



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

July 29, 2013

WELL WORK PERMIT

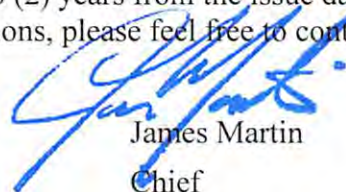
Horizontal 6A Well

This permit, API Well Number: 47-5101649, issued to GASTAR EXPLORATION USA, INC., is evidence of permission granted to perform the specified well work at the location described on the attached pages and located on the attached plat, subject to the provisions of Chapter 22 of the West Virginia Code of 1931, as amended, and all rules and regulations promulgated thereunder, and to all conditions and provisions outlined in the pages attached hereto. Notification shall be given by the operator to the Oil and Gas Inspector at least 24 hours prior to the construction of roads, locations, and/or pits for any permitted work. In addition, the well operator shall notify the same inspector 24 hours before any actual well work is commenced and prior to running and cementing casing. Spills or emergency discharges must be promptly reported by the operator to 1-800-642-3074 and to the Oil and Gas inspector.

Please be advised that form WR-35, Well Operators Report of Well Work is to be submitted to this office within 90 days completion of permitted well work, as should form WR-34 Discharge Monitoring Report within 30 days of discharge of pits, if applicable. Failure to abide by all statutory and regulatory provisions governing all duties and operations hereunder may result in suspension or revocation of this permit and, in addition, may result in civil and/or criminal penalties being imposed upon the operators.

In addition to the applicable requirements of this permit, and the statutes and rules governing oil and gas activity in WV, this permit may contain specific conditions which must be followed. Permit conditions are attached to this cover letter.

Per 35CSR-4-5.2.g this permit will expire in two (2) years from the issue date unless permitted well work is commenced. If there are any questions, please feel free to contact me at (304) 926-0499 ext. 1654.



James Martin
Chief

Operator's Well No: HANSEN NO. 5H
Farm Name: BAYER MATERIAL SCINECES, L
API Well Number: 47-5101649
Permit Type: Horizontal 6A Well
Date Issued: 07/29/2013

Promoting a healthy environment.

08/02/2013

PERMIT CONDITIONS

West Virginia Code § 22-6A-8(d) allows the Office of Oil and Gas to place specific conditions upon this permit. Permit conditions have the same effect as law. Failure to adhere to the specified permit conditions may result in enforcement action.

CONDITIONS

1. If the operator encounters an unanticipated void, or an anticipated void at an unanticipated depth, the operator shall notify the inspector within 24 hours. Modifications to the casing program may be necessary to comply with W. Va. Code § 22-6A-5a (12), which requires drilling to a minimum depth of thirty feet below the bottom of the void, and installing a minimum of twenty (20) feet of casing. Under no circumstance should the operator drill more than fifty (50) feet below the bottom of the void or install less than twenty (20) feet of casing below the bottom of the void.
2. When compacting fills, each lift before compaction shall not be more than 12 inches in height, and the fill material shall be within plus or minus 2% (unless soil test results show a greater range of moisture content is appropriate and 95% compaction can still be achieved) of the optimum moisture content as determined by the standard proctor density test, ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. Each lift must meet 95 % compaction of the optimum density based on results from the standard proctor density test of the actual soils used in specific engineered fill sites. Each lift shall be tested for compaction, with a minimum of two tests per lift per acre of fill. All test results shall be maintained on site and available for review.
3. Operator shall install signage per § 22-6A-8g (6) (B) at all source water locations included in their approved water management plan within 24 hours of water management plan activation.
4. Oil and gas water supply wells will be registered with the Office of Oil and Gas and all such wells will be constructed and plugged in accordance with the standards of the Bureau for Public Health set forth in its Legislative rule entitled *Water Well Regulations*, 64 C.S.R. 19. Operator is to contact the Bureau of Public Health regarding permit requirements. In lieu of plugging, the operator may transfer the well to the surface owner upon agreement of the parties. All drinking water wells within fifteen hundred feet of the water supply well shall be flow tested by the operator upon request of the drinking well owner prior to operating the water supply well.
5. Pursuant to the requirements pertaining to the sampling of domestic water supply wells/springs the operator shall, no later than thirty (30) days after receipt of analytical data provide a written copy to the Chief and any of the users who may have requested such analyses.
6. If any explosion or other accident causing loss of life or serious personal injury occurs in or about a well or well work on a well, the well operator or its contractor shall give notice, stating the particulars of the explosion or accident, to the oil and gas inspector and the Chief, within 24 hours of said accident.
7. During the casing and cementing process, in the event cement does not return to the surface, the oil and gas inspector shall be notified within 24 hours.

