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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

December 08, 2014

EQT PRODUCTION COMPANY  
303 SAND CUT ROAD  
CLARKSBURG, WV 26301

Re: Permit Modification Approval for API Number 1706448 , Well #: WV 514395

Modify target formation from Geneseo to Marcellus, landing point, bottom hole and lateral lengt

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,

Gene Smith  
Assistant Chief of Permitting  
Office of Oil and Gas



July 30, 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 47-01706448

Dear Mr. Smith,

EQT would like to modify the target formation from Genesee to Marcellus, landing point, bottom hole and lateral length on the above API #. No additional leases were affected. I have enclosed a new WW-2B, well schematics, mylar plat and copy of 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 blue ink, appearing to read 'Vicki Roark'.

Vicki Roark  
Permitting Supervisor-WV

Enc.

Received

AUG 5 2014

12/12/14

Office of Oil and Gas  
West Virginia Department of Environmental Protection

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	District	8	Quadrangle	671
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2) Operator's Well Number: 514395      Well Pad Name: WEU49

3) Farm Name/Surface Owner: Mary Farr Secrist Farm      Public Road Access: 50/42

4) Elevation, current ground: 1,158.0      Elevation, proposed post-construction: 1,130.0

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 6648 with the anticipated thickness to be 56 feet and anticipated target pressure of 4484 PSI

8) Proposed Total Vertical Depth: 6,648

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 11,696

11) Proposed Horizontal Leg Length: 4,180

12) Approximate Fresh Water Strata Depths: 243, 292, 352, 487

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

14) Approximate Saltwater Depths: 1,542

15) Approximate Coal Seam Depths: 340, 483

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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**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	Varies	Varies	40	40	38
Fresh Water	13 3/8	New	MC-50	81	1,050	1,050	524
Coal							
Intermediate	9 5/8	New	MC-50	40	5,239	5,239	2,056
Production	5 1/2	New	P-110	20	11,696	11,696	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							

*12/3/14*

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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WV Dept. of Environmental Protection



(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 5793.  
Then kick off the horizontal leg in to 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): 37.4

22) Area to be disturbed for well pad only, less access road (acres): 16.3

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.

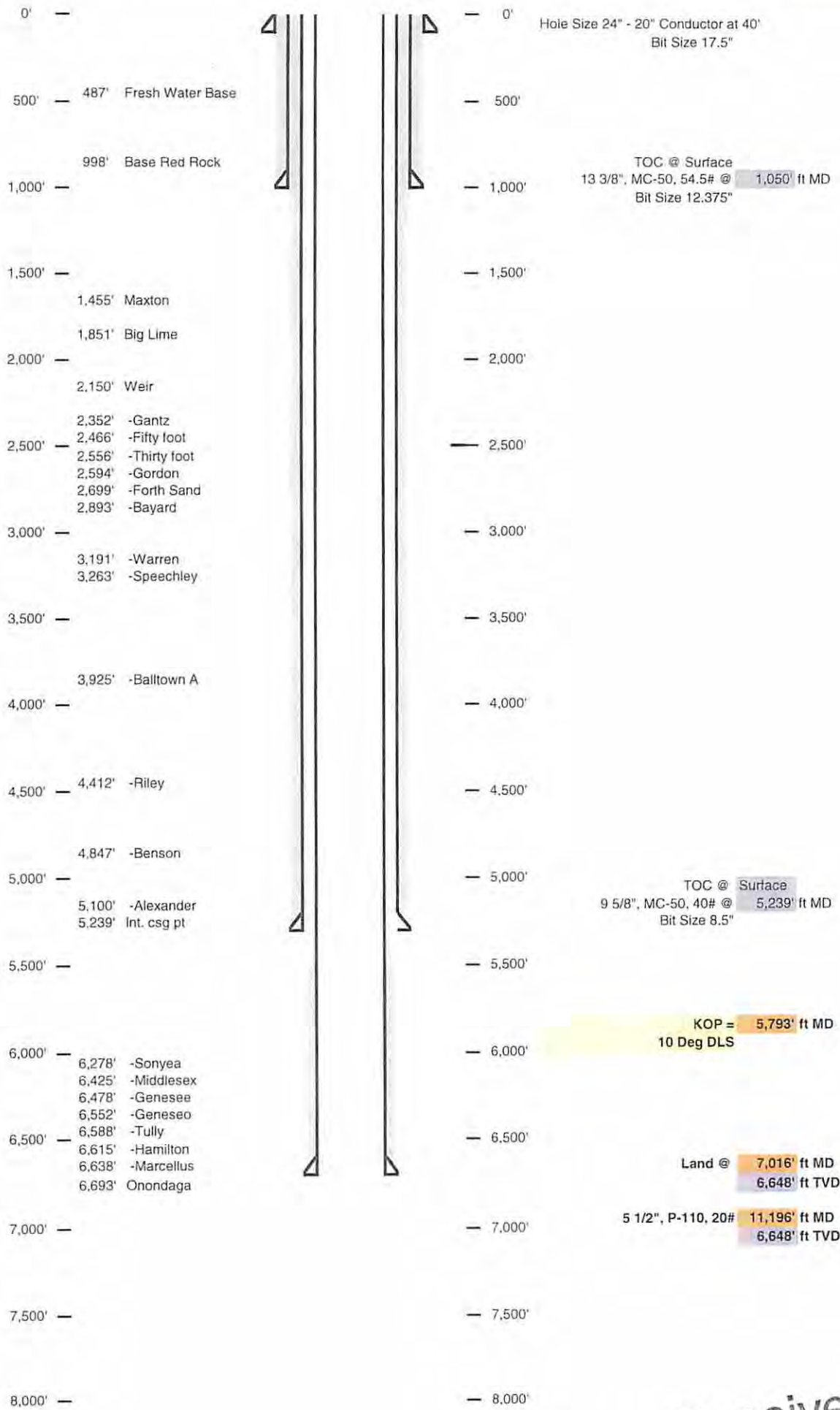
\*Note: Attach additional sheets as needed.

