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 29, 2015

EQT PRODUCTION COMPANY
303 SAND CUT ROAD
CLARKSBURG, WV 26301

Re: Permit Modification Approval for API Number 8510137 , Well #: 513761
Modify formation and azimuth,

Oil and Gas Operator:
The Office of Oil and Gas has reviewed the attached permit modification for the above referenced permit. The attached modification has been approved and well work may begin. Please be reminded that the oil and gas inspector is to be notified twenty-four (24) hours before permitted well work is commenced.

Please call James Martin at 304-926-0499, extension 1654 if you have any questions.

Sincerely,

for Gene Smith

Gene Smith
Assistant Chief of Permitting
Office of Oil and Gas

4708510137 MD

December 18, 2014

Mr. Gene Smith
West Virginia Department of Environmental Protection
Office of Oil and Gas
601 57th Street SE
Charleston, WV 25304

Re: Modification of well 513761 and 513758
47-085-10134, 10137

Dear Mr. Smith,

Enclosed is a new WW-6B, schematics, Mylar plat and rec plan for the above API #. EQT would like to request a modification, to API# 47-085-10137, to change the target formation from Geneseo to Marcellus and to change the azimuth, which would change the landing point and bottom hole.

The modification to API # 47-085-10134 is to change the target formation from Marcellus to Geneseo and to change the azimuth, which would change the landing point and bottom hole.

We have changed the formations because well 513758 is the best candidate for the Geneseo landing zone test. It will need to be bounded by two Marcellus wells and that is why the change to the 513761 well. This way the 513758 will be almost fully bounded by the two Marcellus wells 513759 and 513761.

In order to get meaningful history matched results from Rate Transient Analysis the well needs to be bounded, and the wells on either side need to have had the same completion pumped, that way we can then make the assumption that the effective reservoir boundary is the mid-point between the wells. While there are natural deviations from this assumption, on average the results we get are very consistent with this approach. This then allows us to take the analysis to the next step of predicting how the completion and/or well spacing might be optimized.

If you have any questions, please do not hesitate to contact me at (304) 848-0076.

Sincerely,

Received
Office of Oil & Gas
DEC 22 2014

Vicki Roark
Permitting Supervisor-WV

Enc.

WW - 6B
(9/13)

4708510137

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
W.VA. CODE §22-6A - WELL WORK PERMIT APPLICATION

1) Well Operator: EQT Production Company

Operator ID	County	District	Quadrangle
306686	085	4	526

2) Operator's Well Number: 513761 Well Pad Name: OXF163

3) Farm Name/Surface Owner : Pierce Public Road Access: CR 7/18

4) Elevation, current ground: 1,175.0 Elevation, proposed post-construction: 1,158.5

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 Thicknesses and Associated Pressure(s):

Target formation is Marcellus at a depth of 6527' with the anticipated thickness to be 53 feet and anticipated target pressure of 2190 PSI

8) Proposed Total Vertical Depth: 6,527
9) Formation at Total Vertical Depth: Marcellus
10) Proposed Total Measured Depth 13,593
11) Proposed Horizontal Leg Length 5,730
12) Approximate Fresh Water Strata Depths: 173, 450, & 514
13) Method to Determine Fresh Water Depth: By offset wells
14) Approximate Saltwater Depths: 1,153
15) Approximate Coal Seam Depths: No Coal Seams Present
16) Approximate Depth to Possible Void (coal mine, karst, other): None reported
17)Does proposed well location contain coal seams directly overlying or adjacent to an active mine?
(a) If Yes, provide Mine Info: Name: _____
Depth: _____
Seam: _____
Owner: _____

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CASING AND TUBING PROGRAM

18)

TYPE	Size	New or Used	Grade	Weight per ft.	FOOTAGE: for Drilling	INTERVALS: Left in Well	CEMENT: Fill- up (Cu.Ft.)
Conductor	20	New	MC-50	81	40	40	38 C.T.S.
Fresh Water	13 3/8	New	MC-50	54	1,055	1,055	914 C.T.S.
Coal	-	-	-	-	-	-	-
Intermediate	9 5/8	New	MC-50	40	2,955	2,955	1,152 C.T.S.
Production	5 1/2	New	P-110	20	13,593	13,593	See Note 1
Tubing	2 3/8		J-55	4.6			May not be run, if run will be set 100' less than TD
Liners							

