

State of West Virginia  
Department of Environmental Protection - Office of Oil and Gas  
Well Operator's Report of Well Work

API 47 - 51 - 01621 County Marshall District Franklin  
Quad Powhatan Point 7.5' Pad Name Armstrong Field/Pool Name \_\_\_\_\_  
Farm name CNX Gas Company, LLC Well Number 5H  
Operator (as registered with the OOG) Gastar Exploration Inc.  
Address 229 West Main Street Suite 301 City Clarksburg State WV Zip 26301

As Drilled location NAD 83/UTM Attach an as-drilled plat, profile view, and deviation survey  
Top hole Northing 4400457.4 Easting 516416.1  
Landing Point of Curve Northing 4400547.9 Easting 516320.0  
Bottom Hole Northing 4401216.2 Easting 514671.4

Elevation (ft) 1278' GL Type of Well  New  Existing Type of Report  Interim  Final  
Permit Type  Deviated  Horizontal  Horizontal 6A  Vertical Depth Type  Deep  Shallow  
Type of Operation  Convert  Deepen  Drill  Plug Back  Redrilling  Rework  Stimulate  
Well Type  Brine Disposal  CBM  Gas  Oil  Secondary Recovery  Solution Mining  Storage  Other \_\_\_\_\_  
Type of Completion  Single  Multiple Fluids Produced  Brine  Gas  NGL  Oil  Other \_\_\_\_\_  
Drilled with  Cable  Rotary

Drilling Media Surface hole  Air  Mud  Fresh Water Intermediate hole  Air  Mud  Fresh Water  Brine  
Production hole  Air  Mud  Fresh Water  Brine  
Mud Type(s) and Additive(s)  
Synthetic Oil Base Mud

Date permit issued April 15, 2013 Date drilling commenced 12/1/2013 Date drilling ceased 7/22/2014  
Date completion activities began 9/11/2014 Date completion activities ceased 4/21/2015  
Verbal plugging (Y/N) \_\_\_\_\_ Date permission granted \_\_\_\_\_ Granted by \_\_\_\_\_

Please note: Operator is required to submit a plugging application within 5 days of verbal permission to plug

Freshwater depth(s) ft 55' Open mine(s) (Y/N) depths None  
Salt water depth(s) ft 1664' Void(s) encountered (Y/N) depths None  
Coal depth(s) ft 815'-825' & 1160'-1190' Cavern(s) encountered (Y/N) depths None  
Is coal being mined in area (Y/N) No

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Reviewed by: JR  
10/16/2015

API 47-51 - 01621 Farm name CNX Gas Company, LLC Well number 5H

CASING STRINGS	Hole Size	Casing Size	Depth	New or Used	Grade wt/ft	Basket Depth(s)	Did cement circulate (Y/ N) * Provide details below*
Conductor							
Surface	30"	20"	118'	New	PE / 54.5 #/ft		Yes
Coal	17.5"	13.375"	1252'	New	H-40 / 48 #/ft	80'	Yes
Intermediate 1	12.25"	9.625"	2671'	New	J-55 / 36 #/ft	80'	Yes
Intermediate 2							
Intermediate 3							
Production	8.875" & 8.5"	5.5"	12446'	New	P-110 / 20 #/ft		Yes
Tubing		2.375"	6578'	New	N80/4.7#		
Packer type and depth set							

Comment Details \_\_\_\_\_

CEMENT DATA	Class/Type of Cement	Number of Sacks	Slurry wt (ppg)	Yield (ft <sup>3</sup> /sks)	Volume (ft <sup>3</sup> )	Cement Top (MD)	WOC (hrs)
Conductor							
Surface	Class A	295	15.6	1.21	357	Surface	12
Coal	Class A	934	15.6	1.21	1130	Surface	8
Intermediate 1	Class A	855	15.6	1.19	1022	Surface	8
Intermediate 2							
Intermediate 3							
Production	50:50 Class A	2821	14.5	1.21	3413	Surface	8
Tubing							

Drillers TD (ft) 12,512' Loggers TD (ft) N/A  
 Deepest formation penetrated Marcellus Plug back to (ft) N/A  
 Plug back procedure N/A

Kick off depth (ft) 5736'

Check all wireline logs run  caliper  density  deviated/directional  induction  
 neutron  resistivity  gamma ray  temperature  sonic

