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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

August 07, 2013

**WELL WORK PERMIT**

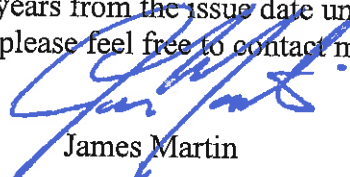
**Horizontal 6A Well**

This permit, API Well Number: 47-8510052, issued to EQT PRODUCTION COMPANY, is evidence of permission granted to perform the specified well work at the location described on the attached pages and located on the attached plat, subject to the provisions of Chapter 22 of the West Virginia Code of 1931, as amended, and all rules and regulations promulgated thereunder, and to all conditions and provisions outlined in the pages attached hereto. Notification shall be given by the operator to the Oil and Gas Inspector at least 24 hours prior to the construction of roads, locations, and/or pits for any permitted work. In addition, the well operator shall notify the same inspector 24 hours before any actual well work is commenced and prior to running and cementing casing. Spills or emergency discharges must be promptly reported by the operator to 1-800-642-3074 and to the Oil and Gas inspector.

Please be advised that form WR-35, Well Operators Report of Well Work is to be submitted to this office within 90 days completion of permitted well work, as should form WR-34 Discharge Monitoring Report within 30 days of discharge of pits, if applicable. Failure to abide by all statutory and regulatory provisions governing all duties and operations hereunder may result in suspension or revocation of this permit and, in addition, may result in civil and/or criminal penalties being imposed upon the operators.

In addition to the applicable requirements of this permit, and the statutes and rules governing oil and gas activity in WV, this permit may contain specific conditions which must be followed. Permit conditions are attached to this cover letter.

Per 35CSR-4-5.2.g this permit will expire in two (2) years from the issue date unless permitted well work is commenced. If there are any questions, please feel free to contact me at (304) 926-0499 ext. 1654.



James Martin  
Chief

Operator's Well No: 513043

Farm Name: HEARTWOOD FORESTLAND FU.

**API Well Number: 47-8510052**

**Permit Type: Horizontal 6A Well**

Date Issued: 08/07/2013

**Promoting a healthy environment.**

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08/09/2013

## PERMIT CONDITIONS

West Virginia Code § 22-6A-8(d) allows the Office of Oil and Gas to place specific conditions upon this permit. Permit conditions have the same effect as law. Failure to adhere to the specified permit conditions may result in enforcement action.

### CONDITIONS

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1. The Office of Oil and Gas has approved your permit application, which includes your addendum. Please be advised that the addendum is part of the terms of the well work permit, and will be enforced as such. The Office of Oil and Gas must receive a copy of all data collected, and submitted in a timely fashion, but no later than the WR35 submittal.
2. Prior to conducting hydraulic fracturing operations, identify any and all shallower producing wells within the area of review that may have multiple levels of completions (more than one producing interval open in the well bore) and communicate this to the DEP. If any wells are found that have multiple completions, evaluate the risk associated with communication into any shallow producing zone(s).
3. If the operator encounters an unanticipated void, or an anticipated void at an unanticipated depth, the operator shall notify the inspector within 24 hours. Modifications to the casing program may be necessary to comply with W. Va. Code § 22-6A-5a (12), which requires drilling to a minimum depth of thirty feet below the bottom of the void, and installing a minimum of twenty (20) feet of casing. Under no circumstance should the operator drill more than fifty (50) feet below the bottom of the void or install less than twenty (20) feet of casing below the bottom of the void.
4. When compacting fills, each lift before compaction shall not be more than 12 inches in height, and the fill material shall be within plus or minus 2% (unless soil test results show a greater range of moisture content is appropriate and 95% compaction can still be achieved) of the optimum moisture content as determined by the standard proctor density test, ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. Each lift must meet 95 % compaction of the optimum density based on results from the standard proctor density test of the actual soils used in specific engineered fill sites. Each lift shall be tested for compaction, with a minimum of two tests per lift per acre of fill. All test results shall be maintained on site and available for review.
5. Operator shall install signage per § 22-6A-8g (6) (B) at all source water locations included in their approved water management plan within 24 hours of water management plan activation.
6. Oil and gas water supply wells will be registered with the Office of Oil and Gas and all such wells will be constructed and plugged in accordance with the standards of the Bureau for Public Health set forth in its Legislative rule entitled *Water Well Regulations*, 64 C.S.R. 19. Operator is to contact the Bureau of Public Health regarding permit requirements. In lieu of plugging, the operator may transfer the well to the surface owner upon agreement of the parties. All drinking water wells within fifteen hundred feet of the water supply well shall be flow tested by the operator upon request of the drinking well owner prior to operating the water supply well.
7. Pursuant to the requirements pertaining to the sampling of domestic water supply wells/springs the operator shall, no later than thirty (30) days after receipt of analytical data provide a written copy to the Chief and any of the users who may have requested such analyses.
8. If any explosion or other accident causing loss of life or serious personal injury occurs in or about a well or well work on a well, the well operator or its contractor shall give notice, stating the particulars of the explosion or accident, to the oil and gas inspector and the Chief, within 24 hours of said accident.
9. During the casing and cementing process, in the event cement does not return to the surface, the oil and gas inspector shall be notified within 24 hours.

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08/09/2013

4708510052

**EQT Production**  
**Hydraulic Fracturing Monitoring Plan**  
**Pad ID: PEN16**  
**Ritchie County, WV**  
**513043**

**7/24/13**

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Office of Oil and Gas  
WV Dept. of Environmental Protection

## Purpose

The purpose of this pad-specific Hydraulic Fracturing Monitoring Plan is to establish a joint effort between EQT, the West Virginia Office of Oil and Gas (OOG), and local conventional well operators in the Ritchie County area. This plan applies to proposed wells on this pad: 513042, 513045, 514387, 513041 and 513043.

