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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

May 01, 2015

STATOIL USA ONSHORE PROPERTIES, INC.  
2103 CITYWEST BOULEVARD - SUITE 800  
HOUSTON, TX 77042

Re: Permit Modification Approval for API Number 10303066, Well #: NORTH HENDERSON NO  
**Casing Revised**

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

47 10303066 MD



April 29, 2015

West Virginia Department of Environmental Protection  
Office of Oil and Gas  
601 57<sup>th</sup> Street, SE  
Charleston, WV 23504-2345

Attention: Ms. Ashley LeMasters

Reference: Casing Modification Request - North Henderson North 2H (47-103-03066),  
3H (47-103-03067), 4H (47-103-03068) and 5H (47-103-03069)

Ms. LeMasters:

Statoil USA Onshore Properties Inc. (Statoil) herein submits a casing modification request for the N. Henderson North 2H (47-103-03066), 3H (47-103-03067), 4H (47-103-03068) and 5H (47-103-03069).

Statoil has updated our structure mapping after drilling other wells in the nearby vicinity. This allowed us to refine our mapping to better determine the location of the Big Injun base. Statoil typically sets the intermediate casing through the base of the Big Injun formation. The casing program has been revised to reflect the new information regarding the depth of the Big Injun, updated conductor setting depth @ 120', and adjustments to the MD/TVD due to refinement of the directional information.

Attached for your consideration of this request please find revised WW-6B's and wellbore schematics signed by the inspector. Mylar plats noting a change in the "estimated depth" will be overnighted to your attention (there were no other changes to the plats).

If you have any questions or require additional information, please contact the undersigned at 713-485-2640 or at [BEKW@statoil.com](mailto:BEKW@statoil.com).

Sincerely,

A handwritten signature in black ink that reads "Bekki Winfree".

Bekki Winfree  
Sr. Regulatory Advisor – Marcellus

RECEIVED  
Office of Oil and Gas

APR 29 2015

WV Department of  
Environmental Protection

05/01/2015

WW-6B  
(9/13)

STATE OF WEST VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS  
WELL WORK PERMIT APPLICATION

1) Well Operator: Statoil USA Onshore Properties Inc. 494505083 Wetzel Center Littleton  
Operator ID County District Quadrangle

2) Operator's Well Number: North Henderson North Unit 2H Well Pad Name: North Henderson (existing pad)

3) Farm Name/Surface Owner: Howard Henderson Public Road Access: Low Gap Rocky Run Road

4) Elevation, current ground: 1,342' Elevation, proposed post-construction: 1,342' (existing pad)

5) Well Type (a) Gas \_\_\_\_\_ Oil \_\_\_\_\_ Underground Storage \_\_\_\_\_  
Other \_\_\_\_\_

(b) If Gas Shallow  Deep \_\_\_\_\_  
Horizontal

6) Existing Pad: Yes or No Yes DMH 4-28-15

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Associated Pressure(s):  
Marcellus: Formation Top 7465' TVD, Target Depth: 7492' TVD, 47' thick, 5251 psi, \*Intermediate Casing MASP 2300 psi

8) Proposed Total Vertical Depth: 7492' TVD

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 15,224' MD/7492' TVD

11) Proposed Horizontal Leg Length: 7349'

12) Approximate Fresh Water Strata Depths: 622' TVD

13) Method to Determine Fresh Water Depths: offset wells

14) Approximate Saltwater Depths: 2077'

15) Approximate Coal Seam Depths: 755-764, 822-834, 882-919, 1102-1160, 1182-1183, 1222-1287

16) Approximate Depth to Possible Void (coal mine, karst, other): NA

17) Does Proposed well location contain coal seams directly overlying or adjacent to an active mine? Yes  No

(a) If Yes, provide Mine Info: Name: \_\_\_\_\_  
Depth: \_\_\_\_\_  
Seam: \_\_\_\_\_  
Owner: \_\_\_\_\_

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APR 30 2015

WW-6B  
(9/13)

18)

