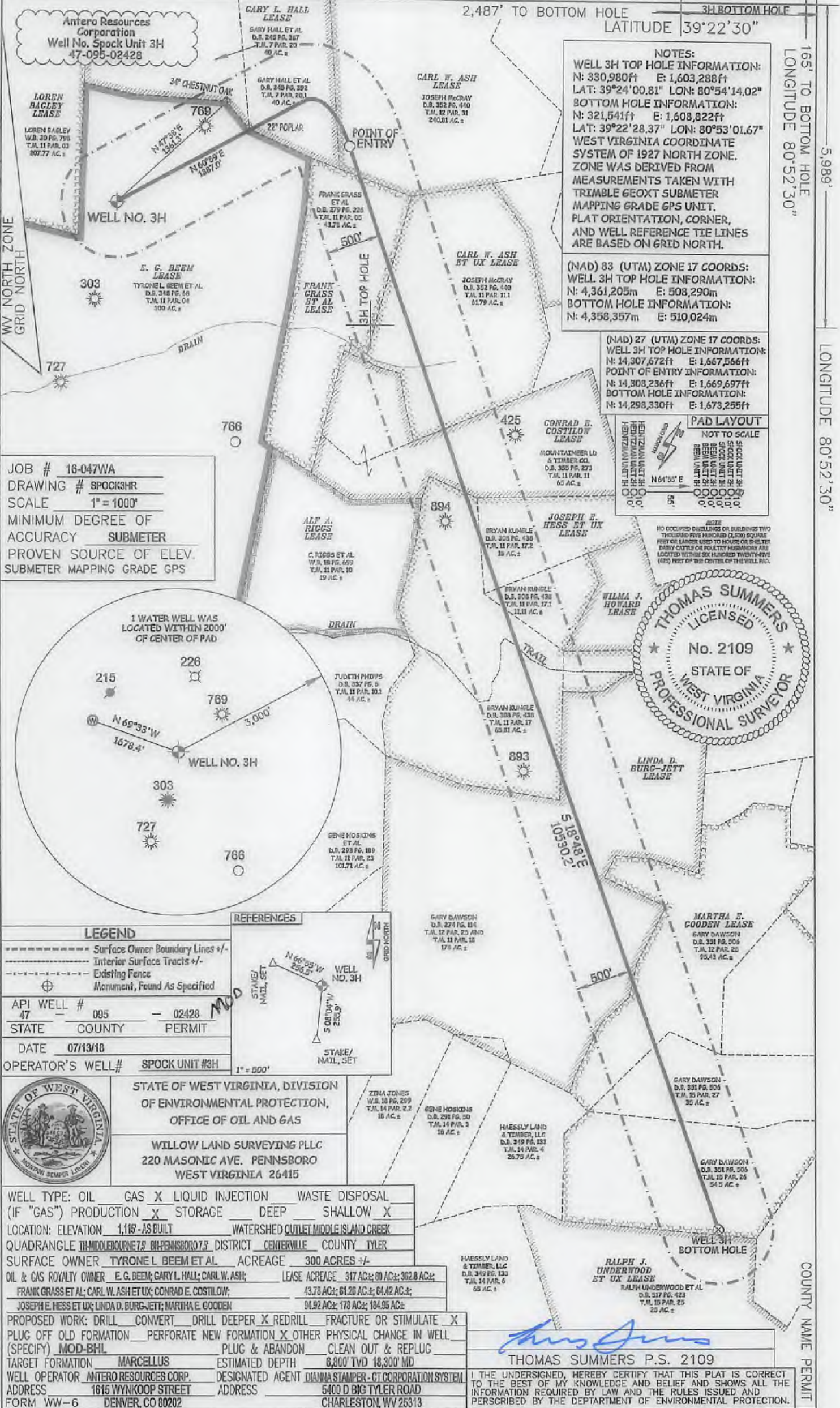
3H BOTTOM HOLE

LATITUDE 39°22'30"

165' TO BOTTOM HOLE  
LONGITUDE 80°52'30"

5,989'

