



west virginia department of environmental protection

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

Austin Caperton, Cabinet Secretary
www.dep.wv.gov

Monday, October 29, 2018
PERMIT MODIFICATION APPROVAL
Horizontal 6A / Horizontal 6A Well - 1

ANTERO RESOURCES CORPORATION
1615 WYNKOOP STREET

DENVER, CO 80202

Re: Permit Modification Approval for KAREN UNIT 3H
47-085-10216-00-00

Bottom Hole Extension with updated lease(s)

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.

A handwritten signature in blue ink, appearing to read "James A. Martin".

James A. Martin
Chief

Operator's Well Number: KAREN UNIT 3H
Farm Name: LYNWOOD IRELAND
U.S. WELL NUMBER: 47-085-10216-00-00
Horizontal 6A Horizontal 6A Well - 1
Date Modification Issued:

Promoting a healthy environment.

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

1) Well Operator: Antero Resources Corporation | 494488557 | 085 -Ritchie | Union | Pullman 7.5'
Operator ID County District Quadrangle

2) Operator's Well Number: Karen Unit 3H Well Pad Name: Ireland North Pad

3) Farm Name/Surface Owner: Lynwood Ireland et al Public Road Access: CR 9

4) Elevation, current ground: 945.5' 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 50 feet, Associated Pressure 3,000#

8) Proposed Total Vertical Depth: 6800' TVD

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 22900' MD

11) Proposed Horizontal Leg Length: 14771'

12) Approximate Fresh Water Strata Depths: 69', 279', 359'

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

14) Approximate Saltwater Depths: 1451', 1807'

15) Approximate Coal Seam Depths: 343'

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: _____

Michael Daff
8-16-18

WW-6B
(04/15)

API# 47-085-10216 PERMIT MODIFICATION

API NO. 47-085 - 10216

OPERATOR WELL NO. Karen Unit 3H

Well Pad Name: Ireland North 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#	40'	40'	CTS, 38 Cu. Ft.
Fresh Water	13-3/8"	New	J-55/H-40	54.5#/48#	410'	410' *See #19	CTS, 570 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#	22900'	22900'	5889 Cu. Ft
Tubing	2-3/8"	New	N-80	4.7#		7100'	
Liners							

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	Less H/POZ & 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			

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 air drills 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): 28.70 acres

22) Area to be disturbed for well pad only, less access road (acres): 4.09 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:

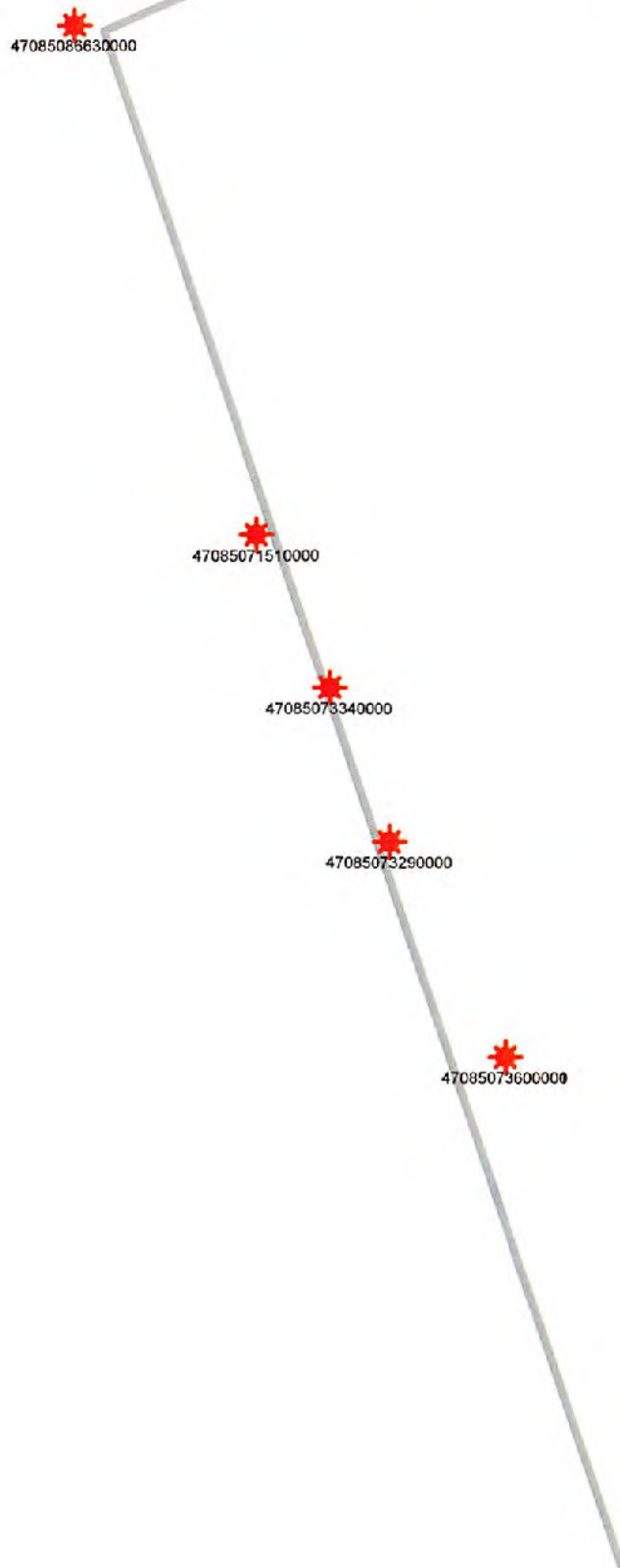
Conductor: blowhole clean with air, run casing, 10 bbls fresh water.