Due to the apparent presence of unique geological conditions, the potential for communication between deep geologic zones exists in this area. This potential communication, via natural gas, water, or both, may occur between hydraulically fractured wells in the Marcellus formation (approximately 6,400' TVD) and existing conventional natural gas wells in the partially-depleted, relatively high permeability Alexander formation (approximately 5,200' TVD).

The plan is being implemented as an additional safety measure to be utilized in conjunction with existing best management practices and emergency action plans for the site. The plan will further enable the participants to obtain data and information for a root cause analysis in the event communication between zones does occur during hydraulic fracturing.

These additional measures include pre-notification of conventional well operators of the timing and location of the hydraulic fracturing, establishment of measures conventional well operators should implement, and assurance that the OOG is notified of the timeline, as well as any issues that may arise during fracturing.

### 1. Communications with Conventional Well Operators

EQT, using available data (WV Geological Survey, WVDEP website, and IHS data service), has identified all known conventional wells and well operators within 1,500 feet of this pad and the lateral sections. A map showing these wells along with a list of the wells and operators is included in **Attachment A**.

Upon approval of this plan, EQT will notify these operators, via letter, of the hydraulic fracturing schedule for these wells. A copy of this letter is included in **Attachment B**.

The letter provides recommendations to these conventional operators to 1) increase their monitoring of their wells during that time period, 2) ensure that their well head equipment is sound, and 3) provide immediate notification to EQT and the OOG in the event of any changes in their well conditions.

Specifically, the letter recommends that conventional well operators conduct the following activities during and after fracturing operations:

1. Inspect their surface equipment prior to fracturing to establish integrity and establish pre-frac well conditions
2. Observe wells closely during and after fracturing and monitor for abnormal increases in water, gas or pressure
3. Inspect or install master valves rated to 3,000 psi or other necessary equipment for wellhead integrity
4. Notify the OOG and EQT if any changes in water, gas production, pressure, or other anomalies are identified

### 2. Monitoring

EQT will conduct pressure monitoring on select conventional wells before, during, and after hydraulic fracturing of this pad. EQT has selected conventional wells which are directly above its lateral section and completed within the Alexander formation, at approximately 1,000' intervals. EQT will also monitor

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The wells to be monitored are conventional wells operated by GasSearch, ECA, Mountain State, Oiltex, and EQT. EQT or the third-party operator will inspect the wells and monitor the pressures daily.

EQT will closely monitor drilling and hydraulic fracturing activities to identify any abnormalities related to geology such as loss of fluid circulation during drilling or pressure anomalies noted during fracturing.

This pad will be drilled and hydraulically fractured by EQT without any other modifications to our normal practices, unless communication is observed. These include casing and cementing practices, hydraulic fracturing volumes, pumping rates, drillout, and flowback timeframes. This will assist in establishing a baseline for future monitoring of activities in this area. Should communication be observed, EQT may vary the completion design on fracturing stages completed after the communication is observed.

### 3. Reporting

EQT will provide information relating to the hydraulic fracturing schedule, communication with conventional operators, and ongoing monitoring of the work on a regular and routine basis, upon request of OOG, or immediately in the event of any noted abnormalities.

Upon completion of the hydraulic fracturing and monitoring, EQT will provide a written report documenting the monitoring activities identified in this plan.

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WV Dept. of Environmental Protection

**Attachment A**

**Conventional Wells Within 1,500' of Pad and Laterals**

**and**

**Wells to be Monitored by EQT**

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Office of Oil and Gas  
Department of Environmental Protection