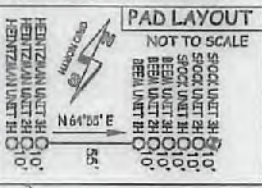
LONGITUDE 80°52'30"



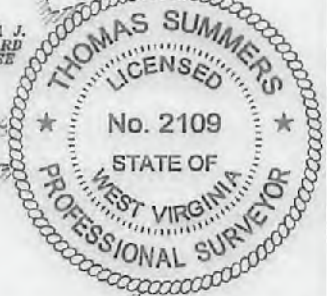
**NOTES:**  
**WELL 3H TOP HOLE INFORMATION:**  
 N: 330,980ft E: 1,603,288ft  
 LAT: 39°24'00.81" LON: 80°54'14.02"  
**BOTTOM HOLE INFORMATION:**  
 N: 321,541ft E: 1,608,822ft  
 LAT: 39°22'28.37" LON: 80°53'01.67"  
 WEST VIRGINIA COORDINATE SYSTEM OF 1927 NORTH ZONE. ZONE WAS DERIVED FROM MEASUREMENTS 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: 4,361,205m E: 508,290m  
**BOTTOM HOLE INFORMATION:**  
 N: 4,358,357m E: 510,024m

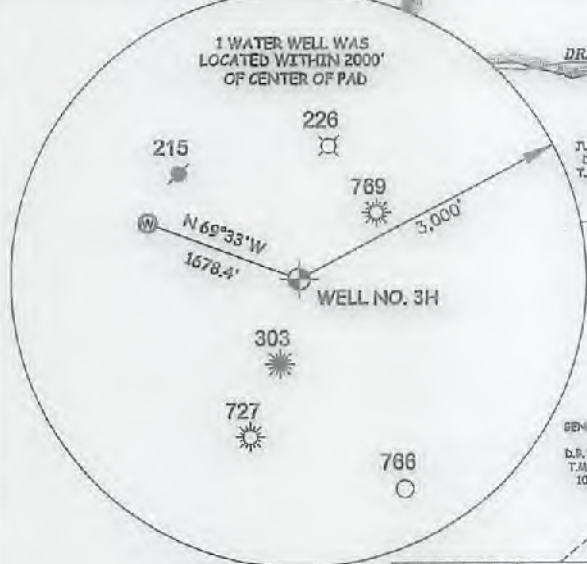
**(NAD) 27 (UTM) ZONE 17 COORDS:**  
**WELL 3H TOP HOLE INFORMATION:**  
 N: 14,307,672ft E: 1,667,566ft  
**POINT OF ENTRY INFORMATION:**  
 N: 14,308,236ft E: 1,669,697ft  
**BOTTOM HOLE INFORMATION:**  
 N: 14,298,330ft E: 1,673,255ft



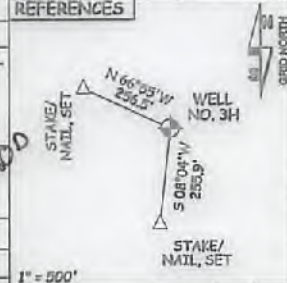
NOTE: NO OCCUPIED BUILDINGS OR BUILDINGS TWO THOUSAND FIVE HUNDRED (2,500) SQUARE FEET OR LARGER USED TO HOUSE OR SHELTER DAIRY CATTLE OR POLETRY HUSBANDRY ARE LOCATED WITHIN SIX HUNDRED TWENTY-FIVE (625) FEET OF THE CENTER OF THIS WELL PAD.



JOB # 16-047WA  
 DRAWING # SPOCK3HR  
 SCALE 1" = 1000'  
 MINIMUM DEGREE OF ACCURACY SUBMETER  
 PROVEN SOURCE OF ELEV. SUBMETER MAPPING GRADE GPS



LEGEND		
-----	Surface Owner Boundary Lines +/-	
-----	Interior Surface Tracts +/-	
-----	Existing Fence	
⊕	Monument, Found As Specified	
API WELL #	47	095 - 02428
STATE	COUNTY	PERMIT
DATE	07/13/18	
OPERATOR'S WELL #	SPOCK UNIT #3H	