**CASING AND TUBING PROGRAM**

<u>TYPE</u>	<u>Size</u>	<u>New or Used</u>	<u>Grade</u>	<u>Weight per ft. (lb/ft)</u>	<u>FOOTAGE: For Drilling</u>	<u>INTERVALS: Left in Well</u>	<u>CEMENT: Fill-up (Cu. Ft.)</u>
Conductor	20"	New	H-40	94#	120'	120'	Cmt to surface-150 cu ft
Fresh Water	13.375"	New	J-55	54.4#	700'	700'	Cmt to surface-512 cuft
Coal							
Intermediate	9.625"	New	J-55	36#	2900'	2900'	Cmt to surface-1205 cuft
Production	5.5"	New	P-110	20#	15224'	15224'	Cmt to 1900'-3399 cuft
Tubing							
Liners							

DMH 4-28-15

<u>TYPE</u>	<u>Size</u>	<u>Wellbore Diameter</u>	<u>Wall Thickness</u>	<u>Burst Pressure</u>	<u>Cement Type</u>	<u>Cement Yield (cu. ft./k)</u>
Conductor	20"	26"	.438"	1530 psi	Class A	1.3 cu ft/sk
Fresh Water	13.375"	17.5"	.380"	2730 psi	Class A	1.29 cu ft/sk
Coal						
Intermediate	9.625"	12.25"	.352"	*3520 psi	Class A	1.29 cu ft/sk
Production	5.5	8.5"	.361"	12640 psi	Class A	2.42 cu ft/sk
Tubing						
Liners						

**PACKERS**

Kind:				
Sizes:				
Depths Set:				

Received

APR 30 2015

WW-6B  
(9/13)

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

See Attached

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

Well will fractured through the plug-n-perf method with +/- 25 fracturing stages per well. Each fracturing treatment will have 400,000 lbs of sand mixed in 7500 Bbls. of fresh water. The fracturing rate will be between 80 and 100 bpm at a pressure lower than a maximum pressure of 10,000 psi.

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 3.3 acres

22) Area to be disturbed for well pad only, less access road (acres): 2.9 acres

23) Describe centralizer placement for each casing string:

DMH 4-28-15

See attached

24) Describe all cement additives associated with each cement type:

See attached

Received

APR 30 2015

25) Proposed borehole conditioning procedures:

Office of Oil and Gas

WV Dept. of Environmental Protection

Surface – Drilled with fresh water to section total depth. Prior to tripping, hole will circulated clean of cuttings and back-reamed if necessary.  
 Intermediate – Drilled with 9.0 ppg 5% KCL Polymer Water Based Mud (WBM) to section total depth. At section total depth, pump 40bbl viscous pill and circulate hole clean.  
 Production - Drilled with 12.5-13.0 ppg Synthetic Based Mud (SBM) to section total depth. At section total depth pump 2-3 20bbl heavy weighted pill sweeps to transport excess cutting from the hole until clean. Pump rates will be maintained in excess of 600 GPM, and rotation in excess of 100 RPM to assist cuttings transport. A 60 bbl tuned weighted spacer will be pumped ahead of the cement to assist in mud cake removal and water wett both casing and formation.

\*Note: Attach additional sheets as needed.

WW-6B – North Henderson North 2H

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

20" conductor will be pre-set prior to start of operations and cemented in place to surface at approximately 120 ft. A 17 ½" surface hole will be drilled with fresh water to approximately 700' md/tvd. 13 3/8" surface casing will be installed and cemented to surface in order to isolate fresh water zones and provide a competent shoe for well control while drilling deeper horizons. A 12 ¼" intermediate hole section will be drilled with 5% KCL Polymer (WBM) and a conventional mud motor to approximately 2900' md/tvd through the base of the Big Injun formation. 9 5/8" Intermediate casing will be installed and cemented to surface in order to isolate the Red Beds and Big Injun formation from lower hydrocarbon bearing zones while providing a competent shoe for well control. An 8 ½" vertical hole section will be to planned kick-off point using Synthetic Based Mud (SBM) and a conventional mud motor. The wellbore will be deviated from vertical and landed horizontally in the Marcellus Target horizon, and extended laterally to total depth of 15,224' MD/7492' VD using SBM and conventional mud motors. A 5 ½" production casing will be installed and cemented so estimated top of cement is at least 300ft inside the previous casing shoe. The Drilling Rig will then be released to the next well.

23) Describe centralizer placement for each casing string

Surface - 1 centralizer w/ stop collar 10 ft above float shoe. One Single Bow every joint to 100ft below surface.