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.



Antero Resources Corporation

Karen East Unit 3H



 WELL SYMBOLS
Gas Well

July 5, 2018

RECEIVED
Office of Oil and Gas
JUL 10 2018
WV Department of
Environmental Protection

API# 47-085-10216 PERMIT MODIFICATION

UWI (API#)	Well Name	Well Number	Operator	Historical Operator	TD	Perforated Interval (shallowest, deepest)	Perforated Formation(s)	Producing Formation(s) not perf'd
47085073600000	VERNON ALLEN E	JK-1158	EASTERN AMERICAN ENE	J & J ENTERPRISES	5975	4306 - 5090	Warren, Speechley, Balltown, Riley, Benson, Elk, Alexander	Big Injun, Weir
47085071510000	IRELAND HEIRS	2	HARPER CROSBY HOLDING	RARE EARTH ENERGY	5720	3130 - 4914	Warren, Speechley, Balltown, Riley, Alexander	Big Injun, Benson, Weir
47085073290000	IRELAND HEIRS	9	HARPER CROSBY HOLDING	RARE EARTH ENERGY	5100	3188 - 4988	Devonian, Warren, Riley, Alexander	Big Injun, Balltown, Benson, Weir
47085073340000	IRELAND HEIRS	8	HARPER CROSBY HOLDING	RARE EARTH ENERGY	5150	3189 - 4977	Speechley, Riley, Benson, Alexander	Big Injun, Weir
47085073600001	FLESHER EARLE & SHIRLEY E	JK-1158	EASTERN AMERICAN ENE	EASTERN AMERICAN ENE	5975	1788 - 2036	Maxton, Little Lime, Big Injun (Grnr), Price Fm and equivs, Greenland Gap Fm, Bradford, Riley, Alexander	Warren, Balltown, Benson, Weir
47085085630000	IRELAND	3	KEY OIL COMPANY	KEY OIL COMPANY	5085	3112 - 4921	Warren, Balltown, Riley, Benson, Alexander	Big Injun, Weir

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 Office of Oil and Gas
 JUL 10 2018
 WV Department of
 Environmental Protection

WW-6A1
(5/13)

Operator's Well No. Karen 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
Delores Wilson Lease				
	Delores Wilson	J.F. Deem	1/8	0212/0715
	J.F. Deem	J.F. Deem Oil & Gas, LLC	Assignment	0228/0230
	J.F. Deem Oil & Gas, LLC	Chesapeake Appalachia, LLC	Assignment	0247/0891
	Chesapeake Appalachia, LLC	Statoilhydro USA Onshore Properties, Inc.	Assignment	0249/0625
	Statoilhydro USA Onshore Properties, Inc	Statoil USA Onshore Properties	Name Change	Exhibit 2
	Statoil USA Onshore Properties	Antero Exchange Properties	Assignment	0301/0194
	Antero Exchange Properties, LLC	Antero Resources Corporation	Merger	0014/0598

*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: Senior Vice President - Production

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Office of Oil and Gas
JUL 10 2018
Department of

INFORMATION SUPPLIED UNDER WEST VIRGINIA CODE
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Grantor, lessor, etc.	Grantee, lessee, etc.	Royalty	Book/Page
<u>Belle Pritchard Lease</u>			
Belle Pritchard	Ritchie A. Ireland	1/8	0077/0019
Ritchie A. Ireland	S.M.Vokel, H.R. Jackson, Sam T. Mallison, & Charles E. Young	Assignment	0080/0386
S.M. Vokel, H.R. Jackson, Sam T. Mallison, & Charles E. Young	Warren Associates, Inc.	Assignment	0126/0464
Warren Associates, Inc.	Haught, Inc.	Assignment	0170/0461
Haught, Inc.	Haught Oil Producing Corporation	Merger	Exhibit 3
Haught Oil Producing Corporation	710 Corporation	Assignment	0180/0791
710 Corporation	Lynwood K. Ireland	Assignment	0204/0553
Lynwood K. Ireland	Antero Resources Appalachian Corporation	*Partial Assignment of Oil & Gas Leases	0255/0652
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>W. P. Ireland, et ux Lease</u>			
W.P. Ireland & L.M. Ireland	M.G. Taylor	1/8	0032/0016
M.G. Taylor	Carnegie Natural Gas Company	Assignment	Recited in 0068/0188
Carnegie Natural Gas Company	Coffman Oil & Gas Company	Assignment	0068/0188
Coffman Oil & Gas Company	United operating Company, Inc.	Assignment	0117/0660
United Operating Company, Inc.	Buttes Resources Company	Assignment	0117/0738
Buttes Resources Company	Earl Stewart	Assignment	0128/0286
Earl Stewart	JCC	Assignment	0205/0483
JCC	Key Oil Company	Assignment	0229/0019
Key Oil Company	Antero Resources Appalachian Corporation	*Partial Assignment of Oil & Gas Leases	0253/0747
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>Joyce E. Webber Lease</u>			
Joyce E. Webber	Antero Resources Appalachian Corporation	1/8+	0254/0999
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>Earl E. Flesher, et al Lease</u>			
Earl E. Flesher, et al	Antero Resources Appalachian Corporation	1/8+	0254/0385
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>Earl E. Flesher Lease</u>			
Earl E. Flesher	Antero Resources Appalachian Corporation	1/8+	0254/0383
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
<u>Elbert Sheets Heirs Lease</u>			
Elbert G. Sheets Heirs	Tower Drilling Corporation	1/8	0128/0308
Tower Drilling Corporation	John R. Umstead	Assignment	0180/0706
John R. Umstead	Solomon Production Company	Assignment	0225/0765
Solomon Production Company	Antero Resources Appalachian Corporation	* Partial Assignment of Oil & Gas Leases	0258/0715
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1

