



west virginia department of environmental protection

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

PERMIT MODIFICATION APPROVAL

May 29, 2014

EQT PRODUCTION COMPANY
POST OFFICE BOX 280
BRIDGEPORT, WV 26330

Re: Permit Modification Approval for API Number 1706381 , Well #: 514661

Extend Lateral

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 black ink, appearing to read 'Gene Smith', with a large flourish extending to the right. Below the signature, the text 'for G.S.' is written in a smaller, less legible hand.

Gene Smith
Regulatory/Compliance Manager
Office of Oil and Gas



mod 1

March 20, 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 WEU51 (47-01706381)

Dear Mr. Smith,

Attached is a modification for the above referenced well. EQT is extending the length of the lateral portion of the well. Included is a new WW-6B (signed by inspector), well schematics, WW-6A1, and mylar plat.

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.

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Office of Oil and Gas
MAR 21 2014
WV Department of
Environmental Protection



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PERMIT MODIFICATION APPROVAL

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BRIDGEPORT, WV 26330

Re: Permit Modification Approval for API Number 1706381 , Well #: 514661

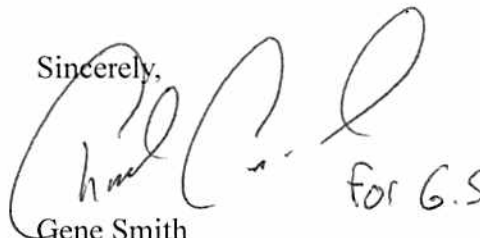
Extend Surface Casing

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 G.S

Gene Smith
Regulatory/Compliance Manager
Office of Oil and Gas



mod 2
4701706381

May 21, 2014

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

Re: Casing change on WEU51 (47-017-06381, 06386, 06385, 06384, 06383)

Dear Mr. Smith,

EQT is requesting the 13 3/8" surface casing to be set 7' 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.

EQT is reviewing the OXF157, 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 1171" KB (7' 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.

Cc: Douglas Newlon
4060 Dutchman Road
Macfarlan, WV 26148

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mod 2

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 017 County 8 District 671 Quadrangle

2) Operator's Well Number: 514661 Well Pad Name WEU51

3) Farm Name/Surface Owner: Jane Hardin Trustee/Mary Holland Public Road Access: CR 13

4) Elevation, current ground: 1,224.0 Elevation, proposed post-construction: 1,208.0

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 6686' with the anticipated thickness to be 57feet and anticipated target pressure of 4500 PSI

8) Proposed Total Vertical Depth: 6686'
9) Formation at Total Vertical Depth: Marcellus
10) Proposed Total Measured Depth: 17,957
11) Proposed Horizontal Leg Length: 9,510
12) Approximate Fresh Water Strata Depths: 171, 176, 207, 334
13) Method to Determine Fresh Water Depth: By offset wells
14) Approximate Saltwater Depths: n/a
15) Approximate Coal Seam Depths: 177, 294
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: _____

DCW
5-23-14

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MAY 27 2014
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mod 2

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	20	New	MC-50	81	40	40	38 C.T.S.
Fresh Water	13 3/8	New	MC-50	54	1,171	1,171	1,011 C.T.S.
Coal							
Intermediate	9 5/8	New	MC-50	40	5,322	5,322	2,085 C.T.S.
Production	5 1/2	New	P-110	20	17,957	17,957	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							

DCW
5-23-14

TYPE	Size	Wellbore Diameter	Wall Thickness	Burst Pressure	Cement Type	Cement Yield (cu. ft./k)
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.

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05/30/2014

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 5695', 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 psl, 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): 51.8

22) Area to be disturbed for well pad only, less access road (acres): 11.5

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 fillrate)
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 & 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.