TYPE	Size	Wellbore Diameter	Wall Thickness	Burst Pressure	Cement Type	Cement Yield (cu. ft./k)
Conductor	20	24	0.375	-	Construction	1.18
Fresh Water	13 3/8	17 1/2	0.38	2,480	* See Note 2	1.21
Coal	-	-	-	-	-	-
Intermediate	9 5/8	12 3/8	0.395	3,590	* See Note 2	1.21
Production	5 1/2	8 1/2	0.361	12,640	-	1.27/1.86
Tubing						
Liners						

Packers

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

Note 1: EQT plans to bring the TOC on the production casing cement job 1,000' above kick off point, which is at least 500' above the shallowest production zone, to avoid communication.
Note 2: Reference Variance 2014-17.

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

Drill and complete a new horizontal well in the Marcellus formation. The vertical drill to go down to an approximate depth of 4682'. Then kick off the horizontal leg into the Marcellus formation using a slick water frac.

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

Hydraulic fracturing is completed in accordance with state regulations using water recycled from previously fractured wells and obtained from freshwater sources. This water is mixed with sand and a small percentage (less than 0.3%) of chemicals (including 15% Hydrochloric acid, gelling agent, gel breaker, friction reducer, biocide, and scale inhibitor), referred to in the industry as a "slickwater" completion. Maximum anticipated treating pressures are expected to average approximately 8500 psi, maximum anticipated treating rates are expected to average approximately 100 bpm. Stage lengths vary from 150 to 300 feet. Average approximately 200,000 barrels of water per stage. Sand sizes vary from 100 mesh to 20/40 mesh. Average approximately 200,000 pounds of sand per stage.

21) Total area to be disturbed, including roads, stockpile area, pits, etc, (acres): 24.6

22) Area to be disturbed for well pad only, less access road (acres): 14.6

23) Describe centralizer placement for each casing string.

- Surface: Bow spring centralizers – One at the shoe and one spaced every 500'.
- Intermediate: Bow spring centralizers– One cent at the shoe and one spaced every 500'.
- Production: One spaced every 1000' from KOP to Int csg shoe

24) Describe all cement additives associated with each cement type. **Surface (Type 1 Cement):** 0-3% Calcium Chloride Used to speed the setting of cement slurries. 0.4% flake. Loss Circulation Material (LCM) is used to combat the loss of the cement slurry to a thief zone.

Intermediate (Type 1 Cement): 0-3% Calcium Chloride. Salt is used in shallow, low temperature formations to speed the setting of cement slurries. 0.4% flake. Loss Circulation Material (LCM) is used to combat the loss of whole drilling fluid or cement slurry (not filtrate) to a thief zone.

Production:

Lead (Type 1 Cement): 0.2-0.7% Lignosulfonate (Retarder). Lengthens thickening time.

0.3% CFR (dispersant). Makes cement easier to mix.

Tail (Type H Cement): 0.25-0.40% Lignosulfonate (Retarder). Lengthens thickening time.

0.2-0.3% CFR (dispersant). This is to make the cement easier to mix.

60 % Calcuim Carbonate. Acid solubility.

0.4-0.6% Halad (fluid loss). Reduces amount of water lost to formation.

25) Proposed borehole conditioning procedures. **Surface:** Circulate hole clean (Approximately 30-45 minutes) rotating & reciprocating one full joint until cuttings diminish at surface. When cuttings returning to surface diminish, continue to circulate an additional 5 minutes. To ensure that there is no fill, short trip two stands with no circulation. If there is fill, bring compressors back on and circulate hole clean. A constant rate of higher than expected cuttings volume likely indicates washouts that will not clean up.

Intermediate: Circulate hole clean (Approximately 30-45 minutes) rotating & reciprocating one full joint until cuttings diminish at surface. When cuttings returning to surface diminish, continue to circulate an additional 5 minutes. If foam drilling, to enhance hole cleaning use a soap sweep or increase injection rate & foam concentration.

