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

March 28, 2014

EQT PRODUCTION COMPANY
POST OFFICE BOX 280
BRIDGEPORT, WV 26330

Re: Permit Modification Approval for API Number 1706324 , Well #: WV 513346
Modified 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,

Gene Smith
Regulatory/Compliance Manager
Office of Oil and Gas

EQT

December 17, 2013

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

Re: Modification of (WEU6) 47-017-06324

Dear Mr. Smith,

Attached is a modification to the casing program for the above well. A new WW-6B & schematics are enclosed for your review. Due to problems encountered drilling the WEU8 wells, we have decided to set the intermediate casing deeper.

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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WW - 6B
9/13)

4701706324 12/19
MOD

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
W.VA. CODE §22-6A - WELL WORK PERMIT APPLICATION

) Well Operator: EQT Production Company

	017	8	671
Operator ID	County	District	Quadrangle

2) Operator's Well Number: 513346 Well Pad Name WEU6

) Farm Name/Surface Owner : Maxwell Public Road Access: Rt. 50

) Elevation, current ground: 1,266.0 Elevation, proposed post-construction: 1,261.0

) Well Type: (a) Gas • Oil _____ Underground Storage _____

Other _____

(b) If Gas: Shallow • Deep _____

Horizontal •

) Existing Pad? Yes or No: No

) Proposed Target Formation(s), Depth(s), Anticipated Thicknesses and Associated Pressure(s):

Target formation is Marcellus at a depth of 6815' with the anticipated thickness to be 110 feet and anticipated target pressure of 4616 PSI

) Proposed Total Vertical Depth: 6,990
) Formation at Total Vertical Depth: Onondaga
0) Proposed Total Measured Depth 13,759
1) Proposed Horizontal Leg Length 6,690
2) Approximate Fresh Water Strata Depths: 352, 464, 507, 966, & 1030
3) Method to Determine Fresh Water Depth: By offset wells
4) Approximate Saltwater Depths: None Reported
5) Approximate Coal Seam Depths: 187
6) 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: _____

Douglas Newlon
1-2-2014

WW - 6B
(3/13)

4701706324
MOD

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
Fresh Water	13 3/8	New	MC-50	54	1,130	1,130	977
Coal	-	-	-	-	-	-	-
Intermediate	9 5/8	New	MC-50	40	5,426	5,426	2,128
Production	5 1/2	New	P-110	20	13,759	13,759	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./k)
Conductor	20	24	0.635	-	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.

DCN
1-2-2014

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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 6990'. Tag the onondaga not more than 100', run logs, then plug back to approximately 6242. 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): 49.7

22) Area to be disturbed for well pad only, less access road (acres): 17.5

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.

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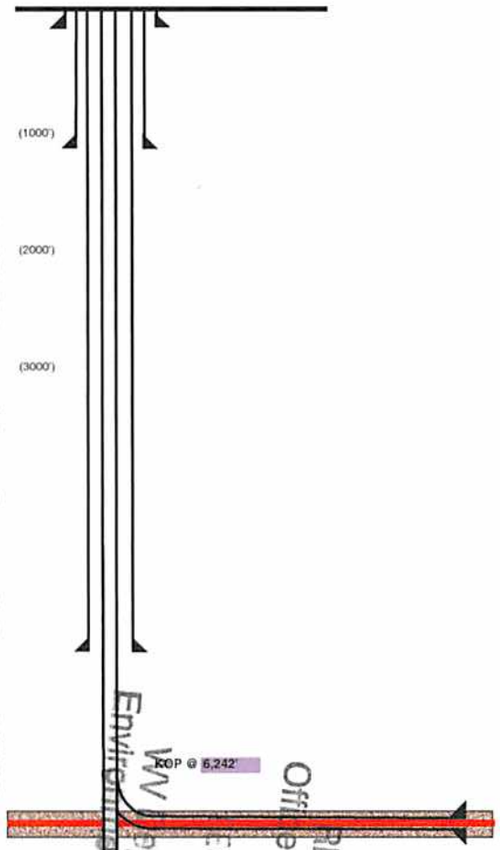
Well 513346(WEU6H5)
EQT Production
West Union
Doddridge West Virgina

