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

Earl Ray Tomblin, Governor
Randy C. Huffman, Cabinet Secretary
www.dep.wv.gov

PERMIT MODIFICATION APPROVAL
Horizontal 6A / Horizontal 6A Well - 1

ANTERO RESOURCES CORPORATION
1615 WYNKOOP STREET

DENVER, CO 80202

Re: Permit Modification Approval for DUCHENE UNIT 4H
47-085-10168-00-00

Extend Lateral

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

Operator's Well Number: DUCHENE UNIT 4H
Farm Name: WAGGONER, EDDY D. ET AL
U.S. WELL NUMBER: 47-085-10168-00-00
Horizontal 6A / Horizontal 6A Well - 1
Date Issued: 10/18/2016

PERMIT MODIFICATION API# 47-085-10168

WW-6B
(04/15)

API NO. 47- 085 - 10168
OPERATOR WELL NO. Duchene Unit 4H
Well Pad Name: Kelly Pad

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

1) Well Operator: Antero Resources Corp.	494507062	085 - Ritchie	Clay	Pennsboro 7.5'
	Operator ID	County	District	Quadrangle

2) Operator's Well Number: Duchene Unit 4H Well Pad Name: Kelly Pad

3) Farm Name/Surface Owner: Eddy D. Waggoner, et al Public Road Access: CR 74

4) Elevation, current ground: 1127' Elevation, proposed post-construction: 1145'

5) Well Type (a) Gas X Oil _____ Underground Storage _____
Other _____
(b)If Gas Shallow X Deep _____
Horizontal X

4708510168 mod

6) Existing Pad: Yes or No No

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):
Marcellus Shale: 6800' TVD, Anticipated Thickness 75 feet, Associated Pressure 2800#

8) Proposed Total Vertical Depth: 6800'

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 17,600'

11) Proposed Horizontal Leg Length: 8854'

12) Approximate Fresh Water Strata Depths: 303', 380'

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

14) Approximate Saltwater Depths: 533', 1567', 1802'

15) Approximate Coal Seam Depths: None identified

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: _____

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PERMIT MODIFICATION API# 47-085-10168

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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#	430' *see #19	430' *see #19	CTS, 597 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2485'	2485'	CTS, 1012 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	17,600'	17,600'	3749 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	20"	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"	12630	2500	Lead-H/POZ & Tail - H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11200			
Liners							

4708510168 MDT

PACKERS

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

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WW-6B
(10/14)

API NO. 47- 085 - 10168
OPERATOR WELL NO. Duchene Unit 4H
Well Pad Name: Kelly 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."

Max Pressure - 9300 lbs
Max Rate - 80 bpm

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 20.11 acres

22) Area to be disturbed for well pad only, less access road (acres): 5.57 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 + 0.5% C51.
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:

