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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

July 20, 2015

EQT PRODUCTION COMPANY  
120 PROFESSIONAL PLACE  
BRIDGEPORT, WV 26330

Re: Permit Modification Approval for API Number 4902347, Well #: 514746

**Modify path of lateral and target formation**

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".

Gene Smith  
Assistant Chief of Permitting  
Office of Oil and Gas

Promoting a healthy environment.

07/24/2015



June 29, 2015

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

Re: Modification of 049-02347

Dear Mr. Smith,

Enclosed is an updated WW-6B, schematics, WW-6A1 and mylar plat. EQT would like to modify the path of the lateral and the target formation from Genesee to Marcellus. The top hole has not changed.

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

Sincerely,

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

Vicki Roark  
Permitting Supervisor-WV

Enc.

cc:  
Bill Hendershot  
403 James Street  
Mannington, WV 26582

07/24/2015

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

1) Well Operator: EQT Production Company  

<u>306686</u>	<u>049</u>	<u>4</u>	<u>374</u>
Operator ID	County	District	Quadrangle

2) Operator's Well Number: 514746 Well Pad Name GLO76

3) Farm Name/Surface Owner : Robert E Tonkery Public Road Access: Co Rt 1

4) Elevation, current ground: 1,455.0 Elevation, proposed post-construction: 1,425.0

5) Well Type: (a) Gas  Oil  Underground Storage   
Other \_\_\_\_\_

(b) If Gas: Shallow  Deep   
Horizontal

6) Existing Pad? Yes or No: no

7) Proposed Target Formation(s), Depth(s), Anticipated Thicknesses and Associated Pressure(s):

Target formation is Marcellus at a depth of 7682 with the anticipated thickness to be 50 feet and anticipated target pressure of 2593 PSI

8) Proposed Total Vertical Depth: 7682

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 11374

11) Proposed Horizontal Leg Length 2,809

12) Approximate Fresh Water Strata Depths: 264

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

14) Approximate Saltwater Depths: 1884, 2124, 2439

15) Approximate Coal Seam Depths: 653, 809, 1068, 1167

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? Yes \_\_\_\_\_ No x

(a) If Yes, provide Mine Info: Name: \_\_\_\_\_  
Depth: \_\_\_\_\_  
Seam: \_\_\_\_\_  
Owner: \_\_\_\_\_

*WBK*  
*7-1-15* Page 1 of 3

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**CASING AND TUBING PROGRAM**

18)

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.)
Conductor	20	New	MC-50	81	40	40	38 C.T.S.
Fresh Water	13 3/8	New	MC-50	54	948	948	825 C.T.S.
Coal	-	-	-	-	-	-	-
Intermediate	9 5/8	New	MC-50	40	3,051	3,051	1,193 C.T.S.
Production	5 1/2	New	P-110	20	11,374	11,374	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							

*WRH 7-1-15*

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	0.375	-	18	Construction	1.18
Fresh Water	13 3/8	17 1/2	0.38	2,480	2,184	* See Note 2	1.21
Coal							
Intermediate	9 5/8	12 3/8	0.395	3,590	3,160	* See Note 2	1.21
Production	5 1/2	8 1/2	0.361	12,640	10,112	-	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. (Attached)

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

Drill and complete a new vertical well in the Marcellus formation. The vertical to go down to an approximate depth of 5634'.  
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 internal casing pressure is 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): no additional disturbance

22) Area to be disturbed for well pad only, less access road (acres): no additional disturbance

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.