Azimuth 165
Vertical Section 6690

TVD Depth (feet)	Formation Tops (TVD)		
0'			
250'			
500'			
750'			
1,000'	Base Fresh Water	1030	(1000')
	Base Red Rock	1058	
1,250'			
1,500'			
1,750'	Big Injun	1718 - 2145	
2,000'	-Gantz	2145 - 2235	(2000')
	-Fifty foot	2235 - 2329	
2,250'	-Thirty foot	2329 - 2392	
	-Gordon	2392 - 2490	
2,500'	-Forth Sand	2490 - 2645	
	-Bayard	2645 - 2722	
2,750'			
3,000'			(3000')
3,250'			
	-Warren	3380 - 3449	
3,500'	-Speechley	3449 - 4135	
3,750'			
4,000'			
	-Balltown A	4135 - 4599	
4,250'			
4,500'			
4,750'			
5,000'	-Benson	5037 - 5293	
5,250'	-Alexander	5293 - 5376	
	Int. csg pt	5426	
5,500'			
5,750'			
6,000'	-Sonyea	6418 - 6556	
	-Middlesex	6556 - 6623	
6,250'	-Genesee	6623 - 6698	
	-Geneseo	6698 - 6739	
6,500'	-Tully	6739 - 6763	
	-Hamilton	6763 - 6780	
6,750'	Marcellus top	6780	
	Target Inside Marcellus	**6815**	
7,000'	Marcellus Bottom	6890	



Hole Size (inches)	Casing Type	Casing 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 6990'.
Tag the Onondaga not more than 100', run logs, then plug back to approximately 6242'.
Then kick off the horizontal leg into the Marcellus formation using a slick water frac.

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Well Schematic
EQT Production

Well Name	513346(WEU6H5)
County	Doddridge
State	West Virgina

Elevation KB:	1272
Target	Marcellus
Prospect	
Azimuth	165
Vertical Section	6690

0'

500'

1,000' — 1,030' Fresh Water Base
1,056' Base Red Rock

1,500' — 1,713' Big Injun

2,000' — 2,145' -Gantz
2,236' -Fifty foot
2,329' -Thirty foot
2,392' -Gordon
2,490' -Forth Sand
2,500' — 2,645' -Bayard

3,000'

3,380' -Warren
3,449' -Speechley
3,500'

4,000' — 4,135' -Balltown A

4,500'

5,000' — 5,037' -Benson
5,293' -Alexander
5,426' Int. csg pt
5,500'

6,000'

6,418' -Sonyea
6,566' -Middlesex
6,623' -Genesee
6,698' -Geneseo
6,500' — 6,738' -Tully
6,763' -Hamilton
6,780' -Marcellus
6,890' Onondaga

7,000'

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

TOC @ Surface
13 3/8", MC-50, 54.5# @ 1,130' ft MD
Bit Size 12.375"

TOC @ Surface
9 5/8", MC-50, 40# @ 5,426' ft MD
Bit Size 8.5"