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Office of Oil and Gas
JUL 10 2018
WV Department of Environmental Protection

*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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Grantor, lessor, etc.	Grantee, lessee, etc.	Royalty	Book/Page
Yvonne Joyce Riggleman Lease			
Yvonne Joyce Riggleman	Antero Resources Appalachian Corporation	1/8	0254/0548
Antero Resources Appalachian Corporation	Antero Resources Corporation	Name Change	Exhibit 1
Al G. Kelley Lease			
Al G. Kelley	Carnegie Production Company	1/8	0050/0410
Carnegie Production Company	EQT Production Company	Amendment & Ratification	0252/0385
EQT Production Company	Antero Resources Corporation	Partial Assignment of Oil and Gas Leases	0277/0836

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 JUL 1-0 2018
 WV Department of
 Environmental Protection

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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



Penny Barker, Manager
Corporations Division
Tel: (304)558-8000
Fax: (304)558-8381

Website: www.wvsof.com

E-mail: business@wvsof.com

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

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

APPLICATION FOR
AMENDED CERTIFICATE
OF AUTHORITY

**** 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:

- Name under which the corporation was authorized to transact business in WV: Antero Resources Appalachian Corporation
- Date Certificate of Authority was issued in West Virginia: 6/25/2008
- Corporate name has been changed to: Antero Resources Corporation
(Attach one Certified Copy of Name Change as filed in home State of Incorporation.)
- Name the corporation elects to use in WV: Antero Resources Corporation
(due to home state name not being available)
- Other amendments: (attach additional pages if necessary)
- 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.)

<u>Alvyn A. Schopp</u>	<u>(303) 357-7310</u>
Contact Name	Phone Number
- Signature information (See below Important Legal Notice Regarding Signature):

Print Name of Signer: <u>Alvyn A. Schopp</u>	Title/Capacity: <u>Authorized Person</u>
Signature: <u><i>Alvyn A. Schopp</i></u>	Date: <u>June 10, 2013</u>

***Important Legal Notice Regarding Signature:** Per 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.

State of West Virginia



Certificate

*I, Mac Warner, Secretary of State of the
State of West Virginia, hereby certify that*

an Amended Certificate of Authority of

STATOILHYDRO USA ONSHORE PROPERTIES INC.

was filed in my office as required by the provisions of the West Virginia Code and was found
to conform to law.

Therefore I issue this

CERTIFICATE OF AMENDMENT TO THE CERTIFICATE OF AUTHORITY

changing the name of the corporation to

STATOIL USA ONSHORE PROPERTIES INC.

RECEIVED
Office of Oil and Gas
JUL 10 2018
WV Department of
Environmental Protection



*Given under my hand and the
Great Seal of the State of
West Virginia on this day of
November 30, 2009*

Mac Warner

Secretary of State



*I, Ken Fleckler, Secretary of State of the
State of West Virginia, hereby certify that*
THE FOLLOWING IS A TRUE AND CORRECT COPY OF THE ARTICLES OF MERGER
OF:

HAUGHT, INC., A WEST VIRGINIA CORPORATION AND HAUGHT OIL
PRODUCING CORP., A UTAH CORPORATION DULY SIGNED AND VERIFIED
PURSUANT TO THE PROVISIONS OF SECTION 38, ARTICLE 1, CHAPTER
31 OF THE CODE OF WEST VIRGINIA, 1931, AS AMENDED, HAVE
BEEN RECEIVED AND ARE FOUND TO CONFORM TO LAW.

ACCORDINGLY, I HEREBY ISSUE THIS CERTIFICATE OF MERGER, MERGING
HAUGHT, INC., WITH AND INTO HAUGHT OIL PRODUCING CORP., THE
SURVIVOR AND ATTACH A DUPLICATE ORIGINAL OF SAID ARTICLES
OF MERGER AS APPEARS FROM THE RECORDS OF MY SAID OFFICE.

*Given under my hand and the
Great Seal of the State of
West Virginia, on this*

TWELFTH day of

JANUARY 19 87

Ken Fleckler

Secretary of State.



