

06/14/2019



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

Thursday, June 13, 2019
PERMIT MODIFICATION APPROVAL
Horizontal 6A / New Drill

ANTERO RESOURCES CORPORATION
1615 WYNKOOP STREET

DENVER, CO 80202

Re: Permit Modification Approval for HENNESSY UNIT 1H
47-095-02577-00-00

Lateral Extension

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 written over the printed name and title.

Operator's Well Number: HENNESSY UNIT 1H
Farm Name: ANTERO MIDSTREAM LLC
U.S. WELL NUMBER: 47-095-02577-00-00
Horizontal 6A New Drill
Date Modification Issued: June 13, 2019

Promoting a healthy environment.

WW-6B
(04/15)

API NO. 47-095 - 02577 **06/14/2019**
 OPERATOR WELL NO. Hennessy Unit 1H
 Well Pad Name: Ferrell 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 Ellsworth Middlebourne 7.5'
 Operator ID County District Quadrangle

2) Operator's Well Number: Hennessy Unit 1H Well Pad Name: Ferrell Pad

3) Farm Name/Surface Owner: Antero Resources Midstream Public Road Access: CR 7

4) Elevation, current ground: 757' 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: 6500' TVD, Anticipated Thickness- 55 feet, Associated Pressure- 2850#

8) Proposed Total Vertical Depth: 6500' TVD

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 16400' MD

11) Proposed Horizontal Leg Length: 8678'

12) Approximate Fresh Water Strata Depths: 194', 222', 243'

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

14) Approximate Saltwater Depths: 1224', 1347'

15) Approximate Coal Seam Depths: 770'

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: _____

WW-6B
(04/15)

API NO. 47-095 - 02577 **06/14/2019**

OPERATOR WELL NO. Hennessy Unit 1H

Well Pad Name: Ferrell Pad

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#	80	80	CTS, 77 Cu. Ft.
Fresh Water	13-3/8"	New	J-55	54.5#	300	300	CTS, 417 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2500	2500	CTS, 1018 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	23#	16400	16400	CTS, 4102 Cu. Ft
Tubing	2-3/8"	New	N-80	4.7#			
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	20"	24"	0.438"	1530	50	Class A	~1.18
Fresh Water	13-3/8"	17-1/2"	0.38"	2730	1000	Class A	~1.18
Coal	9-5/8"	12-1/4"	0.352"	3520	1500	Class A	~1.18
Intermediate							
Production	5-1/2"	8-3/4" & 8-1/2"	0.415"	12,630	2500	Lead-H/POZ & Tail - H	H/POZ~1.44 & H~1.8
Tubing	2-3/8"	4.778"	0.19"	11,200			
Liners							

PACKERS

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

WW-6B
(10/14)

API NO. 47- 095 - 02577 **06/14/2019**

OPERATOR WELL NO. Hennessy Unit 1H

Well Pad Name: Ferrell 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.

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): 38.20 acres

22) Area to be disturbed for well pad only, less access road (acres): 10.78 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.

06/14/2019

WW-6A1

Operator's Well Number Hennessy Unit 1H

INFORMATION SUPPLIED UNDER WEST VIRGINIA CODE
Chapter 22, Article 6A, Section 5(a)(5)
IN LIEU OF FILING LEASE(S) AND OTHER CONTINUING CONTRACT(S)

Under the oath required to make the verification on page 1 of this Notice and Application, I depose and say that I am the person who signed the Notice and Application for the Applicant, and that –

(1) the tract of land is the same tract described in this Application, partly or wholly depicted in the accompanying plat, and described in the Construction and Reclamation Plan;

(2) the parties and recordation data (if recorded) for lease(s) or other continuing contract(s) by which the Applicant claims the right to extract, produce or market the oil or gas are as follows:

Grantor, lessor, etc.	Grantee, lessee, etc.	Royalty	Book/Page
<u>Larry R. Henthorn et ux Lease</u> Larry R. Henthorn et ux	Antero Resources Corporation	1/8+	0579/0847
<u>Richard L. Clark Lease</u> Richard L. Clark	Antero Resources Corporation	1/8+	0583/0544
<u>John P.L. Hennessy Lease</u> John P.L. Hennessy Statoil USA Onshore Properties Inc Equinor USA Onshore Properties Inc	Statoil USA Onshore Properties Inc Equinor USA Onshore Properties Inc Antero Resources Corporation	1/8 Affidavit Agreement	0466/0364 0604/0703 0639/0677
<u>J. Howard Hassig & Teresa Hassig Lease</u> J. Howard Hassig & Teresa Hassig Chesapeake Appalachia LLC SWN Production Company Antero Exchange Properties LLC	Chesapeake Appalachia LLC SWN Production Company Antero Exchange Properties LLC Antero Resources Corporation	1/8 Assignment Assignment Merger	0368/0649 0465/0463 0544/0242 0552/0315
<u>Joseph W. Anderson Lease</u> Joseph W. Anderson	Antero Resources Corporation	1/8	0563/0581
<u>Robert Earl Pitts Lease</u> Robert Earl Pitts Chesapeake Appalachia LLC Statoil USA Onshore Properties Inc Antero Exchange Properties LLC	Chesapeake Appalachia LLC Statoil USA Onshore Properties Inc Antero Exchange Properties LLC Antero Resources Corporation	1/8+ Assignment Assignment Merger	0379/0356 0390/0056 0544/0291 0552/0315
<u>Hilda Steen Lease</u> Hilda Steen	Antero Resources Corporation	1/8+	0589/0333