Attachment A

Monitor	API Number	Prior Operator on Record	Operator-DEP	STATUS	LAT	LONG	Vertical Well TD	Closest Distance from Pen16 Lateral Map View	Pen16 Horizontal TVD minus Vertical TD	Hypotenuse Distance	Producing Formation	Gas Show/Pay Zone Depths
Y	4708509227	GASSEARH	GASSEARH CORP	GAS	39.259129	-80.943018	5307	392	859	863		
Y	4708509226	GASSEARH	GASSEARH CORP	GAS	39.261065	-80.945765	5311	32	909	1001	Alexander, 3rd Riley, & Bradford	5024-5030, 4603-4794, 4358-4386
Y	4708509225	GASSEARH	GASSEARH CORP	GAS	39.257825	-80.94668	5350	1484	960	1006	Alexander/Benson/3rd Riley & 2nd Riley	4811-5173, 4496-4531
Y	4708507963	EAE	ECA	GAS	39.2555	-80.9375	5172	1403	1026	1026	Benson, 3rd Riley, & Riley	4653-4712, 4338-4350
Y	4708509243	GASSEARH	GASSEARH CORP	GAS	39.256955	-80.940635	5120	430	1000	1045	Alexander, 3rd Riley/Benson, & Bradford	4896-5012, 4629-4694, 4292-4331
Y	4708507956	TERM ENERGY	Mountain State Oil Co	GAS	39.2557	-80.9444	5287	525	1051	1061	Alexander, Benson, Riley, & Warren	5132-5155, 4868-4866, 4496-4509, 3388-3408
Y	4708507685	EAE	ECA	GAS	39.2441	-80.9327	5130	680	1063	1065	Riley & Warren	4102-4339, 3230-3198
Y	4708507675	EAE	ECA	GAS	39.2482	-80.9368	4995	145	1061	1101	Benson, Speechley, & Warren	4566-4569, 3859-4209, 3528-3650, 3066-3108
Y	4708507884	EAE	ECA	GAS	39.2603	-80.9495	5398	1421	981	1194	Alexander, Benson, 3rd Riley, Riley, & Warren	5206-5236, 4868-4939, 4569-4590, 3434-3487
Y	4708507677	EAE	ECA	GAS	39.2517	-80.9401	4939	293	1104	1194	Riley & Warren	4190-4210, 3066-3098
Y	4708507869	E A E	ECA	GAS	39.2622	-80.9413	5380	1145	1019	1236	Alexander, Benson, 3rd Riley, Riley, & Warren	5216-5221, 4874-4936, 4548-4575, 3445-3477
Y	4708507704	EAE	ECA	GAS	39.2477	-80.9306	4942	455	1330	1337	Benson, Riley, & Warren	4659-4797, 4403-4467, 3307-3325
Y	4708507686	EAE	ECA	GAS	39.2442	-80.9275	4988	141	1331	1353	Riley & Warren	4111-4475, 3335-3357
Y	4708507697	E A E	ECA	GAS	39.239	-80.9303	5085	700	962	1458	Benson, Riley, & Warren	4110-4206, 3528-3982, 3064-3094
Y	4708507873	EAE	ECA	GAS	39.2647	-80.9464	5396	1252	1003	1522	Alexander, Riley, & Warren	5237-5241, 4585-4606, 3463-3494
Y	4708507821	TERM ENERGY	Mountain State Oil Co	GAS	39.2516	-80.9478	4966	1095	1024	1617	Benson & Riley	4539-4636, 4262-4286
Y	4708507875	EAE	ECA	GAS	39.264	-80.9516	5322	1424	965	1720	Alexander & Riley	5106-5126, 4472-4492
Y	4708507836	EAE	ECA	GAS	39.2602	-80.9342	5075	1215	1045	1764	Benson, Riley, Warren	4639-4498, 4246-4282, 3133-3168
Y	4708507676	E A E	ECA	GAS	39.2523	-80.9329	4506	63	1698	1777	Riley & Warren	4326-4346, 3197-3228
Y	4708506816	FRENCH CREEK DEVELOP	OILTEK, INC	GAS	39.2437	-80.9379	5016	305	1144	1810	Riley	4726-4235
	4708507768	EAE	ECA	GAS	39.2413	-80.9243	4604	242	1698	2255	Riley, Warren, Speechley, Big Injun, & Maxton	4404-4522, 4009-4293, 1982-2063, 1858-1878
	4708530854	HOPE NAT GAS	Not Found	GAS	39.25611	-80.945	4604	690	4174	4174	Big Injun	2010-2021
	4708530527	HOPE NAT GAS	Not Found	GAS	39.25195	-80.94056	1983	858	4235	4233	Big Injun	1844-1870
	4708530803	PGH & WV GAS	Not Found	GAS	39.25028	-80.94334	1941	254	4251	4273	Big Injun	1844-1870
	4708503975	EPC	EQT	GAS	39.24291	-80.92554	1924	419	4216	4302	Maxton, Big Lime, & Big Injun	1668-1849
Y	4708503978	EPC	EQT	GAS	39.24479	-80.92999	1845	16	4295	4303	Big Lime & Big Injun	1668-1849
Y	4708503974	EPC	EQT	GAS	39.256219	-80.947747	2003	78	4247	4303	Big Lime & Big Injun	1653-1790
	4708530382	I H BEREN	Not Found	GAS	39.25889	-80.93528	1860	977	4229	4340	Big Injun	1883-1974
	4708503976	EQUITRANS	EQUITRANS	P&A	39.2407	-80.9348	1797	300	4238	4409	Maxton & Big Injun	1709-1714
												1515-1722

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Attachment A

Monitor	API Number	Notes
Y	4708509227	Only Plat is available (2005)
Y	4708509226	Fractured 2007 - 3 stage frac - HCl, 20/40 sand, cross-link gel
Y	4708509225	Fractured 2006 - 2 stage frac - HCl, 20/40 sand, N2, and water
Y	4708507963	Fractured 1990 - 2 stage foam frac - 65Q Foam, Gel, 20/40 sand, HCl, and N2
Y	4708509243	Fractured 2007 - 3 stage frac - sand and SLF
Y	4708507956	Fractured 1990 - 3 stage foam frac - Acid, 70Q Foam, 20/40 sand, and N2
Y	4708507685	Fractured 1988 - 2 stage foam frac - 75Q Foam, 20/40 sand, and N2 - drilled to the Alexander
Y	4708507675	Fractured 9/15/1987 - Benson, 5 holes, 15K# 20/40, 10,500 SCF of N2 Assist - remaining stages 20/40 sand, 75Q Foam - Drilled to the Alexander
Y	4708507884	Fractured 1988 - 4 stage foam frac - 60Q Foam, 20/40 sand, gel, HCl, and N2 (first two stages) - 75Q Foam, 20/40 sand, gel, HCl, and N2 (last two stages
Y	4708507677	Fractured 1990 - 2 stage foam frac - Acid, 75Q Foam, 20/40 sand, and N2
Y	4708507869	Fractured 1989 - 4 stage foam frac - 60Q Foam, 20/40 sand, gel, HCl, and N2 (first two stages) - 75Q Foam, 20/40 sand, gel, HCl, and N2 (last two stages
Y	4708507686	Fractured 1988 - 3 stage foam frac - 75Q Foam, 20/40 sand, and N2 - drilled to the Alexander
Y	4708507704	Fractured 1988 - 2 stage foam frac - 75Q Foam, 20/40 sand, and N2 - drilled to the Alexander
Y	4708507697	Fractured 1988 - 3 stage foam frac - 75Q Foam, 20/40 sand, and N2 - drilled to the Alexander
Y	4708507873	Fractured 1988 - 2 stage foam frac - 60Q Foam, 20/40 sand, and N2 (Alexander) - 75Q Foam, 20/40 sand, gel, HCl, and N2 (Riley and Warren
Y	4708507821	Fractured 1989 - 3 stage foam frac - 20/40 and 80/100 sand, HCl, and N2
Y	4708507875	Fractured 1989 - 2 stage foam frac - Gel, 20/40 sand, HCl, and N2
Y	4708507836	Fractured 1989 - 3 stage frac - 75Q Foam, 20/40 sand, HCl, and N2
Y	4708507676	Fractured 1988 - 12 holes each stage, 75 Q foam, 30 lbs gel/gal, 20/40 sand, Acid, N2
Y	4708506816	Fractured 1/16/1984 with 800K SCF N2 + 500 gal 15% HCl - Drilled down to the Marcellus Shale
	4708507768	First Fractured in 1988 (Riley, Warren, Speechley - 75Q Foam, 20/40 Sand, and N2 - made perfs from 3339-3404 and did not see breakdown). Fractured again in 2001 (Big Injun & Maxton, HCl, 20/40 sand, and cross-link gel
	4708530854	No Completion Data
	4708530527	State report notes well was completed (no further data) - deepest formation drilled to is Squaw
	4708530803	State report notes well was completed in 1918 (no further data)
	4708503975	Well is dead (Aries note - 2/12, no pressure on well)
Y	4708503978	State report notes well was completed (no further data)
Y	4708503974	Well is dead (Aries note) - State report notes well was completed in 1917
	4708530882	State report notes well was completed in 1917 (no further data)
	4708503976	Plugged

