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west virginia department of environmental protection

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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](http://www.dep.wv.gov)

## PERMIT MODIFICATION APPROVAL

May 01, 2014

EQT PRODUCTION COMPANY  
POST OFFICE BOX 280  
BRIDGEPORT, WV 26330

Re: Permit Modification Approval for API Number 10302940, Well #: 514566

**Horizontal Extended**

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,

Gene Smith  
Regulatory/Compliance Manager  
Office of Oil and Gas



47 10302940  
MOD

January 31, 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 (BIG367)514566, 47-10302940

Dear Mr. Smith,

Attached is a modification for the above well. EQT would like to extend the length of the horizontal section. A new WW-6B, well schematics and mylar plat are enclosed for your review.

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

Sincerely,

A handwritten signature in blue ink, appearing to read 'Vicki Roark'.

Vicki Roark  
Permitting Supervisor-WV

Received

FEB 19 2014

Office of Oil and Gas  
WV Dept. of Environmental Protection

Enc.

Cc: Derek Haught  
P.O. Box 85  
Smithville, WV 26178

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

4710302940

MOD

1) Well Operator: EQT Production Company

Operator ID	103	District	4	Quadrangle	254
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2) Operator's Well Number: 514566 Well Pad Name: BIG367

3) Farm Name/Surface Owner : Henthorn et al Public Road Access: Rt. 74

4) Elevation, current ground: 1,474.6 Elevation, proposed post-construction: 1,442.9

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 7574' with the anticipated thickness to be 53 feet and anticipated target pressure of 4795 PSI

8) Proposed Total Vertical Depth: 7,574

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 15,414

11) Proposed Horizontal Leg Length: 6,936

12) Approximate Fresh Water Strata Depths: 433, 478, 705

13) Method to Determine Fresh Water Depth: By offset wells

14) Approximate Saltwater Depths: 1965, 2130, 2168

15) Approximate Coal Seam Depths: 513, 727, 831, 882, 1019, 1190, 1680

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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2-12-14

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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	26	New	MC-50	77	80	80	98 CTS
Fresh Water	13 3/8	New	MC-50	54	956	956	832 CTS
Coal							
Intermediate	9 5/8	New	MC-50	40	2,900	2,900	1134 CTS
Production	5 1/2	New	P-110	20	15,414	15,414	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	26	30	0.312	-	Construction	1.18
Fresh Water	13 3/8	17 1/2	0.38	2,480	1	1.21
Coal						
Intermediate	9 5/8	12 3/8	0.395	3,600	1	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.

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WV Dept. of Environmental Protection

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 6854',  
then kick off the horizontal leg into the Marcellus 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): 16.2

22) Area to be disturbed for well pad only, less access road (acres): 15.42

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.

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\*Note: Attach additional sheets as needed.

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2-12-14

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Office of Oil and Gas  
WV Dept. of Environmental Protection



47 10302940  
MOD

January 31, 2014

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

Re: Casing on BIG367(514566) 47-10302940

Dear Mr. Smith,

EQT is requesting the 13 3/8" surface casing to be set 50' below the deepest red rock show to cover potential red rock issues. The proposed casing set depth is above ground elevation. The reason for this is the red rock swells during drilling of the intermediate section causing many drilling problems such as but not limited to lost drilling assemblies and casing running issues.

In reviewing the BIG367, we would like to request to set the surface casing deeper on each well. The 13 3/8" casing will be set at a depth of approximately 956' KB (50' below the anticipated red rock show).

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

Sincerely,

Vicki Roark  
Permitting Supervisor-WV

Enc.

