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 28, 2014

EQT PRODUCTION COMPANY
POST OFFICE BOX 280
BRIDGEPORT, WV 26330

Re: Permit Modification Approval for API Number 1706385 , Well #: 514663
Mod 2 - increase depth of 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



12/09/2022

Mod 2
4701706385

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

RECEIVED
Office of Oil and Gas
MAY 27 2014
WV Department of
Environmental Protection

WW - 6B
(9/13)

Mod 2
4701706385

**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 | | 017 | 8 | 671
Operator ID | County | District | Quadrangle

2) Operator's Well Number: 514663 Well Pad Name: WEU51

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

4) Elevation, current ground: 1,225.0 Elevation, proposed post-construction: 1,208.0

5) Well Type: (a) Gas ▪ Oil _____ Underground Storage _____

Other _____

(b) If Gas: Shallow ▪ Deep _____

Horizontal ▪

DLW
5-23-14

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 15,172
11) Proposed Horizontal Leg Length 7,580
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: _____

WW - 6B
(3/13)

Mod 2
4701706385

## 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 | 111 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 | 15,172 | 15,172 | 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 | | | | | | | |

DCN
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.

. WW - 6B

(3/13)

Mod 2
4701706385

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 6817'. Tag the Onondaga not more than 100', run logs, then plug back to approximately 5670'.

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): 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 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.



