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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 10302941, Well #: 514567

**Extended Horizontal**

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

Regulatory/Compliance Manager  
Office of Oil and Gas



4710302941  
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)514567, 47-10302941

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,

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

4710302941  
MOD

1) Well Operator: EQT Production Company  
Operator ID: 103 County: 4 District: 254 Quadrangle

2) Operator's Well Number: 514567 Well Pad Name: BIG367

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

4) Elevation, current ground: 1,475.1 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

DmH  
2-12-14

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: 17,815

11) Proposed Horizontal Leg Length: 8,995

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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FEB 19 2014

Office of Oil and Gas  
WV Dept. of Environmental Protection

05/02/2014

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	17,815	17,815	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.

DmH  
2-12-14

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FEB 19 2014

Office of Oil and Gas  
WV Dept. of Environmental Protection

05/02/2014

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 6011', 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.

\*Note: Attach additional sheets as needed.

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FEB 19 2014

Office of Oil and Gas WV Dept. of Environmental Protection

DmH 2-12-14

05/02/2014



47 10302941  
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(514567) 47-10302941

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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Office of Oil and Gas  
WV Dept. of Environmental Protection

DmH  
2-12-14

05/02/2014

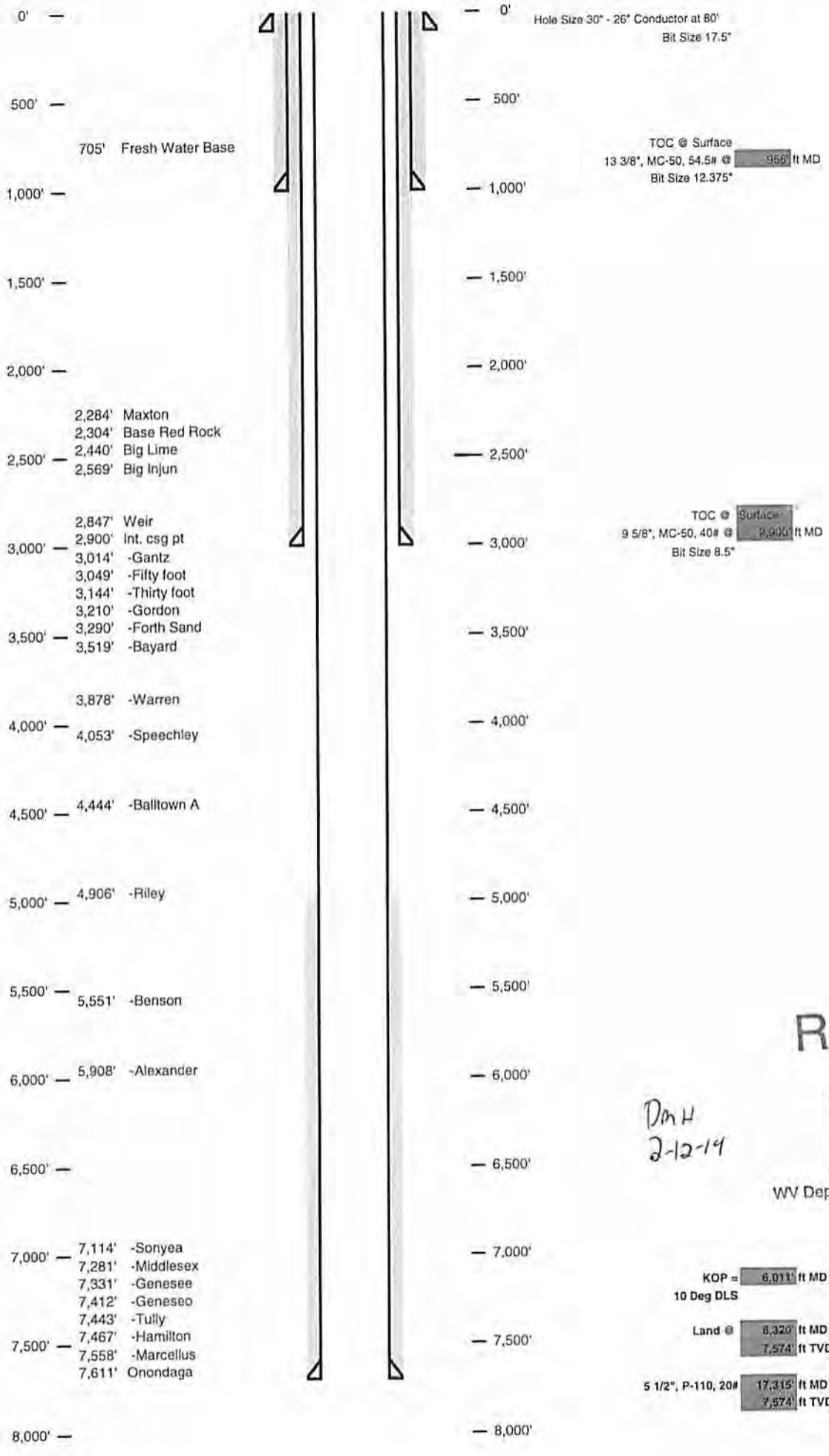
4710302941

MOD

Well Schematic  
EQT Production

Well Name: S14567 (B 0362-16)  
County: Wetzell  
State: West Virginia

Elevation KB: 1466  
Target: Marcellus  
Prospect: 162  
Azimuth: 9729  
Vertical Section



Received

FEB 19 2014

DMH  
2-12-14

Office of Oil and Gas  
WV Dept. of Environmental Protection

05/02/2014

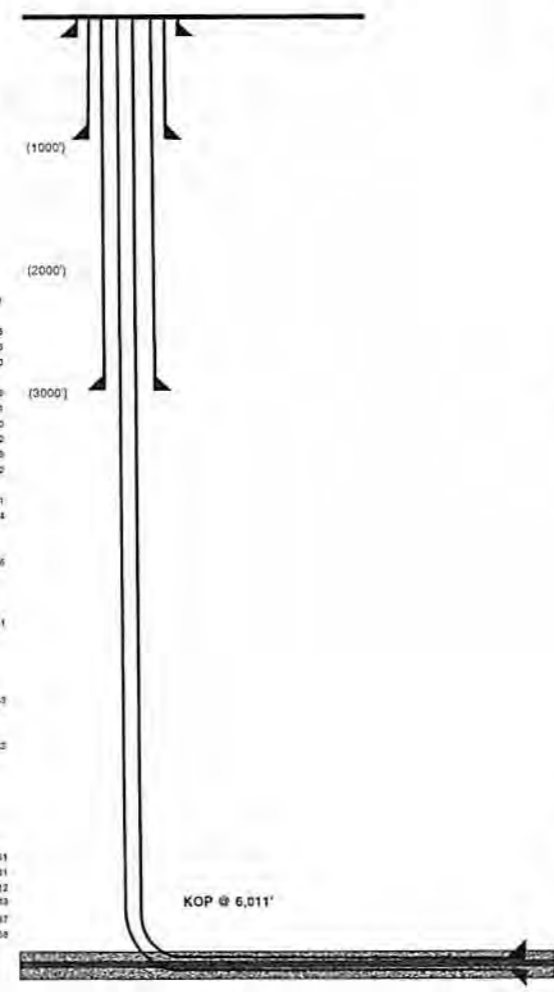
4710302941

MOD

Well 514567 (BIG367H6)  
 EQT Production  
 Big Run  
 Wetzel West Virginia

Azimuth 162  
 Vertical Section 8721

TVD Depth (feet) ±	Formation Tops (TVD)	Hole Size (inches)	Casing Type	Casing Size (inches)	Wt (ppf/Grade)
250'		30"	Conductor	26"	
500'		17 1/2"	Surface	13 3/8"	54#/MC-50
750'	Base Fresh Water 735				
1,000'					
1,250'					
1,500'					
1,750'					
2,000'					
2,250'	Moxley 2284 - 2411				
2,500'	Base Red Rock 2304				
	Big Lime 2440 - 2353				
	Big Injun 2509 - 2719				
2,750'	Wet 2847 - 2540				
	Int. cap of 2900				
3,000'	Gardner 3014 - 3019	12 3/8"	Intermediate	9 5/8"	40#/MC-50
	Fifty foot 3049 - 3091				
3,250'	Thirty foot 3146 - 3210				
	Gordon 3210 - 3242				
3,500'	Fourth Band 3282 - 3323				
	Bayard 3319 - 3372				
3,750'					
4,000'	Warren 3378 - 4001				
	Spicetley 3053 - 4444				
4,250'					
4,500'	Belton A 4344 - 4906				
4,750'					
5,000'	Finley 4900 - 5331				
5,250'					
5,500'	Benson 5551 - 5753				
5,750'	Alexander 5900 - 6342				
6,000'					
6,250'					
6,500'					
6,750'	Girtyva 7114 - 7231				
	Middlesex 7281 - 7331				
7,000'	Germess 7331 - 7412				
	Germessop 7412 - 7443				
7,250'	Tully 7443 - 7487				
	Hamilton 7467 - 7558				
7,500'	Marcellus top 7558				
	Target inside Marcellus 7574				
7,750'	Marcellus Bottom 7611				



Land curve @ 7,574' ft TVD  
 8,320' ft MD  
 Est. TD @ 7,574' ft TVD  
 7,719' ft MD  
 8,925' 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 6011'.  
 Then kick off the horizontal leg into the Marcellus using a slick water frac.