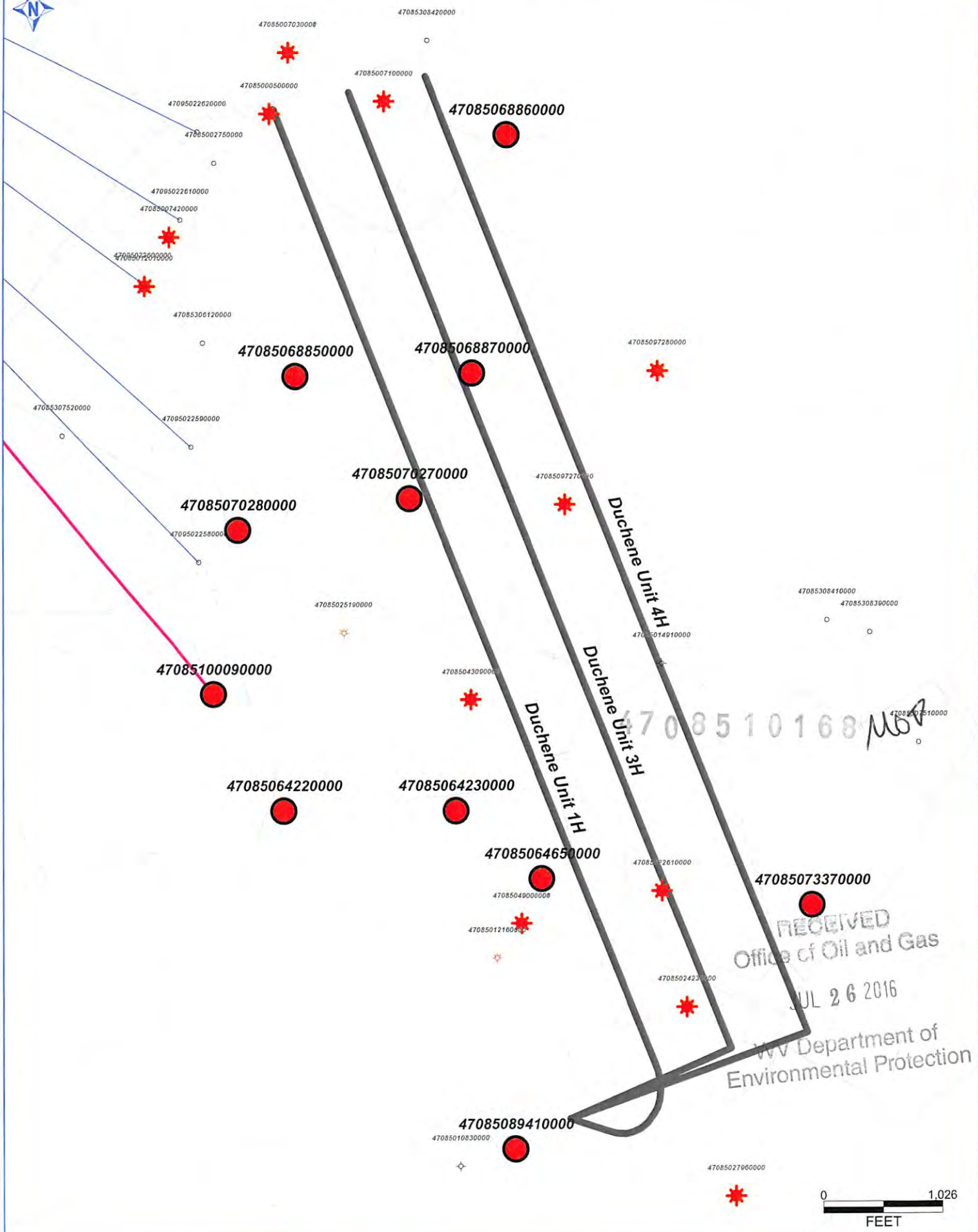
Conductor: blowhole clean with air, run casing, 10 bbls fresh water.
Surface: blowhole clean with air, trip to conductor shoe, trip to bottom, blowhole clean with air, trip out, run casing, circulate pipe capacity + 40 bbls fresh water followed by 25 bbls bentonite mud, 10 bbls fresh water spacer.
Intermediate: 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.

JUL 26 2016

WV Department of Environmental Protection

*Note: Attach additional sheets as needed.