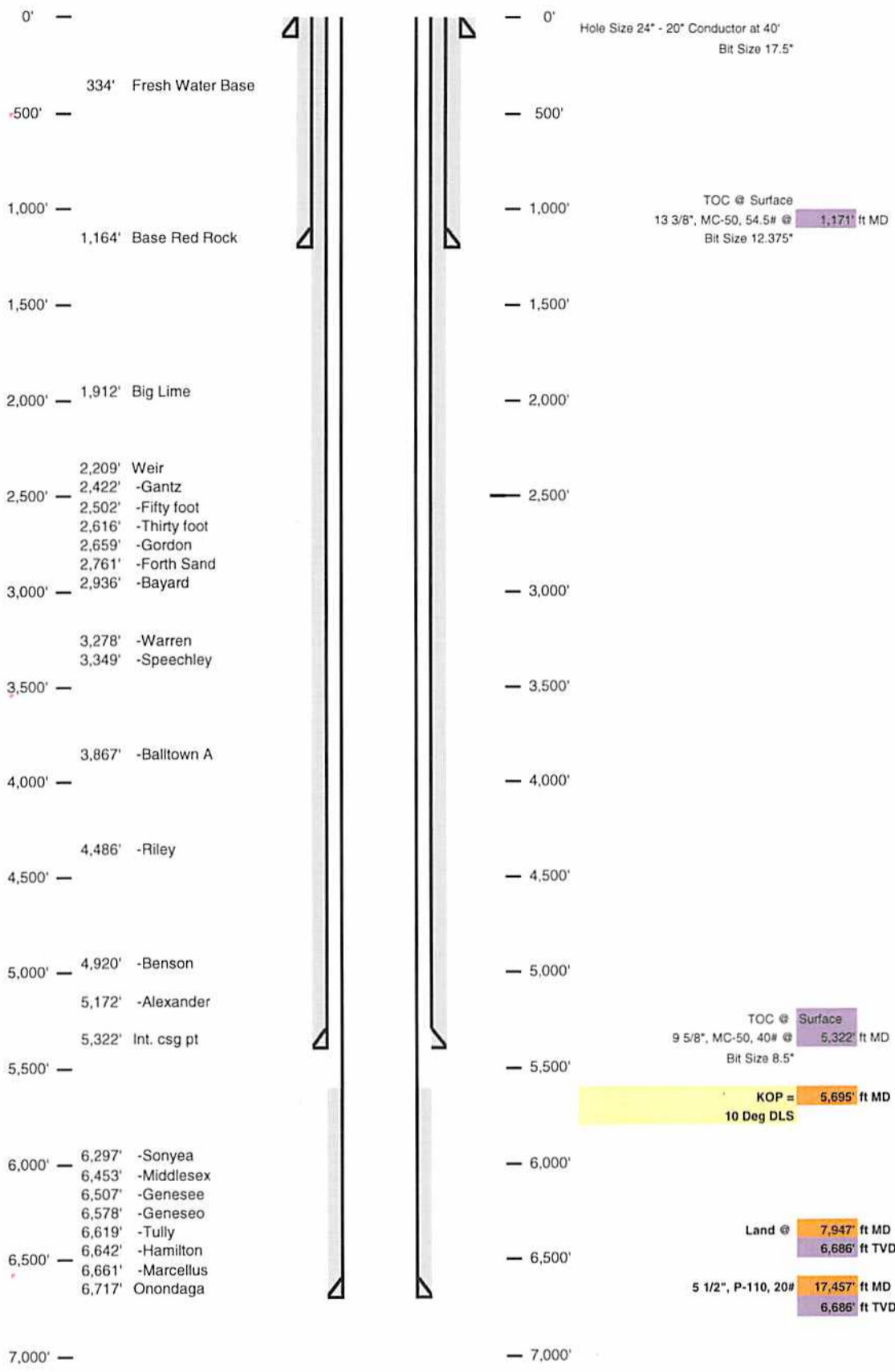
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 Office of Oil and Gas 05/30/2014
 MAY 27 2014
 WV Department of
 Environmental Protection

4701706381
Mod 2

Well Schematic
EQT Production

Well Name: 514661 (WEU51H1)
County: Doddridge
State: West Virginia

Elevation KB: 1221
Target Prospect: Marcellus
Azimuth: 155
Vertical Section: 9758



05/30/2014

Well 514661 (WEU51H1)
 EQT Production
 West Union
 Doddridge
 West Virginia

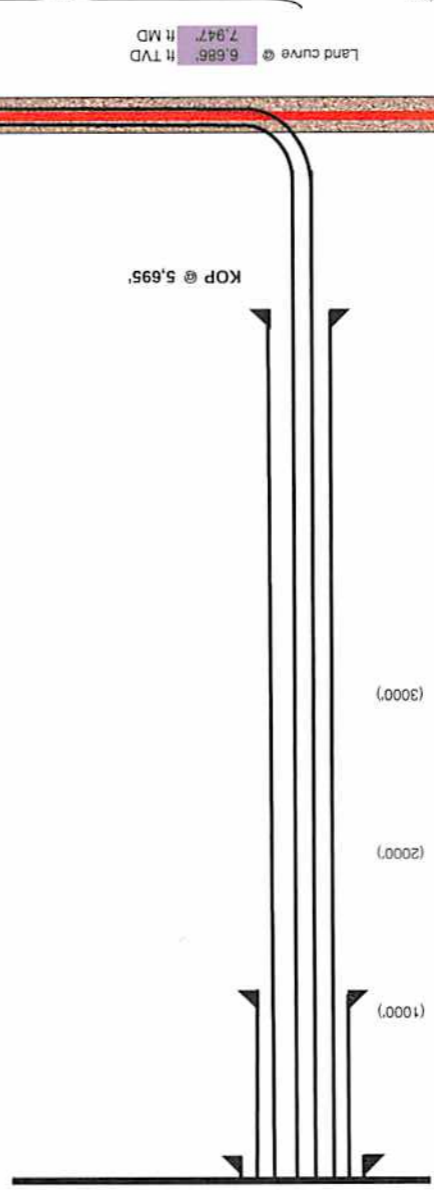
Azimuth 155
 Vertical Section 9758

TVD Depth (feet)