06/14/2019

WW-6A1
(5/13)Operator's Well No. Hennessy Unit 1H

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- (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>Larry Allen Anderson Lease</u>	Larry Allen Anderson Triad Hunter LLC	Triad Hunter LLC Antero Resources Corporation	1/8 Assignment	0380/0107 0573/0012

*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 CorporationBy: Kevin KilstromIts: Senior Vice President - Production

FORM WV-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



Fenney Baker, Manager
Corporations Division
Tel: (304)558-8000
Fax: (304)558-4381
Website: www.wvscod.com
E-mail: business@wvscod.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 Appalachia 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)

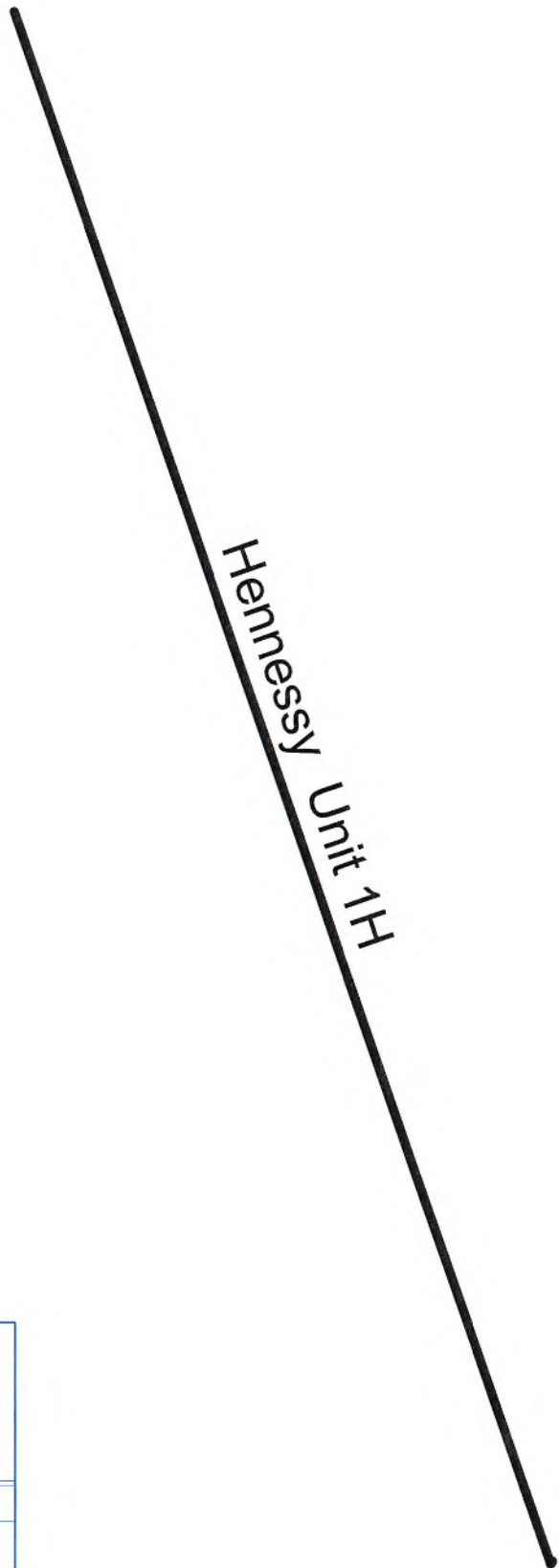
6. Name and phone number of contact person. (This is optional; however, if there is a problem with the filing, listing a contact person and phone number may avoid having to return or reject the document.)

Alvyn A. Schopp (304) 357-7310
Contact Name Phone Number

7. Signature information (See below **Important Legal Notice Regarding Signatures**):

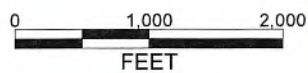
Print Name of Signer: Alvyn A. Schopp Title/Capacity: Authorized Person
Signature: [Handwritten Signature] Date: June 10, 2013

Important Legal Notice Regarding Signatures For West Virginia Code §11D-1-12b. 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.



Antero Resources Corporation

Hennessy Unit 1H



REMARKS
No Wells of Interest

October 18, 2018

**Antero Resources Well
No. Hennessy Unit 1H**

Antero Resources Corporation

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 prescribed by the Department of Environmental Protection.