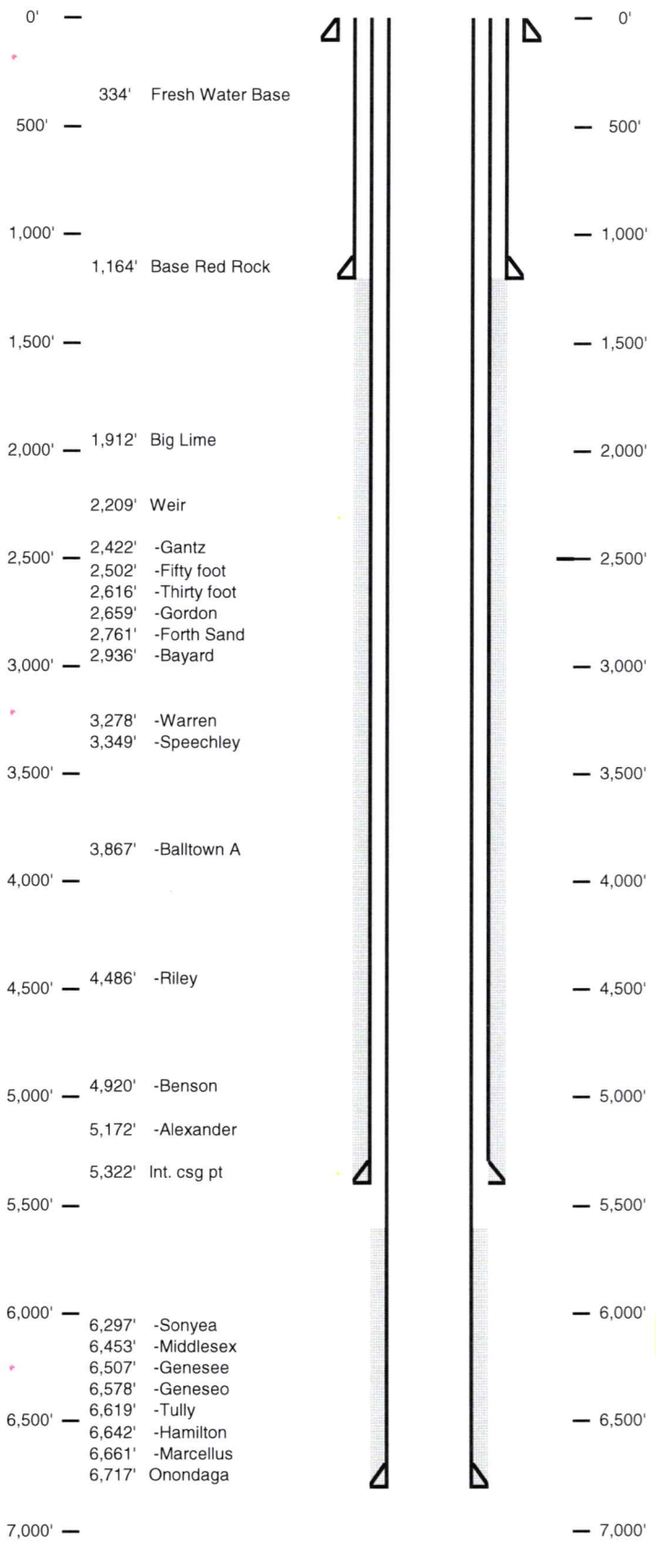
12/09/2022

4701706385 Mod 2

## Well Schematic
## EQT Production

| | |
|---|---|
| **Well Name** | 514663 (WEU51H3) |
| **County** | Doddridge |
| **State** | West Virgina |

| | |
|---|---|
| **Elevation KB:** | 1221 |
| **Target** | Marcellus |
| **Prospect** | |
| **Azimuth** | 155 |
| **Vertical Section** | 8064 |




Hole Size 24" - 20" Conductor at 40'
Bit Size 17.5"

TOC @ Surface
13 3/8", MC-50, 54.5# @ 1,171' ft MD
Bit Size 12.375"

TOC @ Surface
9 5/8", MC-50, 40# @ 5,322' ft MD
Bit Size 8.5"

**KOP = 5,670' ft MD**
**10 Deg DLS**

**Land @ 7,092' ft MD**
**6,686' ft TVD**

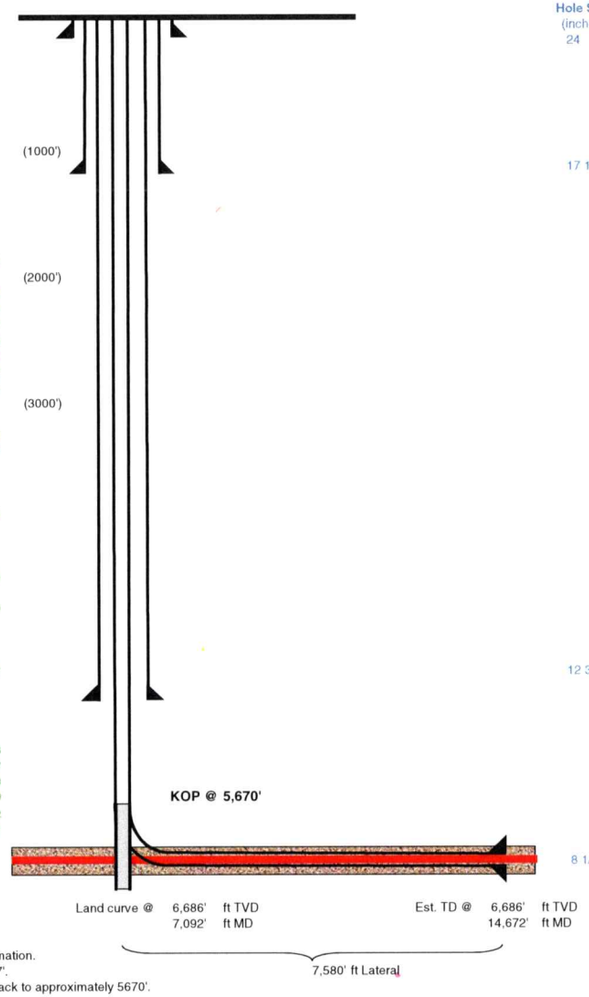
**5 1/2", P-110, 20# 14,672' ft MD**
**6,686' ft TVD**