RECEIVED
Office of Oil and Gas
JUL 1 2018
WV Department of
Environmental Protection

LATITUDE 39°12'30"

6,890'

LATITUDE 39°10'00" 2,919' TO BOTTOM HOLE

LONGITUDE 80°52'30"

12.127' TO BOTTOM HOLE

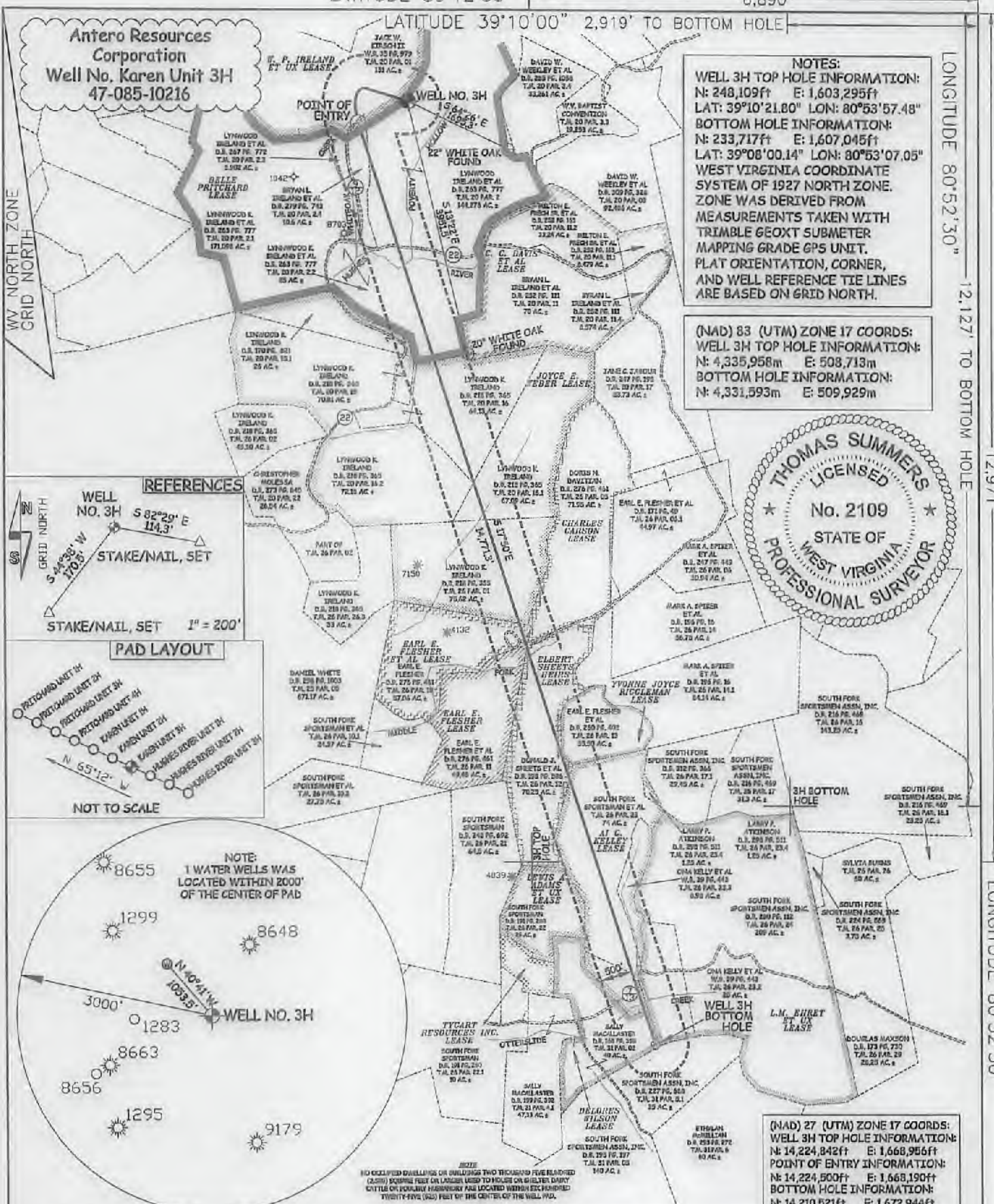
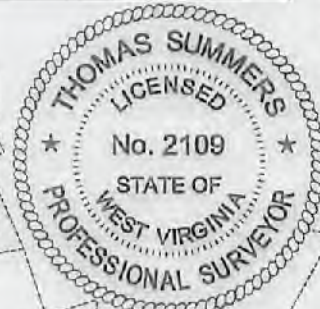
12.971'

LONGITUDE 80°52'30"

Antero Resources Corporation
Well No. Karen Unit 3H
47-085-10216

NOTES:
WELL 3H TOP HOLE INFORMATION:
N: 248,109ft E: 1,603,295ft
LAT: 39°10'21.80" LON: 80°53'57.48"
BOTTOM HOLE INFORMATION:
N: 233,717ft E: 1,607,045ft
LAT: 39°08'00.14" LON: 80°53'07.05"
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.