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2-12-14

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WV Dept. of Environmental Protection

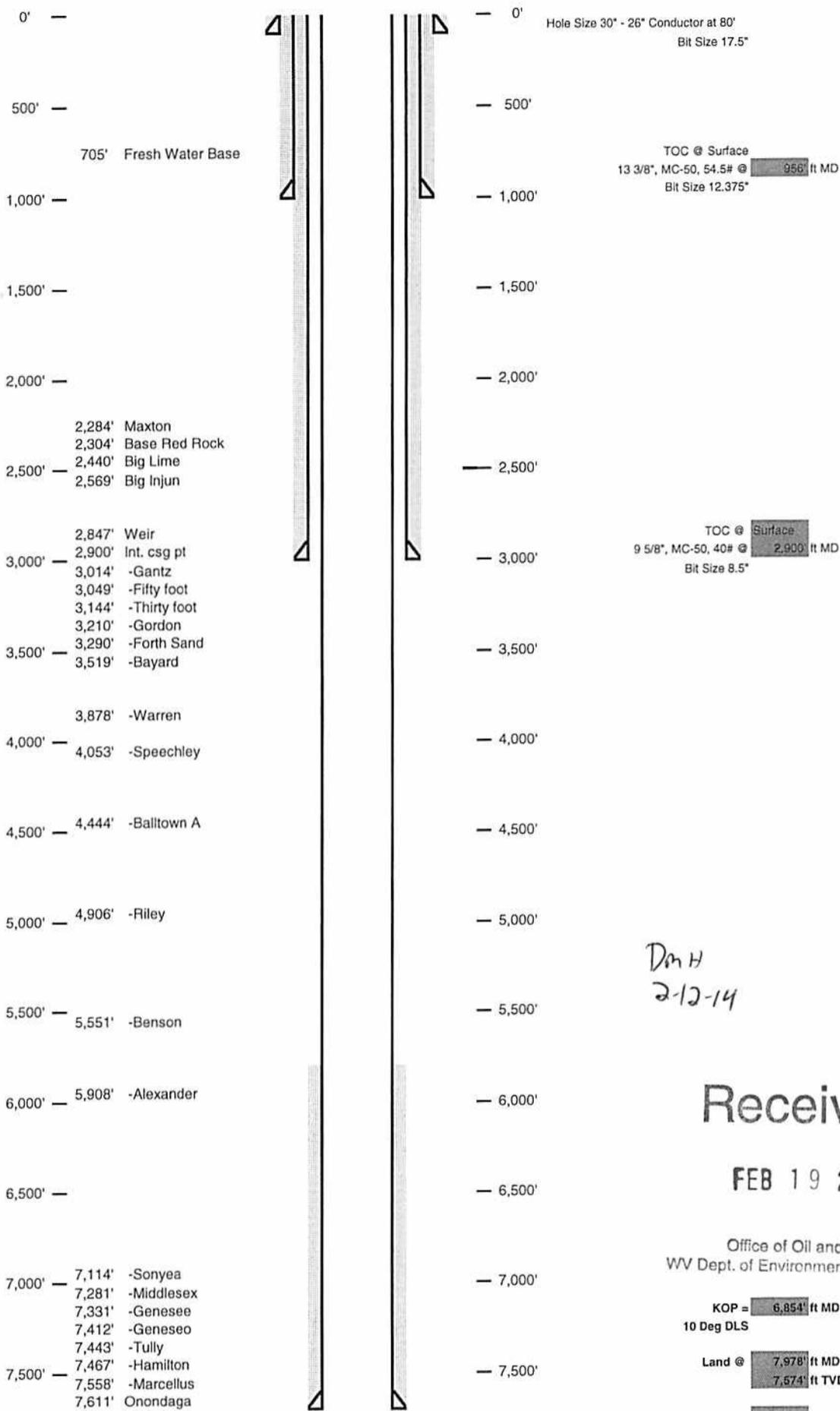
4710302940

MOD

Well Schematic  
EQT Production

Well Name: 514566 (BIG307HS)  
County: Wetzel  
State: West Virginia

Elevation KB: 1456  
Target: Marcellus  
Prospect: 162  
Azimuth: 7617  
Vertical Section