DUCHENE UNIT 1H, 3H & 4H (KELLY PAD) - DATA COLLECTED ON OFFSET WELLS



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JUL 26 2016
WV Department of
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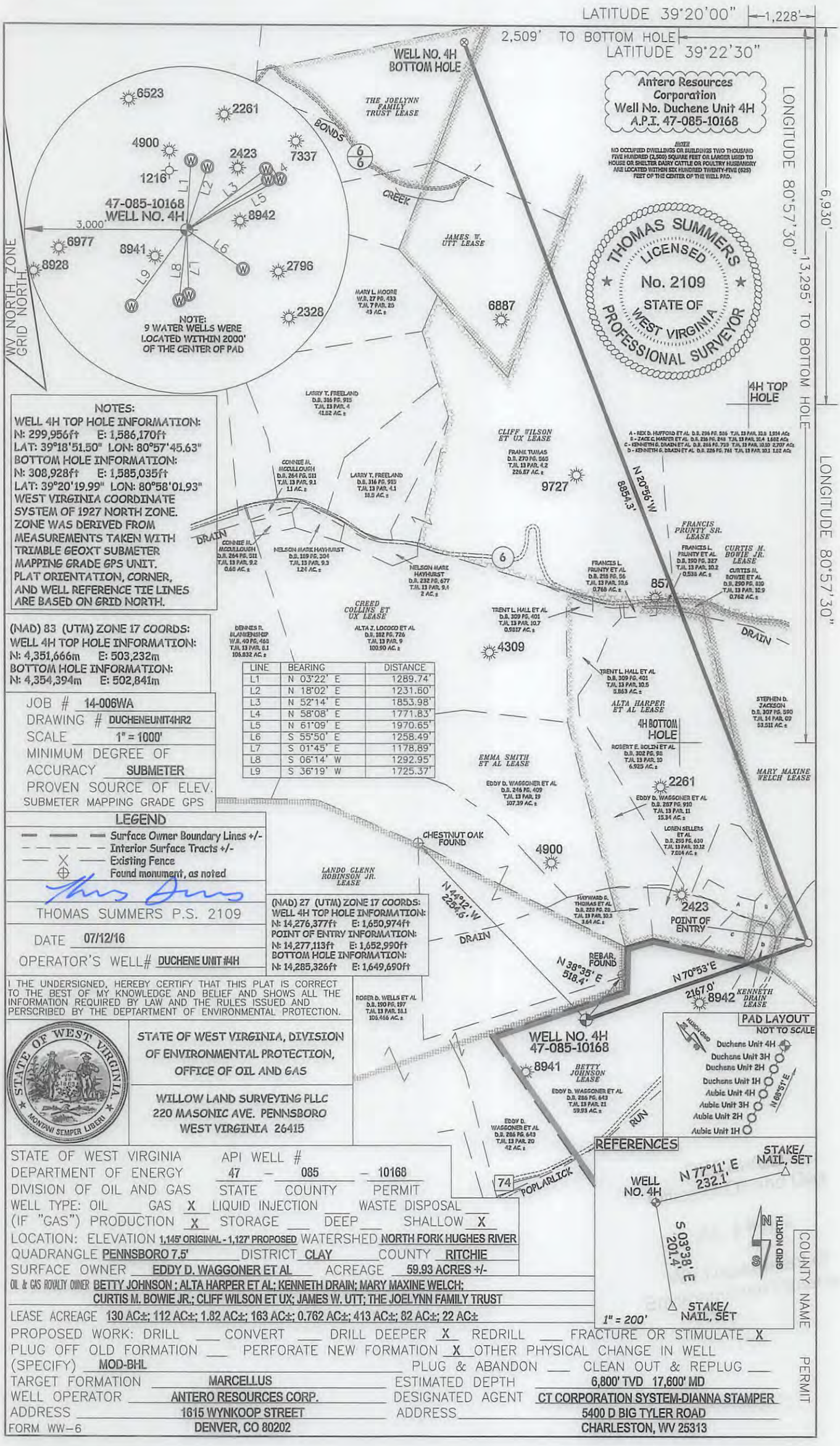
DUCHENE UNIT 1H, 3H & 4H (KELLY PAD) - DATA COLLECTED FROM OFFSET WELLS								
UWI (APINum)	Well Name	Well Numbe	Operator	Hist Oper	TD	ELEV_GR	TD (SSTVD)	Perfs (shallowest, deepest)
47085100090000	CNX GAS COMPANY LLC	PENS1AHS	NOBLE ENERGY INC	NOBLE ENERGY INC	12955	1137	-5250	Marcellus Sh (7125-7327), Marcellus Sh (12808-12810)
47085070280000	FREELAND E G ET AL	JK-1012	ALLIANCE PETR CORP	KEPCO INCORPORATED	5995	1021	-4974	Benson (4886-4888), Rhinestreet Sh (5725-5834)
47085070270000	FREELAND E G ET AL	JK-1020	ALLIANCE PETR CORP	KEPCO INCORPORATED	5995	1182	-4813	Benson (5009-5011)
47085068850000	UTT JAMES W	JK-904	ALLIANCE PETR CORP	J & J ENTERPRISES	5995	1110	-4885	Riley (4830-4833), Rhinestreet Sh (5730-5975)
47085068870000	UTT JAMES W	JK-906	ALLIANCE PETR CORP	J & J ENTERPRISES	5995	990	-5005	Riley (4465-4475), Rhinestreet Sh (5683-5844)
47085068860000	UTT JAMES W	JK-905	ALLIANCE PETR CORP	J & J ENTERPRISES	5995	996	-4999	Warren (3371-3393), Rhinestreet Sh (5678-5776)
47085064650000	DENNING W F HEIRS	1-C	NASHVILLE ASSOC	STALNAKER GENE INC	5990	1070	-4920	Production data present, (cancelled?)
47085073370000	SPENCER RUTH & HARLEY E	WK-342	ALLIANCE PETR CORP	KEPCO INCORPORATED	5835	855	-4980	Riley (4377-4400), Rhinestreet Sh (5611-5714)
47085064220000	DENNING W F HEIRS	1-A	ZICKEFOOSE W F & R L	STALNAKER GENE INC	5450	1195	-4255	Gordon (3492-3863), Balltown (4591-5277)
47085064230000	DENNING W F HEIRS	1-B	ZICKEFOOSE W F & R L	STALNAKER GENE INC	5450	1145	-4305	Lower Huron (3492-3857), Lower Huron (4591-4941)
47085089410000	JOHNSON	1	KEY OIL COMPANY	KEY OIL COMPANY	5310	1035	-4275	Riley (4532-4551), Benson (4892-4895)
47085049000001	DENNING	1	PERKINS PROD CO	PERKINS PROD CO	2990	1018	-1972	
47085049000000	DENNING W F	1	PERKINS PROD CO	DENNING G&O	2990	1018	-1972	
47085097280000	THOMAS DOLLY	7	PERKINS OIL & GAS	PERKINS OIL & GAS	2550	1282	-1268	
47085097270000	THOMAS DOLLY	6	PERKINS OIL & GAS	PERKINS OIL & GAS	2380	1175	-1205	
47085007030001	FARLEY	2	PERKINS OIL & GAS	PERKINS OIL & GAS	2308	940	-1368	