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FEB 19 2014

Office of Oil and Gas  
 WV Dept. of Environmental Protection

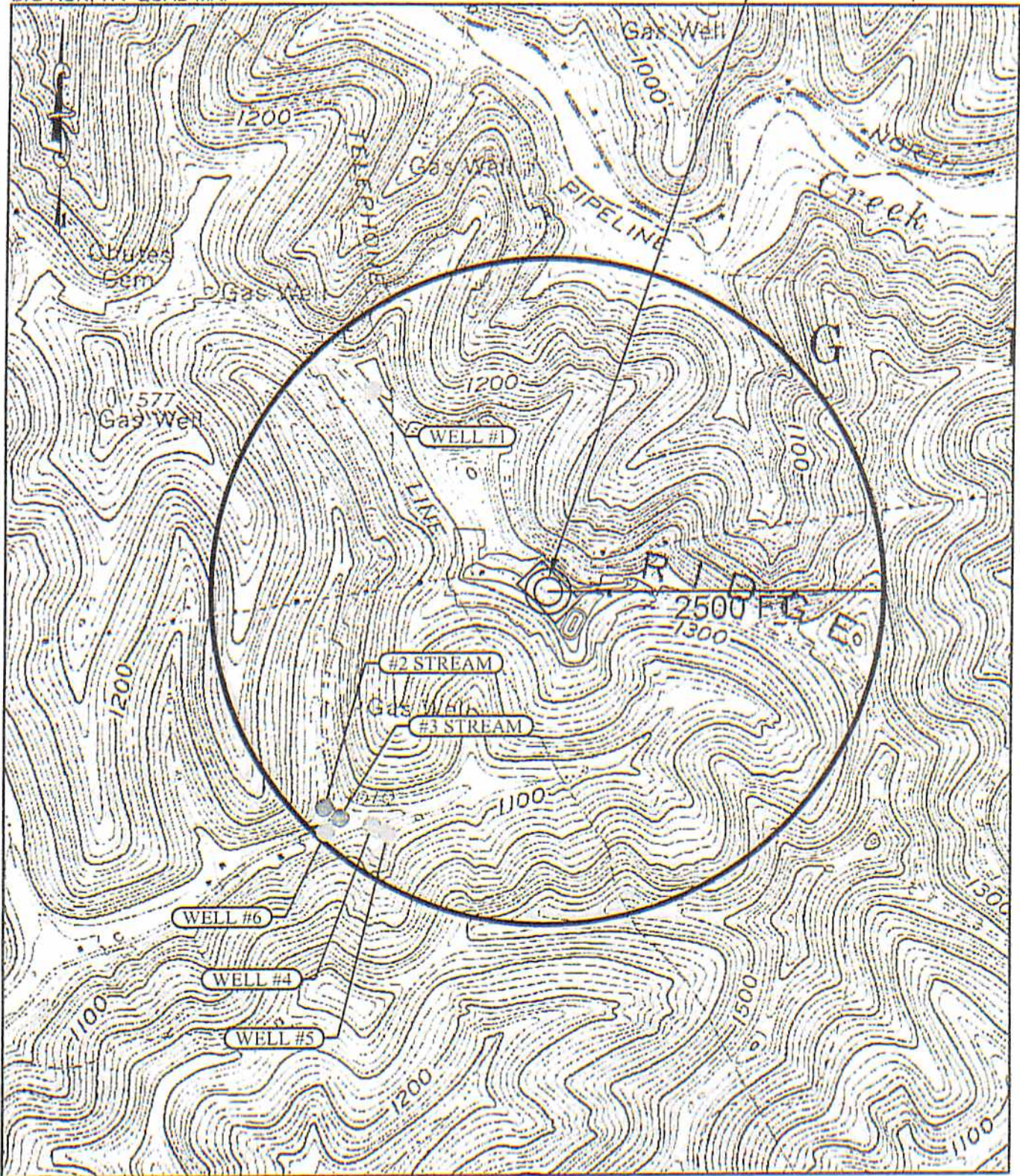


**EQT PRODUCTION**  
**BIG 367 WELL PAD AND ACCESS ROAD** **AD 0302941**  
**WETZEL COUNTY, WV**

*plat spotted*

BIG RUN, WV QUAD MAP

PROJECT LOCATION



- EXISTING WELL
- EXISTING STREAM



*DWH  
4-12-13*

**05/02/2014**  
**RECEIVED**  
**Office of Oil and Gas**  
**SEP 16 2013**  
**WV Department of**  
**Environmental Protection**

