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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 02, 2014

EQT PRODUCTION COMPANY  
POST OFFICE BOX 280  
BRIDGEPORT, WV 26330

Re: Permit Modification Approval for API Number 8510097 , Well #: 515279

*Extended freshwater casing*

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



July 1, 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 47-08510093, 08510094, 08510095, 08510096, 08510097

Dear Mr. Smith,

EQT would like to modify the depth of the fresh water casing (13 3/8") from 973' to 1075'. This will be below the current elevation of 1119' due to the potential show of red rock. I have enclosed a new WW-2B, well schematics, and rec plan for your review.

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.

4708510097

3/28

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	085	1	539
County		District	Quadrangle

2) Operator's Well Number: 515279 Well Pad Name: PEN15

3) Farm Name/Surface Owner : Dewayne Britton et ux Public Road Access: WV-74

4) Elevation, current ground: 1,119.0 Elevation, proposed post-construction: 1,119.0

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 6395' with the anticipated thickness to be 50 feet and anticipated target pressure of 4176 PSI

- 8) Proposed Total Vertical Depth: 6,395
- 9) Formation at Total Vertical Depth: Marcellus
- 10) Proposed Total Measured Depth: 11,279
- 11) Proposed Horizontal Leg Length: 3,020
- 12) Approximate Fresh Water Strata Depths: 83, 163, 242, 394, 770, 873
- 13) Method to Determine Fresh Water Depth: By offset wells
- 14) Approximate Saltwater Depths: 1652, 1943, 2521
- 15) Approximate Coal Seam Depths: 14, 273, 379, 744
- 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: \_\_\_\_\_

*Dave*

WW - 6B  
(3/13)

**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.Fl.)
Conductor	20	New	MC-50	81	40	40	38 C.T.S.
Fresh Water	13 3/8	New	MC-50	54	1,075	1,075	931 C.T.S.
Coal							
Intermediate	9 5/8	New	MC-50	40	5,330	5,330	2,092 C.T.S.
Production	5 1/2	New	P-110	20	11,279	11,279	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./ft)
Conductor	20	24	0.375	-	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	3,590	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.

*David Wilson*  
7-1-14

WW - 6B

(3/13)

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 5389'.

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): no additional disturbance22) Area to be disturbed for well pad only, less access road (acres): ±.3 ac

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 % Calcium 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 &amp; 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.

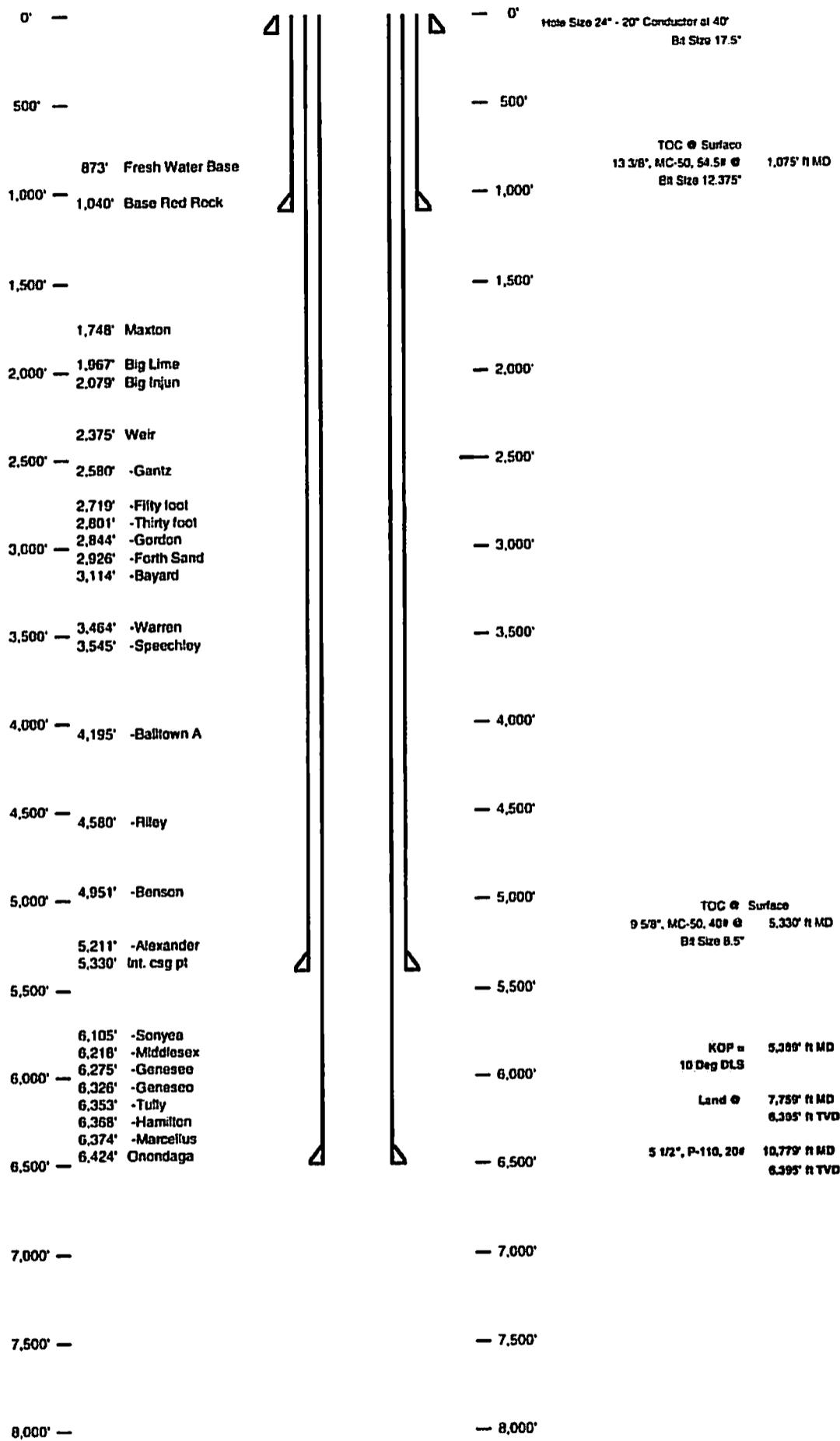
\*Note: Attach additional sheets as needed.