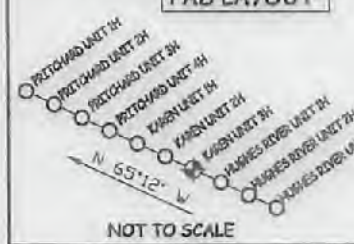
(NAD) 83 (UTM) ZONE 17 COORDS:
WELL 3H TOP HOLE INFORMATION:
N: 4,335,958m E: 508,713m
BOTTOM HOLE INFORMATION:
N: 4,331,593m E: 509,929m



REFERENCES



PAD LAYOUT



NOT TO SCALE



NOTE: 1 WATER WELLS WAS LOCATED WITHIN 2000' OF THE CENTER OF PAD

NO OCCUPIED DWELLINGS OR BUILDINGS TWO THOUSAND FIVE HUNDRED (2,000) FEET OR LONGER ADJACENT TO HOLES OR SHELTER BARRY COTTLE OR FORMERLY HABITABLE ARE LOCATED WITHIN EXHIBITED TWENTY-FIVE (25) FEET OF THE CENTER OF THE WELL PAD.

(NAD) 27 (UTM) ZONE 17 COORDS:
WELL 3H TOP HOLE INFORMATION:
N: 14,224,842ft E: 1,668,956ft
POINT OF ENTRY INFORMATION:
N: 14,224,500ft E: 1,668,190ft
BOTTOM HOLE INFORMATION:
N: 14,210,521ft E: 1,672,944ft

JOB # 14-127WA
DRAWING # KARENHR3
SCALE 1" = 200'
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

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 +/-
--- Existing Fence
⊕ Found monument, as noted

THOMAS SUMMERS P.S. 2109
DATE 06/26/18
OPERATOR'S WELL# KAREN UNIT#3H

WELL TYPE: OIL GAS X LIQUID INJECTION WASTE DISPOSAL
(IF "GAS") PRODUCTION X STORAGE DEEP SHALLOW X
LOCATION: ELEVATION 945.5' AS BUILT WATERSHED SOUTH FORK HUGHES RIVER
QUADRANGLE PULLMAN 7.5 DISTRICT UNION COUNTY RITCHIE
SURFACE OWNER LYNWOOD IRELAND ET AL ACREAGE 144.276 ACRES +/-
OIL & GAS ROYALTY OWNER BELLE PRITCHARD; W. P. IRELAND ET UX; LEASE ACREAGE 415 AC±; 222 AC±
JOYCE E. WEBER; EARL E. FLESHER ET AL; EARL E. FLESHER; ELBERT SHEETS HEIRS; 445.87 AC±; 57 AC±; 82 AC±; 70.25 AC±;
YVONNE JOYCE RIGGLEMAN; AI G. KELLEY; DELORES WILSON 35.5 AC±; 100 AC±; 40 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
TARGET FORMATION MARCELLUS ESTIMATED DEPTH 6,800' TVD 22,900' MD
WELL OPERATOR ANTERO RESOURCES CORP. DESIGNATED AGENT DIANNA STAMPER
ADDRESS 1615 WYNKOOP STREET ADDRESS 5400 D BIG TYLER ROAD
FORM WW-6 DENVER, CO 80202 CHARLESTON, WV 25313

COUNTY NAME PERMIT

LATITUDE 39°12'30"

6,890'

LATITUDE 39°10'00" 2,919' TO BOTTOM HOLE

LONGITUDE 80°52'30"