Received  
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Office of Oil and Gas  
WW Dept. of Environmental Protection

Well Schematic  
EQT Production

Well Name 514395 (WEU49H6)  
County Doddridge  
State West Virginia

Elevation KB: 1143  
Target Marcellus  
Prospect  
Azimuth 155  
Vertical Section 4729

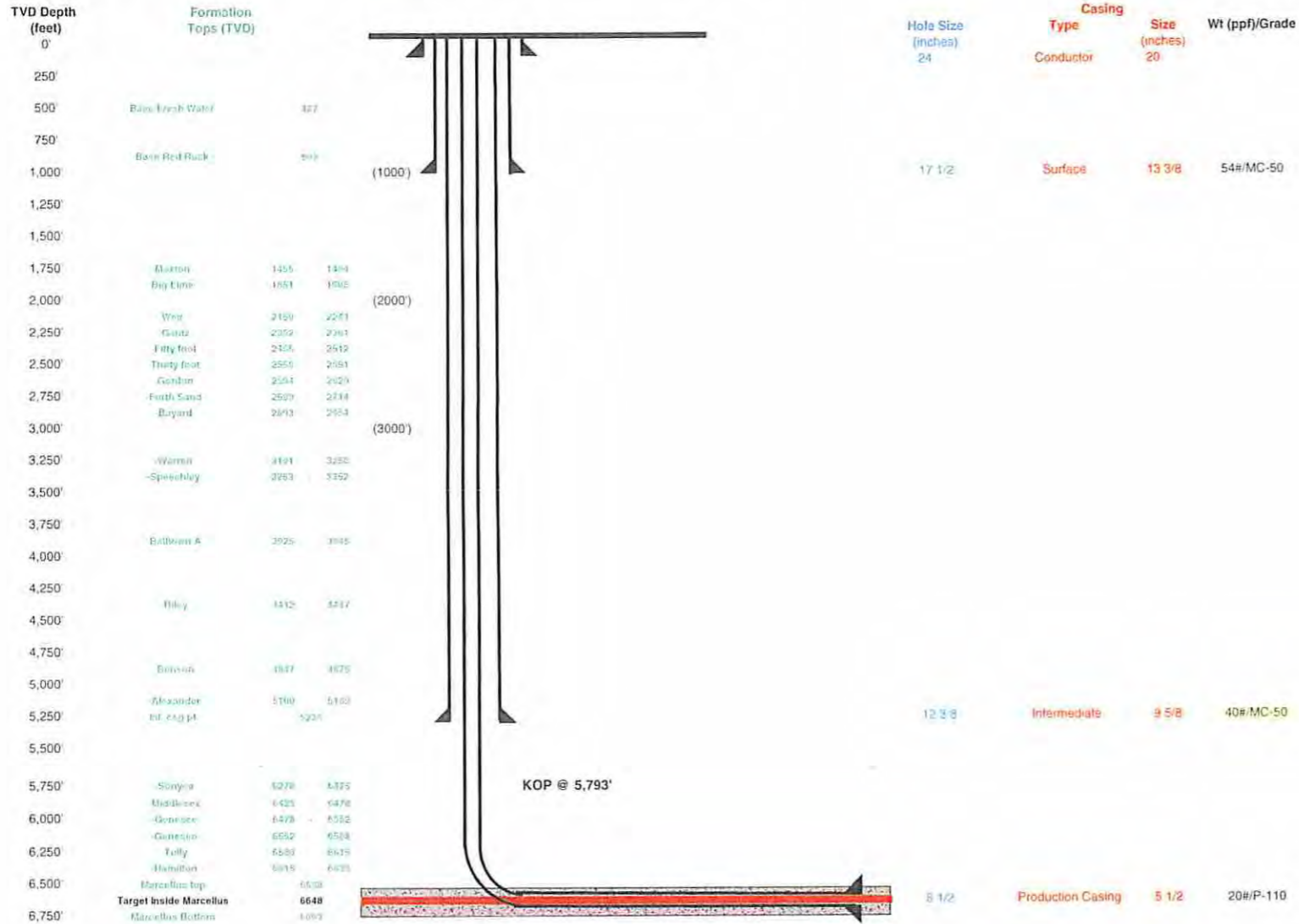


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WV Dept. of Environmental Protection

4701706448 MOD

Well 514395 (WEU49H6)  
 EQT Production  
 West Union  
 Doddridge West Virginia

Azimuth 155  
 Vertical Section 4729



Land curve @ 6,648' ft TVD / 7,016' ft MD      Est. TD @ 6,648' ft TVD / 11,196' ft MD

4,180' 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 5793'.  
 Then kick of the horizontal leg into the Marcellus using a slick water frac.