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**Attachment B**

Letter to Conventional Well Operators

08/09/2013  
**Received**

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Office of Oil and Gas  
WV Dept. of Environmental Protection



July 23, 2013

[Conventional Well Operator]  
[address]  
[state]

**RE: Ritchie County Hydraulic Fracturing Notice**

Dear Sir/Madam,

EQT and Energy Corporation of America (ECA) have been working closely with the West Virginia Office of Oil and Gas (OOG) to investigate hydraulic fracturing activities in Ritchie County, WV. As an owner or operator of conventional natural gas wells in this area, we are requesting your assistance in this matter.

Due to the apparent presence of unique geological conditions, the potential for communication between deep geologic zones exists in this area. This potential communication, via natural gas, water, or both, may occur between hydraulically fractured wells in the Marcellus formation (approximately 6,400' TVD) and existing conventional natural gas wells in the partially-depleted, relatively high permeability Alexander formation (approximately 5,200' TVD).

EQT is implementing a Hydraulic Fracturing Monitoring Plan as an additional safety measure to be utilized in conjunction with existing best management practices and emergency action plans for the PEN13 pad in Ritchie County. The plan will further enable us to obtain data and information for a root cause analysis in the event communication between zones does occur during hydraulic fracturing.

We will be closely monitoring our drilling and fracturing activities, as well as obtaining real-time pressure data from selected EQT and ECA conventional wells.

EQT anticipates conducting hydraulic fracturing at the PEN13 pad on {insert date}. We have identified conventional natural gas wells operated by your company within 1,500' of this pad and laterals. We have included plats for each well on this pad in **Attachment A**.

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We recommend that conventional well operators conduct the following activities before, during and after fracturing operations:

1. Inspect surface equipment prior to fracturing to establish integrity and establish pre-fracturing well conditions
2. Observe wells closely during and after fracturing and monitor for abnormal increases in water, gas or pressure
3. Inspect or install master valves rated to 3,000 psi or other necessary equipment for wellhead integrity.
4. Notify the OOG and EQT if any changes in water, gas production, pressure, or other anomalies are identified.

Please feel free to contact me at 412-395-3305 with any questions or comments. You may also contact the West Virginia Office of Oil and Gas at 304-926-0440.

Sincerely,  
**EQT Production**

John Centofanti  
Corporate Director, Environmental Affairs

cc: James Martin, WV Office of Oil and Gas  
Kyle Mork, ECA

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**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
	085	1	539

2) Operator's Well Number: 513043      Well Pad Name: PEN16

3 Elevation, current ground: 793'      Elevation, proposed post-construction: 793'

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

(b) If Gas:      Shallow       Deep   
                    Horizontal

5) Existing Pad? Yes or No: \_\_\_\_\_

6) Proposed Target Formation(s), Depth(s), Anticipated Thicknesses and Associated Pressure(s):  
Target formation is Marcellus at a depth of 6064' with the anticipated thickness to be 51 feet and anticipated target pressure of 3651 PSI

7) Proposed Total Vertical Depth: 6,185'

8) Formation at Total Vertical Depth: Onondaga

9) Proposed Total Measured Depth: 10,236'

10) Approximate Fresh Water Strata Depths: 21, 94, 144, & 367

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

12) Approximate Saltwater Depths: None reported

13) Approximate Coal Seam Depths: 816'

14) Approximate Depth to Possible Void (coal mine, karst, other): None reported ✓

15) Does proposed well location contain coal seams directly overlying or adjacent to an active mine? If so, indicate name and depth of Mine: None Reported

16) Describe proposed well work: Drill and complete a new horizontal well. The vertical drill to go down to approximately depth of 6,185' Tagging the Onondaga not more than 100' then plug back to approximately 4,782' and kick off the horizontal leg into the marcellus using a slick water frac.

17) Describe fracturing/stimulating methods in detail: \_\_\_\_\_  
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). Stage lengths vary from 150 to 450 feet. Average approximately 400,000 gallons of water per stage. Sand sizes vary from 100 mesh to 20/40 mesh. Average approximately 400,000 pounds of sand per stage.

18) Total area to be disturbed, including roads, stockpile area, pits, etc, (acres): No additional

19) Area to be disturbed for well pad only, less access road (acres): No Additional

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**CASING AND TUBING PROGRAM**

20)

TYPE	Size	New or Used	Grade	Weight per ft.	FOOTAGE: for Drilling	INTERVALS: Left in Well	CEMENT: Fill-up (Cu.Ft.)
Conductor	26	New	Varies	Varies	71	71	87
Fresh Water	13 3/8	New	MC-50	54	1,000	1,000	868 OTS
Coal	20	New	Mc-50	81	467	467	589 CTS
Intermediate	9 5/8	New	MC-50	40	5,089	5,089	1,999 CTS
Production	5 1/2	New	P-110	20	10,236'	10,236'	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
Conductor	26	30	0.5	-	Construction	1.18
Fresh Water	13 3/8	17 1/2	0.38	2,480	1	1.21
Coal	20	24	0.635	1,640	1	1.2
Intermediate	9 5/8	12 3/8	0.395	3,590	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.

21) 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

22) 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 % Calcium Carbonate. Acid solubility.