Intermediate – 1 centralizer w/ stop collar 10 ft above float shoe. 1 centralizer w/ stop collar 10 ft above float collar. 1 centralizer every joint for the first 15 joints. One centralizer every 3 jnts to 100ft below surface.

Production - 1 centralizer w/ stop collar 10ft above shoe. 1 centralizer 10ft above float collar. 1 centralizer every joint (floating) until KOP. 1 centralizer every 3 joints (floating) until 200ft inside intermediate shoe. 1 centralizer 50ft below mandrel hanger.

24) Describe all cement additives associated with each cement type:

Surface - Class A + 3% CaCl<sub>2</sub>

Intermediate - Class A cmt, 0.05% Retarder, 0.25% Defoamer, 1% Accelerator, 0.25% Dispersant, 0.65% Retarder, 9.10 gal/sk Fresh Water.

Production - Class A cmt, 10% bwoc Dispersant, 0.6% bwoc Fluid Loss, 0.4% bwoc Retarder, 0.1% bwoc Free water control agent, 0.25% bwoc Defoamer, 0.1% bwoc Fluid Loss, 6.32 gal/sk Fresh Water.

DMH 4-28-15

Received

APR 30 2015

Office of Oil and Gas  
WV Dept. of Environmental Protection

05/01/2015



# Marcellus - Drilling Well Schematic 47 10 303066 MOD

Well Name: North Henderson North Unit 2H  
 Field Name: Marcellus  
 County: Wetzel Co., WV  
 API #: 47-10303066

BHL: X = 1753184.0  
 SHL: X = 1759189.6  
 GLE (ft): 1,342.7  
 DF (ft): 1,364.7  
 Y = 14419943.0  
 Y = 14414677.5

TVD (ft): 7,492  
 TMD (ft): 15,224  
 Profile: Horizontal  
 AFE No.: 1001929

Formations & Csg Points	Depth, ft			Form. Temp. (F)	Pore Press. (EMW)	Frac Gradient (EMW)	Planned MW	Measure Depth (ft)	Program	Details
	MD	TVD	SS							
Conductor	120	120	2,587	-	-	-	-	120		20" Conductor
							Fresh Water			17-1/2" Surface
							8.6			
Approximate Fresh Water Strata ~622'										
Casing Point	700	700	2,007	65	-	-	-	700		
Washington Coal		758	1,949	-	-	-	Air/Mist			FIT/LOT: 14.0 ppg EMW
Pittsburgh Coal		1,225	1,482	-	-	-	Air/Mist			12-1/4" Intermediate
Top Salt Water		2,077	630	-	-	-	Air/Mist	TOC @ 1900' MD		
Big Injun Base Weir		2,807	-100	-	-	-	Air/Mist			
		2,843	-136	-	-	-				
Casing Point	2,900	2,900	-193	82	-	>18.0	-	2,900		FIT/LOT: 16.6 ppg EMW
Berea		3,014	2,707	-307	-	-	Air/Mist			8-1/2" Production
							Air/Mist			
Gordon		3,283	-576	-	-	-	Air/Mist			
Fifth Sand		3,568	-861	-	-	-	Air/Mist			
Warren		3,963	-1,256	-	-	-	Air/Mist			
Java		5,675	-2,968	-	-	-	Air/Mist			
Benson		5,698	-2,991	-	-	-	Air/Mist			
KOP	6,910	6,898	-4,191	-	-	-	Air/Mist			
Middlesex		7,229	-4,522	-	-	-	12.5-13.0			
West River		7,262	-4,555	-	-	-	12.5-13.0			
Tully		7,362	-4,655	-	-	-	12.5-13.0			
Hamilton		7,386	-4,679	-	-	-	12.5-13.0			
Marcellus		7,481	-4,774	-	-	-	12.5-13.0			
Landing point	7,876	7,492	-4,785	-	-	-	12.5-13.0			
Target Window		7,494	-4,787	-	-	-	12.5-13.0			
Cherry Valley		7,510	-4,803	-	-	-	12.5-13.0			
Onondaga		7,513	-4,806	-	-	-	12.5-13.0			

**Profile:** Vertical  
**Bit Type:** 17-1/2" SMITH MSI716  
**BHA:** 9 5/8" Motor with Shock Sub  
**Mud:** 8.6 ppg Fresh Water  
**Surveys:** n/a  
**Logging:** n/a  
**Casing:** 13.375 54.5 J-55 BTC at 700' MD/700' TVD  
**Centralizers:** 1 centralizer w/ stop collar 10 ft above float shoe. One Single Bow every joint to 100ft below surface.  
**Cement:** 15.8 ppg Tail slurry w/ TOC @ Surface  
**Potential Drilling Problems:** Collision, .