STATE OF WEST VIRGINIA, DIVISION OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS  
 WILLOW LAND SURVEYING PLLC  
 220 MASONIC AVE. PENNSBORO WEST VIRGINIA 26415

WELL TYPE:	OIL	GAS	X	LIQUID INJECTION	WASTE DISPOSAL
(IF "GAS")	PRODUCTION	X	STORAGE	DEEP	SHALLOW
LOCATION:	ELEVATION	1,118 - AS BUILT	WATERSHED	OUTLET MIDDLE ISLAND CREEK	
QUADRANGLE	THAMMIDORNE-7.5 (PENNSBORO) 7.5 DISTRICT CENTERVILLE COUNTY TYLER				
SURFACE OWNER	TYRONE L BEEM ET AL. ACREAGE 300 ACRES +/-				
OIL & GAS ROYALTY OWNER	E.G. BEEM; GARY L. HALL; CARL W. ASH; LEASE ACREAGE 317 AC.; 60 AC.; 362.8 AC.; FRANK GRASS ET AL.; CARL W. ASH ET UX; CONRAD E. COSTILOV; 43.78 AC.; 61.26 AC.; 64.42 AC.; JOSEPH E. HESS ET UX; LINDA D. BURC-JETT; MARTHA E. COODEN 94.92 AC.; 178 AC.; 184.95 AC.				
PROPOSED WORK:	DRILL	CONVERT	DRILL DEEPER	X	REDRILL
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 8,800' TWD 18,300' 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 26313				

*Thomas Summers*  
 THOMAS SUMMERS P.S. 2109  
 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.

LATITUDE 39°25'00"

8,165'

2,487' TO BOTTOM HOLE

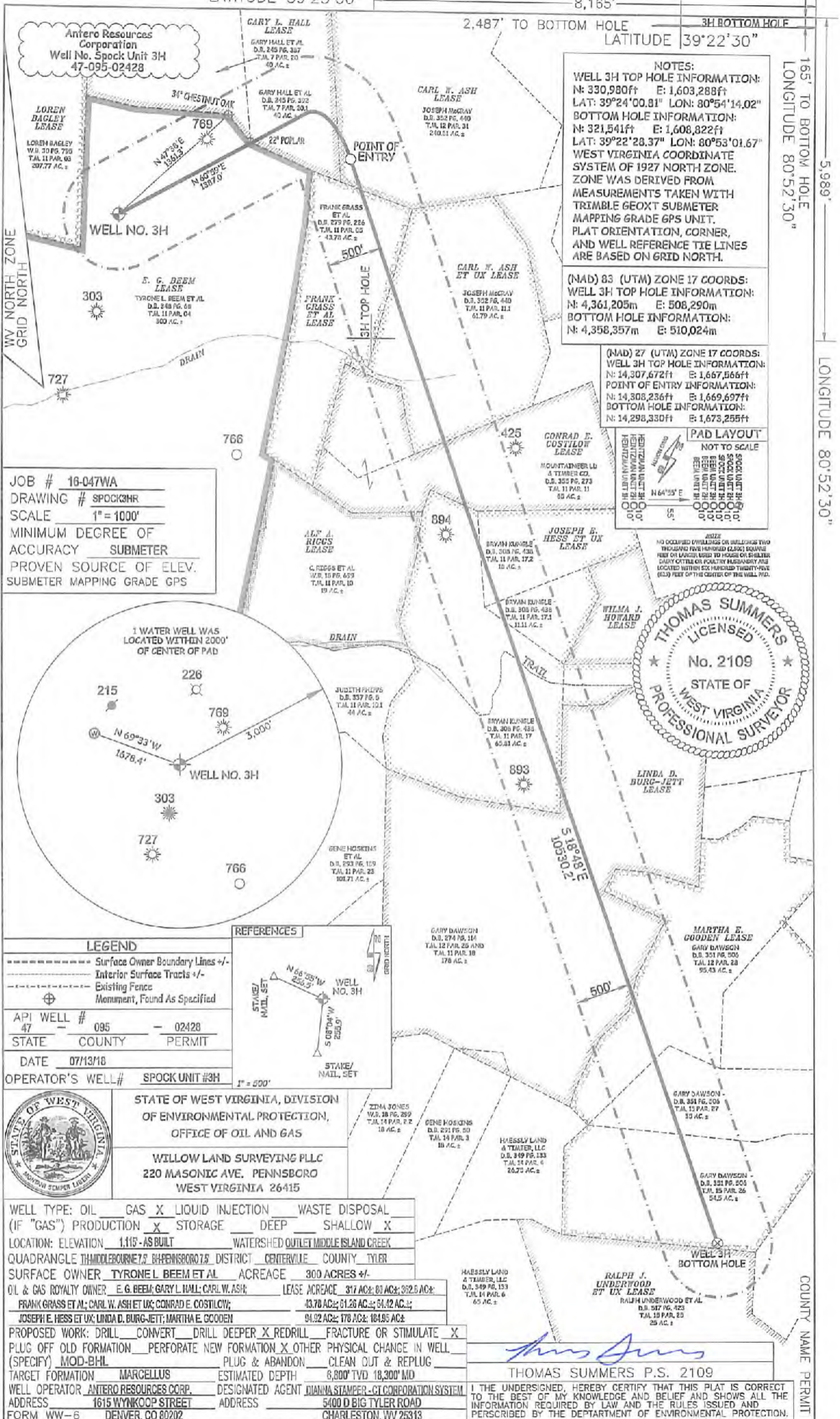
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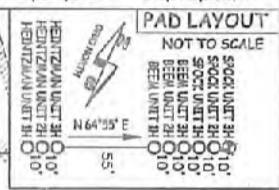