Bradley D. Miller, P.S. 2167

35	13/3.4	Carpenter	415/733	7.505
34	13/3.3	Mathisen	349/563	70.509
33	14/12	Evans	491/331	2.58
32	14/28	Evans	491/331	2.00
31	14/29	Boor Family Trust	478/280	26.00
30	13/5.1	Scales	342/553	2.00
29	13/2	Evans	113/6	35.00
28	13/6	Ball	387/671	21.42
27	20/34	Haught	344/268	7.75
26	20/2	Anderson	282/506	68.05
25	20/12	Steen	264/127	39.76
24	20/12.4	Keller	282/435	4.493
23	20/12.5	Haught	343/731	2.00
22	20/12.1	Nuss	411/206	0.75
21	20/12.3	Nuss	366/467	0.19
20	20/15	Mason	388/834	0.37
19	20/36.1	Wagner	329/366	0.37
18	20/36	Tucker	8/210	0.45
17	20/39	Rymer	219/287	36.40
16	20/38	Rymer	219/287	28.744
15	13/3.1	Owens	350/388	13.919
14	20/37.1	Moore	360/656	1.45
13	20/37.4	Thacker, et al	395/843	4.437
12	20/37.2	Wolf	362/386	4.56
11	20/37	Thacker, et al	443/643	8.892
10	20/37.3	Wolf	384/321	4.095
9	20/83.2	Helmick	311/390	0.545
8	20/83.6	Hall	WB40/335	30.034
7	20/83.7	Helmick	400/592	30.353
6	20/83	Helmick	WB40/335	99.413
5	20/98.1	Brookover	353/386	2.576
4	20/98.2	Price	417/303	10.493
3	20/97	Moore	314/699	66.84
2	26/2	Moore	314/701	63.40
1	26/3	Moore, et al	448/216	63.02
ID	TMP/Par	Owner	Bk/Pg	Acres



Lease	Owner
A	Thomas & Cynthia H. Hall
B	Larry Steven & Diane Helmick
C	Samuel M. Brookover
D	Martha Jean Tucker
E	Thomas J. Wagner
F	Jack J. Mason
G	J.C. & Barbara Nuss
H	Michael P. & Deborah G. Haught
J	Hilda Steen
K	Hilda Steen
L	Phyllis Roth Tobias
M	Richard J. Mathisen & Lisa M. Beane
N	Richard A. Scale

Notes:
West Virginia Coordinate System of 1927, North Zone based upon Differential GPS Measurements.
Well No. Hennessy Unit 1H Top Hole coordinates are
N: 357,321.47' Latitude: 39°28'20.56"
E: 1,599,579.92' Longitude: 80°55'06.54"
Bottom Hole coordinates are
N: 366,238.62' Latitude: 39°29'48.25"
E: 1,596,795.81' Longitude: 80°55'43.85"
UTM Zone 17, NAD 1983
Top Hole Coordinates Bottom Hole Coordinates
N: 4,369,210.865m N: 4,371,913.327m
E: 507,026.035m E: 506,132.491m
Plat orientation and corner and well references are based upon the grid north meridian.
Well location references are based upon the magnetic meridian.

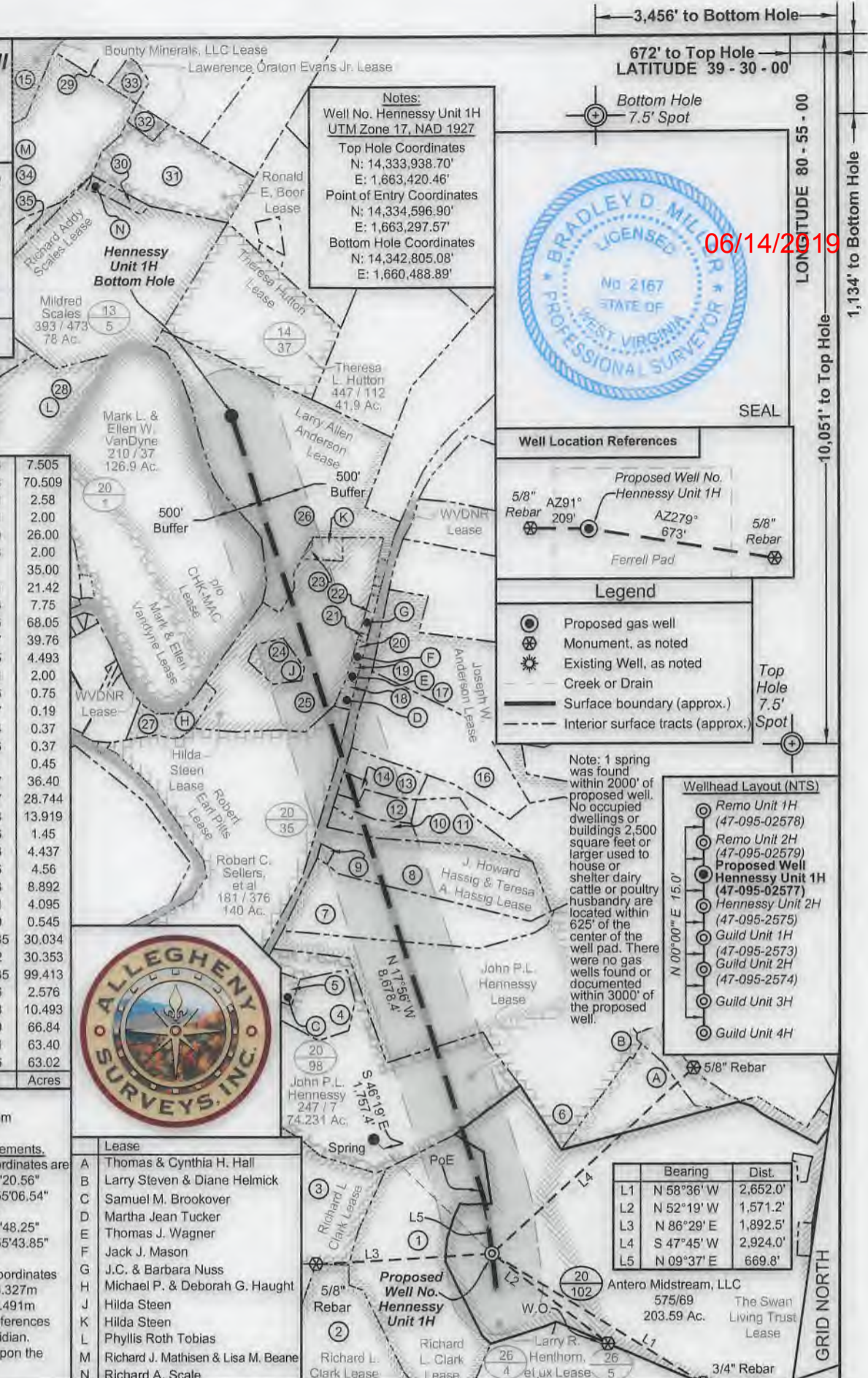
FILE NO: 16-54-E-17
DRAWING NO: Hennessy 1H Well Plat
SCALE: 1" = 1500'
MINIMUM DEGREE OF ACCURACY: Submeter
PROVEN SOURCE OF ELEVATION: WVDOT, Harrisville, WV