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 WV Dept. of Environmental Protection

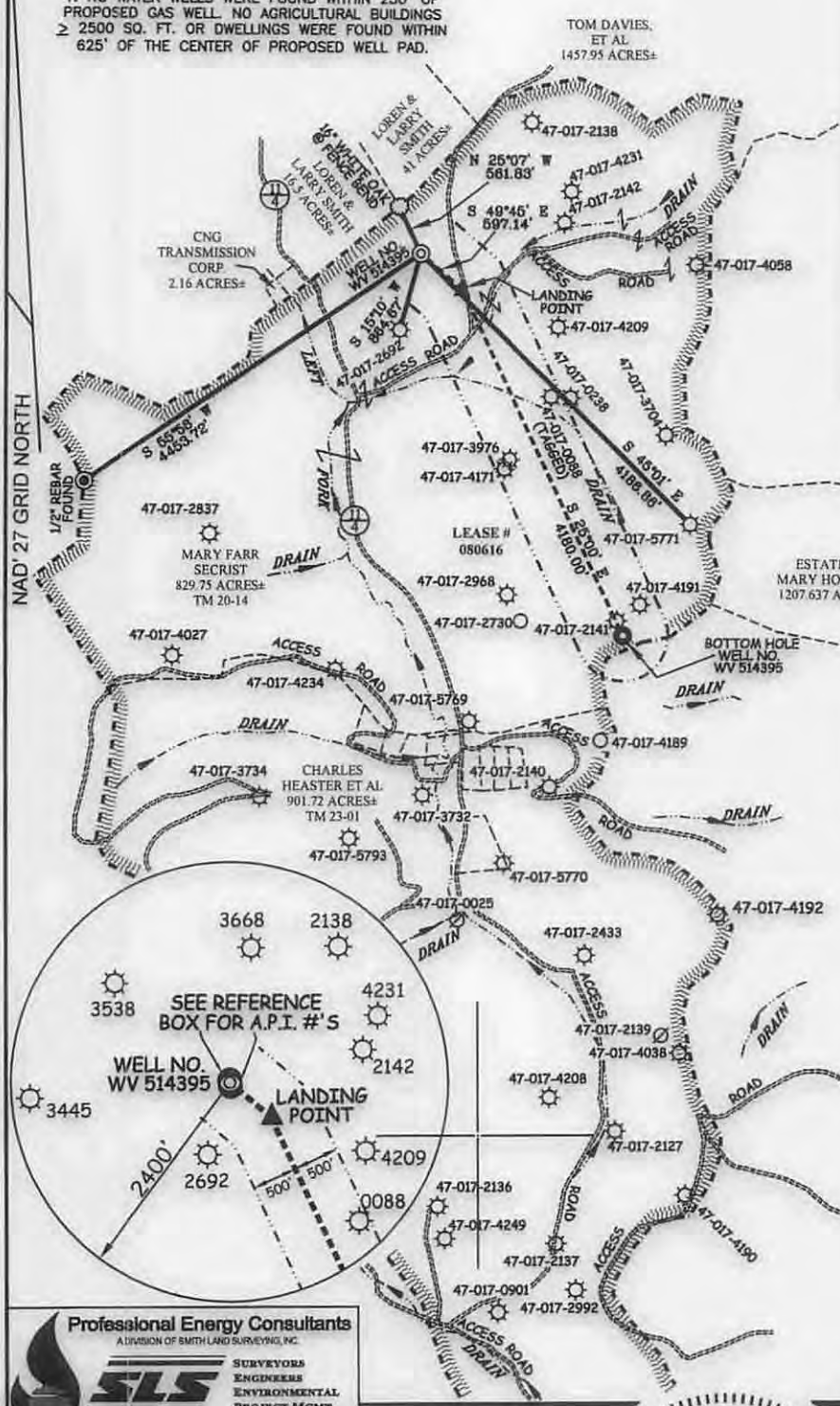


NOTES ON SURVEY

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.