Well cored  Yes  No Conventional Sidewall Were cuttings collected  Yes  No

DESCRIBE THE CENTRALIZER PLACEMENT USED FOR EACH CASING STRING \_\_\_\_\_

Surface/Coal Casing - 3 Centralizers at 300' spacing  
Intermediate Casing - 7 Centralizers at 300' Spacing  
Production Casing - 216 Centralizers total - 1 centralizer every joint in the lateral and curve and 1 centralizer every other joint in the vertical section

WAS WELL COMPLETED AS SHOT HOLE  Yes  No DETAILS \_\_\_\_\_

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WAS WELL COMPLETED OPEN HOLE?  Yes  No DETAILS \_\_\_\_\_

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WERE TRACERS USED  Yes  No TYPE OF TRACER(S) USED \_\_\_\_\_

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Armstrong 5H Perforation Information

<u>Stage</u>	<u>Date</u>	<u>Perforated interval</u>		<u>Number of Perfs</u>	<u>Formation</u>
		<u>From</u> ft	<u>To</u> ft		
1	9/16/2014	12331	12248	48	Marcellus
2	9/28/2014	12069	11835	48	Marcellus
3	9/29/2014	11757.5	11604	48	Marcellus
4	9/30/2014	11527	11444.5	36	Marcellus
5	10/3/2014	11395	11255.5	48	Marcellus
6	10/4/2014	11187	11020	48	Marcellus
7	10/5/2014	10954.5	10828	48	Marcellus
8	10/5/2014	10774	10644	48	Marcellus
9	10/5/2014	10601	10357	48	Marcellus
10	10/5/2014	10279.5	10087	48	Marcellus
11	10/6/2014	10048	9971	36	Marcellus
12	10/6/2014	9899	9742	48	Marcellus
13	10/6/2014	9639	9496	48	Marcellus
14	10/7/2014	9437	9262.5	48	Marcellus
15	10/9/2014	9207	9055	48	Marcellus
16	10/9/2014	8992	8819.5	48	Marcellus
17	10/10/2014	8729	8564	48	Marcellus
18	10/11/2014	8524	8284	48	Marcellus
19	10/12/2014	8237	8093	36	Marcellus
20	10/13/2014	8037	7851.5	48	Marcellus
21	10/14/2014	7800	7611	48	Marcellus
22	<b>10/15/2014</b>	<b>7550</b>	<b>7393</b>	48	Marcellus
23	10/16/2014	<b>7320</b>	<b>7172.5</b>	48	Marcellus
24	10/17/2014	<b>7138</b>	<b>7004</b>	48	Marcellus
25	10/18/2014	<b>6910</b>	<b>6811.5</b>	36	Marcellus

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**Fluid & Sand Volume Summary - Armstrong #5H**

<u>Stage</u>	<u>Stimulation Date</u>	<u>Avg Pump Rate (BPM)</u>	<u>Avg Pressure (PSI)</u>	<u>Max Break Pres. (PSI)</u>	<u>ISIP (PSI)</u>	<u>Sand Total (lbs)</u>	<u>Total Water (bbls)</u>
1	9/27/2014	75	6106	4534	4276	86,090	2907
2	9/28/2014	78	5942	4405	3755	245,294	6173
3	9/29/2014	77	6097	4790	4242	259,713	6205
4	9/30/2014	78	6608	5318	4030	256,585	6200
5	10/3/2014	78	6225	5111	4308	269,564	6907
6	10/4/2014	78	6084	4715	4429	263,444	6481
7	10/5/2014	78	6080	4550	3723	217,303	6098
8	10/5/2014	78	6089	4676	4150	253,914	6279
9	10/5/2014	79	6025	4775	3757	252,603	6325
10	10/6/2015	79	5987	4770	4279	253,990	6325
11	10/6/2014	79	6347	5197	4178	252,897	6260
12	10/6/2014	79	6010	4676	4134	250,401	6127
13	10/7/2014	79	5920	5103	3733	252,858	6375
14	10/7/2014	77	5801	4552	3761	154,409	4978
15	10/9/2014	76	6039	6750	3969	133,024	4615
16	10/10/2014	77	5763	4432	3754	148,291	6082
17	10/10/2014	82	5614	4959	3644	155,690	6089
18	10/12/2014	78	5370	4259	3532	145,075	6099
19	10/13/2014	81	6154	4886	4166	212,012	5990
20	10/14/2014	83	5672	4434	4150	214,595	8607
21	10/15/2014	83	5646	4580	4056	214,901	8509
22	10/16/2014	82	5363	4577	3928	215,678	8486
23	10/17/2014	81	6346	4336	3437	218,192	9208
24	10/18/2014	80	5508	4643	4079	221,760	8543
25	10/19/2014	80	5859	5025	3731	220,245	8533