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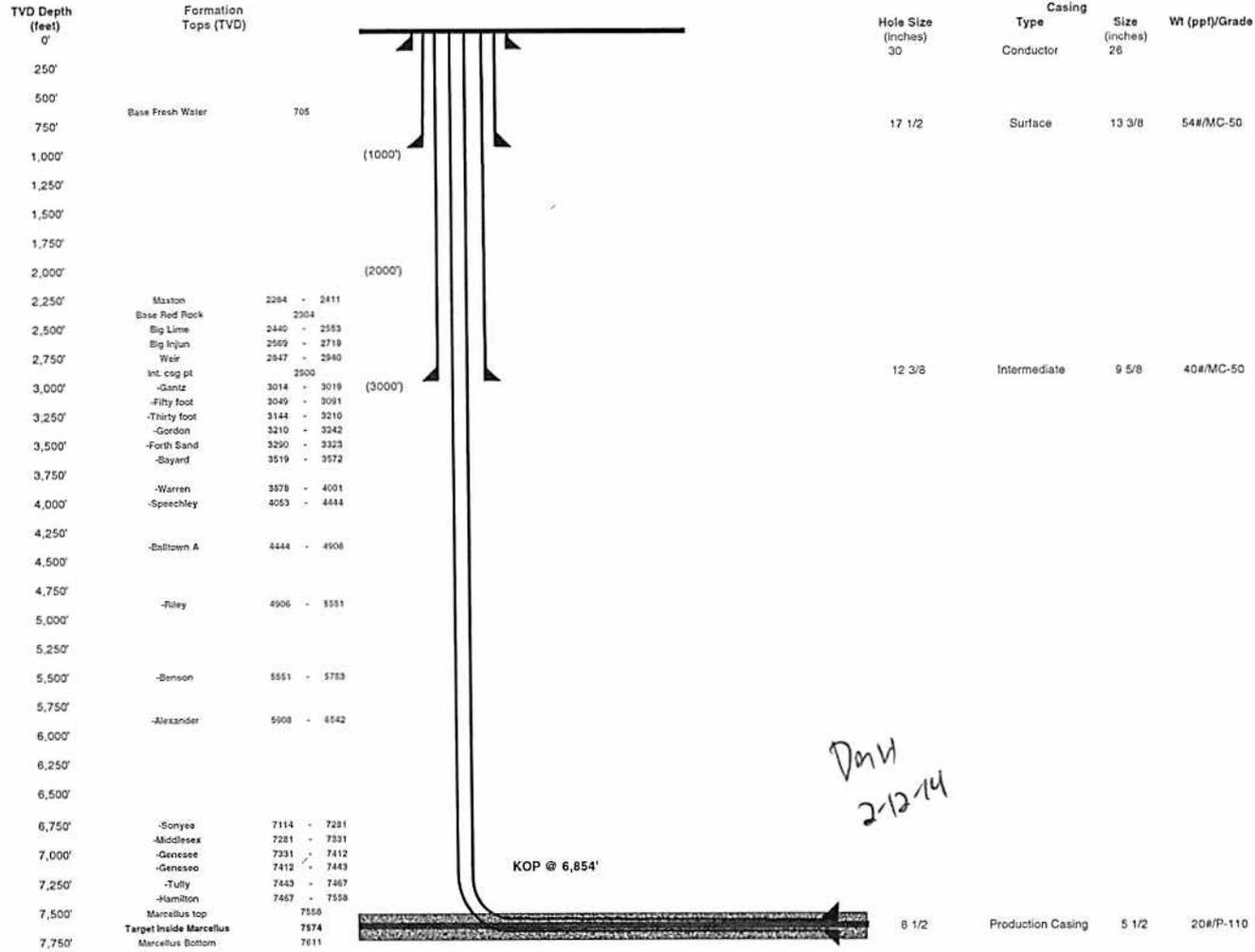
Office of Oil and Gas  
WV Dept. of Environmental Protection

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MOD

Well 514566 (BIG367H5)  
 EQT Production  
 Big Run  
 Wetzel West Virginia

Azimuth 162  
 Vertical Section 7817



DWH  
2-12-14

Land curve @ 7,574' ft TVD / 7,975' ft MD  
 Est. TD @ 7,574' ft TVD / 14,914' ft MD

5,339' 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 6854'.  
 Then kick of the horizontal leg into the Marcellus using a slick water frac.