**FIT/LOT: 14.0 ppg EMW**  
**Profile:** Vertical  
**Bit Type:** 12-1/4" Hughes TCI VG-35ADX1 (IADC:547) w/ 4x20's  
**BHA:** 8" Directional Assy 7:8 Lobe 2.0 Stg. .07 rpg 1.15ABH (0.10 rpg/375 Diff) 0.  
**Mud:** Air/Mist  
**Surveys:** Gyro SS, MWD - EM Pulse  
**Logging:** n/a  
**Casing/Liner:** 9.625 36 J-55 BTC at MD/ TVD  
**Csg Hanger:** Mandrel Hanger  
**Centralizers:** 1 centek centralizer w/ stop collar 10 ft above float shoe. 1 centek centralizer w/ stop collar 10 ft above float collar. 1 centralizer every joint for the first 15 joints. One centralizer every 3 jnts to 100ft below surface.  
**Cement:** 15.8 ppg Tail slurry w/ TOC @ Surface  
**Potential Drilling Problems:** Hole Cleaning, Stuck Pipe, Lost Cones,

**FIT/LOT: 16.6 ppg EMW**  
**Profile:**  
**Bit Type:** 8-1/2" Hughes VG-30ADX1 (IADC: 547) w/ 4x20's  
 8 1/2" Smith SDAI513 Curve Lateral w/ 7 x16's  
**BHA:** Directional Assembly (Steerable Motor) + EM w/ GR  
 6.75in 7:8 Lobe, 2.9 Stg (1.15 degree 0.17rpg, 560 Diff) - Vert  
 6.75in 4/5 Lobe, 7.0 Stg (1.95 deg Fixed, 0.5rpg, 915 Diff) - HZ  
**Mud:** Air/Mist to KOP and 12.5-13.0 ppg SOB M Curve Lateral  
**Surveys:** MWD - EM Pulse w/ 30ft surveys in curve, 100ft surveys in lateral  
**Logging:** GR  
**Casing/Liner:** 5.5 20 P110EC VAM TOP HT at 15224 ft MD/7492 ft TVD  
**Csg Hanger:** Mandrel Hanger  
**Centralizers:** 1 centek centralizer w/ stop collar 10ft above shoe. 1 centek centralizer 10ft above float collar. 1 centek centralizer every joint (floating) until KOP. 1 centek centralizer every 3 joints (floating) until 200ft inside intermediate shoe. 1 centek centralizer 50ft below mandrel hanger.  
**Cement:** 15 ppg Tail slurry w/ TOC @ 1900' MD

**Potential Drilling Problems:** Lost Cones, Hole Cleaning, Torque & Drag  
**Notes / Comments:**  
 Received  
 APR 30 2015

Office of Oil and Gas  
 WV Dept. of Environmental Protection

DMH 4-28-15  
 TMD: 15,224  
 TVD: 7,492

Last Revision Date: 4/28/2015  
 Revised by: Ryan Cardenas

Note: Depths are referenced to RKB  
 Note: Not Drawn to Scale

Cement Outside Casing

05/01/2015

10,111'

Latitude: N 39°42'30"

Longitude: W 80°32'30"