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Formations	Armstrong TOP TVD	Armstrong BASE TVD	Top MD	Base MD
SHALE AND SANDSTONE	0	815	0	815
SEWICKLEY COAL	815	825	815	825
SHALE	825	1160	825	1160
PITTSBURGE COAL	1160	1190	1160	1190
SHALE AND SANDSTONE	1190	1664	1190	1664
3RD SALT SAND	1664	1720	1664	1720
SHALE	1720	1820	1720	1820
MAXTON	1820	1894	1820	1894
SHALE	1894	1914	1894	1914
BIG LIME	1914	2001	1914	2001
BIG INJUN	2001	2251	2001	2251
WEIR SILTSTONE	2251	2524	2251	2524
BEREA SILTSTONE	2524	2724	2524	2724
SAND AND SHALE	2724	2730	2724	2730
GORDON	2730	2787	2730	2787
SILTSTONE AND SANDSTONE	2787	3400	2787	3400
BRAILLER	3400	5280	3400	5325
PIPE CREEK SHALE	5280	5480	5325	5526
SHALE	5480	5905	5526	5958
RHINESTREET	5905	6175	5958	6243
CASHAQUA	6175	6311	6243	6414
MIDDLESEX	6311	6330	6414	6442
WEST RIVER	6330	6389	6442	6538
GENESEO	6389	6416	6538	6588
TULLY LIMESTONE	6416	6452	6588	6666
HAMILTON	6452	6470	6666	6721
MARCELLUS	6470	na	6721	na
ONONDOGA	na	na	na	na

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# Hydraulic Fracturing DISCLOSURE



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### Hydraulic Fracturing Data

[Edit](#)

**Job Start Date** 9/27/2014    **Job End Date** 10/20/2014    **API Number** 47-051-01621-00-00    **State & County** West Virginia --- Marshall  
**Well Name** ARMSTRONG 5H  
**Longitude** -80.82887    **Latitude** 39.76067    **Datum** NAD27    **Federal/Tribal Well?**   
**True Vertical Depth (ft)** 6490    **Total Water Vol (gal)** 16256410.8    **Total Non Water Vol** 0    **Total Mass (lbs)** 141080548.461



### MSDS Chemical Ingredients

[New Additive](#)    [Select Additive](#) ▼    [Add Additive](#)

Trade Name	Supplier	Purpose	Ingredients	CAS #	% High Additive	% HF Job	Comments	Ingredient Mass
<a href="#">Edit</a> Water	Operator	Carrier	Water	7732-18-5	100%	96.0385773%		135542701.96824
<a href="#">Edit</a> Sand, White, 40/70	Baker Hughes	Proppant	MSDS and Non-MSDS Ingredients Listed Below	N/A	0%	2.7008%		3810313
<a href="#">Edit</a> Sand, White, 30/50	Baker Hughes	Proppant	MSDS and Non-MSDS Ingredients Listed Below	N/A	0%	.8595%		1212597
<a href="#">Edit</a> HCl, 10.1 - 15%	Baker Hughes	Acidizing	MSDS and Non-MSDS Ingredients Listed Below	N/A	0%	.271374%	SmartCare Product	382856.67
<a href="#">Edit</a> FRW-18	Baker Hughes	Friction Reducer	MSDS and Non-MSDS Ingredients Listed Below	N/A	0%	.0372759%	SmartCare Product	52589.16
<a href="#">Edit</a> GW-3LDF	Baker Hughes	Gelling Agent	MSDS and Non-MSDS Ingredients Listed Below	N/A	0%	.0283476%	SmartCare Product	39993.03
<a href="#">Edit</a> Alpha 1427	Baker Hughes	Biocide	MSDS and Non-MSDS Ingredients Listed Below	N/A	0%	.0092225%	SmartCare Product	13011.25

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FlexSand MSE, 20/40 mesh Baker Hughes Proppant