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

23) 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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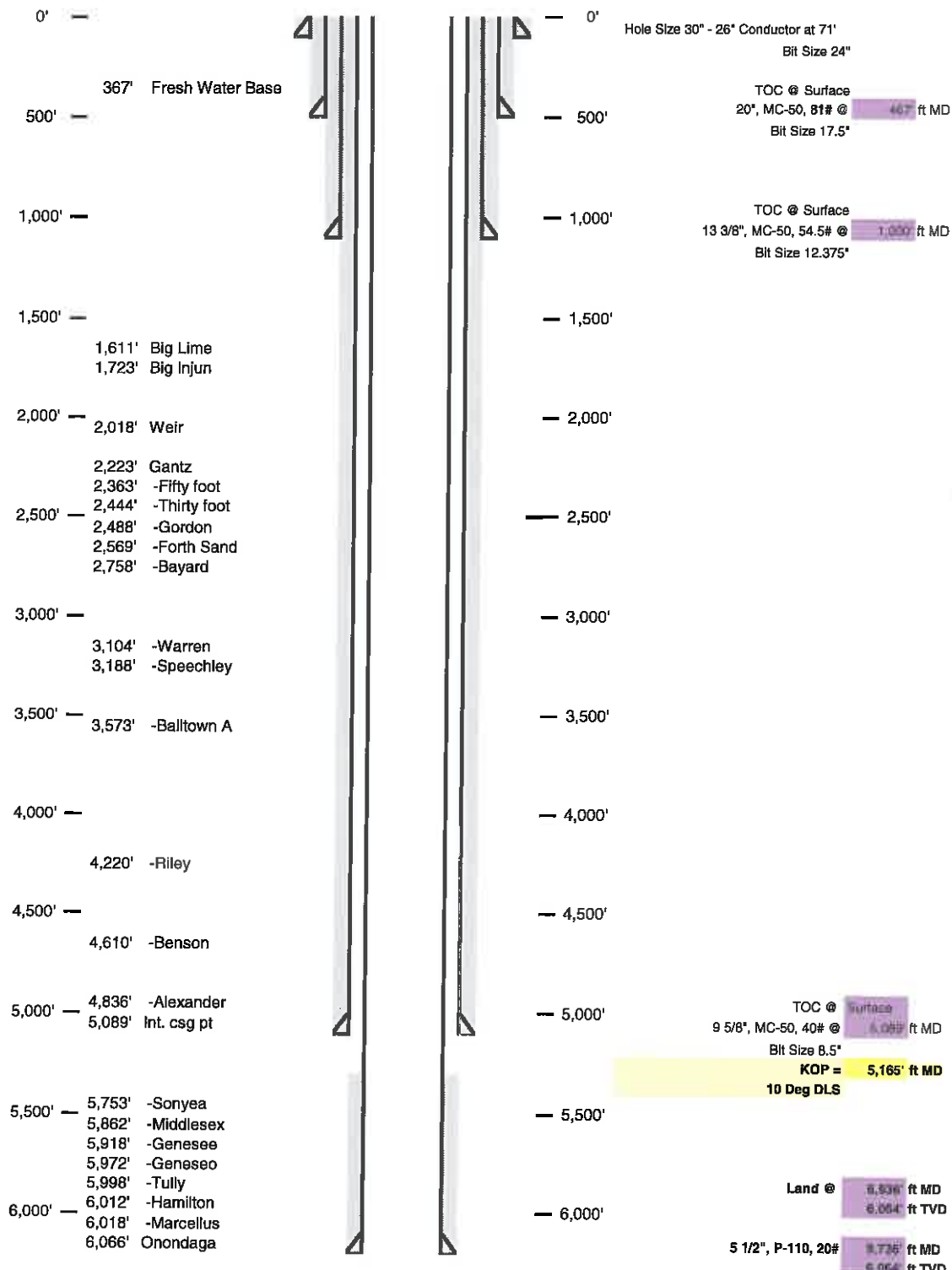
08/09/2013

08/21/2013

**Well Schematic  
EQT Production**

Well Name: 513043 (PEN15RD)  
 County: Boone  
 State: West Virginia

Elevation KB: 805  
 Target: Marcellus  
 Prospect: 342  
 Azimuth: 335  
 Vertical Section: 335



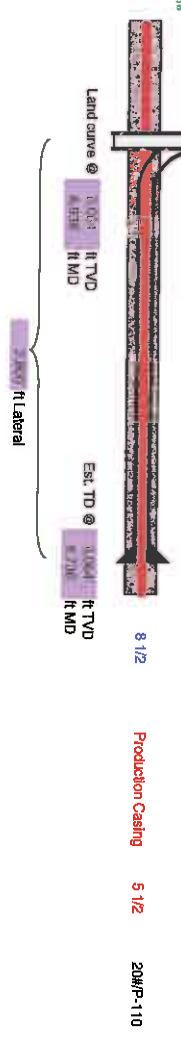
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 08/09/2013

Well: **513043 (PEN16H3)**  
 EOT Production  
 Pennington  
 West Virginia

Admuth  
 Vertical Section

TVL Depth (feet)	Formation Tops (TVL)	Admuth Vertical Section	Hole Size (inches)	Casing Type	Casing Size (inches)	Wt (ppf)/Grade
0			30	Conductor	26	
280'	Beam Fract. Water	357				
500'	Fresh Water Csg pt.	497	24	Surface	20	81#/MC-50
750'						
1,000'	Surface Csg pt.	1000	17 1/2	Coal	13 3/8	54#/MC-50
1,250'						
1,500'						
1,750'	Big Lma	1611 - 1723				
2,000'	Big W/Lm	1723 - 2013				
2,250'	Well	2013 - 2223				
2,500'	Qartz	2223 - 2383				
2,750'	-Bayard	2759 - 3063				
3,000'						
3,250'	-Warren	3104 - 3180				
3,500'	-Speckley	3189 - 3573				
3,750'	-Beltown A	3573 - 4220				
4,000'						
4,250'						
4,500'	-Benson	4110 - 4636				
4,750'						
5,000'	-Alexander	4335 - 3853				
5,250'	Int. csg pt	5049	12 3/8	Intermediate	9 5/8	40#/MC-50
5,500'	-Soyuz	5733 - 5862				
5,750'	-Middicott	5862 - 5919				
6,000'	-Greenwood	5919 - 5972				
	-Greenwood	5972 - 5988				
	-Tully	5988 - 6012				
	-Hamilton	6012 - 6018				
	Reveries top	6018				
	Targel base of Marcellus	6064				
	Marcellus Bottom	6095				