Well Schematic  
EQT Production

Well Name 515279 (PEN15H10)  
County Riche  
State West Virginia

Elevation KB:  
Target  
Prospect  
Azimuth  
Vertical Section

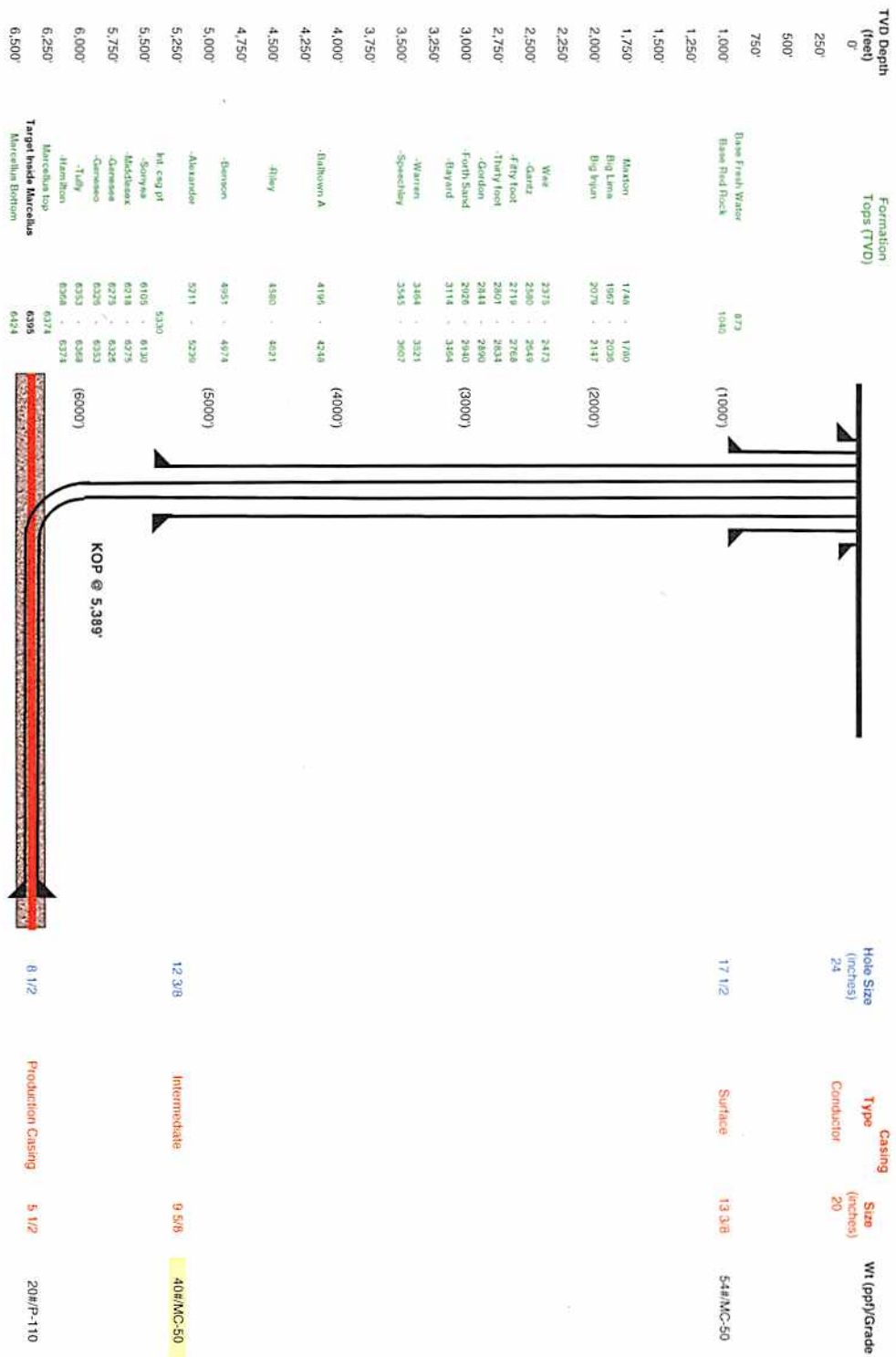
1132
Marcellus
335
3760



4708510097

Well 515279 (PEN15H10)  
 EQT Production  
 Pennsboro  
 Ritchie

West Virginia  