Production: Pump marker sweep with nut plug to determine actual hole washout. Calculate a gauge holes bottoms up volume. Perform a cleanup cycle by pumping 3-5 bottoms up or until the shakers are clean. Check volume of cuttings coming across the shakers every 15 minutes.

*Note: Attach additional sheets as needed.

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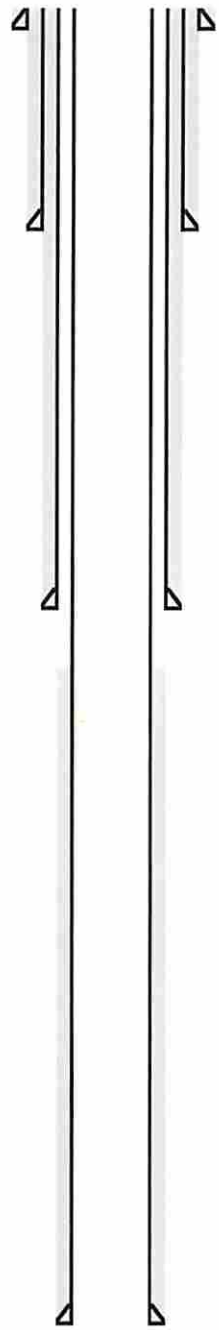
Well Schematic
EQT Production

Well Name	513761 (OXF163H6)
County	Ritchie
State	West Virgina

Elevation KB:	1189
Target	Marcellus
Prospect	
Azimuth	152
Vertical Section	6603



0'

Hole Size 24" - 20" Conductor at 40'
Bit Size 17.5"

500' — 514' Fresh Water Base

1,000'

TOC @ Surface
13 3/8", MC-50, 54.5# @ 1,055' ft MD
Bit Size 12.375"

1,500'

1,692' Maxton

1,877' Big Lime
1,916' Base Red Rock

2,000'

2,146' Weir

2,353' -Gantz
2,432' -Fifty foot
2,528' -Thirty foot
2,571' -Gordon
2,673' -Forth Sand
2,856' -Bayard
2,955' Int. csg pt

2,500'

TOC @ Surface
9 5/8", MC-50, 40# @ 2,955' ft MD
Bit Size 8.5"

3,000'

3,190' -Warren
3,261' -Speechley

3,500'

3,760' -Balltown A

4,000'

4,358' -Riley

KOP = 4,682' ft MD
10 Deg DLS

4,500'

4,731' -Benson

5,000' — 5,028' -Alexander

5,500'

6,165' -Sonyea
6,309' -Middlesex
6,364' -Genesee
6,434' -Geneseo
6,476' -Tully
6,492' -Hamilton
6,504' -Marcellus
6,557' Onondaga

6,000'

Land @ 7,375' ft MD
6,527' ft TVD

5 1/2", P-110, 20# 13,093' ft MD
6,527' ft TVD

6,500'

7,000'

7,500'

8,000'