EQT PRODUCTION COMPANY LEWIS MAXWELL LEASE 2,654 ACRES± WELL NO. WV 514395

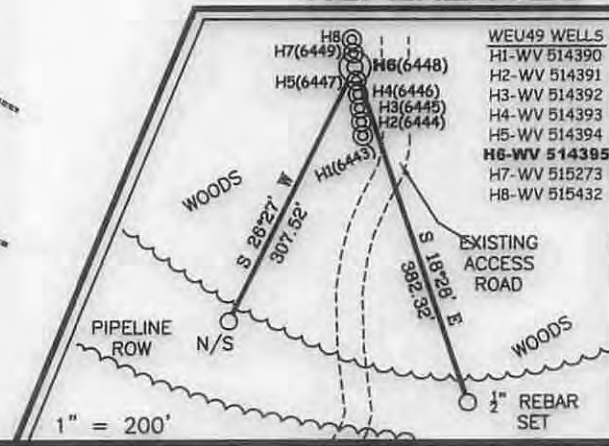
(S.P.C. NORTH ZONE) (UTM(M) ZONE 17 NORTH) NAD'27 S.P.C.(FT) N. 277,569.6 E. 1,635,662.0 NAD'27 GEO. LAT-(N) 39.254930 LONG-(W) 80.786636 NAD'83 UTM (M) N. 4,345,098.0 E. 518,423.9 LANDING POINT NAD'27 S.P.C.(FT) N. 277,183.8 E. 1,636,117.8 NAD'27 GEO. LAT-(N) 39.253888 LONG-(W) 80.785008 NAD'83 UTM (M) N. 4,344,982.8 E. 518,564.7 BOTTOM HOLE NAD'27 S.P.C.(FT) N. 273,395.4 E. 1,637,884.3 NAD'27 GEO. LAT-(N) 39.243557 LONG-(W) 80.778580 NAD'83 UTM (M) N. 4,343,837.7 E. 519,122.2



LEGEND

Legend table with symbols for LEASE LINE, SURFACE LINE, WELL LATERAL, OFFSET LINE, TIE LINE, CREEK, ROAD, TREE LINE, COUNTY ROUTE, PROPOSED WELL, EXISTING WELL, and TAX MAP-PARCEL.

REFERENCES



Professional Energy Consultants logo and contact information: (304) 462-6634, 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. 849 C. Victor Moyers

(+) DENOTES LOCATION OF WELL ON UNITED STATES TOPOGRAPHIC MAPS. DATE DECEMBER 02, 20 13. REVISED 07/01/14 & 07/31/14. OPERATORS WELL NO. WV 514395. API WELL NO. 47-017-06448. STATE COUNTY PERMIT

MINIMUM DEGREE OF ACCURACY 1/200 FILE NO. 7871P514395R2 HORIZONTAL & VERTICAL CONTROL DETERMINED BY DGPS (SURVEY GRADE TIE TO CORS NETWORK) SCALE 1" = 2000'

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

WELL TYPE: OIL GAS X INJECTION WASTE DISPOSAL "GAS" PRODUCTION X STORAGE DEEP SHALLOW X LOCATION: ELEVATION 1,158'(GROUND) 1,130'(PROPOSED) WATERSHED LEFT FORK OF ARNOLD CREEK DISTRICT WEST UNION COUNTY DODDRIDGE QUADRANGLE WEST UNION 7.5' SURFACE OWNER MARY FARR SECRIST ACREAGE 829.75± ROYALTY OWNER LEWIS MAXWELL HRS ACREAGE 2654± LEASE NO. 080616 PROPOSED WORK: DRILL X CONVERT DRILL DEEPER REDRILL FRACTURE OR STIMULATE X 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 TVD 6,622'

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

LONGITUDE 80°45'00" COUNTY NAME PERMIT



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.

TOM DAVIES, ET AL 1457.95 ACRES±

EQT PRODUCTION COMPANY LEWIS MAXWELL LEASE 2,654 ACRES± WELL NO. WV 514395

(S.P.C. NORTH ZONE) (UTM(M) ZONE 17 NORTH) NAD'27 S.P.C.(FT) N. 277,569.6 E. 1,635,662.0 NAD'27 GEO. LAT-(N) 39.254930 LONG-(W) 80.786636 NAD'83 UTM (M) N. 4,344,982.8 E. 518,423.9