 Azimuth 335  
 Vertical Section 3790



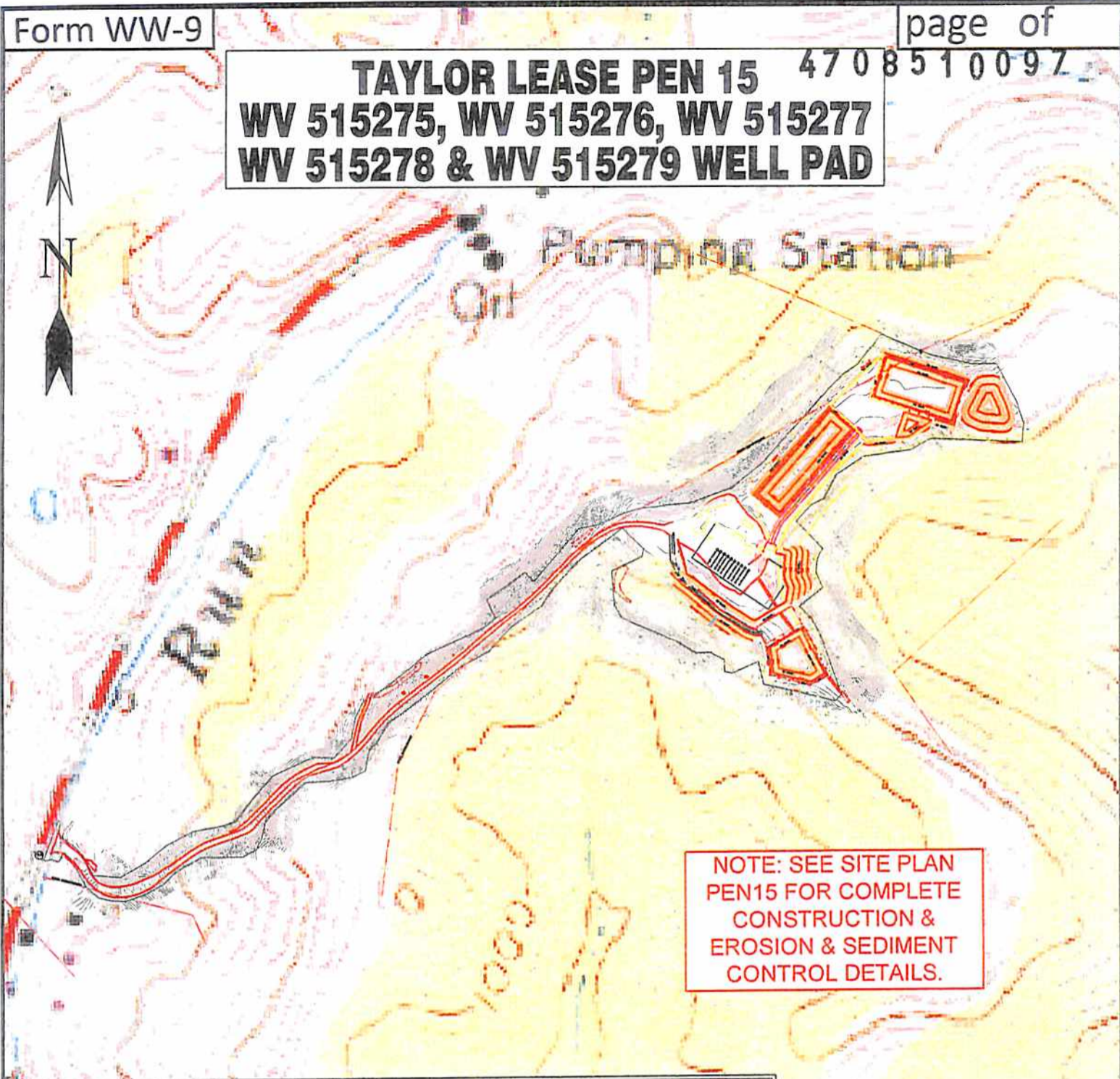
Proposed Well Work:  
 Drill and complete a new horizontal well in the Marcellus formation.  
 The vertical drill to go down to an approximate depth of 5385'.  
 Then kick off the horizontal leg into the Marcellus using a slick water frac.