LEGEND

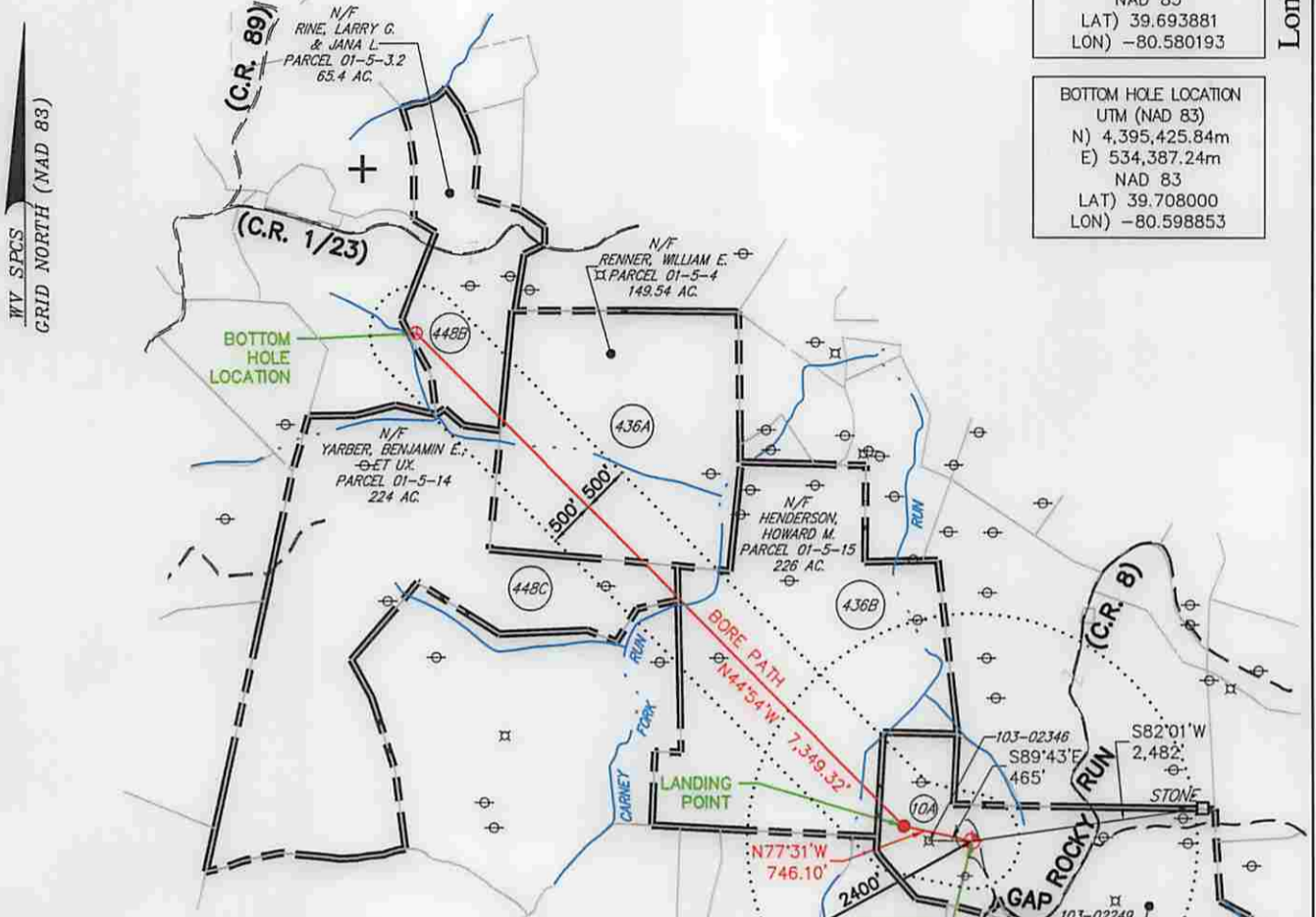
- PROPOSED GAS WELL
- EXISTING GAS WELLS
- PRE-29 WELLS
- PROPOSED BORE
- MINERAL TRACT BOUNDARY
- 500'/2,400' BUFFER
- STREAM LINE
- SURFACE TRACT BOUNDARY
- ROADS
- TOPO MAP POINT

MINERAL TRACT NUMBER	TAX MAP PARCEL NUMBER	TAX GROSS ACRES	MINERAL OWNERSHIP
10A	01-5-26	125.14	MAXINE HENDERSON
436B	01-5-15	226.00	CHARLES E. HORNER et al
448C	01-5-14	224.00	BENJAMIN YARBER, et ux
436A	01-5-4	149.54	ANN MARIE HOVIK et al
448B	01-5-3.2	66.40	MARGARET ANN MYERS, et al

SURFACE LOCATION  
 UTM (NAD 83) METERS  
 N) 4,393,820.75m  
 E) 536,216.89m  
 NAD 83  
 (LAT) 39.693463  
 (LON) -80.577598