TD Pilot Hole @ 6166  
 100' below top of Orondaga  
 Run Logs, Plug back to KOP at 5165  
 Kick off for horizontal well in Marcellus



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6102 11 2013



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

Fluids/Cuttings Disposal & Reclamation Plan

Operator Name PEN16 OP Code \_\_\_\_\_

Watershed (HUC10) North Fork Hughes River Quadrangle Pennsboro 7.5' <sup>539</sup>

Elevation 793' County Ritchie <sup>85</sup> District Clay <sup>01</sup>

Do you anticipate using more than 5,000 bbls of water to complete the proposed well work? Yes x No \_\_\_\_\_

Will a pit be used for drill cuttings: Yes: \_\_\_\_\_ No: X

If so please describe anticipated pit waste: \_\_\_\_\_

Will a synthetic liner be used in the pit? Yes \_\_\_\_\_ No X If so, what ml.? 60

Proposed Disposal Method For Treated Pit Wastes:

- \_\_\_\_\_ Land Application
- \_\_\_\_\_  Underground Injection ( UIC Permit Number 0014, 8462, 4037 )
- \_\_\_\_\_  Reuse (at API Number \_\_\_\_\_ )
- \_\_\_\_\_  Off Site Disposal (Supply form WW-9 for disposal location)
- \_\_\_\_\_ Other (Explain \_\_\_\_\_ )

Will closed loop system be used ? YES

Drilling medium anticipated for this well? Air, freshwater, oil based, etc. Air and water based mud

If oil based, what type? Synthetic, petroleum, etc \_\_\_\_\_

Additives to be used in drilling medium? MILBAR, Viscosifer, Alkalinity Control, Lime, Chloride Salts, Rate Filtration Control,

Deflocculant, Lubricant, Detergent, Defoaming, Walnut Shell, X-Cide, SOLTEX Terra

Drill cuttings disposal method? Leave in pit, landfill, removed offsite, etc. Landfill

If left in pit and plan to solidify what medium will be used? (Cement, Lime, sawdust) n/a

Landfill or offsite name/permit number? See Attached List

I certify that I understand and agree to the terms and conditions of the GENERAL WATER POLLUTION PERMIT issued on August 1, 2005, by the Office of Oil and Gas of the West Virginia Department of Environmental Protection. I understand that the provisions of the permit are enforceable by law. Violations of any term or condition of the general permit and/or other applicable law or regulation can lead to enforcement action.

I certify under penalty of law that I have personally examined and am familiar with the information submitted on this application form and all attachments thereto and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment.

Company Official Signature *Victoria J. Roark*

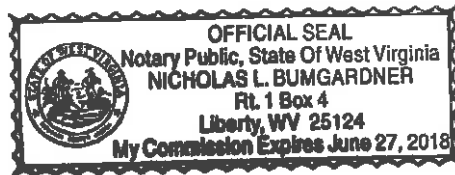
Company Official (Typed Name) Victoria J. Roark

Company Official Title Permitting Supervisor

Subscribed and sworn before me this 11 day of JUNE, 20 13

*Nicholas L. Bumgardner* Notary Public

My commission expires 6/27/2018



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08/09/2013

WW-9

Operator's Well No. 513043

Proposed Revegetation Treatment: Acres Disturbed No additional Prevegetation pH         

Lime 3 Tons/acre or to correct to pH 6.5

Fertilizer (10-20-20 or equivalent) 13 lbs/acre (500 lbs minimum)

Mulch 2 Tons/acre

Seed Mixtures

Area I		Area II	
Seed Type	lbs/acre	Seed Type	lbs/acre
KY-31	40	Orchard Grass	15
Alsike Clover	5	Alsike Clover	5
Annual Rye	15		

Attach:  
Drawing(s) of road, location, pit and proposed area for land application.

Photocopied section of involved 7.5' topographic sheet.

Plan Approved by: [Signature]

Comments: Maintain all ERS in place inspected on timely manner, keep all drainage operational, general maintenance required on location access road

Title: oil grass suscipita Date: 6-21-13

Field Reviewed? ( ) Yes (  ) ~~NO~~

<b>EQT Production Water plan</b> <b>Offsite disposals for Marcellus wells</b>
--

**CWS TRUCKING INC.**

P.O. Box 391  
 Williamstown, WV 26187  
 740-516-3586  
 Noble County/Noble Township  
 Permit # 3390

**LAD LIQUID ASSETS DISPOSAL INC.**

226 Rankin Road  
 Washington, PA 15301  
 724-350-2760  
 724-222-6080  
 724-229-7034 fax  
 Ohio County/Wheeling  
 Permit # USEPA WV 0014

**TRI COUNTY WASTE WATER MANAGEMENT, INC.**

1487 Toms Run Road  
 Holbrook, PA 15341  
 724-627-7178 Plant  
 724-499-5647 Office  
 Greene County/Waynesburg  
 Permit # TC-1009

**Waste Management - Meadowfill Landfill**

Rt. 2, Box 68 Dawson Drive  
 Bridgeport, WV 26330  
 304-326-6027  
 Permit #SWF-1032-98  
 Approval #100785WV