**Antero Resources Corporation**  
Well No. Spock Unit 3H  
47-095-02428

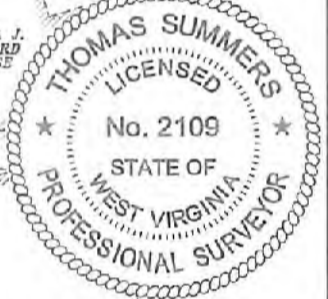
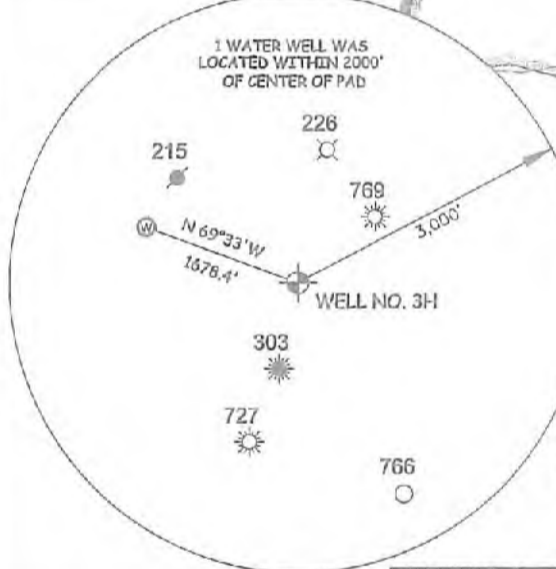
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DRAWING # SPOCK3HR  
SCALE 1" = 1000'  
MINIMUM DEGREE OF ACCURACY SUBMETER  
PROVEN SOURCE OF ELEV. SUBMETER MAPPING GRADE GPS



LEGEND	
---	Surface Owner Boundary Lines +/-
---	Interior Surface Tracts +/-
⊕	Existing Fence Monument, Found As Specified
API WELL #	47 - 095 - 02428
STATE	COUNTY PERMIT
DATE	07/13/16
OPERATOR'S WELL #	SPOCK UNIT #3H



STATE OF WEST VIRGINIA, DIVISION OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS  
WILLOW LAND SURVEYING PLLC  
220 MASONIC AVE. PENNSBORO WEST VIRGINIA 26415