KOP = 6,242' ft MD
10 Deg DLS

Land @ 7,142' ft MD
6,815' ft TVD

5 1/2", P-110, 20# 13,259' ft MD
6,815' ft TVD

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17-06324

WATER SAMPLES

EQT PRODUCTION CO.
LEWIS MAXWELL LEASE
WELL NO. WV 513346

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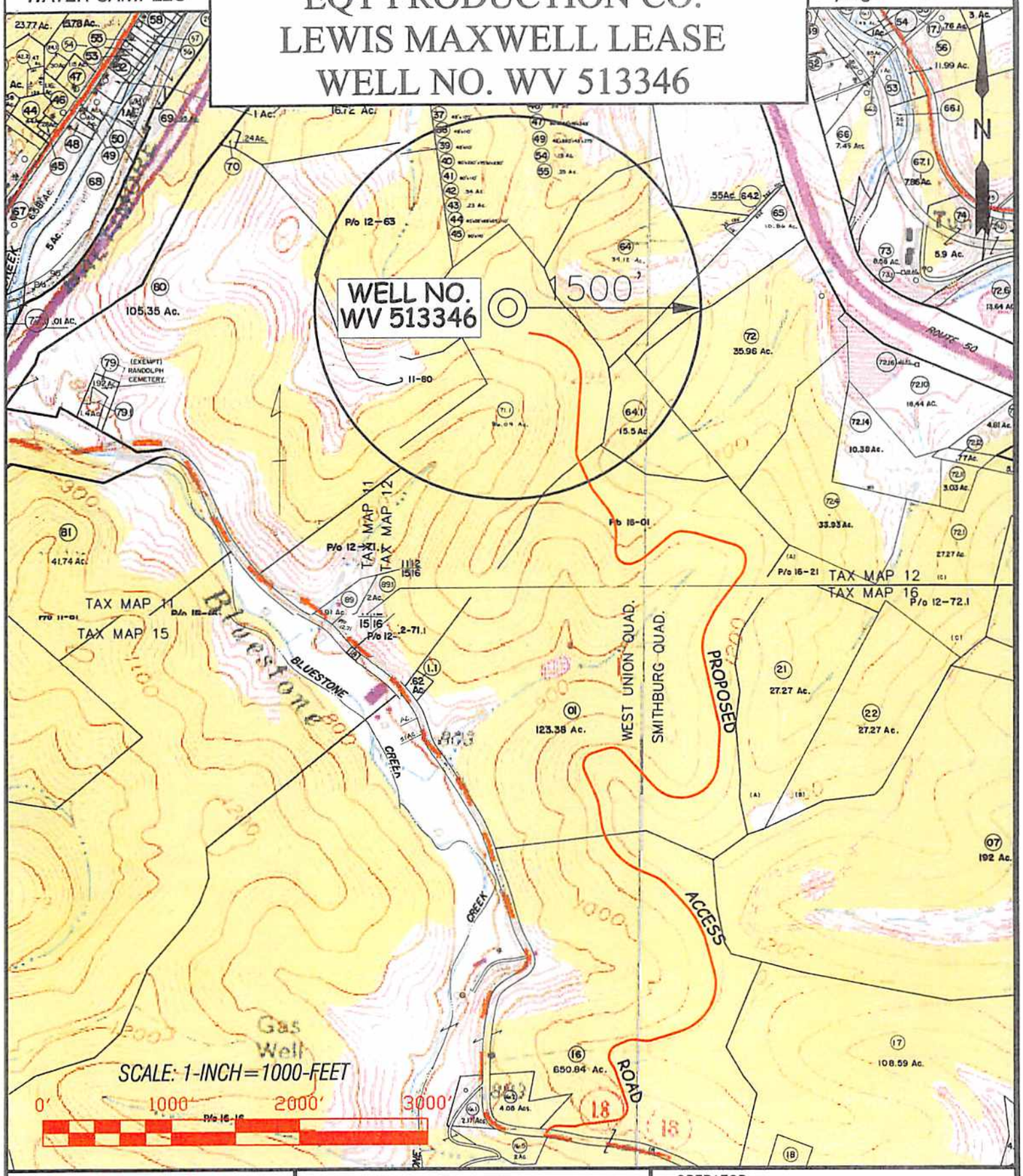

Professional Energy Consultants
A DIVISION OF SMITH LAND SURVEYING
SURVEYORS PROJECT MGMT SLS ENGINEERS ENVIRONMENTAL

DRAWN BY	FILE NO.	DATE	CADD FILE:
K.D.W.	7831	07/17/13	7831WS513346ROAD.DWG

TOPO SECTION OF:
WEST UNION, WV 7.5' QUAD.

DISTRICT	COUNTY	TAX MAP-PARCEL NO.
WEST UNION	DODDRIGE	12-71.1

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

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FORM WW 6

EQT PRODUCTION CO.
LEWIS MAXWELL LEASE

LATITUDE 39° 17' 30"

LONGITUDE 80° 45' 00"

1,084'

515'