47085007030000	NOAH FARLEY HRS	1	PERKINS OIL & GAS	MCBURNEY GLEN F	2308	940	-1368	
47085010830000	G A SMITH & J W WHALEY	1	COLLINS C I	COLLINS C I	2295	1085	-1210	
47085308420000	J L HOGUE	1	MILLIKEN H E	MILLIKEN H E	2272	1052	-1220	
47085027960000	DORIS L WESTFALL	1	PERKINS PROD CO	STONE F C OIL & GAS	2222	998	-1224	
47085307520000	W F FARLEY	7091	HOPE NATURAL GAS	HOPE NATURAL GAS	2140	1127	-1013	
47085007420000	J A & R E MARKLE	1	FINDLEY FRANK	FINDLEY FRANK	2125	1038	-1087	
47085306120000	DENNIS MCCULLOUGH 1	4590	PITTSBURGH&W VA GAS	PITTSBURGH&W VA GAS	2105	1027	-1078	
47085022610000	W & D BRADFORD	1	PERKINS PROD CO	L & M PETROLEUM	2069	933	-1136	
47085000500000	MARY FARLEY	1	MAHANEY & LUCAS	MAHANEY & LUCAS	2051	980	-1071	
47085007100000	NOAH FARLEY HEIRS	2	PERKINS OIL & GAS	PERKINS CARL D	2010	1098	-912	
47085025190000	CREED COLLINS	2	HALLAS GEORGE S	HALLAS GEORGE S	2006	1015	-991	
47085043090000	CREED COLLINS	1	PERKINS PROD CO	PERKINS CARL D	2002	958	-1044	
47085043090001	CREED COLLINS	1	PERKINS PROD CO	PERKINS OIL & GAS	2002	958	-1044	
47085043090002	LOCOCO EST ATTA J	1	PERKINS PROD CO	PERKINS OIL & GAS	2002	958	-1044	
47085024230000	W H & D M BRAFORD	2	PERKINS PROD CO	L & M OIL & GAS	1996	879	-1117	
47085012160000	J W WHALEY & G A SMITH	1	MILLER GUS	MILLER GUS	1990	903	-1087	
47085012010000	R E MARKLE	1	MOSSOR OIL & GAS	MOSSOR OIL & GAS	1982	907	-1075	
47085308410000	DOLLIE THOMAS	5	MILLIKEN H E	MILLIKEN H E	1980	896	-1084	
47085307510000	WILLIAM COLLINS	1	SOUTH PENN OIL	SOUTH PENN OIL	1970	935	-1035	
47085308390000	DOLLIE THOMAS	2	MILLIKEN H E	MILLIKEN H E	1958	907	-1051	
47085014910000	RAY HALL	1	BACHELOR CHOGUILL &R	BACHELOR CHOGUILL &R	1941	912	-1029	
47085002750000	NOAH FARLEY	1968	UNKNOWN	UNKNOWN	1939	907	-1032	
47095022610000	NOBLE ENERGY INC	PEN31E	NOBLE ENERGY INC	NOBLE ENERGY INC		1116	1116	PERMIT
47095022620000	NOBLE ENERGY INC	PEN31F	NOBLE ENERGY INC	NOBLE ENERGY INC		1115	1115	PERMIT
47095022600000	NOBLE ENERGY INC	PEN31D	NOBLE ENERGY INC	NOBLE ENERGY INC		1118	1118	PERMIT
47095022590000	NOBLE ENERGY INC	PEN31C	NOBLE ENERGY INC	NOBLE ENERGY INC		1117	1117	PERMIT
47095022580000	NOBLE ENERGY INC	PEN31B	NOBLE ENERGY INC	NOBLE ENERGY INC		1114	1114	PERMIT