**Waste Management - Northwestern Landfill**

512 E. Dry Road  
 Parkersburg, WV 26104  
 304-428-0602  
 Permit #SWF-1025 WV-0109400  
 Approval #100833WV

**BROAD STREET ENERGY LLC**

37 West Broad Street  
 Suite 1100  
 Columbus, Ohio 43215  
 740-516-5381  
 Washington County/Belpre Twp.  
 Permit # 8462

**TRIAD ENERGY**

P.O. Box 430  
 Reno, OH 45773  
 740-516-6021 Well  
 740-374-2940 Reno Office Jennifer  
 Nobel County/Jackson Township  
 Permit # 4037

**KING EXCAVATING CO.**

Advanced Waste Services  
 101 River Park Drive  
 New Castle, Pa. 16101  
 Facility Permit# PAR000029132

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 Jan 7 1 2013

WATER SAMPLES

# BROADWATER LEASE WELL NO. 513043

page of



Professional Energy Consultants  
A DIVISION OF SOUTHWEST ENERGY SERVICES

**SLES**  
SOUTHWEST ENERGY SERVICES

20000 Old Branch Road  
Bridgeport, WV 26330  
304-675-4111

MARKET: INTERMEDIATE, OIL/GAS

DRAWN BY K.D.W.	FILE NO. 7586	DATE 03-08-13	CADD FILE: 7586WSH3R.DWG
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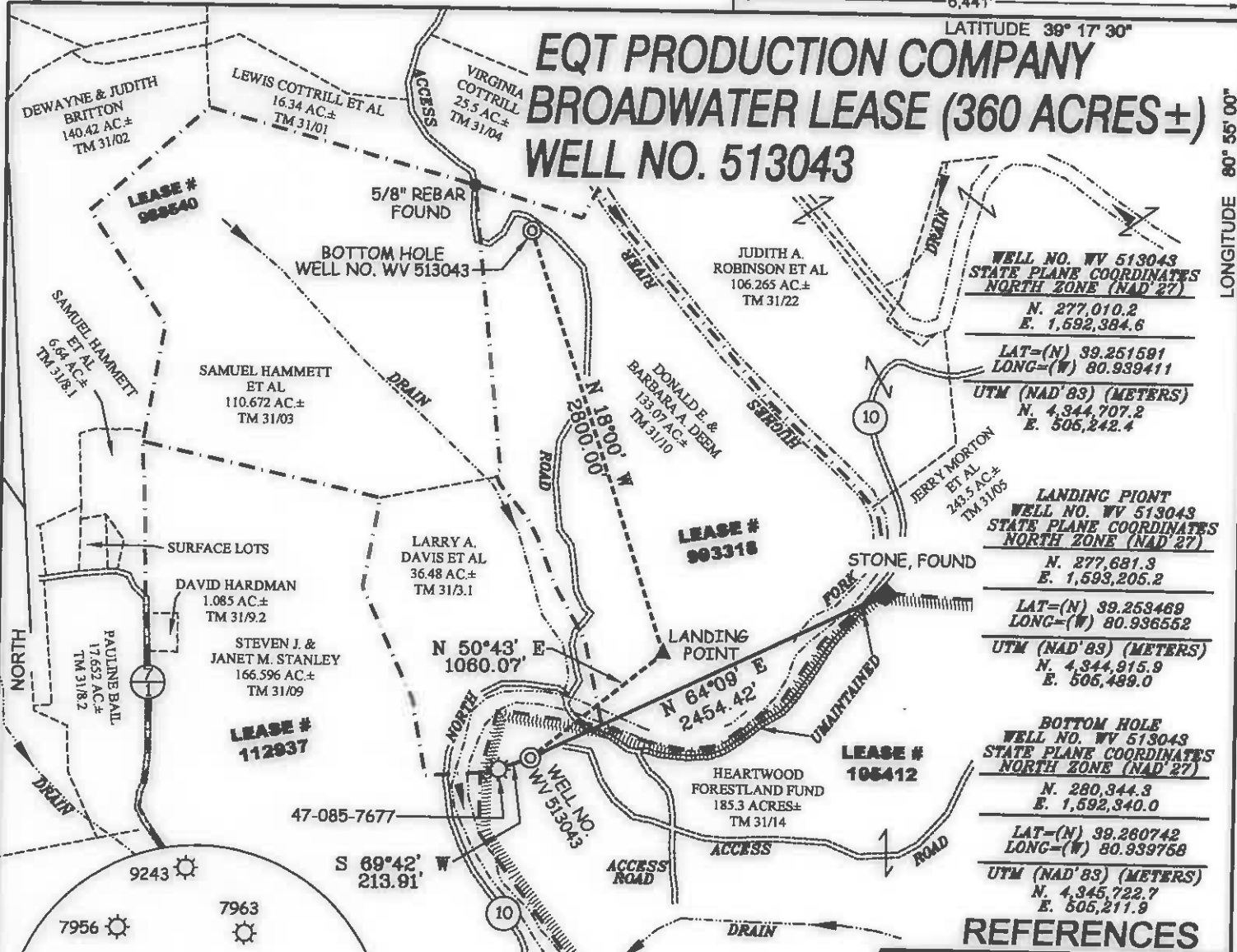
TOPO SECTION OF:  
PENNSBORO, WV 7.5' QUAD.