WELL NO. WV 513346
STATE PLANE COORDINATES
NORTH ZONE (NAD'27)
N. 290,302.2
E. 1,645,131.1

LAT=(N) 39.290252
LONG=(W) 80.753829

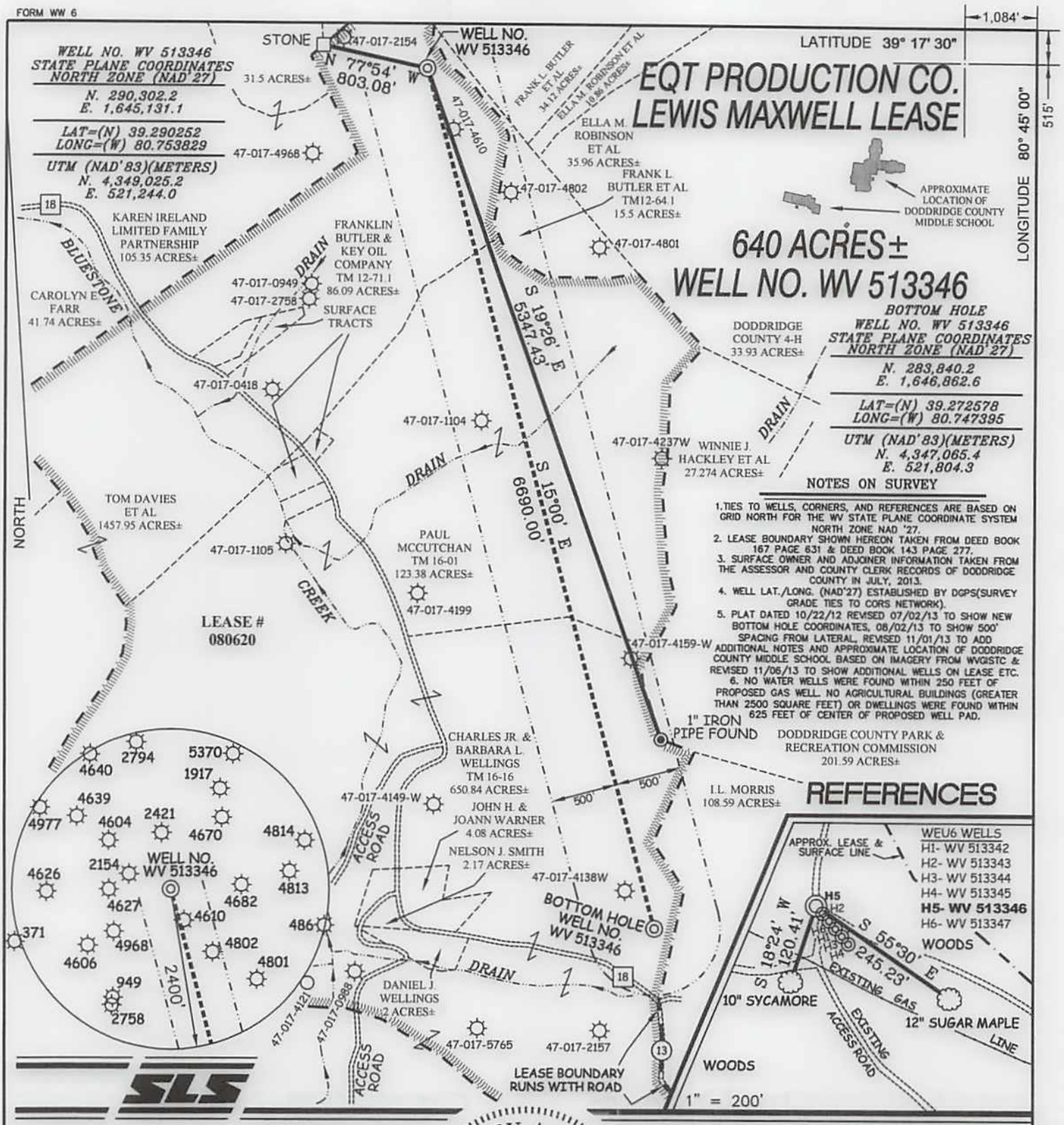
UTM (NAD'83)(METERS)
N. 4,349,025.2
E. 521,244.0

640 ACRES±
WELL NO. WV 513346

BOTTOM HOLE
WELL NO. WV 513346
STATE PLANE COORDINATES
NORTH ZONE (NAD'27)
N. 283,840.2
E. 1,646,862.6

LAT=(N) 39.272578
LONG=(W) 80.747395

UTM (NAD'83)(METERS)
N. 4,347,065.4
E. 521,804.3



SLS

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

GREGORY A. SMITH LICENSED No. 677 STATE OF WEST VIRGINIA PROFESSIONAL SURVEYOR

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

DATE NOVEMBER 6, 20 13

OPERATORS WELL NO. WV 513346

API WELL NO. 47 — 017 — 06324 H6A
STATE COUNTY PERMIT

MINIMUM DEGREE OF ACCURACY 1 / 200 FILE NO. 7831P513346R3 (390-47)

SCALE 1" = 1000'

PROVEN SOURCE OF ELEVATION DGPS (SURVEY GRADE TIES 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 1,266 (GROUND) 1,261' (PROPOSED) WATERSHED BLUESTONE CREEK & MIDDLE ISLAND CREEK

DISTRICT WEST UNION COUNTY DODDRIDGE QUADRANGLE WEST UNION 7.5'

SURFACE OWNER FRANKLIN BUTLER & KEY OIL COMPANY ACREAGE 86.09±

ROYALTY OWNER LEWIS MAXWELL HEIRS ACREAGE 640±

PROPOSED WORK: LEASE NO. 080620

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 ___

COUNTY NAME

PERMIT

WELL OPERATOR EQT PRODUCTION COMPANY DESIGNATED AGENT REX C. RAY

ADDRESS 115 PROFESSIONAL PLACE P.O. BOX 280 ADDRESS 115 PROFESSIONAL PLACE P.O. BOX 280

BRIDGEPORT, WV 26330 BRIDGEPORT, WV 26330