LANDING POINT

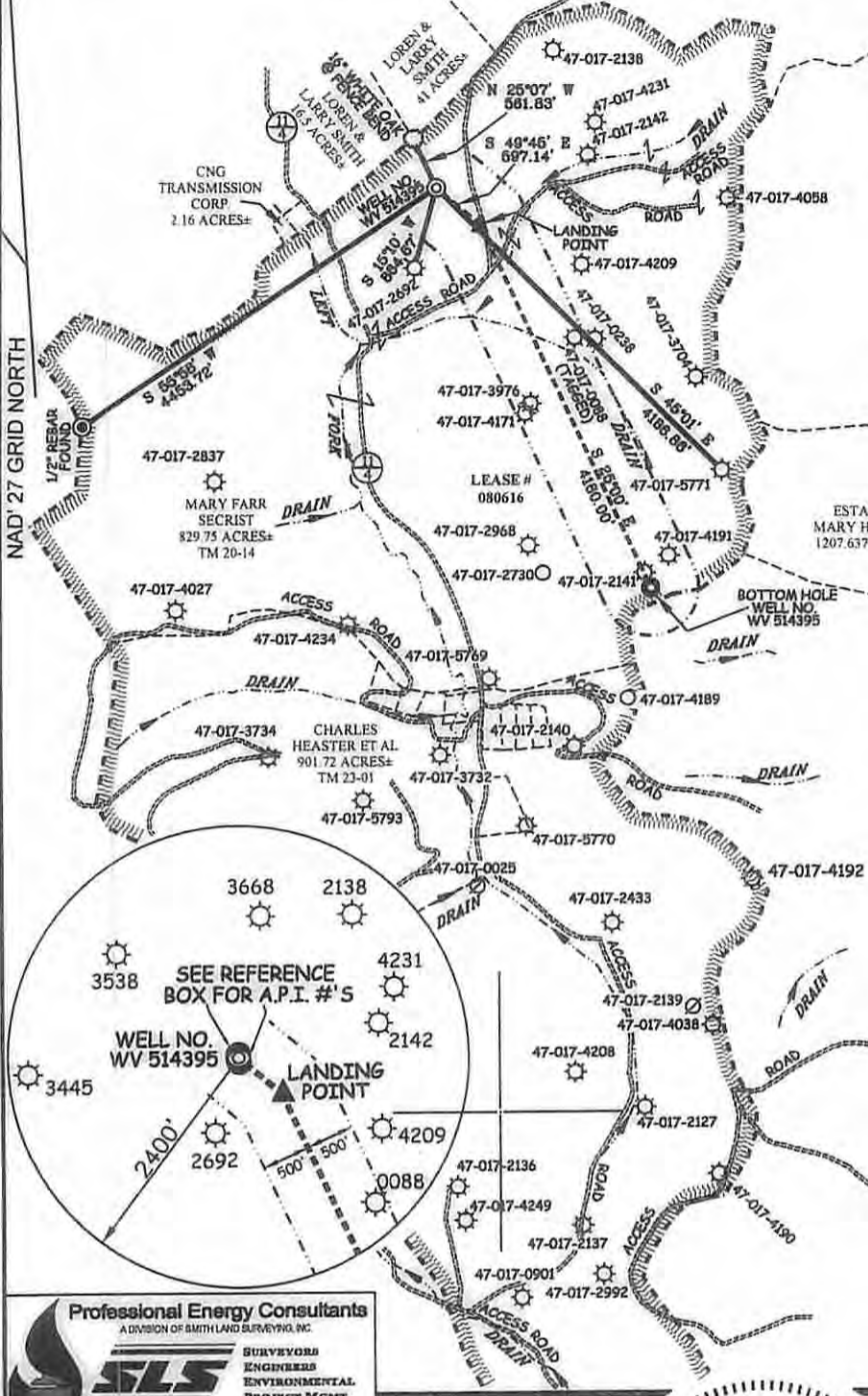
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BOTTOM HOLE

NAD'27 S.P.C.(FT) N. 273,395.4 E. 1,637,884.3 NAD'27 GEO. LAT-(N) 39.243557 LONG-(W) 80.778580 NAD'83 UTM (M) N. 4,343,837.7 E. 519,122.2

NAD'27 GRID NORTH

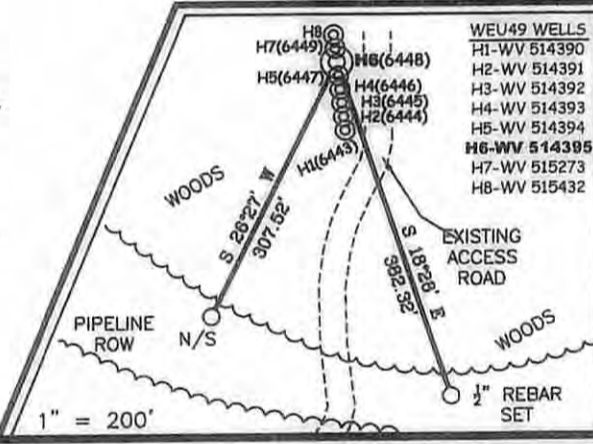
13,381'



LEGEND

Table with 2 columns: Symbol and Description. Includes Lease Line, Surface Line, Well Lateral, Offset Line, Tie Line, Creek, Road, Tree Line, County Route, Proposed Well, Existing Well, Tax Map-Parcel.

REFERENCES



Professional Energy Consultants logo and contact information: (304) 462-6634, www.slsurveyors.com

I THE UNDERSIGNED, HEREBY CERTIFY THAT THIS PLAN 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.



Form fields for well location: (+) DENOTES LOCATION OF WELL ON UNITED STATES TOPOGRAPHIC MAPS. DATE DECEMBER 02, 20 13. REVISED 07/01/14 & 07/31/14. OPERATORS WELL NO. WV 514395. API WELL NO. 47-017-06448. STATE COUNTY PERMIT.

Form fields for accuracy: MINIMUM DEGREE OF ACCURACY 1/200. FILE NO. 7871P514395R2. SCALE 1" = 2000'. HORIZONTAL & VERTICAL CONTROL DETERMINED BY DGPS (SURVEY GRADE TIE TO CORS NETWORK)

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

Form fields for well type and location: WELL TYPE: OIL GAS X INJECTION WASTE DISPOSAL IF "GAS" PRODUCTION X STORAGE DEEP SHALLOW X. LOCATION: ELEVATION 1,158'(GROUND) 1,130'(PROPOSED) WATERSHED LEFT FORK OF ARNOLD CREEK. DISTRICT WEST UNION COUNTY DODDRIDGE QUADRANGLE WEST UNION 7.5'. SURFACE OWNER MARY FARR SECRIST ACREAGE 829.75±. ROYALTY OWNER LEWIS MAXWELL HRS ACREAGE 2654±. PROPOSED WORK: DRILL X CONVERT DRILL DEEPER REDRILL FRACTURE OR STIMULATE X 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 TVD 6,622'

Form fields for operator and agent: WELL OPERATOR EQT PRODUCTION COMPANY DESIGNATED AGENT REX C. RAY. ADDRESS 115 PROFESSIONAL PLACE P.O. BOX 280 BRIDGEPORT, WV 26330.