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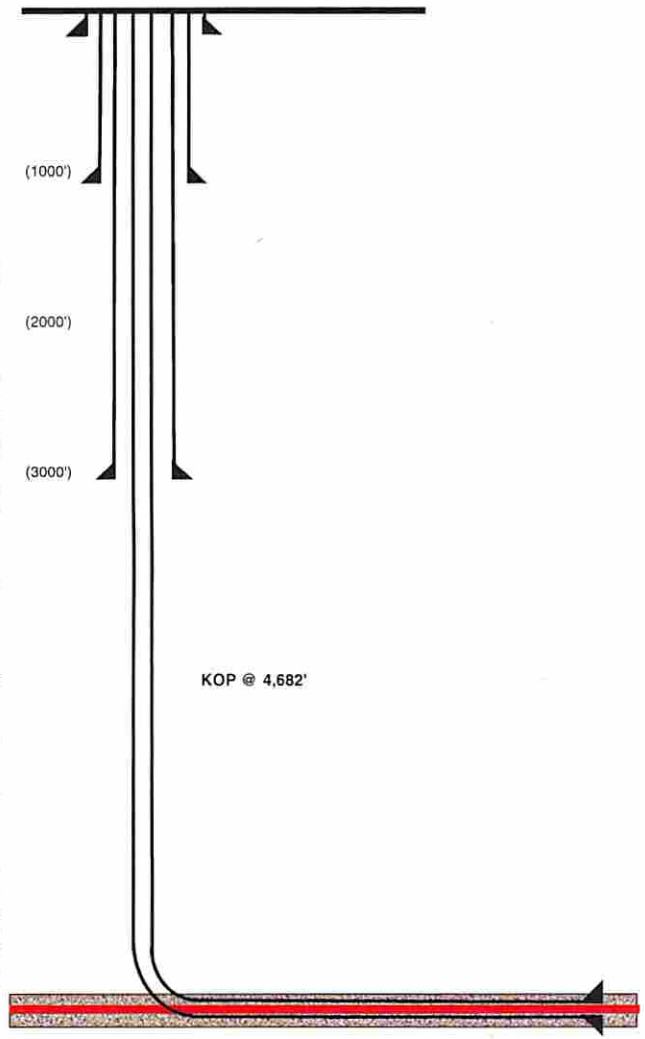
DEC 22 2014

Well 513761 (OXF163H6)
EQT Production
Oxford
Ritchie **West Virgina**

Azimuth: 162
Vertical Section: 6603

TVD Depth (feet)	Formation Tops (TVD)		
0'			
250'			
500'	Base Fresh Water	514	
750'			
1,000'			
1,250'			
1,500'			
	Maxton	1692	1753
1,750'	Big Lime	1877	1977
	Base Red Rock	1916	
2,000'			
	Weir	2146	2217
2,250'	-Gantz	2353	2407
	-Fifty foot	2432	2471
2,500'	-Thirty foot	2528	2558
	-Gordon	2571	2603
2,750'	-Forth Sand	2673	2704
	-Bayard	2856	2905
3,000'	Int. csg pt	2955	
	-Warren	3190	3242
3,250'	-Speechley	3261	3341
3,500'			
3,750'	-Balltown A	3760	3916
4,000'			
4,250'			
	-Riley	4358	4395
4,500'			
4,750'	-Benson	4731	4808
5,000'			
	-Alexander	5028	5093
5,250'			
5,500'			
	-Sonyea	6165	6309
5,750'	-Middlesex	6309	6354
	-Genesee	6364	6434
6,000'	-Geneseo	6434	6476
	-Tully	6476	6492
6,250'	-Hamilton	6492	6504
	-Marcellus	6504	6557
6,500'	**Target Inside Marcellus**	**6527**	
	Onondaga	6657	
6,750'			
7,000'			



Hole Size (inches)	Casing Type	Casing Size (inches)	Wt (ppf)/Grade
24	Conductor	20	81#/MC-50
17 1/2	Surface	13 3/8	54#/MC-50
12 3/8	Intermediate	9 5/8	40#/MC-50
8 1/2	Production Casing	5 1/2	20#/P-110

Land curve @ 6,527' ft TVD, 7,375' ft MD

Est. TD @ 6,527' ft TVD, 13,093' ft MD

5,730' ft Lateral

Proposed Well Work:
Drill and complete a new horizontal well in the Marcellus formation.
The vertical drill to go down to an approximate depth of 4682',
Then kick off the horizontal leg into the Marcellus formation using a slick water frac.

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FORM WW 6

ROYALTY OWNERS		
B.M. PIERCE ET UX	84.50 AC.±	LEASE NO. 118210
CRAIG H. WILLIAMS	243.83 AC.±	LEASE NO. 987447
J.P. SMITH ET UX	130 AC.±	LEASE NO. 107857

EQT PRODUCTION COMPANY
J.E. PIERCE ET AL LEASE
108 (98.73±) ACRES±
WELL NO. WV 513761

(S.P.C. NORTH ZONE) (UTM(M) ZONE 17 NORTH)