RECEIVED  
 Office of Oil and Gas  
 MAR 28 2014  
 WV Department of  
 Environmental Protection

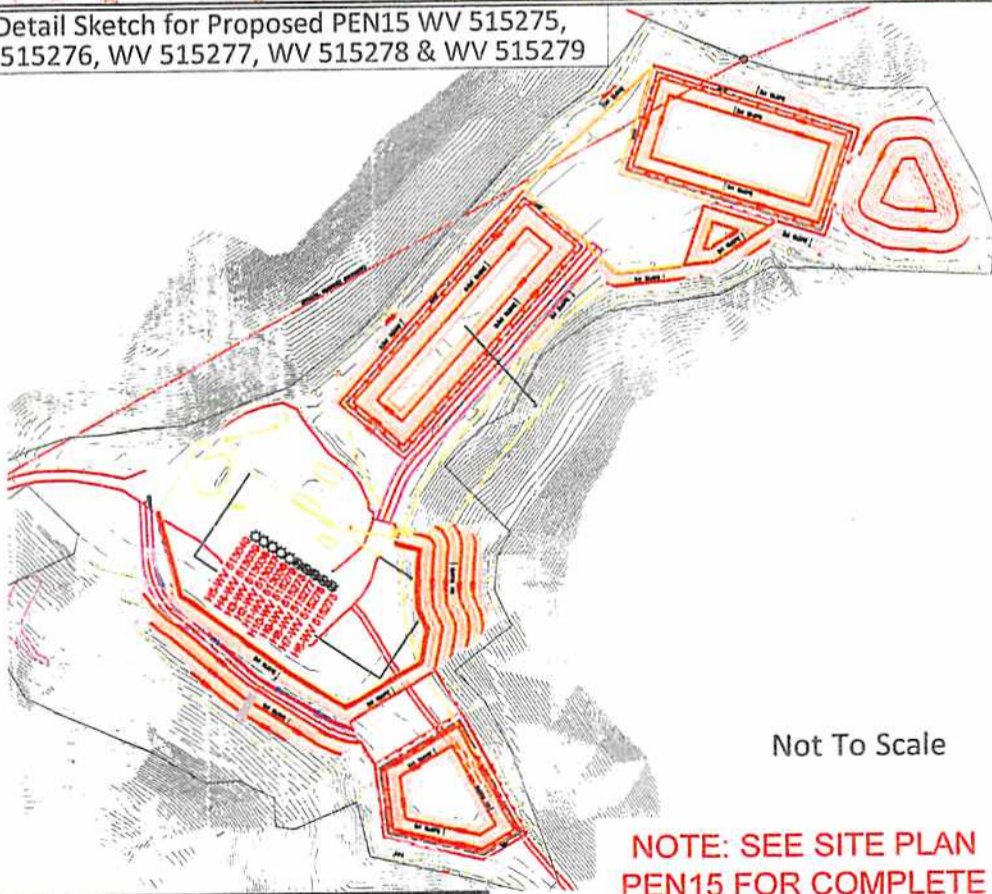
**TAYLOR LEASE PEN 15**  
**WV 515275, WV 515276, WV 515277**  
**WV 515278 & WV 515279 WELL PAD**

4708510097



NOTE: SEE SITE PLAN  
PEN15 FOR COMPLETE  
CONSTRUCTION &  
EROSION & SEDIMENT  
CONTROL DETAILS.