Received stamp

AUG 5 2014 stamp

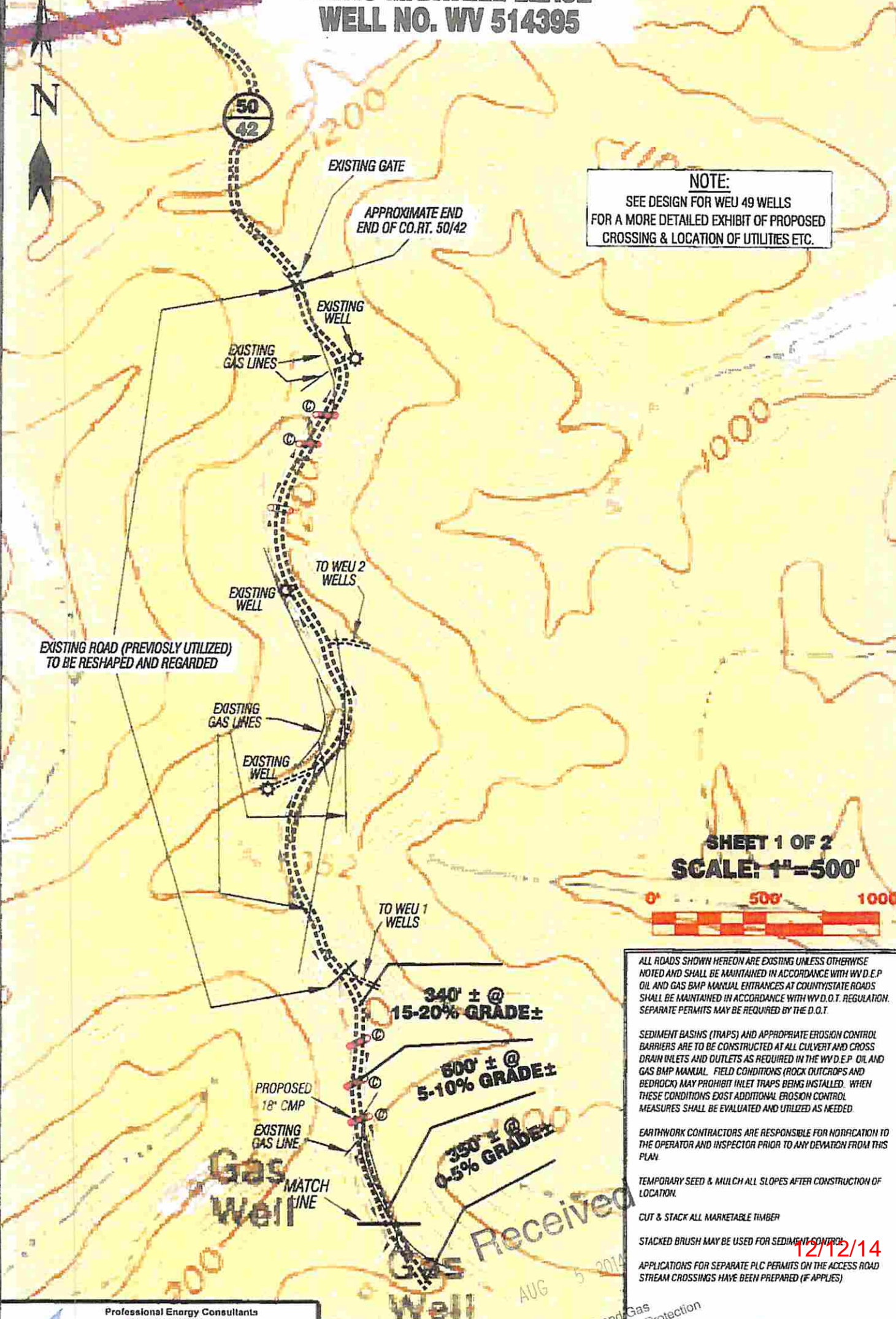
12/12/14 stamp



# EQT PRODUCTION COMPANY LEWIS MAXWELL LEASE WELL NO. WV 514395



**NOTE:**  
SEE DESIGN FOR WEU 49 WELLS  
FOR A MORE DETAILED EXHIBIT OF PROPOSED  
CROSSING & LOCATION OF UTILITIES ETC.



**SHEET 1 OF 2**  
**SCALE: 1"=500'**



ALL ROADS SHOWN HEREON ARE EXISTING UNLESS OTHERWISE NOTED AND SHALL BE MAINTAINED IN ACCORDANCE WITH WV D.E.P OIL AND GAS BMP MANUAL ENTRANCES AT COUNTY/STATE ROADS SHALL BE MAINTAINED IN ACCORDANCE WITH WV D.O.T. REGULATION. SEPARATE PERMITS MAY BE REQUIRED BY THE D.O.T.