12/09/2022

**Well** 514663 (WEU51H3)
**EQT Production**
**West Union**
**Doddridge** **West Virgina**

**Azimuth** 155
**Vertical Section** 8064

| TVD Depth (feet) | Formation Tops (TVD) | | |
|---|---|---|---|
| 0' | | | |
| 250' | | | |
| | Base Fresh Water | 334 | |
| 500' | | | |
| 750' | | | |
| 1,000' | | | |
| | Base Red Rock | 1164 | |
| 1,250' | | | |
| 1,500' | | | |
| 1,750' | | | |
| | Big Lime | 1912 - | 2209 |
| 2,000' | | | |
| | Weir | 2209 - | 2422 |
| 2,250' | -Gantz | 2422 - | 2502 |
| | -Fifty foot | 2502 - | 2616 |
| 2,500' | -Thirty foot | 2616 - | 2659 |
| | -Gordon | 2659 - | 2761 |
| 2,750' | -Forth Sand | 2761 - | 2797 |
| | -Bayard | 2936 - | 3031 |
| 3,000' | | | |
| 3,250' | -Warren | 3278 - | 3340 |
| | -Speechley | 3349 - | 3675 |
| 3,500' | | | |
| 3,750' | | | |
| | -Balltown A | 3867 - | 4196 |
| 4,000' | | | |
| 4,250' | | | |
| | -Riley | 4486 - | 4726 |
| 4,500' | | | |
| | -Benson | 4920 - | 5060 |
| 4,750' | | | |
| 5,000' | | | |
| | -Alexander | 5172 - | 6297 |
| 5,250' | | | |
| | Int. csg pt | 5322 | |
| 5,500' | | | |
| 5,750' | -Sonyea | 6297 - | 6453 |
| | -Middlesex | 6453 - | 6507 |
| 6,000' | -Genesee | 6507 - | 6578 |
| | -Geneseo | 6578 - | 6619 |
| 6,250' | -Tully | 6619 - | 6642 |
| | -Hamilton | 6642 - | 6661 |
| 6,500' | Marcellus top | 6661 | |
| | **Target Inside Marcellus** | **6686** | |
| 6,750' | Marcellus Bottom | 6717 | |
| 7,000' | | | |




| Hole Size (inches) | Casing Type | Size (inches) | Wt (ppf)/Grade |
|---|---|---|---|
| 24 | Conductor | 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 |

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 6817'.
Tag the Onondaga not more than 100', run logs, then plug back to approximately 5670'.