MSDS and Non-MSDS Ingredients Listed Below N/A 0% .0070881% 10000

Enzyme G-NE Baker Hughes Breaker

MSDS and Non-MSDS Ingredients Listed Below N/A 0% .0058036% SmartCare Product 8187.7196

ScaleSorb 4, (50# bag) Baker Hughes Scale Inhibitor

MSDS and Non-MSDS Ingredients Listed Below N/A 0% .0028714% SmartCare Product 4051

Ferrotrol 300L Baker Hughes Iron Control

MSDS and Non-MSDS Ingredients Listed Below N/A 0% .0018691% SmartCare Product 2636.91313

CI-14 Baker Hughes Corrosion Inhibitor

MSDS and Non-MSDS Ingredients Listed Below N/A 0% .0008582% SmartCare Product 1210.75

ScaleSorb 7 (50 lb) Baker Hughes Scale Inhibitor

MSDS and Non-MSDS Ingredients Listed Below N/A 0% .0002835% 400

**Non-MSDS Chemical Ingredients**

Trade Name	Supplier	Purpose	Ingredients	CAS #	% High Additive	% HF Job	Comments	Ingredient Mass
<input type="button" value="Edit"/> Ingredients in Additive(s) (MSDS and non-MSDS)	Baker Hughes	See Trade Name(s) List	Crystalline Silica (Quartz)	14808-60-7	100%	3.5590069%		5022954.51
			Water	7732-18-5	95%	.2574862%		363399.481185
			Hydrochloric Acid	7647-01-0	15%	.0406995%		57440.608
			Mineral Oil	8042-47-5	70%	.0198359%		27995.121
			Guar Gum	9000-30-0	60%	.0170022%		23995.818
			Hydrotreated Light Distillate	64742-47-8	30%	.0111786%		15776.748
			Poly (acrylamide-co-acrylic acid) partial sodium salt	62649-23-4	30%	.0111786%		15776.748
			Petroleum Distillates	64742-47-8	30%	.0085011%		11997.909
			Paraffinic Petroleum Distillate	64742-55-8	30%	.0085011%		11997.909
			Walnut Shells	84012-43-1	90%	.0063769%		9000
			Diatomaceous Earth, Calcined	91053-39-3	100%	.0031537%		4451
			Glutaraldehyde	111-30-8	30%	.0027657%		3903.375
			Sodium Chloride	7647-14-5	10%	.0018914%		2669.458
			Crystalline Silica: Quartz	14808-60-7	5%	.0014169%		1999.6515
			Isotridecanol, ethoxylated	9043-30-5	5%	.0014169%		1999.6515
			1-butoxy-2-propanol	5131-66-8	5%	.0014169%		1999.6515
			Citric Acid	77-92-9	60%	.001121%		1582.147878
			Ammonium Chloride	12125-02-9	3%	.0011179%		1577.6748
			Didecyl Dimethyl Ammonium Chloride	7173-51-5	10%	.0009219%		1301.125
			Methanol	67-56-1	100%	.0008579%		1210.75

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Alcohols, C12-16, ethoxylated	68551-12-2	2%	.0007452%	1051.7832
Oleamide DEA	93-83-4	2%	.0007452%	1051.7832
Cured Resin	25085-99-8	10%	.0007085%	1000
Quaternary Ammonium Compound	68424-85-1	5%	.000461%	650.5625
Ethanol	64-17-5	5%	.000461%	650.5625
Sodium chloride	7647-14-5	15%	.0004305%	607.65
Sodium Carboxymethyl inulin	430439-54-6	15%	.0004305%	607.65
Hemicellulase Enzyme Concentrate	9025-56-3	5%	.0002901%	409.38598
Polyoxyalkylenes	68951-67-7	30%	.0002574%	363.225
Sorbitan Monooleate	1338-43-8	.5%	.0001863%	262.9458
Polyoxyethylene Sorbitan Monooleate	9005-65-6	.5%	.0001863%	262.9458
Sodium diglycolate	35249-69-5	5%	.0001435%	202.55
Sodium glycolate	2836-32-0	5%	.0001435%	202.55
Fatty Acids	61790-12-3	10%	.0000858%	121.075
Organo Phosphorus Salt	Trade Secret, disc.	30%	.000085%	120
Modified Thiourea Polymer	68527-49-1	7%	.0000601%	84.7525
Propargyl Alcohol	107-19-7	5%	.0000429%	60.5375
Olefin	64743-02-8	5%	.0000429%	60.5375
Crystalline Silica (Cristobalite)	14464-46-1	1%	.0000287%	40.51
2-butoxy-1-propanol	15821-83-7	.1%	.0000283%	39.99303
Formaldehyde	50-00-0	1%	.0000086%	12.1075
Sodium Bisulfate	7631-90-5	1%	.0000028%	4
Sodium Sulfonate	870-72-4	.5%	.0000014%	2