NAD'27 S.P.C.(FT)	N. 234,445.3	E. 1,619,075.4
NAD'27 GEO.	LAT-(N) 39.135873	LONG-(W) 80.842926
NAD'83 UTM (M)	N. 4,331,876.0	E. 513,590.2
LANDING POINT		
NAD'27 S.P.C.(FT)	N. 233,325.0	E. 1,617,963.9
NAD'27 GEO.	LAT-(N) 39.132752	LONG-(W) 80.846785
NAD'83 UTM (M)	N. 4,331,529.0	E. 513,257.2
BOTTOM HOLE		
NAD'27 S.P.C.(FT)	N. 227,875.4	E. 1,619,734.6
NAD'27 GEO.	LAT-(N) 39.117863	LONG-(W) 80.840257
NAD'83 UTM (M)	N. 4,329,877.9	E. 513,824.4

LATITUDE 39°10'00"

LONGITUDE 80°50'00"

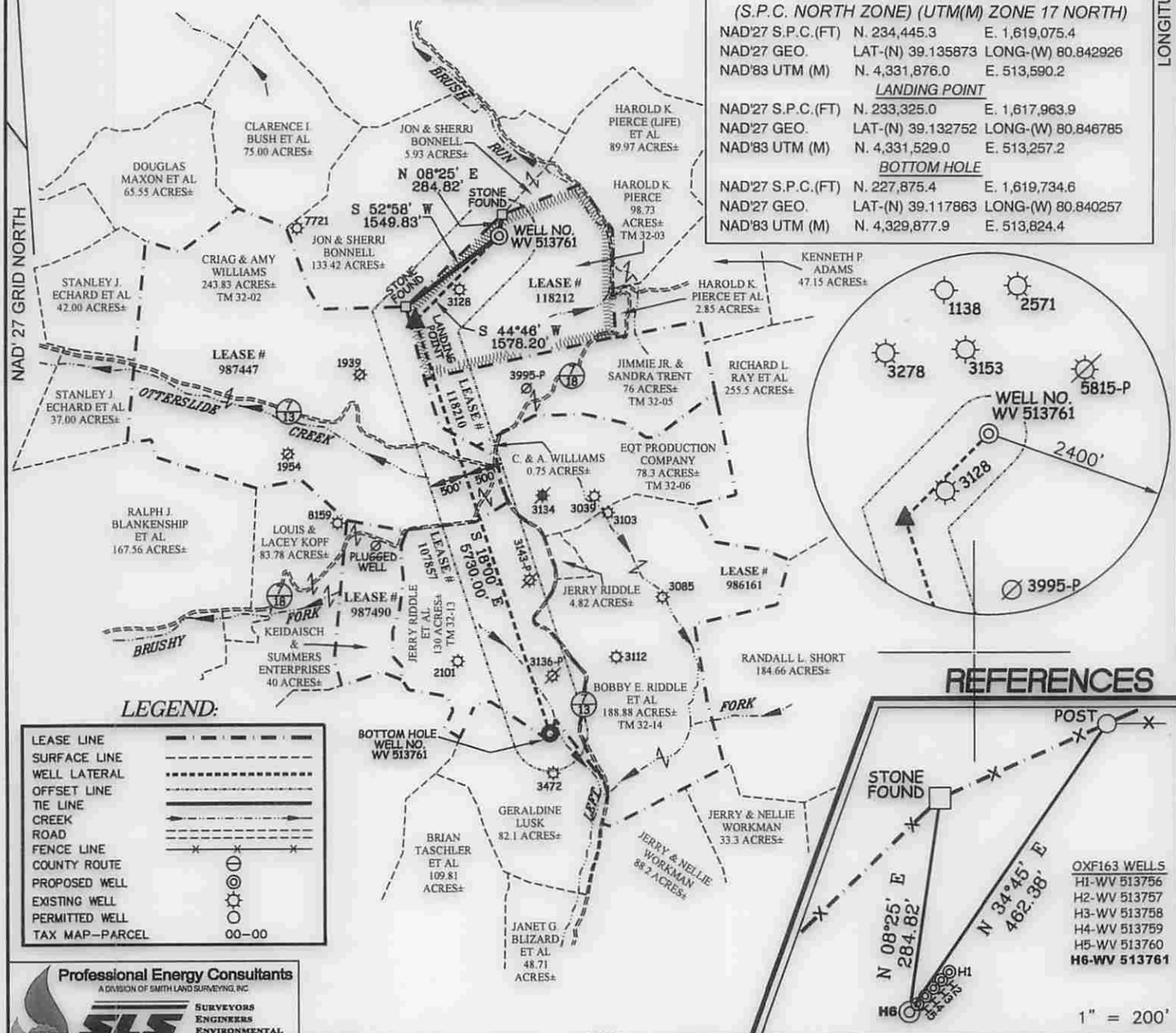
2,721'