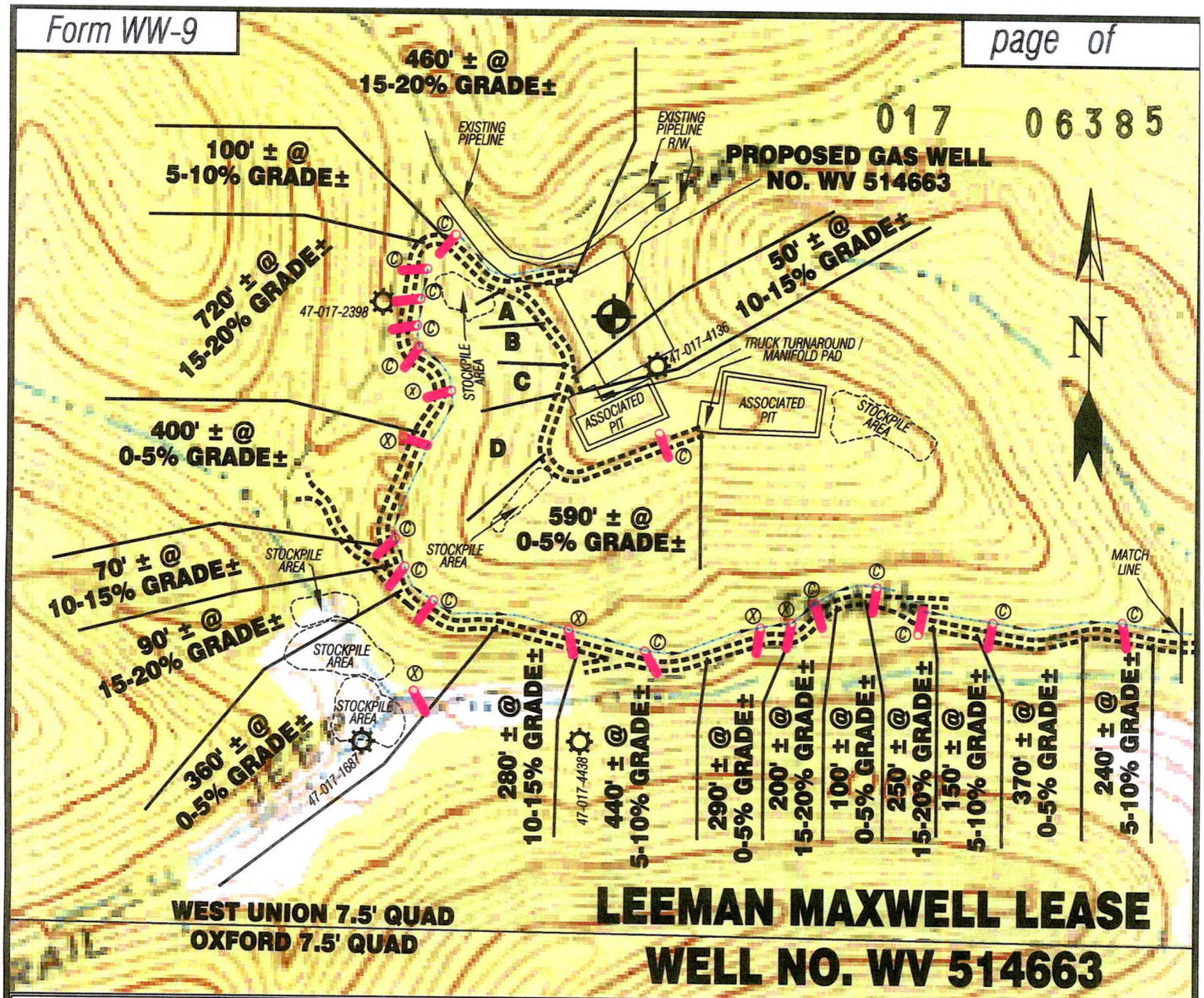


4701706385
Wall 2

Form WW-9

page of

017 06385

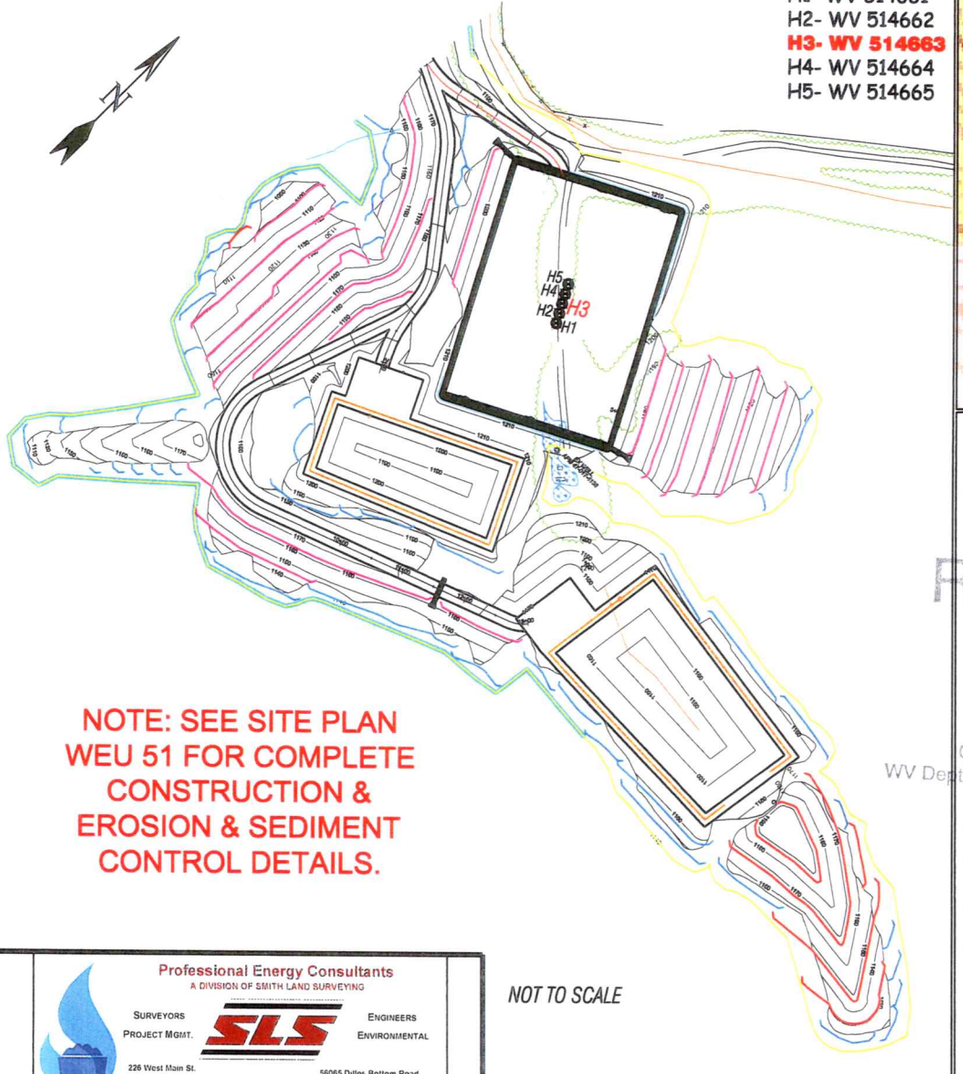



WEST UNION 7.5' QUAD
OXFORD 7.5' QUAD

# LEEMAN MAXWELL LEASE
# WELL NO. WV 514663

Detail Sketch for Proposed Well WV 514663

**WEU51 WELLS**
H1- WV 514661
H2- WV 514662
**H3- WV 514663**
H4- WV 514664
H5- WV 514665




| | DISTANCE | GRADE± |
|---|---|---|
| A | 170' ± | 0-5% |
| B | 160' ± | 15-20% |
| C | 100' ± | 0-5% |
| D | 210' ± | 15-20% |

**SCALE: 1"=500'**

0' 500' 1000'

NOTE: SEE SITE PLAN WEU 51 FOR COMPLETE CONSTRUCTION & EROSION & SEDIMENT CONTROL DETAILS.

NOT TO SCALE

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).