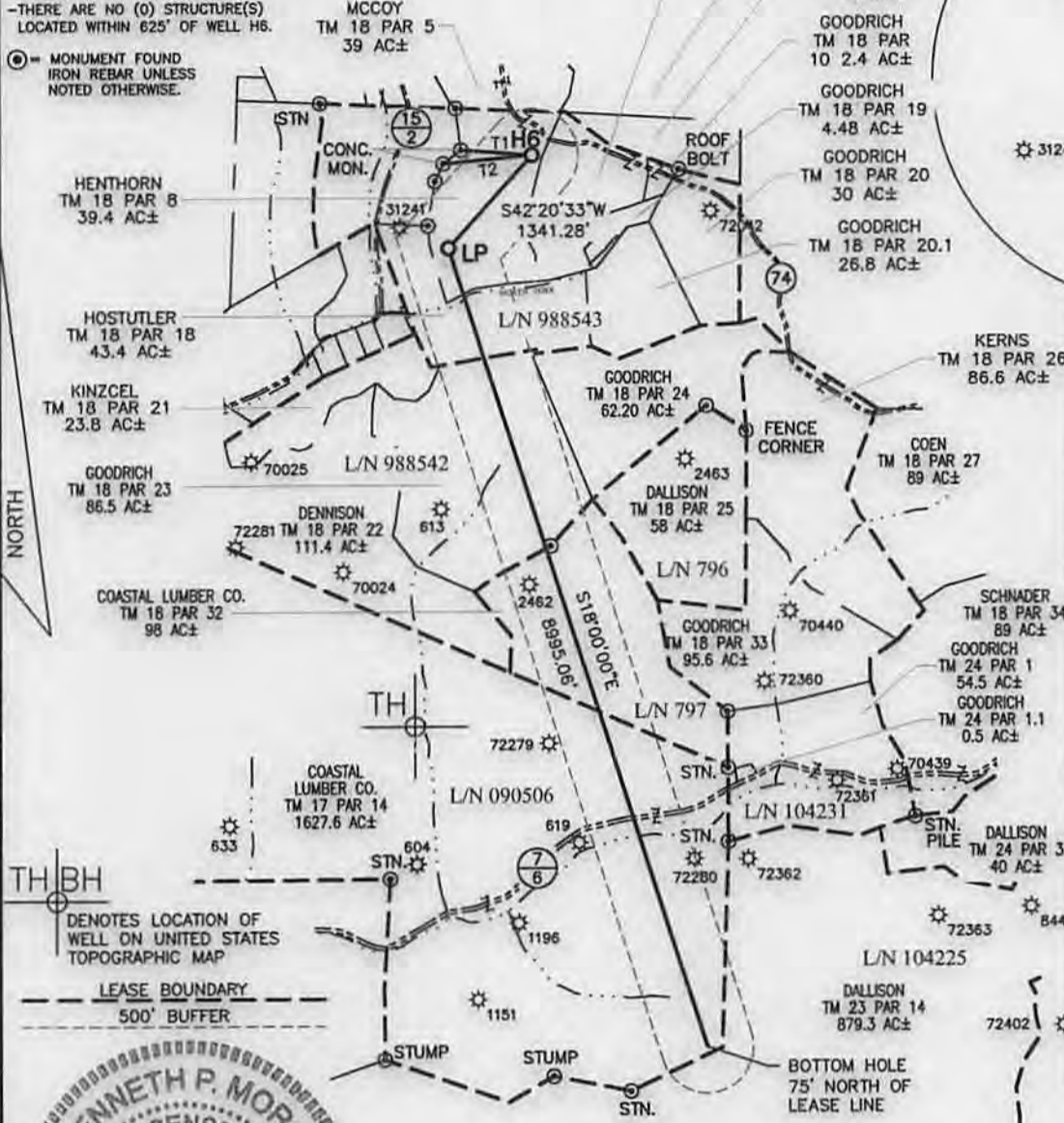
# EQT WELL NO. 514567

LATITUDE 39° 35' 00"

LONGITUDE 80° 32' 30"

**NOTES:**  
 -PLAT ORIENTATION, CORNERS, AND WELL REFERENCES ARE BASED UPON THE GRID NORTH MERIDIAN FOR THE WV STATE PLANE COORDINATE SYSTEM, NORTH ZONE NAD 27. WELL LOCATION REFERENCE TIES ARE BASED UPON THE MAGNETIC MERIDIAN.  
 -THERE ARE NO (O) WATER WELL(S) LOCATED WITHIN 250' OF WELL H6.  
 -THERE ARE NO (O) STRUCTURE(S) LOCATED WITHIN 625' OF WELL H6.