DISTRICT	COUNTY	TAX MAP-PARCEL NO.
CLAY	RITCHIE	31-14

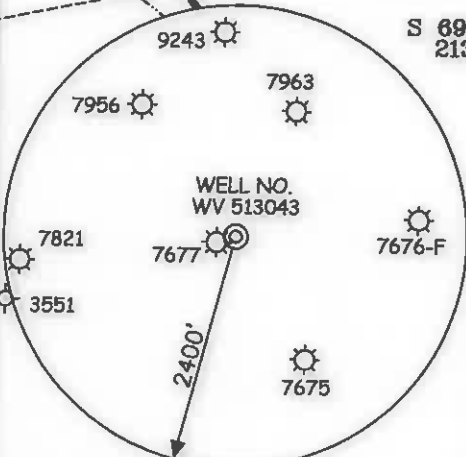
OPERATOR:  
EQT PRODUCTION COMPANY  
115 PROFESSIONAL PLACE  
P.O. BOX 280  
BRIDGEPORT, WV 26330

08/09/2013  
Received  
Office of Oil & Gas  
JUL 21 2013

# EQT PRODUCTION COMPANY BROADWATER LEASE (360 ACRES±) WELL NO. 513043

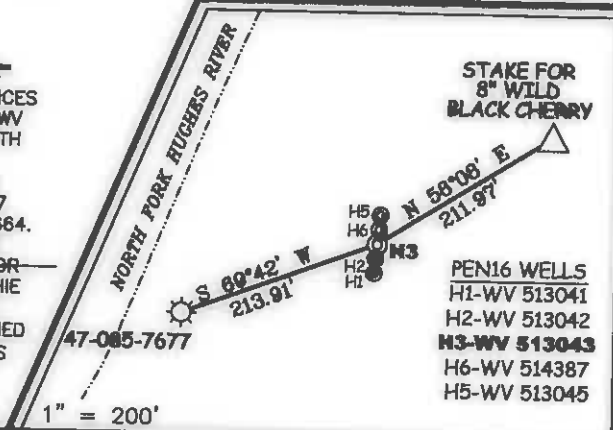


<b>WELL NO. WV 513043</b> STATE PLANE COORDINATES NORTH ZONE (NAD '27)
N. 277,010.2 E. 1,592,384.6
LAT=(N) 39.251591 LONG=(W) 80.939411
UTM (NAD'83) (METERS)
N. 4,344,707.2 E. 505,242.4
<b>LANDING POINT</b> WELL NO. WV 513043 STATE PLANE COORDINATES NORTH ZONE (NAD '27)
N. 277,681.3 E. 1,593,205.2
LAT=(N) 39.253489 LONG=(W) 80.936552
UTM (NAD'83) (METERS)
N. 4,344,915.9 E. 505,489.0
<b>BOTTOM HOLE</b> WELL NO. WV 513043 STATE PLANE COORDINATES NORTH ZONE (NAD '27)
N. 280,344.3 E. 1,592,340.0
LAT=(N) 39.260742 LONG=(W) 80.939758
UTM (NAD'83) (METERS)
N. 4,345,722.7 E. 505,211.9



### NOTES ON SURVEY

1. TIES TO WELLS, CORNERS & REFERENCES ARE BASED ON GRID NORTH FOR THE WV STATE PLANE COORDINATE SYSTEM NORTH ZONE NAD '27.
2. LEASE BOUNDARY SHOWN HEREON TAKEN FROM DEED BOOK 197 PAGE 568 AND DEED BOOK 251 PAGE 664.
3. SURFACE OWNER AND ADJOINER INFORMATION TAKEN FROM THE ASSESSOR AND COUNTY CLERK RECORDS OF RITCHIE COUNTY IN JULY, 2012.
4. WELL LAT./LONG. (NAD'27) ESTABLISHED BY DGPS (SURVEY GRADE TIE TO CORS NETWORK).



### REFERENCES

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. 677 *Gregory A. Smith*



(+) DENOTES LOCATION OF WELL ON UNITED STATES TOPOGRAPHIC MAPS.  
 DATE JUNE 03, 20 13  
 OPERATORS WELL NO. WV 513043  
 API WELL NO. 47 - 85 - K0052 H6A  
 STATE COUNTY PERMIT

MINIMUM DEGREE OF ACCURACY 1 / 200 FILE NO. 7566P513043R3 (329-36)  
 PROVEN SOURCE OF ELEVATION DGPS (SURVEY GRADE TIE TO CORS NETWORK) SCALE 1" = 1000'

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

WELL TYPE: OIL <input type="checkbox"/> GAS <input checked="" type="checkbox"/>	LIQUID INJECTION <input type="checkbox"/>	WASTE DISPOSAL <input type="checkbox"/>	IF "GAS" PRODUCTION <input checked="" type="checkbox"/>	STORAGE <input type="checkbox"/>	DEEP <input type="checkbox"/>	SHALLOW <input checked="" type="checkbox"/>
LOCATION: ELEVATION <u>793' (PAD ELEVATION)</u> WATERSHED <u>NORTH FORK HUGHES RIVER</u>						
DISTRICT <u>CLAY</u> COUNTY <u>RITCHIE</u> QUADRANGLE <u>PENNSBORO 7.5'</u>						
SURFACE OWNER <u>HEARTWOOD FORESTLAND FUND</u> ACREAGE <u>353.50±</u>						
ROYALTY OWNER <u>JEFFERSON BROADWATER HEIRS ET AL (360 AC±), MIKE ROSS ET AL (133.07AC±), JOELYNN FAMILY PRESERVATION TRUST (140.0809/2013)</u>						
PROPOSED WORK: LEASE NO. <u>105412 / 993318 / 988540</u>						
DRILL <input checked="" type="checkbox"/> CONVERT <input type="checkbox"/> DRILL DEEPER <input type="checkbox"/> REDRILL <input type="checkbox"/> FRACTURE OR STIMULATE <input checked="" type="checkbox"/> PLUG OFF OLD FORMATION <input type="checkbox"/>						
PERFORATE NEW FORMATION <input type="checkbox"/> PLUG AND ABANDON <input type="checkbox"/> CLEAN OUT AND REPLUG <input type="checkbox"/> OTHER <input type="checkbox"/>						
PHYSICAL CHANGE IN WELL (SPECIFY) _____ TARGET FORMATION <u>MARCELLUS</u>						
ESTIMATED DEPTH _____						
WELL OPERATOR <u>EQT PRODUCTION COMPANY</u> DESIGNATED AGENT <u>REX C. RAY</u>						
ADDRESS <u>115 PROFESSIONAL PLACE P.O. BOX 280 BRIDGEPORT, WV 26330</u> ADDRESS <u>115 PROFESSIONAL PLACE P.O. BOX 280 BRIDGEPORT, WV 26330</u>						