SEDIMENT BASINS (TRAPS) AND APPROPRIATE EROSION CONTROL BARRIERS ARE TO BE CONSTRUCTED AT ALL CULVERT AND CROSS DRAIN INLETS AND OUTLETS AS REQUIRED IN THE WV D.E.P. OIL AND GAS BMP MANUAL. FIELD CONDITIONS (ROCK OUTCROPS AND BEDROCK) MAY PROHIBIT INLET TRAPS BEING INSTALLED. WHEN THESE CONDITIONS EXIST ADDITIONAL EROSION CONTROL MEASURES SHALL BE EVALUATED AND UTILIZED AS NEEDED.

EARTHWORK CONTRACTORS ARE RESPONSIBLE FOR NOTIFICATION TO THE OPERATOR AND INSPECTOR PRIOR TO ANY DEVIATION FROM THIS PLAN.

TEMPORARY SEED & MULCH ALL SLOPES AFTER CONSTRUCTION OF LOCATION.

CUT & STACK ALL MARKETABLE TIMBER

STACKED BRUSH MAY BE USED FOR SEDIMENT CONTROL

APPLICATIONS FOR SEPARATE PLC PERMITS ON THE ACCESS ROAD STREAM CROSSINGS HAVE BEEN PREPARED (IF APPLIES)