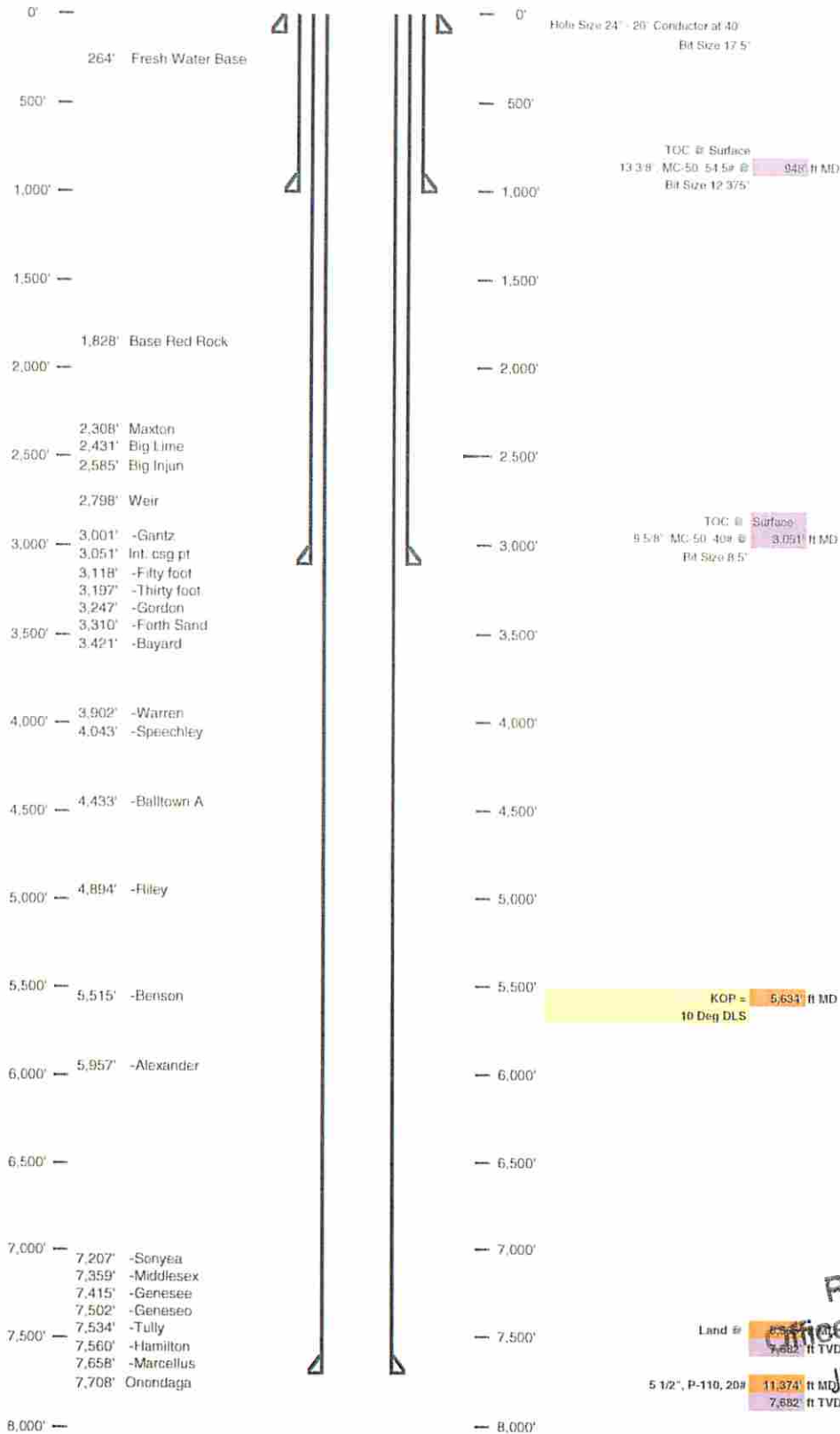
\*Note: Attach additional sheets as needed.