11,216'

NAD' 27 GRID NORTH

NOTES ON SURVEY

1. NO WATER WELLS WERE FOUND WITHIN 250' OF PROPOSED GAS WELL. NO AGRICULTURAL BUILDINGS ≥ 2500 SQ. FT. OR DWELLINGS WERE FOUND WITHIN 625' OF THE CENTER OF PROPOSED WELL PAD.



LEGEND:

LEASE LINE	
SURFACE LINE	
WELL LATERAL	
OFFSET LINE	
TIE LINE	
CREEK	
ROAD	
FENCE LINE	
COUNTY ROUTE	
PROPOSED WELL	
EXISTING WELL	
PERMITTED WELL	
TAX MAP–PARCEL	00–00

REFERENCES

OXF163 WELLS
H1-WV 513756
H2-WV 513757
H3-WV 513758
H4-WV 513759
H5-WV 513760
H6-WV 513761

1" = 200'

Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING, INC
SLS SURVEYORS ENGINEERS ENVIRONMENTAL PROJECT MGMT.
(304) 462-4634 WWW.SLSSURVEYS.COM

I THE UNDERSIGNED, HEREBY CERTIFY THAT THIS PLAT IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AND SHOWS ALL THE INFORMATION REQUIRED BY LAW AND THE REGULATIONS ISSUED AND PRESCRIBED BY THE DIVISION OF ENVIRONMENTAL PROTECTION.

P.S. 849 C. Victor Moyers

C. VICTOR MOYERS LICENSED No. 849 STATE OF WEST VIRGINIA PROFESSIONAL SURVEYOR

(+) DENOTES LOCATION OF WELL ON UNITED STATES TOPOGRAPHIC MAPS.

DATE JUNE 3, 20 14

REVISED 08/22/14, 10/27/14, 10/31/14 & 12/05/14

OPERATORS WELL NO. WV 513761

API WELL NO. 47 — 085 — 10137 (STATE COUNTY PERMIT)

MINIMUM DEGREE OF ACCURACY 1 / 2500 FILE NO. 7698P51376R5

SCALE 1" = 2000'

HORIZONTAL & VERTICAL CONTROL DETERMINED BY DGPS (SURVEY GRADE TIE TO CORS NETWORK)

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

WELL TYPE: OIL ___ GAS X LIQUID INJECTION ___ WASTE DISPOSAL ___ IF "GAS" PRODUCTION X STORAGE ___ DEEP ___ SHALLOW X

LOCATION:

ELEVATION 1,173'(GROUND)1,158.5'(PROPOSED) WATERSHED BRUSH RUN OF MIDDLE FORK

DISTRICT UNION COUNTY RITCHIE QUADRANGLE OXFORD 7.5'

SURFACE OWNER HAROLD K. PIERCE ACREAGE 98.73±

ROYALTY OWNER J.E. PIERCE ET AL ACREAGE 108± (98.73±)

PROPOSED WORK: LEASE NO. 118212

DRILL X CONVERT ___ DRILL DEEPER ___ REDRILL ___ FRACTURE OR STIMULATE X PLUG OFF OLD FORMATION ___ PERFORATE NEW FORMATION ___ PLUG AND ABANDON ___ CLEAN OUT AND REPLUG ___ OTHER ___

PHYSICAL CHANGE IN WELL (SPECIFY) ___ TARGET FORMATION MARCELLUS

ESTIMATED DEPTH TVD 6495'