12,127' TO BOTTOM HOLE

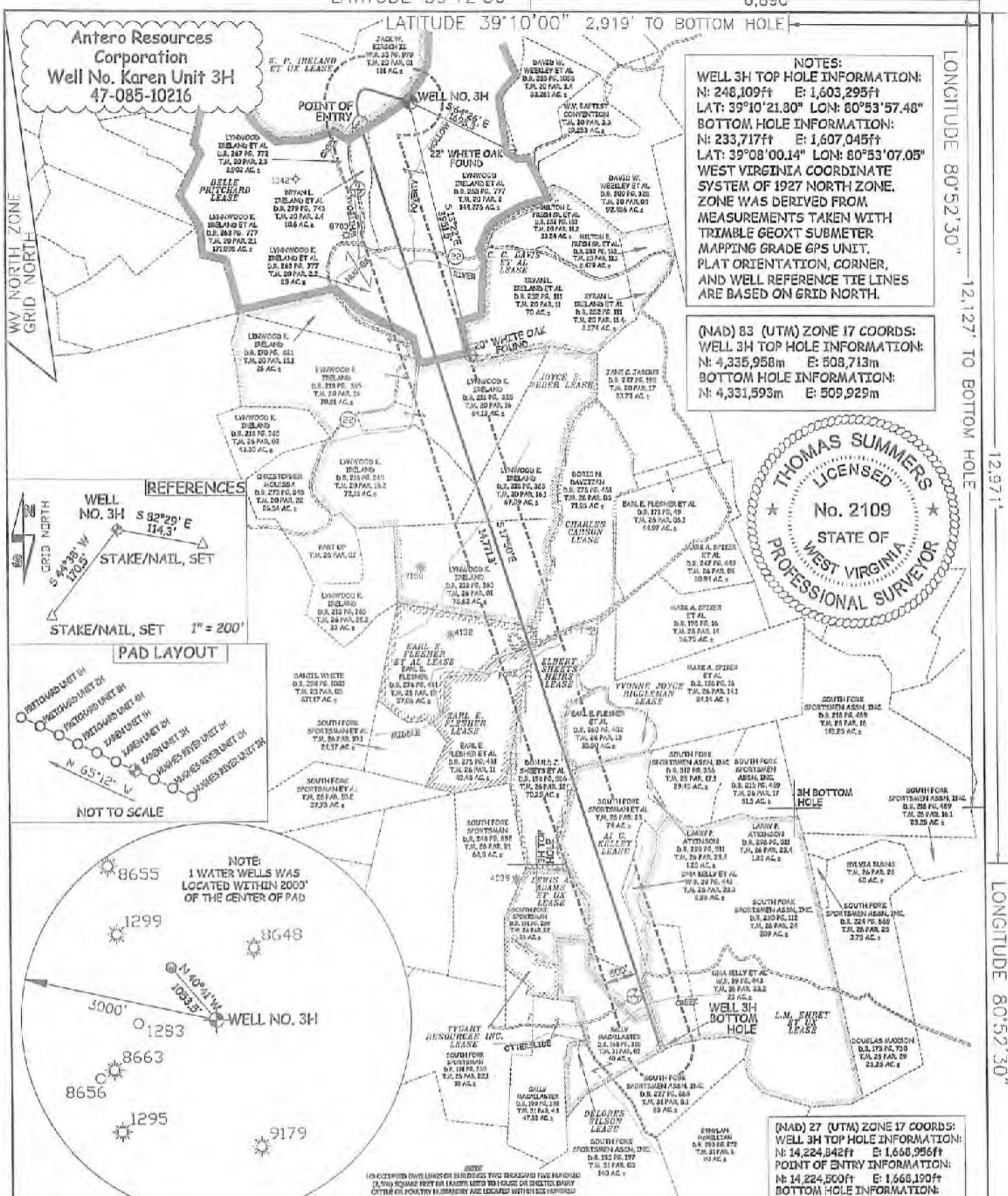
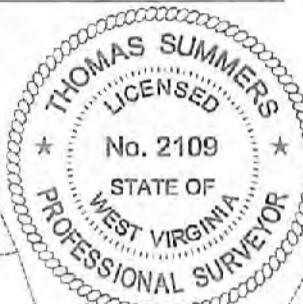
12,971'

LONGITUDE 80°52'30"

Antero Resources Corporation
Well No. Karen Unit 3H
47-085-10216

NOTES:
WELL 3H TOP HOLE INFORMATION:
N: 248,109ft E: 1,603,295ft
LAT: 39°10'21.80" LON: 80°53'57.48"
BOTTOM HOLE INFORMATION:
N: 233,717ft E: 1,607,045ft
LAT: 39°08'00.14" LON: 80°53'07.05"
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.

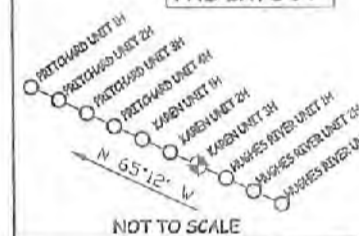
(NAD) 83 (UTM) ZONE 17 COORDS:
WELL 3H TOP HOLE INFORMATION:
N: 4,335,958m E: 508,713m
BOTTOM HOLE INFORMATION:
N: 4,331,593m E: 509,929m



REFERENCES



PAD LAYOUT



NOTE:
1 WATER WELLS WAS LOCATED WITHIN 2000' OF THE CENTER OF PAD



NOTE:
NO COUNTRYSIDE OWNERS OR BUILDINGS TWO THOUSAND FIVE HUNDRED (2,500) SQUARE FEET OR LARGER USED TO HOUSE OR OPERATE DAILY OFFICE OR POLYTRIP IN REMOTE ARE LOCATED WITHIN ONE HUNDRED TWENTY-FIVE (125) FEET OF THE CENTER OF THE WELL PAD.

JOB # 14-127WA
DRAWING # KAREN3HR3
SCALE 1" = 2000'
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

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 +/-
----- Existing Fence
----- Found monument, as noted
THOMAS SUMMERS P.S. 2109
DATE 06/26/18
OPERATOR'S WELL # KAREN UNIT #3H

WELL TYPE: OIL ___ GAS X LIQUID INJECTION ___ WASTE DISPOSAL ___
(IF "GAS") PRODUCTION X STORAGE ___ DEEP ___ SHALLOW X
LOCATION: ELEVATION 945.5' AS BUILT WATERSHED SOUTH FORK HUGHES RIVER
QUADRANGLE PULLMAN 7.5' DISTRICT UNION
SURFACE OWNER LYNWOOD IRELAND ET AL
OIL & GAS ROYALTY OWNER BELLE PRITCHARD; W. P. IRELAND ET UX;
JOYCE E. WEBER; EARL E. FLESHER ET AL; EARL E. FLESHER; ELBERT SHEETS HEIRS;
YVONNE JOYCE RIGGLEMAN; AI G. KELLEY; DELORES WILSON
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 ___
TARGET FORMATION MARCELLUS ESTIMATED DEPTH 6,800' TVD 22,900' MD
WELL OPERATOR ANTERO RESOURCES CORP. DESIGNATED AGENT DIANNA STAMPER
ADDRESS 1615 WYNKOOP STREET ADDRESS 5400 D BIG TYLER ROAD
FORM WW-6 DENVER, CO 80202 CHARLESTON, WV 25313