4704902347 MOD

Well Schematic  
EQT Production

Well Name: 614748 (GL) 1764H  
County: Marion  
State: West Virginia

Elevation KB: 1138  
Target: Marcellus  
Prospect: Marcellus  
Azimuth: 163.45  
Vertical Section: 4185



47 0 4 9 0 2 3 4 7 MON

Well: 514746 (GL076H3)  
 EOT Production  
 Glover GSP  
 Marion

Account: 133-3E  
 Vertical Section: 4188

TVD Depth (feet)	Formation	Formation Top (TVD)	Head Size (inches)	Casing Type	Casing Size (inches)	WT (lb/ft)	Grade
250'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
500'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
750'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
1000'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
1250'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
1500'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
1750'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
2000'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
2250'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
2500'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
2750'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
3000'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
3250'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
3500'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
3750'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
4000'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
4250'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
4500'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
4750'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
5000'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
5250'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
5500'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
5750'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
6000'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
6250'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
6500'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
6750'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
7000'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	
7250'	Shale		13 5/8	Surface	13 5/8	54#/MC-56	

WRH  
 7-16

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 5534'



WV 514746  
EQT Production Company  
Bower et al LEASE  
111.0 Acres ±

Lease No.	Acres	Owner
300684	79	Richard G. Thorne et. al.
993296	35	Ronnie David Starkey
991928	34.5	Kennis S. Ketterer Jr. et al.
993303	106.5	East Resources Inc. et. al.

Latitude: 39° 35' 00"

WV 514746 Well Point Coordinates

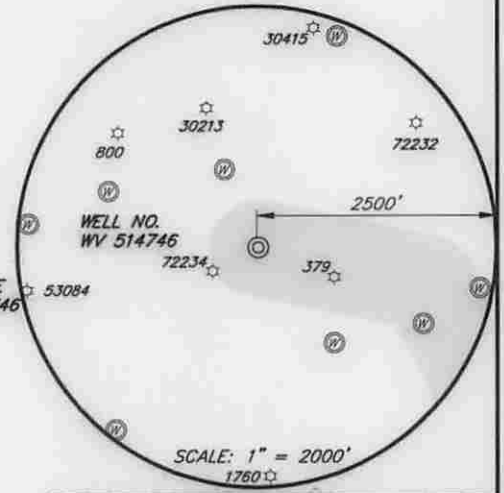
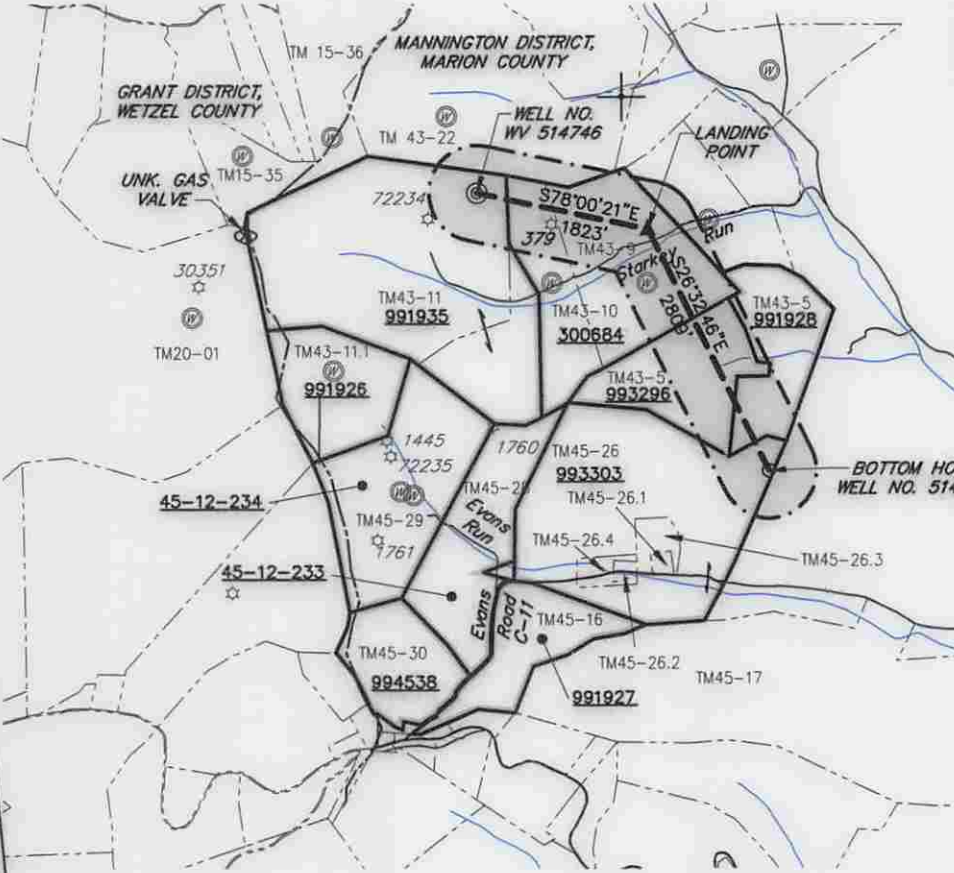
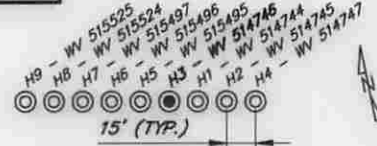
Top Hole Coordinates		
NAD 27 S.P.C. (Ft.)	N: 389,063.632	E: 1,721,000.643
NAD 27 GEO	LAT: 39.563988	LONG: 80.489634
NAD 83 UTM 17N (M)	N 4,379,499.8	E: 543,856.9
NAD 83 S.P.C. (Ft.)	N 389,101.3	E: 1,689,561.9
Landing Point Coordinates		
NAD 27 S.P.C. (Ft.)	N: 388,684.830	E: 1,722,783.740
NAD 27 GEO	LAT: 39.563002	LONG: 80.489295
NAD 83 UTM 17N (M)	N 4,379,393.4	E: 544,402.1
NAD 83 S.P.C. (Ft.)	N 388,722.4	E: 1,691,345.0
Bottom Hole Coordinates		
NAD 27 S.P.C. (Ft.)	N: 386,172.058	E: 1,724,039.180
NAD 27 GEO	LAT: 39.556141	LONG: 80.478745
NAD 83 UTM 17N (M)	N 4,378,634.3	E: 544,797.3
NAD 83 S.P.C. (Ft.)	N 386,209.7	E: 1,692,600.3