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
OIL AND GAS DIVISION

DATE: May 13 20 19
OPERATOR'S WELL NO. Hennessy Unit 1H
API WELL NO
47 - 095 - 02577
STATE COUNTY PERMIT

WELL TYPE: OIL GAS LIQUID INJECTION WASTE DISPOSAL
(IF GAS) PRODUCTION: STORAGE DEEP SHALLOW
LOCATION: ELEVATION: As-Built 757' WATERSHED: Outlet Middle Island Creek QUADRANGLE: Middlebourne-SHL Paden City-BHL
DISTRICT: Ellsworth COUNTY: Tyler
SURFACE OWNER: Antero Midstream, LLC ACREAGE: 203.59
ROYALTY OWNER: West Virginia Division of Natural Resources; Richard L. Clark; Hilda Steen LEASE NO: ACREAGE: 109.14; 99.413
PROPOSED WORK: DRILL CONVERT DRILL DEEPER FRACTURE OR STIMULATE PLUG OFF OLD FORMATION
 PERFORATE NEW FORMATION OTHER PHYSICAL CHANGE IN WELL (SPECIFY) BHL Mod
 PLUG AND ABANDON CLEAN OUT AND REPLUG TARGET FORMATION: Marcellus Shale ESTIMATED DEPTH: 6,500' TVD 16,400' MD

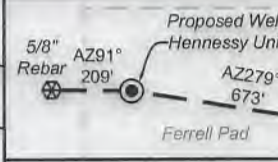
WELL OPERATOR: Antero Resources Corporation DESIGNATED AGENT: Dianna Stamper - CT Corporation System
ADDRESS: 1615 Wynkoop Street ADDRESS: 5400 D Big Tyler Road
Denver, CO 80202 Charleston, WV 25313



Notes:
Well No. Hennessy Unit 1H
UTM Zone 17, NAD 1927
Top Hole Coordinates
N: 14,333,938.70'
E: 1,663,420.46'
Point of Entry Coordinates
N: 14,334,596.90'
E: 1,663,297.57'
Bottom Hole Coordinates
N: 14,342,805.08'
E: 1,660,488.89'



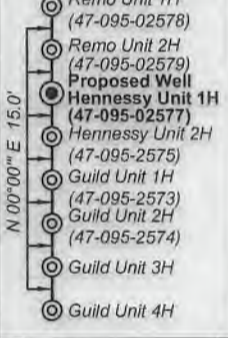
Well Location References



Legend

- Proposed gas well
- Monument, as noted
- Existing Well, as noted
- Creek or Drain
- Surface boundary (approx.)
- Interior surface tracts (approx.)

Wellhead Layout (NTS)



Bearing	Dist.
L1 N 58°36' W	2,652.0'
L2 N 52°19' W	1,571.2'
L3 N 86°29' E	1,892.5'
L4 S 47°45' W	2,924.0'
L5 N 09°37' E	669.8'