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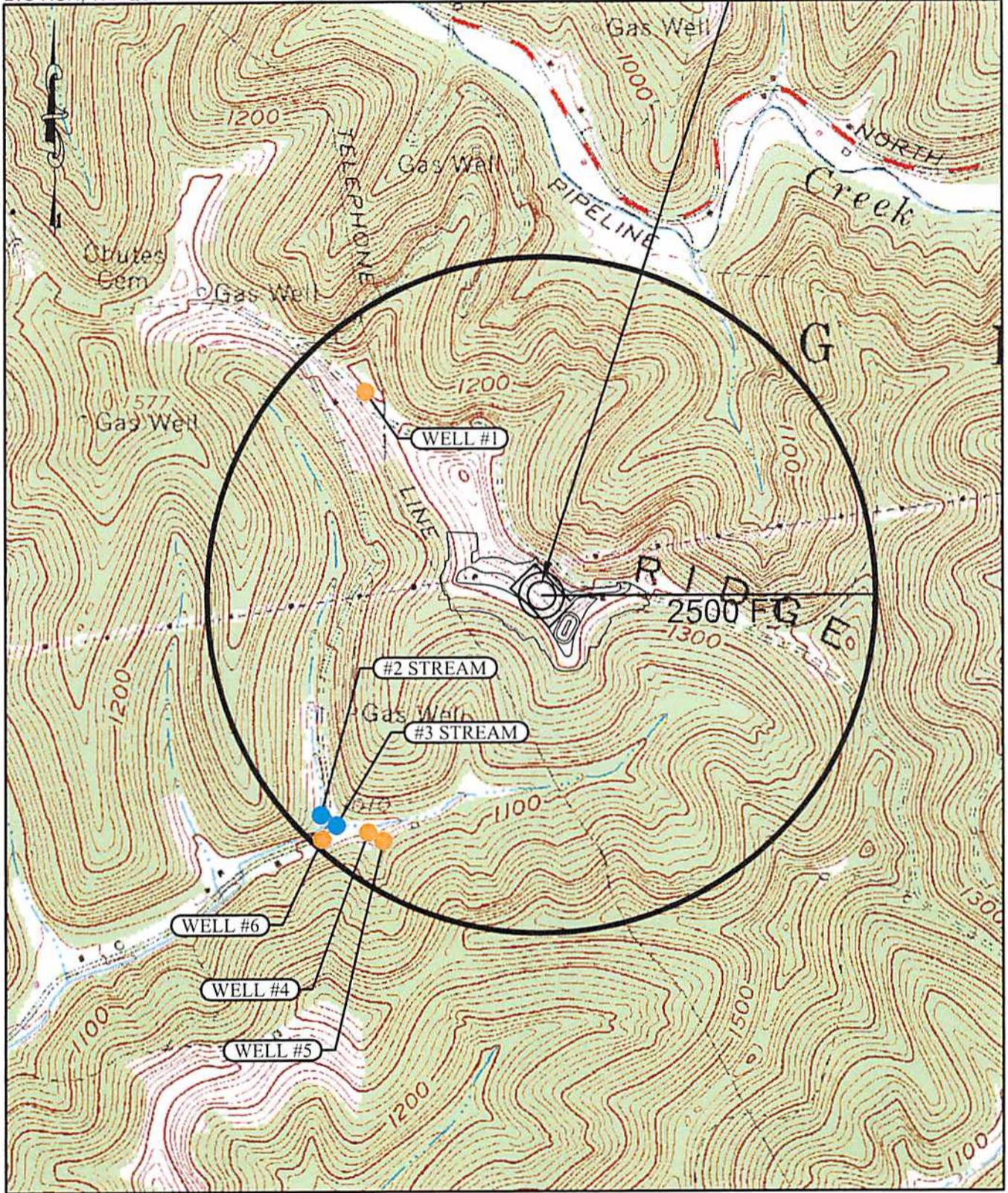
**EQT PRODUCTION**  
**BIG 367 WELL PAD AND ACCESS ROAD**  
**WETZEL COUNTY, WV**

103-02940

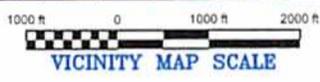
plat spotted

BIG RUN, WV QUAD MAP

PROJECT LOCATION



- EXISTING WELL
- EXISTING STREAM



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SEP 12 2013

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