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Armstrong 5H Cement and additives

Surface: Class A + 3% CaCl + 1/4 #per sack Flake

Coal: Class A + 2% CaCl + ¼ # per sack flake

Intermediate: Class A + 1% EC-1 + ¼ per sack flake +.5% SMS + .55% BA-10A

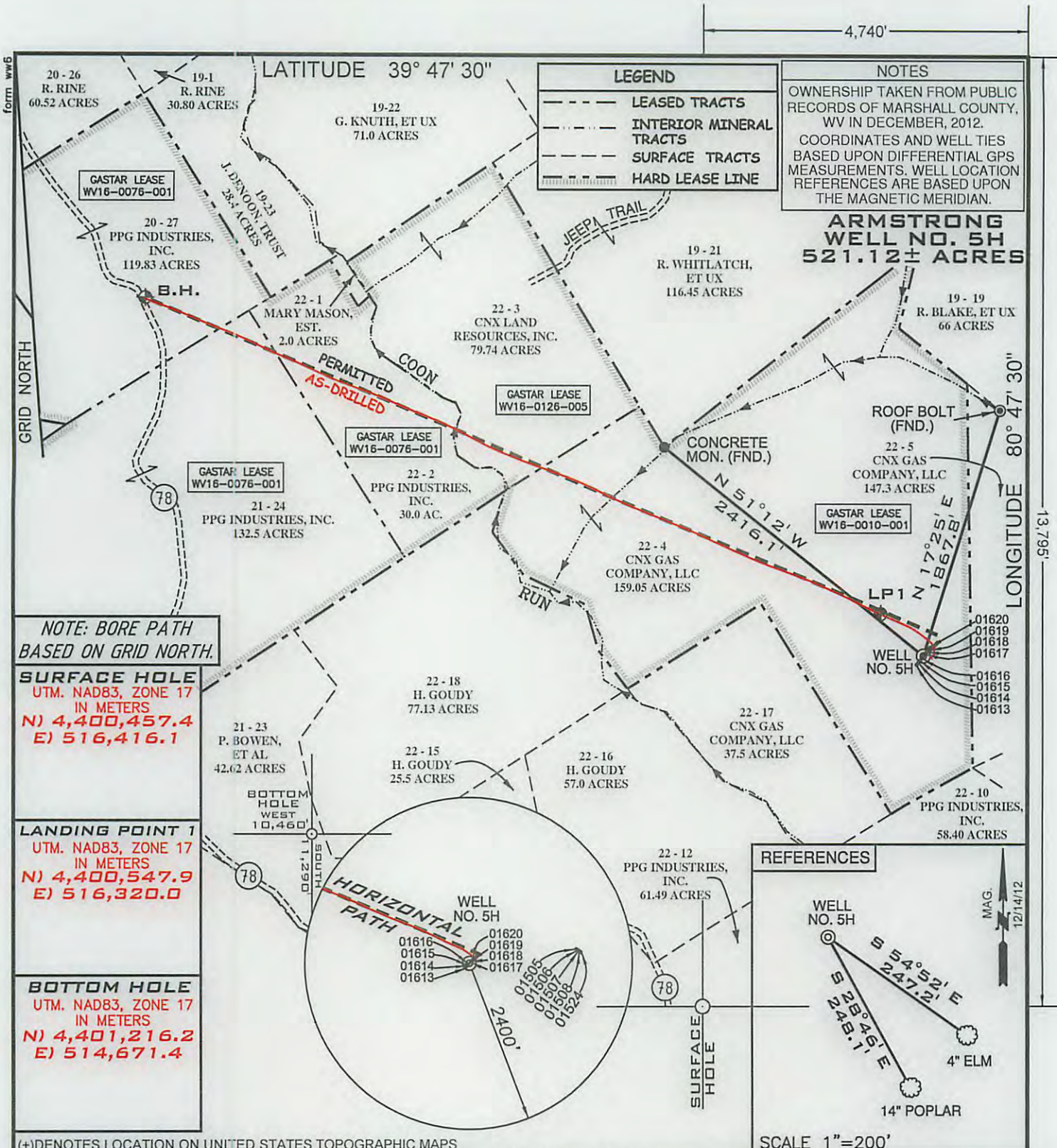
Production: 50:50 Class A + 3 lbs/sk BA-90 + .35% R-3 + .3% MPA-170

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NOTE: BORE PATH BASED ON GRID NORTH.