12/12/14

**Professional Energy Consultants**  
A DIVISION OF SMITH LAND SURVEYING

**SLS**

SURVEYORS PROJECT MGMT. ENGINEERS ENVIRONMENTAL

235 Third Main St. P.O. Box 128 Okemore, WV 26131 (304) 462-2812

20051 Dohrs Station Road Sandusky, OH 44877 (740) 871-9111

HONESTY. FREEDOM. QUALITY

DRAWN BY: K.D.W. FILE NO.: 7871 DATE: 12/04/13 CADD FILE: 7871RECS14395.dwg

TOPO SECTION OF WEST UNION 7.5' USGS TOPO QUADRANGLE

Office of Oil and Gas Protection  
WV Dept. of Environmental Protection

12/12/14

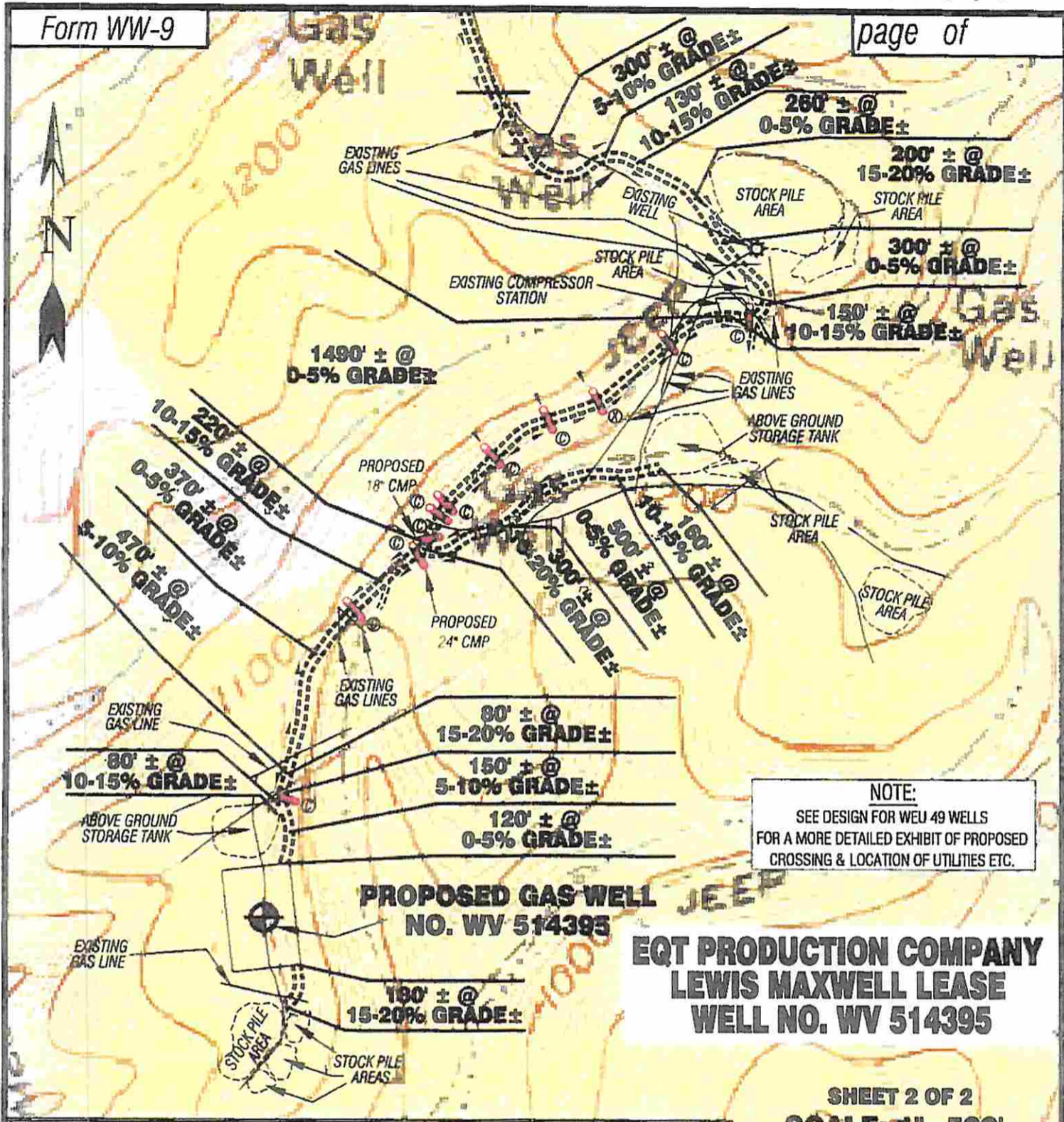
EXISTING CULVERT

PROPOSED CULVERT 15' MIN UNLESS OTHERWISE NOTED

PROPOSED STREAM CROSSING

APPROXIMATE LIMITS OF DISTURBANCE





**NOTE:**  
SEE DESIGN FOR WEU 49 WELLS  
FOR A MORE DETAILED EXHIBIT OF PROPOSED  
CROSSING & LOCATION OF UTILITIES ETC.

**EQT PRODUCTION COMPANY  
LEWIS MAXWELL LEASE  
WELL NO. WV 514395**

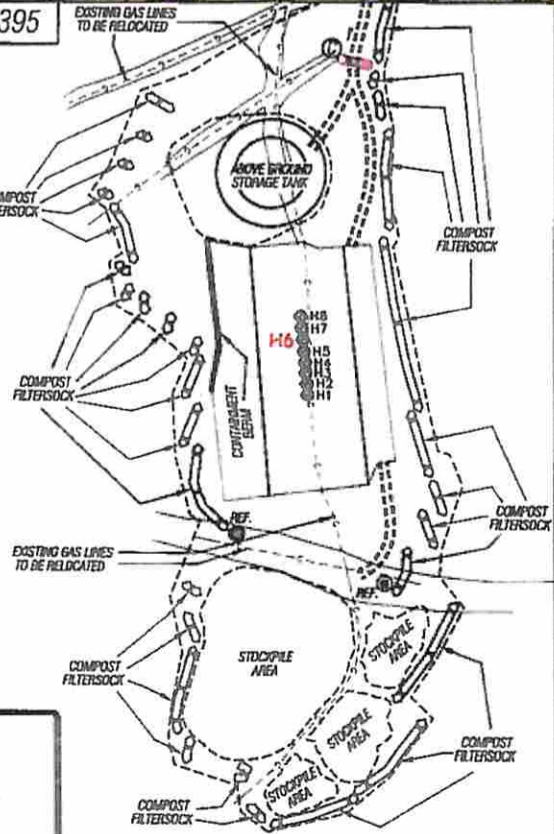
**SHEET 2 OF 2  
SCALE: 1"=500'**



Detail Sketch for Proposed Well WV 514395

- WEU49 WELLS**  
 H1-WV 514390  
 H2-WV 514391  
 H3-WV 514392  
 H4-WV 514393  
 H5-WV 514394  
**H6-WV 514395**  
 H7-WV 51273  
 H8- NOT YET DETERMINED

**NOTE:**  
SEE DESIGN FOR WEU 49 WELLS  
FOR A MORE DETAILED EXHIBIT OF PROPOSED  
CROSSING & LOCATION OF UTILITIES ETC.



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TEMPORARY SEED & MULCH ALL SLOPES AFTER CONSTRUCTION OF LOCATION.

CUT & STACK ALL MARKETABLE TIMBER.  
Stacked brush may be used for sediment control.

APPLICATIONS FOR SEPARATE PLC PERMITS ON THE ACCESS ROAD STREAM CROSSINGS HAVE BEEN PREPARED (IF APPLIES).

Office of Oil and Gas  
WV Dept. of Environmental Protection  
15-18N UNLESS OTHERWISE NOTED

EXISTING CULVERT  
PROPOSED CULVERT  
PROPOSED STREAM CROSSING  
APPROXIMATE LIMITS OF DISTURBANCE

Not To Scale

**Professional Energy Consultants**  
A DIVISION OF SOUTH LAND SURVEYING

Surveyors  
Project Mgr.  
228 Vinyl Glen Dr.  
P.O. Box 129  
Glennville, WV 26031  
(606) 482-5634

ENGINEERS  
ENVIRONMENTAL  
16253 Oakes Bottom Road  
Shawmansville, WV 26047  
(206) 631-9971

Integrity. Integrity. Quality.

DRAWN BY: K.D.W. FILE NO.: 7871 DATE: 12/04/13 CADD FILE: 7871RCCS14395.dwg

TOPO SECTION OF WEST UNION 7.5' USGS TOPO QUADRANGLE

12/12/14

AUG