WELL TYPE: OIL \_\_\_ GAS X LIQUID INJECTION \_\_\_ WASTE DISPOSAL \_\_\_  
(IF "GAS") PRODUCTION \_\_\_ STORAGE \_\_\_ DEEP \_\_\_ SHALLOW X  
LOCATION: ELEVATION 1,115' AS BUILT WATERSHED OUTLET MIDDLE ISLAND CREEK  
QUADRANGLE TH MIDDLEBORNE 7 2 2 PENNSBORO 7 2 2 DISTRICT CENTERVILLE COUNTY TYLER  
SURFACE OWNER TYRONEL BEEM ET AL ACREAGE 300 ACRES +/-  
OIL & GAS ROYALTY OWNER E. G. BEEM; GARY L. HALL; CARL W. ASH; LEASE ACREAGE 317 AC; 80 AC; 382.8 AC;  
FRANK GRASS ET AL; CARL W. ASH ET UX; CONRAD E. COSTLOW; 43.78 AC; 61.26 AC; 54.42 AC;  
JOSEPH E. HESS ET UX; LINDA D. BURG-JETT; MARTHA E. COODEN 84.92 AC; 178 AC; 184.95 AC

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



RECEIVED  
Office of Oil and Gas

JUL 17 2018

WV Department of  
Environmental Protection

WW-6A1

JUL 17 2018

Operator's Well Number

Spock Unit 3H

WV Department of  
Environmental Protection

Permit Modification API # 47-095-02428

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>E.G. Beem Lease</u></b>			
E.G. Beem	Warren R. Haught	1/8	213/662
Warren R. Haught	Sancho Oil and Gas Corporation	Assignment	369/506
Sancho Oil and Gas Corporation	Antero Resources Corporation	Assignment	436/177
<b><u>Gary L. Hall Lease</u></b>			
Gary L. Hall	Chesapeake Appalachia LLC	1/8+	373/328
Chesapeake Appalachia LLC	SWN Production Co. LLC	Assignment	465/463
SWN Production Co. LLC	Antero Resources Corporation	Assignment	544/242
<b><u>Carl W. Ash Lease 12-31</u></b>			
Carl W. Ash and Judith Ash	Chesapeake Appalachia LLC	1/8	368/631
Chesapeake Appalachia LLC	SWN Production Co. LLC	Assignment	465/463
SWN Production Co. LLC	Antero Resources Corporation	Assignment	544/242
<b><u>Frank Grass et al Lease</u></b>			
Frank Grass et al	Sancho Oil and Gas Corporation	1/8	335/601
Sancho Oil and Gas Corporation	Antero Resources Corporation	Assignment	436/216
<b><u>Carl W. Ash et ux Lease 11-11.1</u></b>			
Carl W. Ash and Judith Ash	Chesapeake Appalachia LLC	1/8	368/641
Chesapeake Appalachia LLC	SWN Production Company LLC	Assignment	465/463
SWN Production Company LLC	Antero Resources Corporation	Assignment	544/242
<b><u>Conrad E. Costilow Lease</u></b>			
Conrad E. Costilow	Antero Resources Corporation	1/8+	500/645
<b><u>Joseph E. Hess et ux Lease</u></b>			
Joseph E. Hess aka Joseph Elden Hess and Judith C. Hess	Antero Resources Corporation	1/8+	447/625
<b><u>Linda D. Burg-Jett Lease</u></b>			
Linda D. Burg-Jett	Antero Resources Appalachian Corporation	1/8+	400/324
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.

WW-6A1  
(5/13)

Operator's Well No. Spock Unit 3H

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Chapter 22, Article 6A, Section 5(a)(5)  
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Lease Name or Number	Grantor, Lessor, etc.	Grantee, Lessee, etc.	Royalty	Book/Page
<u>Martha E. Gooden Lease</u>	Martha E. Gooden Chesapeake Appalachia LLC SWN Production Company LLC	Chesapeake Appalachia LLC SWN Production Company LLC Antero Resources Corporation	1/8 Assignment Assignment	369/622 465/463 544/242

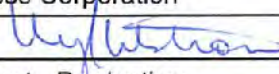
\*Partial Assignments to Antero Resources Corporation include 100% rights to extract, produce and market the oil and gas from the Marcellus and any other formations completed with this well.