Detail Sketch for Proposed PEN15 WV 515275,  
WV 515276, WV 515277, WV 515278 & WV 515279



Not To Scale

NOTE: SEE SITE PLAN  
PEN15 FOR COMPLETE  
CONSTRUCTION &  
EROSION & SEDIMENT  
CONTROL DETAILS.

**Professional Energy Consultants**  
A DIVISION OF EARTH LAND SURVEYING, INC.



**SLS**  
SURVEYORS  
ENGINEERS  
ENVIRONMENTAL  
PROJECT MGMT.

(304) 462-5934      www.SLSSURVEYS.COM

DRAWN BY K.D.W.	FILE NO. 7496	DATE 01-31-14	CADD FILE: 7496REC-PEN15.dwg
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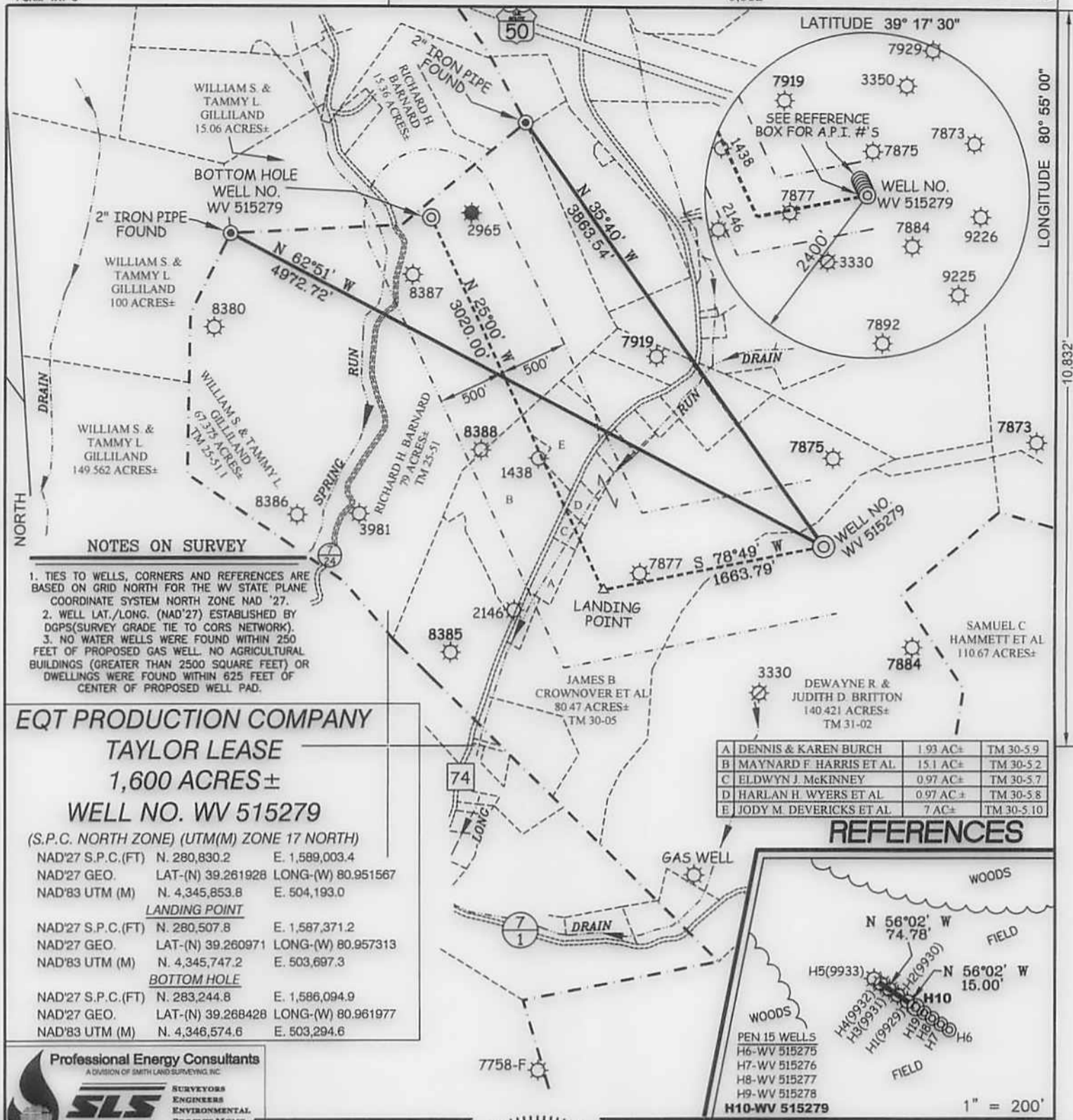
TOPO SECTION OF PENNSBORO 7.5'  
USGS TOPO QUADRANGLE