**SURFACE HOLE**  
 UTM. NAD83, ZONE 17  
 IN METERS  
 N) 4,400,457.4  
 E) 516,416.1

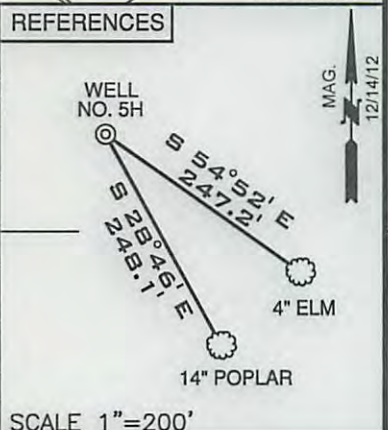
**LANDING POINT 1**  
 UTM. NAD83, ZONE 17  
 IN METERS  
 N) 4,400,547.9  
 E) 516,320.0

**BOTTOM HOLE**  
 UTM. NAD83, ZONE 17  
 IN METERS  
 N) 4,401,216.2  
 E) 514,671.4

**LEGEND**  
 - - - - - LEASED TRACTS  
 - - - - - INTERIOR MINERAL TRACTS  
 - - - - - SURFACE TRACTS  
 - - - - - HARD LEASE LINE

**NOTES**  
 OWNERSHIP TAKEN FROM PUBLIC RECORDS OF MARSHALL COUNTY, WV IN DECEMBER, 2012.  
 COORDINATES AND WELL TIES BASED UPON DIFFERENTIAL GPS MEASUREMENTS. WELL LOCATION REFERENCES ARE BASED UPON THE MAGNETIC MERIDIAN.

**ARMSTRONG WELL NO. 5H**  
 521.12± ACRES



(+) DENOTES LOCATION ON UNITED STATES TOPOGRAPHIC MAPS

FILE NUMBER W0120316 (WB1-56)

DRAWING NUMBER ARMSTRONG\_WP\_5H-WR35

SCALE 1" = 1000'

MINIMUM DEGREE OF ACCURACY 1/200

PROVEN SOURCE OF ELEVATION SUBMETER MAPPING  
GRADE 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 REGULATIONS ISSUED AND PRESCRIBED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION

P.S. Jonathan R. White  
 2122



WVDEP  
 OFFICE OF OIL & GAS  
 601 57TH STREET  
 CHARLESTON, WV 25304

DATE: JULY 27, 2015

OPERATORS WELL NO. ARMSTRONG NO. 5H AS-DRILLED  
 API WELL NO. 47-051-01621

WELL TYPE: OIL  GAS  LIQUID INJECTION  WASTE DISPOSAL   
 (IF "GAS") PRODUCTION  STORAGE  DEEP  SHALLOW

LOCATION ELEVATION 1278' WATERSHED TRIBUTARY OF COON RUN  
 DISTRICT FRANKLIN COUNTY MARSHALL

QUADRANGLE POWHATAN POINT 7.5' LEASE NUMBER WV16-0010-001, WV16-0076-001, WV16-0126-005

SURFACE OWNER CNX GAS COMPANY, LLC ACREAGE 159.05

OIL & GAS ROYALTY OWNER CNX GAS COMPANY, LLC LEASE ACREAGE 521.12

PROPOSED WORK: DRILL  CONVERT  DRILL DEEPER  REDRILL  FRACTURE OR STIMULATE  PLUG OFF OLD FORMATION   
 PERFORATE NEW FORMATION  OTHER PHYSICAL CHANGE (SPECIFY) \_\_\_\_\_

TARGET FORMATION MARCELLUS ESTIMATED DEPTH TVD: 6514' TMD: 12,512'

WELL OPERATOR GASTAR EXPLORATION INC. DESIGNATED AGENT MICHAEL McCOWN

ADDRESS 229 W MAIN STREET, SUITE 301 CLARKSBURG WV, 26301

10/16/2015

COUNTY NAME  
 PERMIT