= EXISTING CULVERT

Ⓒ = PROPOSED CULVERT 12" MIN. UNLESS OTHERWISE NOTED

Ⓧ = PROPOSED STREAM CROSSING

= APPROXIMATE LIMITS OF DISTURBANCE



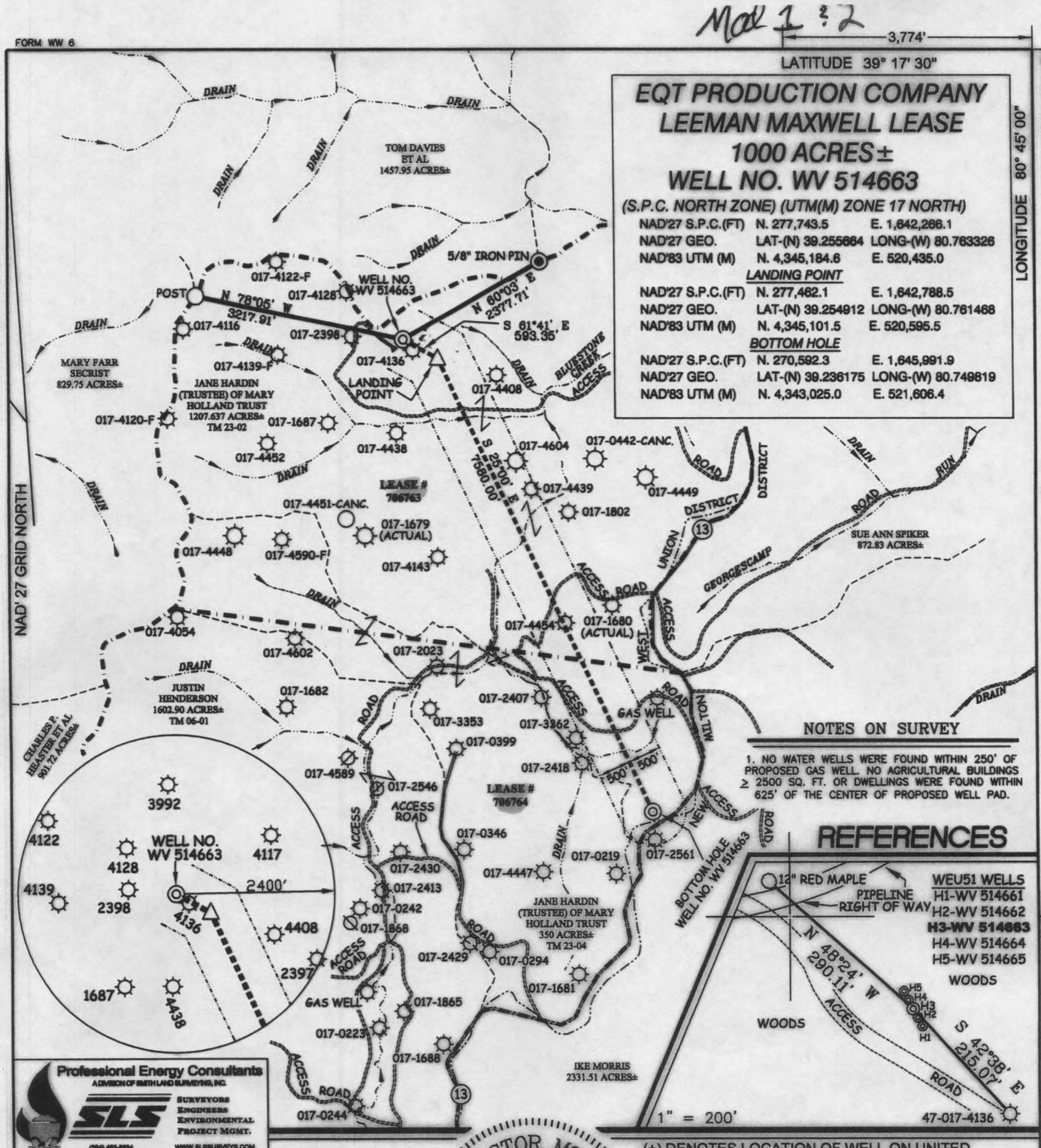
Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING
SURVEYORS PROJECT MGMT. SLS ENGINEERS ENVIRONMENTAL
226 West Main St. P.O. Box 150 Glenville, WV 26351 (304) 462-5634
56065 Dilles Bottom Road Shadyside, OH 43947 (740) 671-9911
HONESTY, INTEGRITY, QUALITY

| DRAWN BY | FILE NO. | DATE | CADD FILE: |
|---|---|---|---|
| K.D.W. | 8051 | 09/12/13 | 8051RECWV514663.DWG |

TOPO SECTION OF USGS WEST UNION 7.5' QUADRANGLE

Mod 1 & 2

FORM WW 6




Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING, INC.
SLS SURVEYORS ENGINEERS ENVIRONMENTAL PROJECT MGMT.
(304) 483-0834 WWW.SLSSURVEYS.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

C. VICTOR MOYERS LICENSED No. 849 STATE OF WEST VIRGINIA PROFESSIONAL SURVEYOR

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

DATE OCTOBER 1 , 20 13

REVISED MARCH 13 , 20 14

OPERATORS WELL NO. WV 514663

API WELL NO. 47 — 017 — 06385
STATE COUNTY PERMIT

HGA MW 1 & 2

MINIMUM DEGREE OF ACCURACY 1 / 200

FILE NO. 8051P514663R2

SCALE 1" = 2,000'

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

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

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.±)

12/09/2022

PROPOSED WORK : LEASE NO. 706763 / 706764

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 6661'

COUNTY NAME

PERMIT

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

DESIGNATED AGENT REX C. RAY
ADDRESS 115 PROFESSIONAL PLACE P.O. BOX 280
BRIDGEPORT, WV 26330

SLS