API WELL # 47 - 085 - 10216
STATE COUNTY PERMIT
COUNTY RITCHIE
ACREAGE 144.276 ACRES +/-
LEASE ACREAGE 415 AC +/- 222 AC +/-
445.67 AC +/- 57 AC +/- 82 AC +/- 70.25 AC +/-
35.5 AC +/- 100 AC +/- 40 AC +/-
PERMIT

COUNTY NAME PERMIT

WEST VIRGINIA COUNTY MAP



APPROVED WVDEP OOG 6/27/2017

Ireland North Site

As-Built Antero Resources Corporation Ritchie County Union District Latitude 39.172824° Longitude -80.899096°

White Oak Creek - South Fork Hughes River Watershed

Pertinent Site Information Ireland North Site Emergency Number: 204-559-5770 Union District: Ritchie County, WV Watershed: White Oak Creek Watershed 511 Address: 4392 Oakwood Rd West Union, WV 26421 Antero Resources Franchise Number: 6048378-1372

Table with 4 columns: Property, Area, Acres, and other metrics. Includes a summary row at the bottom.

Table with 3 columns: Location, Coordinates, and other site details.

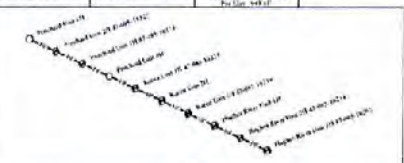


Table with 4 columns: Property, Area, Acres, and other metrics. Includes a summary row at the bottom.



As-Built Detailed Area table with 4 columns: Property, Area, Acres, and other metrics.

Table with 4 columns: Property, Area, Acres, and other metrics.

Table with 4 columns: Property, Area, Acres, and other metrics.

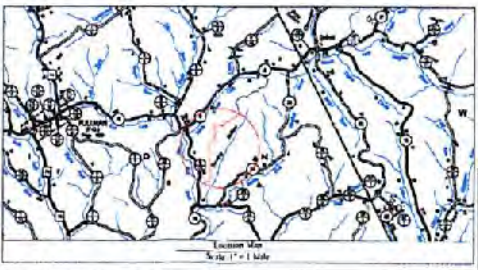
Project Contacts: Name, Address, Phone, Email, etc.



Table with 2 columns: Site Location (RAD 27) and Site Location (RAD 82). Includes coordinates and other data.

Speech Bank

From US E. 26, turn east WV-79 South. Follow W to N South for 1.4 mi. Turn left onto Co #117 Main St. Follow Co #117 for 4.5 mi. Turn right onto Potters Run Rd (Site Entrance).



Signature and date of the surveyor.

Table with 2 columns: Sheet and Description. Lists various sheets and their contents.

MISS VITALITY OF WEST VIRGINIA 1-800-244-4488



Table with 2 columns: Flood Hazard Conditions and other details.



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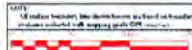
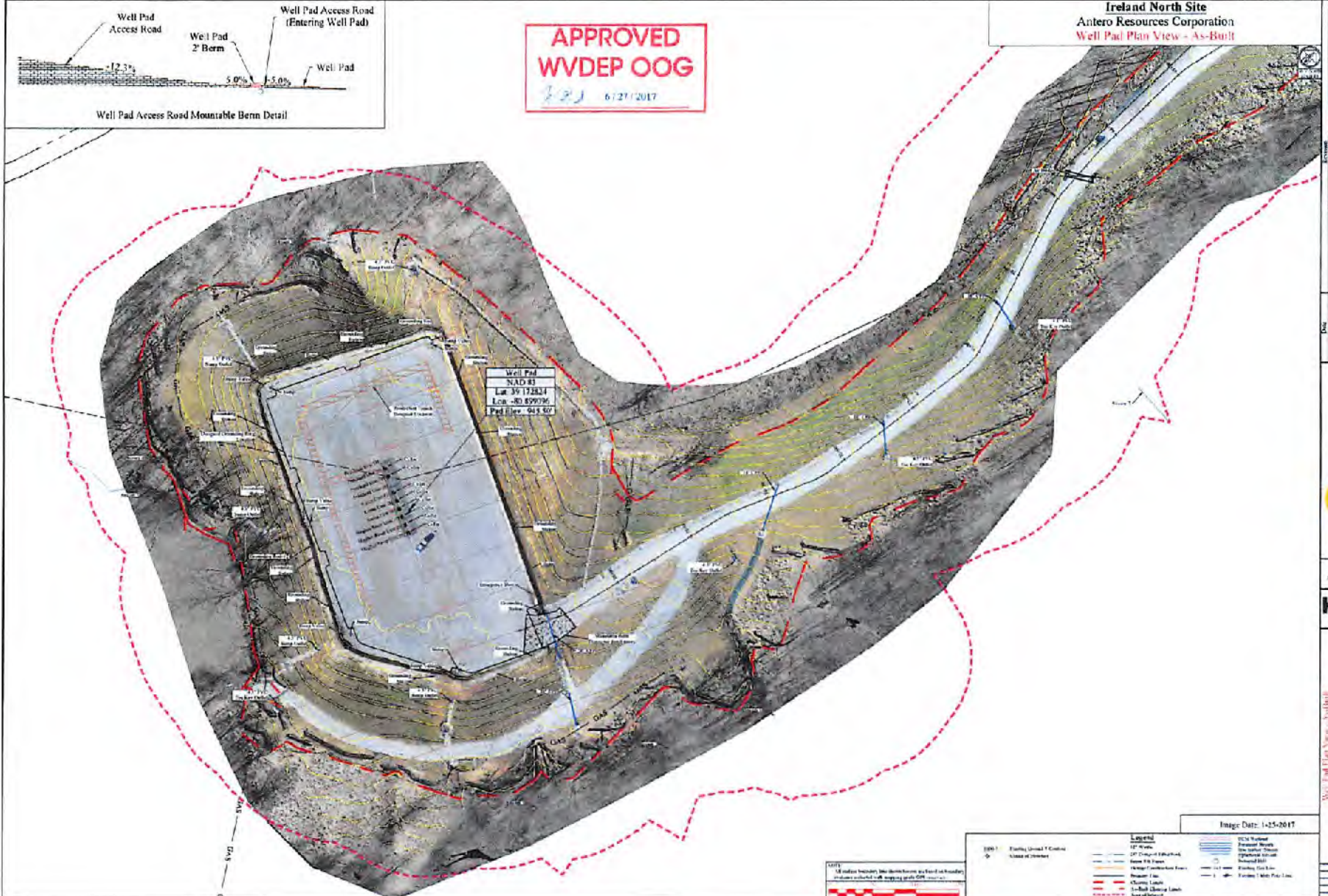
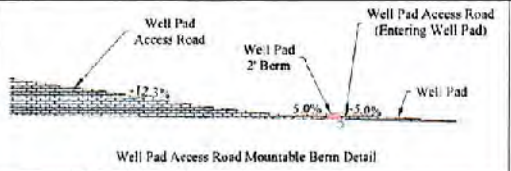
Union District: Ritchie County, WV