3,456' to Bottom Hole

672' to Top Hole
LATITUDE 39 - 30 - 00

Bottom Hole
7.5' Spot

LONGITUDE 80 - 55 - 00

1,134' to Bottom Hole

10,051' to Top Hole

06/14/2019

SEAL

Top Hole
7.5'
Spot

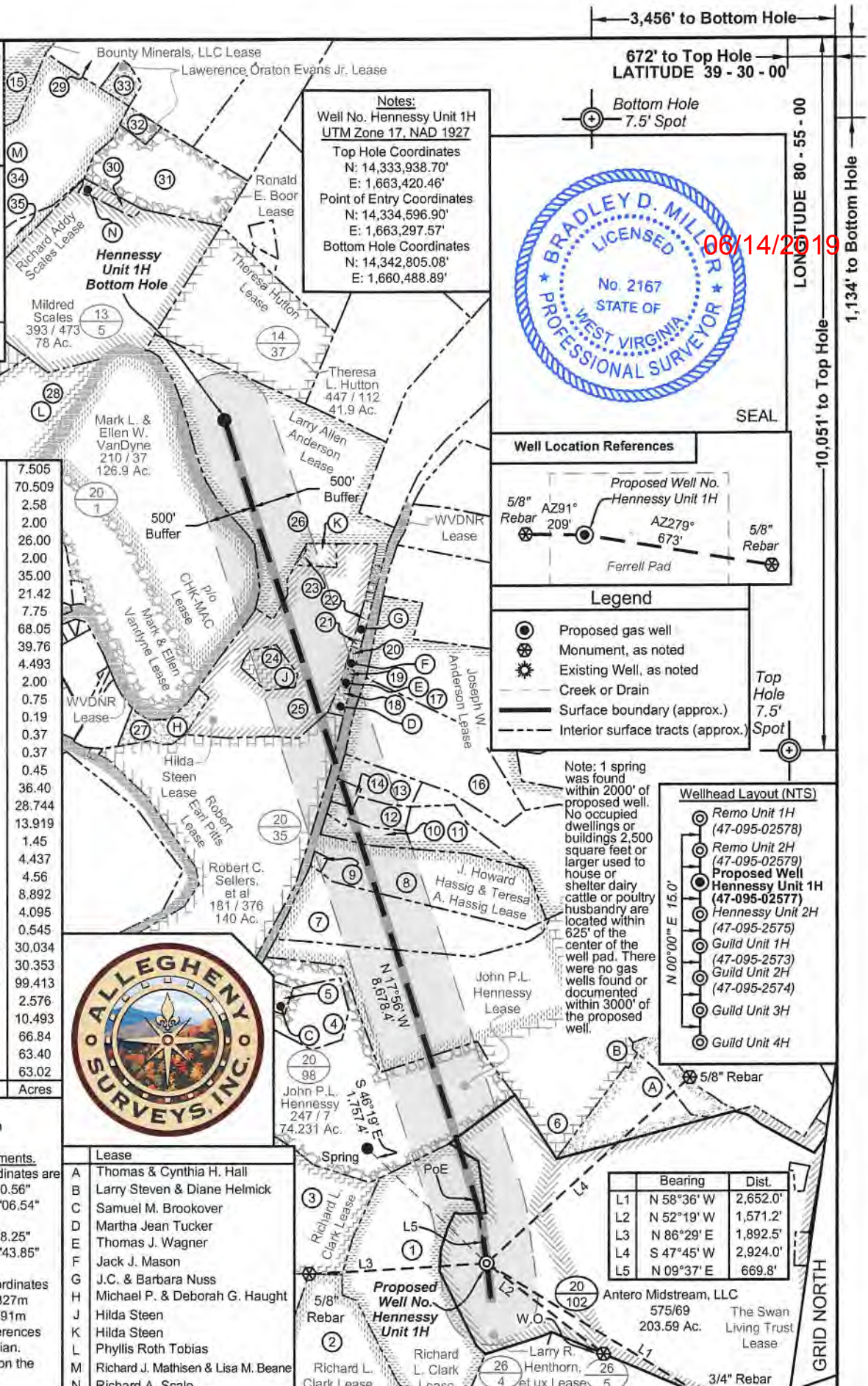
GRID NORTH

**Antero Resources Well
No. Hennessy Unit 1H**

Antero Resources Corporation

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 prescribed by the Department of Environmental Protection.

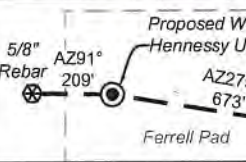
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Bradley D. Miller, P.S. 2167



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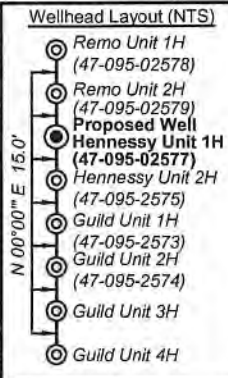
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- ⊙ Proposed gas well
- ⊗ Monument, as noted
- ⊙ Existing Well, as noted
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5	20/98.1	Brookover	353/386	2.576
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2	26/2	Moore	314/701	63.40
1	26/3	Moore, et al	448/216	63.02
ID	TM/Par	Owner	Bk/Pg	Acres



Note: 1 spring was found within 2000' of proposed well. No occupied dwellings or buildings 2,500 square feet or larger used to house or shelter dairy cattle or poultry husbandry are located within 625' of the center of the well pad. There were no gas wells found or documented within 3000' of the proposed well.



Bearing	Dist.
L1 N 58°36' W	2,652.0'
L2 N 52°19' W	1,571.2'
L3 N 86°29' E	1,892.5'
L4 S 47°45' W	2,924.0'
L5 N 09°37' E	669.8'

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Well No. Hennessy Unit 1H Top Hole coordinates are
N: 357,321.47' Latitude: 39°28'20.56"
E: 1,599,579.92' Longitude: 80°55'06.54"
Bottom Hole coordinates are
N: 366,238.62' Latitude: 39°29'48.25"
E: 1,596,795.81' Longitude: 80°55'43.85"
UTM Zone 17, NAD 1983
Top Hole Coordinates Bottom Hole Coordinates
N: 4,369,210.865m N: 4,371,913.327m
E: 507,026.035m E: 506,132.491m
Plat orientation and corner and well references are based upon the grid north meridian.
Well location references are based upon the magnetic meridian.