**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: SR Vice President - Production

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WV Department of  
Environmental Protection

**FORM WW-6A1  
EXHIBIT 1**

**FILED**

**JUN 10 2013**

Natalie E. Tennant,  
Secretary of State  
1900 Kanawha Blvd E  
Bldg 1, Suite 157-K  
Charleston, WV 25305



Penney Barker, Manager  
Corporations Division  
Tel: (304)558-8000  
Fax: (304)558-8381  
Website: [www.wvssos.com](http://www.wvssos.com)  
E-mail: [business@wvssos.com](mailto:business@wvssos.com)

**APPLICATION FOR  
AMENDED CERTIFICATE  
OF AUTHORITY**

Office Hours: Monday - Friday  
8:30 a.m. - 5:00 p.m. ET

**FILE ONE ORIGINAL**  
(Two if you want a filed  
stamped copy returned to you)  
**FEE: \$25.00**

\*\*\*\* In accordance with the provisions of the West Virginia Code, the undersigned corporation hereby \*\*\*\*  
applies for an Amended Certificate of Authority and submits the following statement:

1. Name under which the corporation was authorized to transact business in WV: Antero Resources Appalachian Corporation
2. Date Certificate of Authority was issued in West Virginia: 6/25/2008
3. Corporate name has been changed to: Antero Resources Corporation  
(Attach one Certified Copy of Name Change as filed in home State of incorporation.)
4. Name the corporation elects to use in WV: Antero Resources Corporation  
(due to home state name not being available)
5. Other amendments: \_\_\_\_\_  
(attach additional pages if necessary)
6. Name and phone number of contact person. (This is optional, however, if there is a problem with the filing, listing a contact person and phone number may avoid having to return or reject the document.)  
Alvyn A. Schopp (303) 367-7310  
Contact Name Phone Number
7. Signature information (See below *\*Important Legal Notice Regarding Signature\**):  
Print Name of Signer: Alvyn A. Schopp Title/Capacity: Authorized Person  
Signature: *Alvyn A. Schopp* Date: June 10, 2013

*\*Important Legal Notice Regarding Signature:* For West Virginia Code §31D-1-129. Penalty for signing false document. Any person who signs a document he or she knows is false in any material respect and knows that the document is to be delivered to the secretary of state for filing is guilty of a misdemeanor and, upon conviction thereof, shall be fined not more than one thousand dollars or confined in the county or regional jail not more than one year, or both.

WW-6B  
(04/15)

API NO. 47-095-02428  
 OPERATOR WELL NO. Spock Unit 3H  
 Well Pad Name: Pyle Run 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 Centerville Middlebourne 7.5'  
 Operator ID County District Quadrangle

2) Operator's Well Number: Spock Unit 3H Well Pad Name: Pyle Run Pad

3) Farm Name/Surface Owner: Tyrone L Beem et al Public Road Access: Bearsville-Mole Hole

4) Elevation, current ground: 1115' 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: 6800' TVD, Anticipated Thickness- 55 feet, Associated Pressure- 2800#

8) Proposed Total Vertical Depth: 6800' TVD

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 18300' MD

11) Proposed Horizontal Leg Length: 10530'

12) Approximate Fresh Water Strata Depths: 301', 332'

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

14) Approximate Saltwater Depths: 674', 1584'

15) Approximate Coal Seam Depths: 811'

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)

API NO. 47-095 - 02428  
OPERATOR WELL NO. Speck Unit 3H  
Well Pad Name: Pyle Run 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#	80'	80'	CTS, 77 Cu. Ft.
Fresh Water	13-3/8"	New	J-55/H-40	54.5#/48#	385' *see #19	385' *see #19	CTS, 535 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2500'	2500'	CTS, 1018 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	18300'	18300'	4625 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	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	Legg-HPOZ & Tail-H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11,200			
Liners							

**PACKERS**

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

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WW-6B  
(10/14)

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WV Department of  
Environmental Protection

Permit Modification API# 47-095-02428

API NO. 47- 095 - 02428

OPERATOR WELL NO. Spock Unit 3H

Well Pad Name: Pyle Run 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.

\*Antero will be air drilling the fresh water string which makes it difficult to determine when freshwater 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): 29.70 acres

22) Area to be disturbed for well pad only, less access road (acres): 10.67 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

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.