LEGEND

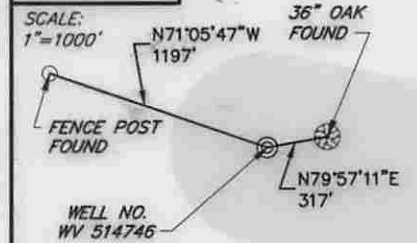
- ☆ EXISTING OIL/GAS WELL
- ⊙ WATER FEATURE
- ⊙ WELL HEAD TOP HOLE
- ▲ WELL LANDING POINT
- WELL BOTTOM HOLE
- REBAR FOUND
- STONE FOUND
- WELL LATERAL LINE
- LEASE BOUNDARY
- BUFFER
- PROPERTY LINE
- STREAM
- 500' LATERAL COLLECTION

**Coordinate Notes**  
West Virginia Coordinate System of 1927 (North Zone) Based upon Differential GPS Measurements.  
Plat orientation, Corner and well ties are based upon the grid north meridian.  
Well location references are based upon the grid north meridian.  
UTM Coordinates are NAD83, Zone 17 Meters.

GLO 76



Well References



- PLAN -

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



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 REGULATIONS ISSUED AND PRESCRIBED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.

*[Signature]*



FILE NO.: EES-60635  
DRAWING NO.: GLO76\_Well Plat  
SCALE: 1" = 2000'  
MINIMUM DEGREE OF ACCURACY: ±3'  
PROVEN SOURCE OF ELEVATION: GPS

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



DATE: JUNE 26, 2015  
OPERATORS WELL NO. WV 514746  
API WELL NO. 47  
STATE COUNTY PERMIT 049 02347

WELL TYPE:  OIL  GAS  LIQUID INJECTION  WASTE DISPOSAL  (IF GAS) PRODUCTION:  STORAGE  DEEP  SHALLOW  
LOCATION, ELEVATION: 1455' (Ground) 1425' (Prop.) WATERSHED: Starkey Run QUADRANGLE: GLOVER GAP, WV  
DISTRICT: MANNINGTON COUNTY: Marion  
SURFACE OWNER: Robert E. Tonkery ACREAGE: 111.00± AC  
ROYALTY OWNER: Lynn Ann Brower, et al LEASE NO.: 991935 ACREAGE: 111.00± AC  
PROPOSED WORK:  DRILL  CONVERT  DRILL DEEPER  FRACTURE OR STIMULATE  PLUG OFF OLD FORMATION  
 PERFORATE NEW FORMATION  OTHER PHYSICAL CHANGE IN WELL (SPECIFY)  
 PLUG AND ABANDON  CLEAN OUT AND REPLUG TARGET FORMATION: MARCELLUS ESTIMATED DEPTH: 7,649'

WELL OPERATOR: EQT Production Company DESIGNATED AGENT: Rex. C. Ray  
ADDRESS: 115 Professional Pl., P.O. Box 280 ADDRESS: 115 Professional Pl., P.O. Box 280  
Bridgeport, WV 26330 Bridgeport, WV 26330

WWW.ENCOMPASSSERVICES.COM PLOT DATE: 6/26/2015 CAD FILE: GLO76\_WELL PLAT\_6-26-2015.DWG

07/24/2015



**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:

Lease Name or Number	Grantor, Lessor, etc.	Grantee, Lessee, etc.	Royalty	Book/Page
<u>991935</u>	Donald E. Huey, et al	EQT Production Company	min 1/8 pd	DB1128/230
<u>300684</u>	A.S. Kendall and Pricilla Kendall, his wife	Hope Natural Gas Company	min pd 1/8th	DB170/404
	Hope Natural Gas Company	Consolidated Gas Supply Corp		DB680/35
	Consolidated Gas Supply Corp	Consolidated Gas Transmission Corp		AB9/912
	Consolidated Gas Transmission Corp	CNG Transmission Corp		CB46/654
	CNG Transmission Corp	Eastern States Oil & Gas, Inc		AB16/993
	Eastern States Oil & Gas, Inc	Blazer Energy Corp		CB53/99
	Blazer Energy Corp	Eastern States Oil & Gas, Inc		CB53/96
	Eastern States Oil & Gas, Inc	Equitable Production Company		CB13/14
	Equitable Production Company	EQT Production Co.		CB61/558
<u>993296</u>	Ronnie David Starkey	EQT Production Company	min pd 1/8th	LB1125/532
<u>991928</u>	Kennis S. Ketterer, Jr.	EQT Production Company	min pd 1/8th	LB 1123/166
	Sharon Joette Poe Conger	EQT Production Company		LB 1124/25
<u>993303</u>	East Resources, Inc., et al	EQT Production Company	min pd 1/8th	DB1145/565

Upon information and belief, Operator's lease and/or other real property rights permit it to conduct drilling operations for the subject well in the location shown on the plat, including under any public roads that the well lateral crosses.

**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: EQT Production Company  
 By: [Signature]  
 Its: Permitting Supervisor

Page 1 of 1

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Office of Oil & Gas  
JUL 07 2015



June 29, 2015

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

Re: Modification of 049-02347

VOID

Dear Mr. Smith,

Enclosed is an updated WW-6B, schematics, WW-6A1 and mylar plat. EQT would like to modify the path of the lateral. The top hole has not changed.

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

Enc.

cc:  
Bill Hendershot  
403 James Street  
Mannington, WV 26582

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