Lease
A Thomas & Cynthia H. Hall
B Larry Steven & Diane Helmick
C Samuel M. Brookover
D Martha Jean Tucker
E Thomas J. Wagner
F Jack J. Mason
G J.C. & Barbara Nuss
H Michael P. & Deborah G. Haught
J Hilda Steen
K Hilda Steen
L Phyllis Roth Tobias
M Richard J. Mathisen & Lisa M. Beane
N Richard A. Scale

FILE NO: 16-54-E-17
DRAWING NO: Hennessy 1H Well Plat
SCALE: 1" = 1500'
MINIMUM DEGREE OF ACCURACY: Submeter
PROVEN SOURCE OF ELEVATION: WVDOT, Harrisville, WV

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
OIL AND GAS DIVISION

DATE: May 13 20 19
OPERATOR'S WELL NO. Hennessy Unit 1H
API WELL NO
47 - 095 - 02577
STATE COUNTY PERMIT

WELL TYPE: OIL GAS LIQUID INJECTION WASTE DISPOSAL
(IF GAS) PRODUCTION: STORAGE DEEP SHALLOW
LOCATION: ELEVATION: As-Built 757' WATERSHED: Outlet Middle Island Creek QUADRANGLE: Paden City-BHL
DISTRICT: Ellsworth COUNTY: Tyler
SURFACE OWNER: Antero Midstream, LLC ROYALTY OWNER: West Virginia Division of Natural Resources; Richard L. Clark; Hilda Steen
PROPOSED WORK: DRILL CONVERT DRILL DEEPER FRACTURE OR STIMULATE PLUG OFF OLD FORMATION
 PERFORATE NEW FORMATION OTHER PHYSICAL CHANGE IN WELL (SPECIFY) BHL Mod
 PLUG AND ABANDON CLEAN OUT AND REPLUG TARGET FORMATION: Marcellus Shale ESTIMATED DEPTH: 16,400' MD

WELL OPERATOR: Antero Resources Corporation DESIGNATED AGENT: Dianna Stamper - CT Corporation System
ADDRESS: 1615 Wynkoop Street ADDRESS: 5400 D Big Tyler Road
Denver, CO 80202 Charleston, WV 25313

06/14/2019



west virginia department of environmental protection

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

January 28, 2015

STATOIL USA ONSHORE PROPERTIES, INC.
2103 CITYWEST BOULEVARD - SUITE 800
HOUSTON, TX 77042

Re: Permit Modification Approval for API Number 9502176 , Well #: BALL 2H

Revise intermediate casing depth and drilling fluid.

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,

A handwritten signature in blue ink that reads "Gene Smith" with a stylized flourish.

Gene Smith
Assistant Chief of Permitting
Office of Oil and Gas



December 16, 2014

West Virginia Department of Environmental Protection
Office of Oil and Gas
601 57th Street, SE
Charleston, WV 23504-2345

Attention: Ms. Laura Cooper

Reference: Ball Unit 2H (47-095-02176)
WW-6B Casing Revision, Tyler County, WV

Ms. Cooper:

Attached for your approval please find the revised WW-6B and schematic for the Ball 2H (47-095-02176). Statoil is requesting approval to revise the intermediate casing setting depth.

Our standard well design in West Virginia was modified to set the Intermediate Casing below the base of the Big Injun. This change was as a result of successful field Leak-Off Tests in the general region, confirming design assumptions concerning subsurface characterization. This modification continues to allow for necessary well control while drilling the production hole section and is aligned with general practice in the region of offset operators.

In addition, the drilling fluid scheme was modified to include drilling with freshwater instead of air in the surface hole and drilling with air misting with 5%KCL and soap from surface casing shoe to TD of the pilot hole. The curve and lateral will be drilled with synthetic oil based mud.

If you have any questions or require additional information, please contact the undersigned at 713-485-2640 or at BEKW@statoil.com.

Sincerely,

A handwritten signature in blue ink, appearing to read "Bekki Winfree".

Bekki Winfree
Sr. Regulatory Advisor – Marcellus

Received
Office of Oil & Gas

DEC 17 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: Statoil USA Onshore Properties Inc. 494505083 Tyler Ellsworth Porter Falls
Operator ID County District Quadrangle

2) Operator's Well Number: 2H Well Pad Name: Ball

3) Farm Name/Surface Owner: Ball Farm Public Road Access: CR 42/Scales Road

4) Elevation, current ground: 1169' Elevation, proposed post-construction: 1169' (as-built)

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 Associated Pressure(s):
Marcellus, 6918', 50', 4500 psi

8) Proposed Total Vertical Depth: 6,930'

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 13,800'

11) Proposed Horizontal Leg Length: 6100'

12) Approximate Fresh Water Strata Depths: 337'

13) Method to Determine Fresh Water Depths: Identify lowest elevation within 1500' of pad site and project 200' beyond that depth