Ireland North Site

Job: 12-05-011, Scale: As Shown, Drawn by: BK, Date: 6/27/17, Sheet: 1 of 1

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WVDEP OOG
 6/27/2017

Ireland North Site
 Antero Resources Corporation
 Well Pad Plan View - As-Built



Legend

100'	Existing Under-T-C Centerline	UTM Contour	UTM Contour (10m Interval)	UTM Contour (5m Interval)	UTM Contour (2m Interval)
	Under-T-C Centerline	Access Road	Access Road	Access Road	Access Road
		Well Pad	Well Pad	Well Pad	Well Pad
		Well Pad	Well Pad	Well Pad	Well Pad
		Well Pad	Well Pad	Well Pad	Well Pad

Image Date: 1-25-2017



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K&S Engineering

Ireland North Site
 Boone District
 Boone County, WV

Drawn: EAS/MLK
 Checked: JLS/SJS
 Date Plotted: 6/27/17
 Map 2017



July 9th, 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 57th Street
Charleston, WV 25304

Ms. Adkins:

Antero Resources Corporation (Antero) would like to submit the following permit modification for five approved wells on the Ireland North Pad. We are requesting to change the bottom hole locations of the Karen Unit 1H (API# 47-085-10215), Karen Unit 3H (API# 47-085-10216), Hughes River Unit 2H (API# 47-085-10214), Hughes River Unit 3H, (API# 47-085-10265) and Pritchard Unit 2H (API# 47-085-10323).

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) 357-7233.

Thank you in advance for your consideration.

Sincerely,

A handwritten signature in black ink, appearing to read "Karin Cox".

Karin Cox
Permitting Agent
Antero Resources Corporation

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WV Department of
Environmental Protection

Enclosures

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

1) Well Operator: Antero Resources Corporation Operator ID: 494488557 County: 085 -Ritchie District: Union Quadrangle: Pullman 7.5'

2) Operator's Well Number: Karen Unit 3H Well Pad Name: Ireland North Pad

3) Farm Name/Surface Owner: Lynwood Ireland et al Public Road Access: CR 9

4) Elevation, current ground: 945.5' 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 50 feet, Associated Pressure 3,000#

8) Proposed Total Vertical Depth: 6800' TVD

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 22900' MD

11) Proposed Horizontal Leg Length: 14771'

12) Approximate Fresh Water Strata Depths: 69', 279', 359'

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

14) Approximate Saltwater Depths: 1451', 1807'

15) Approximate Coal Seam Depths: 343'

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

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

WV Department of Environmental Protection

18)

CASING AND TUBING PROGRAM

TYPE	<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#	40'	40'	CTS, 38 Cu. Ft.
Fresh Water	13-3/8"	New	J-55/H-40	54.5#/48#	410'	410' *See #19	CTS, 570 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#	22900'	22900'	5889 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7100'	
Liners							

TYPE	<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	Lead-H/POZ & Tail - H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11,200			
Liners							

VOID

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 air drills 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): 28.70 acres

22) Area to be disturbed for well pad only, less access road (acres): 4.09 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.

VOID

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

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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.