COUNTY NAME

PERMIT

WELL OPERATOR EQT PRODUCTION COMPANY DESIGNATED AGENT REX C. RAY

ADDRESS 115 PROFESSIONAL PLACE P.O. BOX 280 ADDRESS 115 PROFESSIONAL PLACE P.O. BOX 280

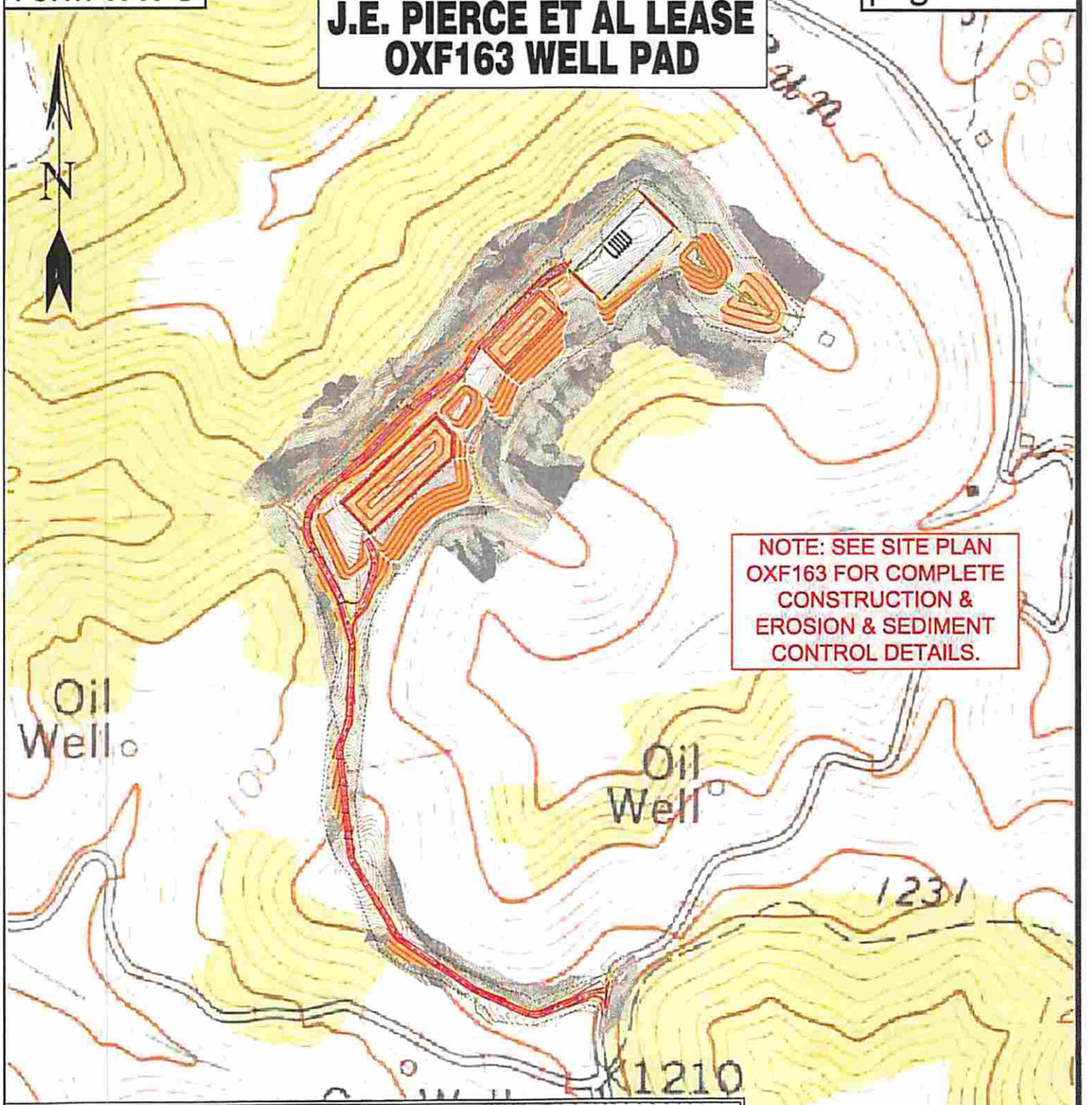
BRIDGEPORT, WV 26330 BRIDGEPORT, WV 26330