MONUMENT FOUND  
 IRON REBAR UNLESS  
 NOTED OTHERWISE.

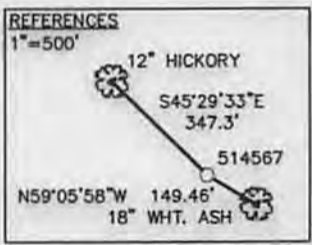


USER: kpoth  
 LAYOUT: H6 (2)  
 PLOT DATE/TIME: 1/7/2014 - 2:25pm  
 NORTH  
 CAD FILE: R:\030-2259 EQT BIG367 Well Pad and Access Rd\Survey\030-2259 BIG 367 -EQT 2000.dwg

**WELL 514567  
 TOP HOLE**  
**STATE PLANE COORDINATES**  
 (NAD 27 NORTH ZONE)  
 N:386623.497  
 E:1695492.143  
 LAT:39.556565  
 LON:80.579816  
**UTM COORDINATES**  
 (NAD 83-METER)  
 N:4378626.457  
 E:536097.746

**WELL 514567  
 LAUNCH POINT**  
**STATE PLANE COORDINATES**  
 (NAD 27 NORTH ZONE)  
 N:385632.147  
 E:1694588.771  
 LAT:39.553814  
 LON:80.582978  
**UTM COORDINATES**  
 (NAD 83-METER)  
 N:4378319.829  
 E:535827.548

**WELL 514567  
 BOTTOM HOLE**  
**STATE PLANE COORDINATES**  
 (NAD 27 NORTH ZONE)  
 N:377077.342  
 E:1697368.696  
 LAT:39°31'49.511"  
 LON:80°34'21.929"  
**UTM COORDINATES**  
 (NAD 83-METER)  
 N:4375727.664  
 E:536717.886



LINE	BEARING	DIST.
T1	S85°50'46\"/>	



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.

FILE NO. 030-2259  
 SCALE: 1"=2000'  
 MINIMUM DEGREE OF ACCURACY: 1 in 2500  
 PROVEN SOURCE OF ELEVATION: OPUS SURVEY GRADE GPS

**STATE OF WEST VIRGINIA**  
**DIVISION OF ENVIRONMENTAL PROTECTION**  
**OFFICE OF OIL & GAS**

DATE JANUARY 3, 2014  
 OPERATOR'S WELL NO. 514567  
 API WELL NO. MOD  
47 - 103 - 02941 H6A  
 STATE COUNTY PERMIT

**WELL TYPE:** OIL  GAS  LIQUID INJECTION  WASTE DISPOSAL  (IF "GAS"), PRODUCTION  STORAGE  DEEP  SHALLOW   
**LOCATION:** ELEVATION: EG: 1,475.1' PROP: 1,442.90' WATER SHED: NORTH FORK OF FISHING CREEK  
 DISTRICT: GRANT COUNTY: WETZEL  
 QUADRANGLE: BIG RUN ACREAGE: 39.4 AC±  
 SURFACE OWNER: DENCIL HENTHORN ET AL LEASE ACREAGE: 1,894.9 AC±  
 OIL & GAS ROYALTY OWNER: SHIBEN ESTATE, INC., CNX GAS CO., LLC LEASE NO. 988543/988542 797/0090506

**THRASHER**  
 THE THRASHER GROUP, INC.  
 600 WHITE OAKS BLVD.  
 BRIDGEPORT, WV 26330  
 PHONE: 805/627-2014

**PROPOSED WORK:** DRILL  CONVERT  DRILL DEEPER  REDRILL  FRACTURE OR STIMULATE   
 PERFORATE NEW FORMATION  PLUG OFF OLD FORMATION  OTHER PHYSICAL CHANGE IN WELL (SPECIFY) \_\_\_\_\_

PLUG AND ABANDON \_\_\_\_\_ CLEAN OUT AND REPLUG \_\_\_\_\_  
 TARGET FORMATION: MARCELLUS SHALE ESTIMATED DEPTH: TVD/MD

WELL OPERATOR: EQT PRODUCTION DESIGNATED AGENT: REX C. RAY  
 ADDRESS: 115 PROFESSIONAL PLACE ADDRESS: 115 PROFESSIONAL PLACE  
BRIDGEPORT, WV 26330 BRIDGEPORT, WV 26330