NOTES:
WELL 4H TOP HOLE INFORMATION:
N: 299,956ft E: 1,586,170ft
LAT: 39°18'51.50" LON: 80°57'45.63"
BOTTOM HOLE INFORMATION:
N: 308,928ft E: 1,585,035ft
LAT: 39°20'19.99" LON: 80°58'01.93"
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 4H TOP HOLE INFORMATION:
N: 4,351,666m E: 503,232m
BOTTOM HOLE INFORMATION:
N: 4,354,394m E: 502,841m

LINE	BEARING	DISTANCE
L1	N 03°22' E	1289.74'
L2	N 18°02' E	1231.60'
L3	N 52°14' E	1853.98'
L4	N 58°08' E	1771.83'
L5	N 61°09' E	1970.65'
L6	S 55°50' E	1258.49'
L7	S 01°45' E	1178.89'
L8	S 06°14' W	1292.95'
L9	S 36°19' W	1725.37'

JOB # 14-006WA
DRAWING # DUCHENEUNIT4HR2
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
Found monument, as noted

THOMAS SUMMERS P.S. 2109

DATE 07/12/16

OPERATOR'S WELL# DUCHENE UNIT #4H

(NAD) 27 (UTM) ZONE 17 COORDS:
WELL 4H TOP HOLE INFORMATION:
N: 14,276,377ft E: 1,650,974ft
POINT OF ENTRY INFORMATION:
N: 14,277,113ft E: 1,652,990ft
BOTTOM HOLE INFORMATION:
N: 14,285,326ft E: 1,649,690ft

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 DEPTARTMENT OF ENVIRONMENTAL PROTECTION.