4708510137

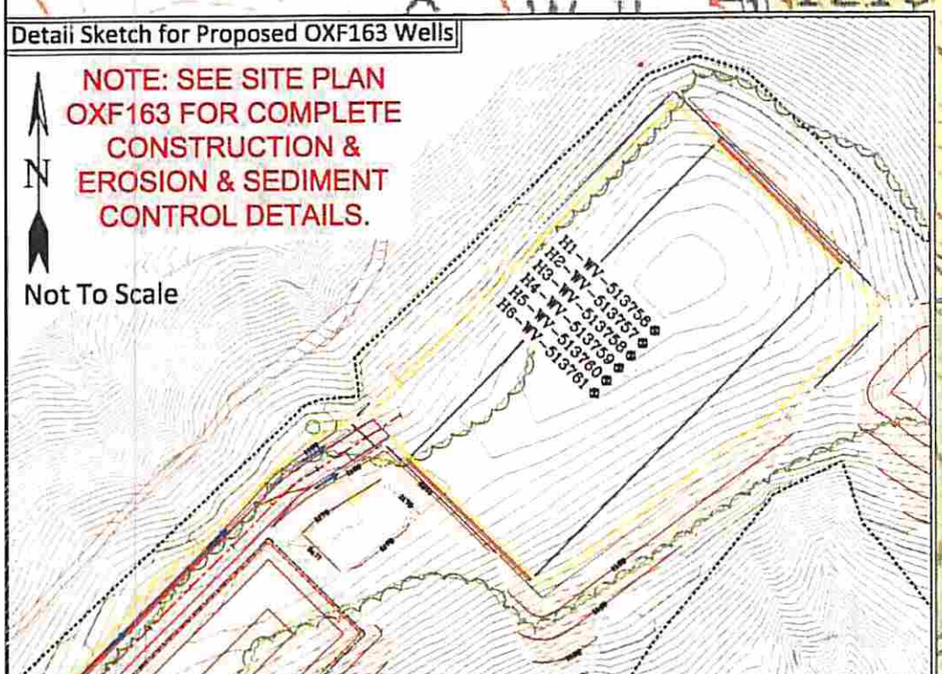
Form WW-9

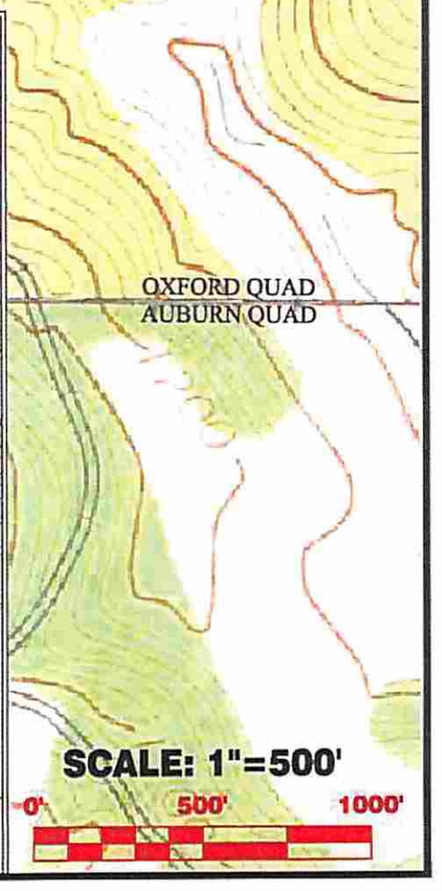
page of

J.E. PIERCE ET AL LEASE
OXF163 WELL PAD



Detail Sketch for Proposed OXF163 Wells





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DRAWN BY	FILE NO.	DATE	CADD FILE:
K.G.M.	7698	05-23-14	7698REC163.dwg

TOPO SECTION OF OXFORD 7.5' AND AUBURN 7.5' USGS TOPO QUADRANGLE