14) Approximate Saltwater Depths: 587'

15) Approximate Coal Seam Depths: 395'-398', 855'-858'

16) Approximate Depth to Possible Void (coal mine, karst, other): N/A

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: _____

MAD
12-16-14

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WW-6B
(9/13)

18)

CASING AND TUBING PROGRAM

<u>TYPE</u>	<u>Size</u>	<u>New or Used</u>	<u>Grade</u>	<u>Weight per ft. (lb/ft)</u>	<u>FOOTAGE: For Drilling</u>	<u>INTERVALS: Left in Well</u>	<u>CEMENT: Fill-up (Cu. Ft.)</u>
Conductor	20	New	H40	94.0	120	120	cement to surface
Fresh Water	13.375	New	J/K55	54.5	450	430	cement to surface 456 cu-ft
Coal							
Intermediate	9.625	New	J/K55	36.0	2612	2597	cement to surface 1093 cu-ft
Production	5.50	New	P110	20.0	13800	13780	1000 ft into previous shoe 3112 cu-ft
Tubing	2.375	New	L80	4.7		6121	production tubing
Liners							

MAG
12-16-14

<u>TYPE</u>	<u>Size</u>	<u>Wellbore Diameter</u>	<u>Wall Thickness</u>	<u>Burst Pressure</u>	<u>Cement Type</u>	<u>Cement Yield (cu. ft./k)</u>
Conductor	20	24	0.438	1530	Class A	2.31
Fresh Water	13.375	17.5	0.380	2730	Class A-BondCem	2.31
Coal						
Intermediate	9.625	12.25	0.352	3520	Class A-BondCem	2.31
Production	5.50	8.50	0.361	12640	Class A-ShaleCem	1.37
Tubing	2.375		0.19	11200		
Liners						

PACKERS

Kind:				
Sizes:				
Depths Set:				

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DEC 17 2014

WW-6B
(9/13)

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

see attached

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

Well will fractured through the plug-n-perf method with +/- 25 fracturing stages per well. Each fracturing treatment will have 400,000 lbs of sand mixed in 7500 Bbls. of fresh water. The fracturing rate will be between 80 and 100 bpm at a pressure lower than a maximum pressure of 10,000 psi.

21) Total Area to be disturbed, including roads, stockpile area, pits, etc.. (acres): Existing Pad - 16.88 acres

22) Area to be disturbed for well pad only, less access road (acres): Existing Pad - 5.53 acres

23) Describe centralizer placement for each casing string:

Surface - 1 centralizer w/ stop collar 10 ft above float shoe. One Single Bow every joint to 100ft below surface.
Intermediate - 1 centek centralizer w/ stop collar 10 ft above float shoe. 1 centek centralizer w/ stop collar 10 ft above float collar. 1 centralizer every joint for the first 15 joints. One centralizer every 3 jnts to 100ft below surface.
Production - 1 centek centralizer w/ stop collar 10ft above shoe. 1 centek centralizer 10ft above float collar. 1 centek centralizer every joint

24) Describe all cement additives associated with each cement type:

Surface - Class A + 3% CaCl₂
Intermediate - Class A cmt, 0.05% Retarder, 0.25% Defoamer, 1% Accelerator, 0.25% Dispersant, 0.65% Retarder, 9.10 gal/sk Fresh Water.
Production - Class A cmt, 10% bwow Dispersant, 0.6% bwoc Fluid Loss, (See attached "Cement Additives" for remainder)

25) Proposed borehole conditioning procedures:

Surface - Drilled with 9.2 freshwater. At TD pump 40 bbls viscous pill and circulate hole clean. Intermediate - Drilled with air misting with 5%KCL at 25 GPM and soap at 1 GPH. At section total depth, blow hole clean with 4600 CFM, displace to water. Production - Drilled with air misting with 5%KCL at 25 GPM and soap at 1 GPH. At kick-off point, blow hole clean with 4600 CFM, displace to 5%KCL mud to section total depth of the pilot hole. Spot two 600 ft st plugs. Curve and lateral drilled with 12.0-12.5 ppg synthetic oil based mud. Approximately 500ft from total depth, pump 20 bbl heavy weight pill for hole cleaning. At section total depth pump another 20bbl heavy weight pill and continue to circulate at least bottoms up. Pump rates will be maintained in excess of 600 GPM, and rotation in excess of 100 RPM to assist cuttings transport. A 50 bbl weighted spacer will be pumped ahead of the cement to assist in mud removal and reduction of cement contamination.

*Note: Attach additional sheets as needed.

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WW-6B – Ball 2H (revised 12-9-2014)

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

20" conductor will be pre-set prior to start of operations and cemented in place to surface at approximately 120ft. A 17 1/2" surface hole will be drilled with air to approximately 450' md/vd. 13 3/8" surface casing will be installed and cemented to surface in order to isolate fresh water zones and provide a competent shoe for well control while drilling deeper horizons. A 12 1/4" intermediate hole section will be drilled with Synthetic Based Mud (SBM) and a conventional mud motor to approximately 2612' md/vd through the base of the Big Injun. 9 5/8" Intermediate casing will be installed and cemented to surface in order to isolate the Big Injun from lower hydrocarbon bearing zones and provide a competent shoe for well control while drilling deeper horizons. An 8 1/2" pilot hole section will be drilled vertically, and potentially cored over the Marcellus horizon, and TD'd into the Onodaga at approximately 7068' vd, at which point wireline formation evaluation logs will be taken. The vertical pilot hole will be plugged back and permanently abandoned with cement plugs from total depth to planned kick-off point. The wellbore will be open-hole sidetracked, deviated, and landed horizontally in the Marcellus Target horizon and extended laterally to total depth of 13,800' md/ 6930' vd using SBM and conventional mud motors. A 5 1/2" production casing will be installed and cemented to surface, at which point the rig will be released to the next well.