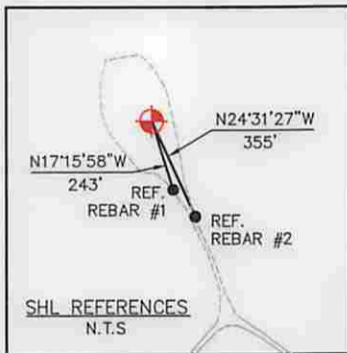
LANDING POINT LOCATION  
 UTM (NAD 83)  
 N) 4,393,866.17m  
 E) 535,994.13m  
 NAD 83  
 (LAT) 39.693881  
 (LON) -80.580193

BOTTOM HOLE LOCATION  
 UTM (NAD 83)  
 N) 4,395,425.84m  
 E) 534,387.24m  
 NAD 83  
 (LAT) 39.708000  
 (LON) -80.598853



GENERAL NOTES:

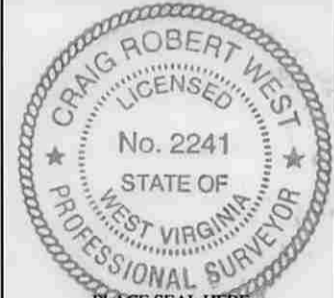
1. THE BOUNDARY LINES SHOWN HEREON ARE BASED ON RECORD DEED, PLATS, AND TAX MAPS BEST FIT TO FOUND FIELD EVIDENCE AND AERIAL PHOTOS.
2. THIS PLAT DOES NOT REPRESENT AN ACTUAL BOUNDARY SURVEY OF THE INDIVIDUAL PARCELS.
3. THERE ARE NO WATER WELLS OR DEVELOPED SPRINGS WITHIN 250' OF PROPOSED WELL.
4. THERE ARE NO EXISTING OCCUPIED DWELLINGS, BUILDINGS OR RAILROADS WITHIN 625' OF PROPOSED WELL.
5. THE PROPOSED WELL IS GREATER THAN 100' FROM PERENNIAL STREAM, WETLAND, POND, RESERVOIR OR LAKE.
6. THERE ARE NO NATIVE TROUT STREAMS WITHIN 300' OF PROPOSED WELL.



FILE #: 099912016  
 DRAWING #: 099912016\_WELL PLAT  
 SCALE: 1" = 2,000'  
 MINIMUM DEGREE OF ACCURACY: 1/200  
 PROVEN SOURCE OF ELEVATION: SUBMETER MAPPING GPS

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 RULES ISSUED AND PRESCRIBED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.

SIGNED: [Signature]  
 R.P.E.: \_\_\_\_\_ L.L.S.: 2241



(+) DENOTES LOCATION OF WELL ON UNITED STATES TOPOGRAPHIC MAPS WVDEP  
 OFFICE OF OIL & GAS  
 601 57TH STREET  
 CHARLESTON, WV 25304



DATE: OCTOBER 20, 2014 - REVISED  
 OPERATOR'S WELL #: NORTH HENDERSON NORTH UNIT 2H  
 API WELL #: 47 103 03066400  
 STATE COUNTY PERMIT

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

WATERSHED: LOWER WEST VIRGINIA FORK FISH CREEK ELEVATION: 1,342' (AS-BUILT) 05/01/2015

COUNTY/DISTRICT: WETZEL / CENTER QUADRANGLE: LITTLETON

SURFACE OWNER: HOWARD HENDERSON ACREAGE: 125±

OIL & GAS ROYALTY OWNER: MAXINE HENDERSON LEASE ACREAGE: SEE MINERAL INTEREST TABLE

CONVERT  DRILL DEEPER  REDRILL  FRACTURE OR STIMULATE  PERFORATE NEW FORMATION  PLUG & ABANDON

DRILL  PLUG OFF OLD FORMATION  CLEAN OUT & REPLUG  OTHER CHANGE  (SPECIFY): \_\_\_\_\_

TARGET FORMATION: MARCELLUS ESTIMATED DEPTH: 7,492'

WELL OPERATOR: STATOIL USA ONSHORE PROPERTIES INC. DESIGNATED AGENT: RICHARD PYLES

ADDRESS: 2103 CITYWEST BLVD., SUITE 800 ADDRESS: 803 NASH ROAD

CITY: HOUSTON STATE: TX ZIP CODE: 77042 CITY: MIDDLEBOURNE STATE: WV ZIP CODE: 26149