RECEIVED  
Office of Oil and Gas  
MARCH 20 2014  
West Virginia Department of Environmental Protection

**SCALE: 1" = 500'**







**NOTES ON SURVEY**

1. TIES TO WELLS, CORNERS AND REFERENCES ARE BASED ON GRID NORTH FOR THE WV STATE PLANE COORDINATE SYSTEM NORTH ZONE NAD '27.
2. WELL LAT./LONG. (NAD'27) ESTABLISHED BY DGPS(SURVEY GRADE TIE TO CORS NETWORK).
3. NO WATER WELLS WERE FOUND WITHIN 250 FEET OF PROPOSED GAS WELL. NO AGRICULTURAL BUILDINGS (GREATER THAN 2500 SQUARE FEET) OR DWELLINGS WERE FOUND WITHIN 625 FEET OF CENTER OF PROPOSED WELL PAD.

**EQT PRODUCTION COMPANY  
TAYLOR LEASE  
1,600 ACRES±  
WELL NO. WV 515279**

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

NAD'27 S.P.C.(FT) N. 280,830.2 E. 1,589,003.4  
 NAD'27 GEO. LAT.-(N) 39.261928 LONG.-(W) 80.951567  
 NAD'83 UTM (M) N. 4,345,853.8 E. 504,193.0

**LANDING POINT**

NAD'27 S.P.C.(FT) N. 280,507.8 E. 1,587,371.2  
 NAD'27 GEO. LAT.-(N) 39.260971 LONG.-(W) 80.957313  
 NAD'83 UTM (M) N. 4,345,747.2 E. 503,697.3

**BOTTOM HOLE**

NAD'27 S.P.C.(FT) N. 283,244.8 E. 1,586,094.9  
 NAD'27 GEO. LAT.-(N) 39.268428 LONG.-(W) 80.961977  
 NAD'83 UTM (M) N. 4,346,574.6 E. 503,294.6



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 JANUARY 10, 20 14  
 REVISED \_\_\_\_\_ 20 \_\_\_\_\_  
 OPERATORS WELL NO. WV 515279  
 API WELL NO. 47 - 85 - 10097 H6A  
 STATE COUNTY PERMIT

MINIMUM DEGREE OF ACCURACY 1/200 FILE NO. 7496P515279  
 PROVEN SOURCE OF ELEVATION DGPS (SUVERY GRADE TIE TO CORS NETWORK) SCALE 1" = 1000'

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

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

**LOCATION:**  
 ELEVATION 1,119' (PAD ELEVATION) WATERSHED LONG RUN OF NORTH FORK HUGHES RIVER  
 DISTRICT CLAY COUNTY RITCHIE QUADRANGLE PENNSBORO 7.5'  
 SURFACE OWNER DEWAYNE BRITTON ET UX ACREAGE 140.421  
 ROYALTY OWNER E. R. TAYLOR HEIRS ACREAGE 1,600±  
 PROPOSED WORK: 105804

DRILL  CONVERT  DRILL DEEPER  REDRILL  FRACTURE OR STIMULATE  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 6395 TVD

WELL OPERATOR EQT PRODUCTION COMPANY DESIGNATED AGENT REX C. RAY  
 ADDRESS 115 PROFESSIONAL PLACE P.O. BOX 280 BRIDGEPORT, WV 26330 ADDRESS 115 PROFESSIONAL PLACE BRIDGEPORT, WV 26330

COUNTY NAME PERMIT