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DEC 17 2014

Marcellus - Drilling Well Schematic



Well Name: Ball 2H
 Field Name: Marcellus
 County: Tyler, WV
 API #: 0

BHL: X = 520791.00 Y = 4374994.42
 SHL: X = 520988.06 Y = 4372965.72

GLE (ft): 1,195
 DF (ft): 22
 TVD (ft): 6,930
 TMD (ft): 13,800
 Profile: Horizontal
 AFE No.: n/a

Formations & Csg. Points	Depth, ft			Form. Temp. (F)	Pore Press. (EMW)	Frac Gradient (EMW)	Planned MW	Measure Depth (ft)	Program	Details
	MD	TVD	SS							
Conductor	120	120	1,097					120		20" Conductor 17 1/2" Surface
Casing Point	450	450	767	65				450		Profile: Vertical Bit Type: 17-1/2" SMITH MS716 BHA: Mud: Fresh Water Surveys: n/a Logging: n/a Casing: 13.375in 54.5 # J-SS BTC set @ - 450 MD/450 TVD Centralizers: 1 centralizer w/ stop collar 10 ft above float shoe. One Single Bow every joint to 100ft below surface. Cement: 15.8 ppg BondCem gas tight single slurry tail design to surface Potential Drilling Problems: FIT/LOT: 14.0 ppg EMW Profile: Nudge and hold for anticollision Bit Type: 12-1/4" SMITH TCI F47YA (IADC:627Y) BHA: Bin 7:8 Lobe 2.0 Stg 1.5 ABH (0.10 rpg/375 Diff) Mud: Air/Mist Surveys: Gyro MS, MWD EM Pulse Logging: n/a Casing/Liner: 9.625in 36# J55 BTC set at MD/ TVD. Liner Hanger: n/a Centralizers: 1 centek centralizer w/ stop collar 10 ft above float shoe. 1 centek centralizer w/ stop collar 10 ft above float collar. 1 centralizer every joint for the first 15 joints. One centralizer every 3 jnts to 100ft below surface. Cement: 15.8 ppg, BondCem gas tight, single slurry tail design to surface Potential Drilling Problems: Slow ROP, DHR in matrix FIT/LOT: 15.0 ppg EMW Profile: KO from Vertical, Land HZ Bit Type: 8-1/2" SMITH TCI F47YAPS (IADC: 617Y) - Vert 8 1/2" Smith SDia513 (curve & lateral) BHA: Directional Assembly (Steerable Motor) + EM w/ GR 6.75in 7:8 lobe 2.9 stg 1.5 ABH (0.17 rpg 560 DIFF) - Vert 6.75in 6:7 lobe 5.0 stg 1.95 FBH (0.29 rpg, 715 DIFF) - CAL Mud: Vertical on Air. Curve & Lateral using 12.7ppg SHM Surveys: MWD EM Pulse w/ 30ft surveys in curve, 100ft surveys in lateral Logging: n/a Casing/Liner: 5.5in 20# P110EC Vam Top HT to 0' to TD @ 13800 ft MD Csg Hanger: Fluted mandrel hanger Centralizers: 1 centek centralizer w/ stop collar 10ft above shoe. 1 centek centralizer 10ft above float collar. 1 centek centralizer every joint (floating) until KOP. 1 centek centralizer every 3 joints (floating) until 200ft inside intermediate shoe. 1 centek centralizer 50ft below mandrel hanger. Cement: 15.0 ppg Gas tight, single slurry tail design to surface Potential Drilling Problems: Wellbore instability in lateral w/ MW < 11.5 ppg Notes / Comments:
Big Lime	2,057	2,057	810					8.6		
Big Injun (Base)	2,512	2,512	1,245					8.6		
Casing Point	2,612	2,612	1,395	82	+18.0	Air/Mist		8.6		
Berea Sand	2,705	2,705	1,468					0		
Gordon Sand	2,944	2,944	1,727					8.6		
Riley	4,804	4,804	3,567					8.6		
KOP1	6,140	6,140	4,927					12.0		
Genesen	6,823	6,823	5,605					12.0		
Tully	6,848	6,848	5,631	117				12.0		
Marcellus	6,918	6,918	5,701	118				12.0		
Tgt Landing Point	7,400	6,942	5,725	118				12.0		
Onondaga	6,968	6,968	5,751							

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TMD: 13,800
TVD: 6,930

DEC 17 2014

MOG
12/16/2014

Last Revision Date: 12/9/2014
Revised by: Ryan Gardenas

Note: Depths are referenced to RKB
Note: Not Drawn to Scale

Cement Outside Casing