MAY 27 2014

Office of Oil and Gas
 WV Department of
 Environmental Protection

Formation	Tops (TVD)
Base Fresh Water	331
Base Red Rock	1164 (1000')
Big Lime	1912 - 2209
Well	2209 - 2422 (2000')
-Gantz	2422 - 2502
-Fifty foot	2502 - 2616
-Thirty foot	2616 - 2659
-Gordon	2659 - 2761
-Fort Sand	2761 - 2797
-Bayard	2936 - 3031 (3000')
-Warren	3278 - 3340
-Speckley	3319 - 3675
-Bartown A	3687 - 4196
-Hilly	4186 - 4726
-Benson	4920 - 5060
-Alexander	5172 - 6297
Log pt	5322
-Nyka	6297 - 6453
-Friedesax	6453 - 6507
-Chesee	6507 - 6578
-Tully	6578 - 6619
-Hamilton	6619 - 6642
-Marcellus top	6642 - 6661
Marcellus Bottom	6661
Get Inside Marcellus	6668
Marcellus Bottom	6717



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 5695'. Then kick off the horizontal leg into the Marcellus using a slick water frac.

Hole Size (inches)	Casing Type	Size (inches)	Wt (ppf)/Grade	Conductor (inches)
24		20		
17 1/2	Surface	13 3/8	54#MC-50	
12 3/8	Intermediate	9 5/8	40#MC-50	
8 1/2	Production Casing	5 1/2	20#P-110	

Est TD @ 6,686 ft TVD (17,457 ft MD)
 Land curve @ 6,686 ft TVD (7,947 ft MD)

9,510' ft Lateral

KOP @ 5,695'

Mod 2
 4701706381

EQT PRODUCTION COMPANY LEEMAN MAXWELL LEASE 1000 ACRES± WELL NO. WV 514661

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

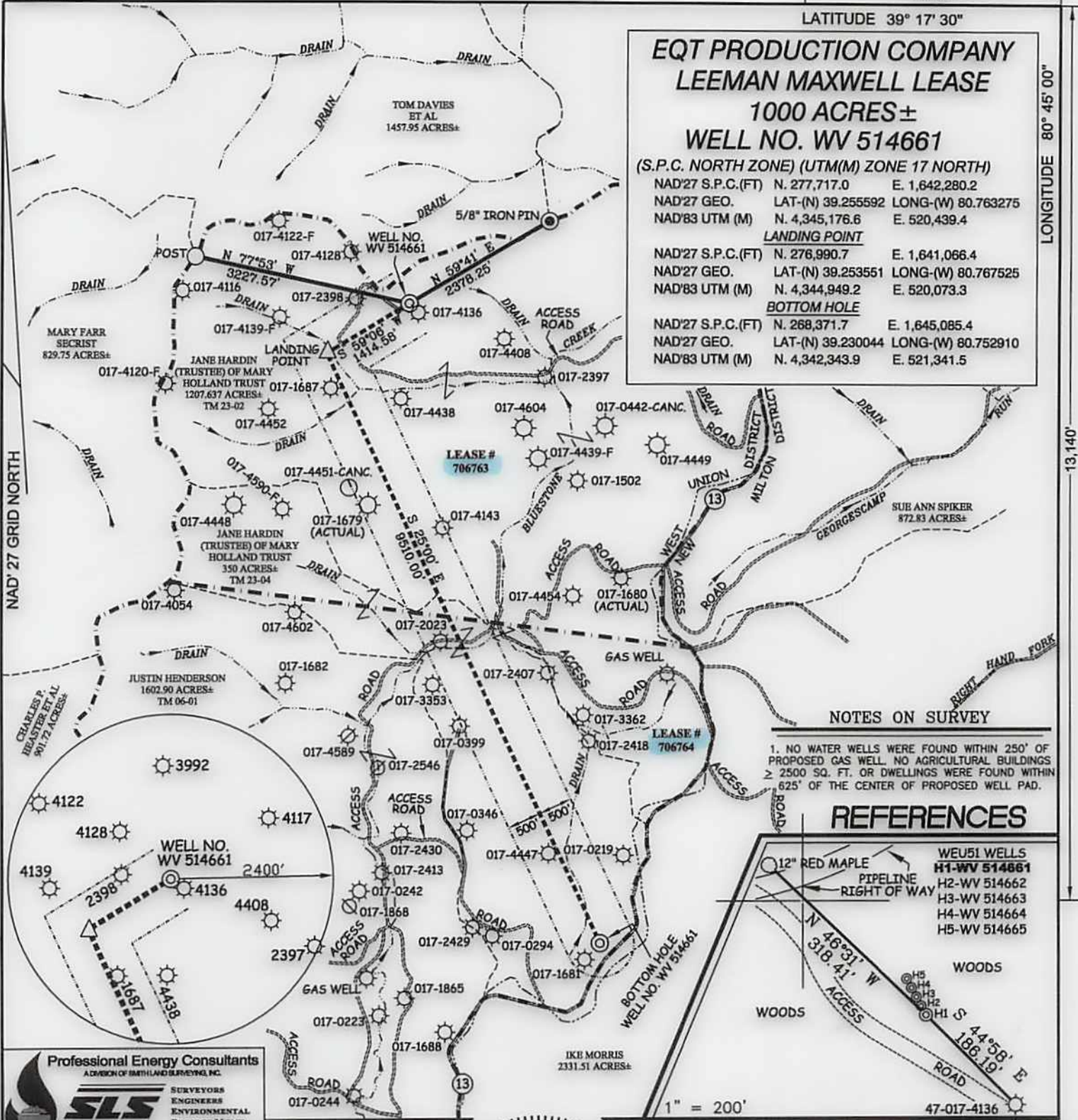
NAD'27 S.P.C.(FT) N. 277,717.0 E. 1,642,280.2
 NAD'27 GEO. LAT-(N) 39.255592 LONG-(W) 80.763275
 NAD'83 UTM (M) N. 4,345,176.6 E. 520,439.4