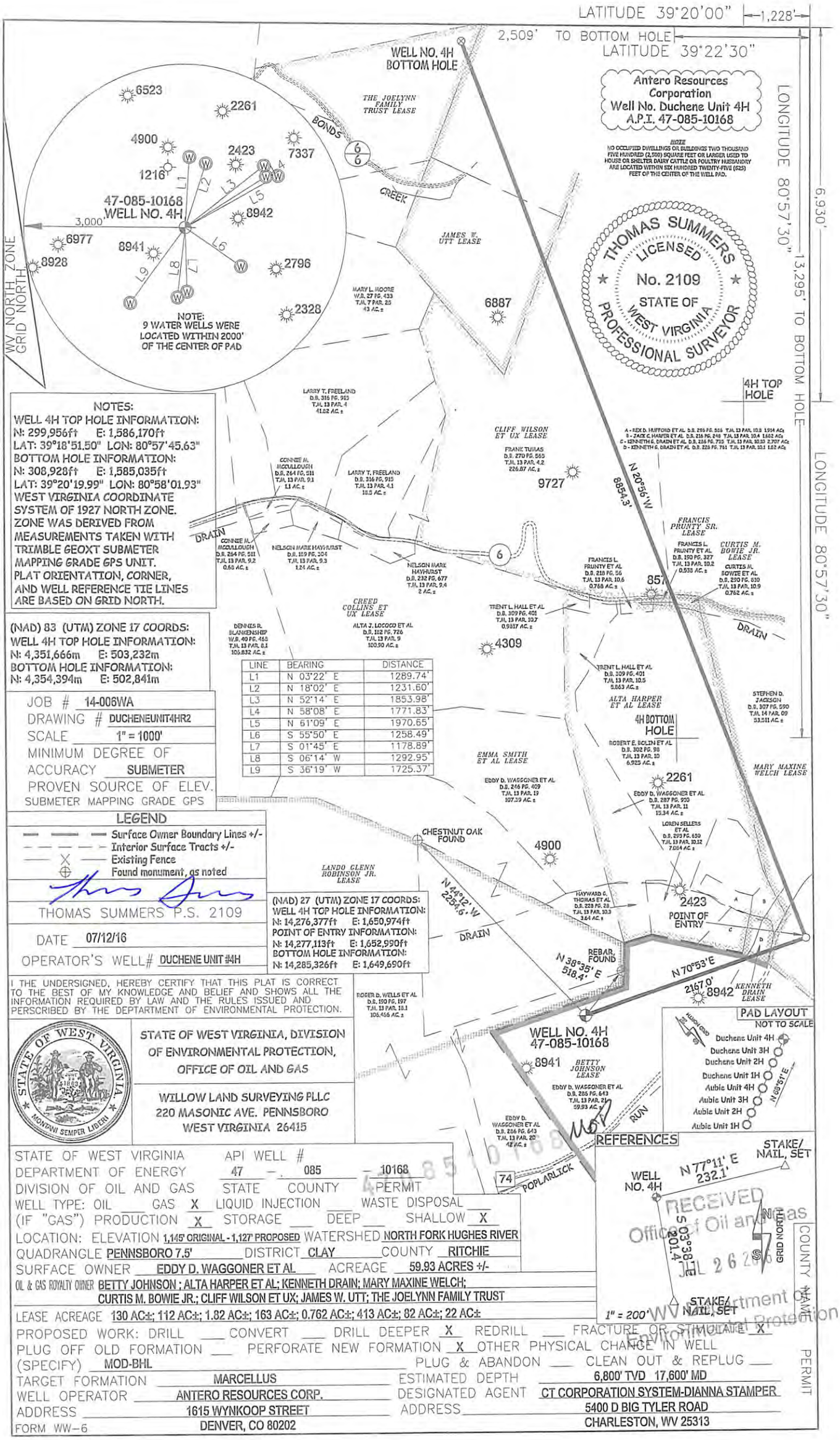
STATE OF WEST VIRGINIA, DIVISION OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS

WILLOW LAND SURVEYING PLLC
220 MASONIC AVE. PENNSBORO
WEST VIRGINIA 26415

STATE OF WEST VIRGINIA DEPARTMENT OF ENERGY DIVISION OF OIL AND GAS
API WELL # 47 – 085 – 10168
STATE COUNTY PERMIT

WELL TYPE: OIL ___ GAS X LIQUID INJECTION ___ WASTE DISPOSAL ___
(IF "GAS") PRODUCTION X STORAGE ___ DEEP ___ SHALLOW X
LOCATION: ELEVATION 1,145' ORIGINAL - 1,127' PROPOSED WATERSHED NORTH FORK HUGHES RIVER
QUADRANGLE PENNSBORO 7.5' DISTRICT CLAY COUNTY RITCHIE
SURFACE OWNER EDDY D. WAGGONER ET AL ACREAGE 59.93 ACRES +/-
OIL & GAS ROYALTY OWNER BETTY JOHNSON ; ALTA HARPER ET AL; KENNETH DRAIN; MARY MAXINE WELCH; CURTIS M. BOWIE JR.; CLIFF WILSON ET UX; JAMES W. UTT; THE JOELYNN FAMILY TRUST
LEASE ACREAGE 130 AC±; 112 AC±; 1.82 AC±; 163 AC±; 0.762 AC±; 413 AC±; 82 AC±; 22 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 17,600' MD
WELL OPERATOR ANTERO RESOURCES CORP. DESIGNATED AGENT CT CORPORATION SYSTEM-DIANNA STAMPER
ADDRESS 1615 WYNKOOP STREET ADDRESS 5400 D BIG TYLER ROAD
DENVER, CO 80202 CHARLESTON, WV 25313
FORM WW-6

COUNTY NAME PERMIT



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