LANDING POINT

NAD'27 S.P.C.(FT) N. 276,990.7 E. 1,641,066.4
 NAD'27 GEO. LAT-(N) 39.253551 LONG-(W) 80.767525
 NAD'83 UTM (M) N. 4,344,949.2 E. 520,073.3

BOTTOM HOLE

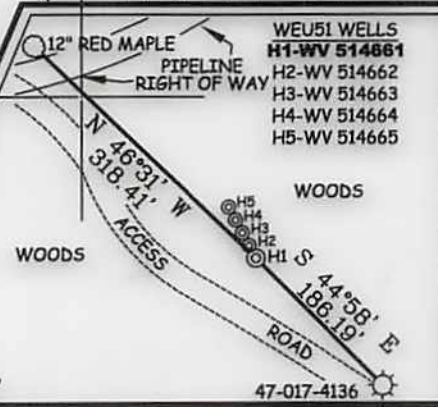
NAD'27 S.P.C.(FT) N. 268,371.7 E. 1,645,085.4
 NAD'27 GEO. LAT-(N) 39.230044 LONG-(W) 80.752910
 NAD'83 UTM (M) N. 4,342,343.9 E. 521,341.5



NOTES ON SURVEY

1. NO WATER WELLS WERE FOUND WITHIN 250' OF PROPOSED GAS WELL. NO AGRICULTURAL BUILDINGS ≥ 2500 SQ. FT. OR DWELLINGS WERE FOUND WITHIN 625' OF THE CENTER OF PROPOSED WELL PAD.

REFERENCES



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

DATE OCTOBER 1, 20 13

REVISED MARCH 05, 20 14

OPERATORS WELL NO. WV 514661

API WELL NO. 47 - 017 - 06381

STATE COUNTY PERMIT

Professional Energy Consultants
 A DIVISION OF BATHLAND SURVEYING, INC.

 SURVEYORS
 ENGINEERS
 ENVIRONMENTAL
 PROJECT MGMT.
 (304) 482-6854 WWW.SLSURVEYS.COM



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*

MINIMUM DEGREE OF ACCURACY 1 / 200 FILE NO. 8051P514661R

HORIZONTAL & VERTICAL CONTROL DETERMINED BY DGPS (SURVEY GRADE TIE TO CORS NETWORK) SCALE 1" = 2,000'

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 1,224'(GROUND) 1,208'(PROPOSED) WATERSHED BLUESTONE CREEK

DISTRICT WEST UNION COUNTY DODDRIDGE QUADRANGLE WEST UNION 7.5'

SURFACE OWNER JANE HARDIN (TRUSTEE) OF MARY HOLLAND TRUST ACREAGE 1207.637±

ROYALTY OWNER LEEMAN MAXWELL HEIRS (1000 AC.±) (2164 AC.±)

PROPOSED WORK: LEASE NO. 706763 / 706764

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 6661'

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 P.O. BOX 280 BRIDGEPORT, WV 26330

05/30/2014

13,140'

COUNTY NAME PERMIT