51-01649

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

51 03 509

1) Well Operator: Gastar Exploration USA, Inc. 494487685 Marshall Franklin New Martinsville 7.5'
Operator ID County District Quadrangle

2) Operator's Well Number: Hansen No. 5H Well Pad Name: Hansen

3 Elevation, current ground: 1256' Elevation, proposed post-construction: 1246'

4) Well Type: (a) Gas Oil Underground Storage
Other _____
(b) If Gas: Shallow Deep
Horizontal

5) Existing Pad? Yes or No: No

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

The Marcellus is the target formation at a depth of 6480' (top of formation), an anticipated thickness of 50' and a pressure of 3000 psi.

7) Proposed Total Vertical Depth: 6550'

8) Formation at Total Vertical Depth: Onondaga

9) Proposed Total Measured Depth: 12,181'

10) Approximate Fresh Water Strata Depths: 50'

11) Method to Determine Fresh Water Depth: Gastar has drilled several wells in this area

12) Approximate Saltwater Depths: 1600'

13) Approximate Coal Seam Depths: 1000' & 1100'

14) Approximate Depth to Possible Void (coal mine, karst, other): None ✓

15) Does proposed well location contain coal seams directly overlying or adjacent to an active mine? If so, indicate name and depth of mine: No

16) Describe proposed well work: Drill through the Marcellus tagging less than Twenty (20') feet from the top of the Onondaga to get depths and log data. Then plug the well back to proposed kick off point (TBD). Drill the horizontal section to planned and proposed TD. Run casing and cement back to surface. Run a bond log on part of the curve and vertical section, pressure test casing and set a master valve. Make a clean out run on the casing and perforate then stimulate.

17) Describe fracturing/stimulating methods in detail: Gastar Exploration plans to fracture the well using a typical slickwater fracture design. Gastar will pump roughly 6500bbls of water and 350,000 lbs of sand per stage. There will be approximately 15 stages on the fracturing job.

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18) Total area to be disturbed, including roads, stockpile area, pits, etc, (acres): 28.28

19) Area to be disturbed for well pad only, less access road (acres): 6.22

Office of Oil and Gas
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WW - 6B
(3/13)

20)

CASING AND TUBING PROGRAM

TYPE	Size	New or Used	Grade	Weight per ft.	FOOTAGE: For Drilling	INTERVALS: Left in Well	CEMENT: Fill -up (Cu. Ft.)
Conductor	20"	New	PE			110'	Cement to Surface
Fresh Water	13 3/8"	New	H-40	48 #/ft		1150'	Cement to Surface
Coal							
Intermediate	9 5/8"	New	J-55	36 #/ft		2600'	Cement to Surface
Production	5 1/2"	New	P-110	20 #/ft		12,181'	Cement to Surface
Tubing	2 3/8"	New	N-80	4.7 #/ft		6710'	
Liners							

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TYPE	Size	Wellbore Diameter	Wall Thickness	Burst Pressure	Cement Type	Cement Yield
Conductor	20"	24"	.25"	880 psi	Type I + 3% CaCl	1.2 Cuft/sack
Fresh Water	13 3/8"	17"	.33"	1730 psi	See # 22	1.2 Cuft/sack
Coal						
Intermediate	9 5/8"	12 1/4"	.352"	3520 psi	See # 22	1.2 Cuft/sack
Production	5 1/2"	8 7/8" & 8 3/4"	.361"	12,640 psi	See # 22	1.18 Cuft/sack
Tubing	2 3/8"		.19"	11,200		
Liners						

PACKERS

Kind:	n/a			Received MAY 10 2013
Sizes:	n/a			
Depths Set:	n/a			

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21) Describe centralizer placement for each casing string. Gastar will run 3 Centralizers on the Surface casing at an equal distance apart. The Intermediate casing will have 7 Centralizers at 300' spacing.
The production casing will have one centralizer every other joint in the lateral, one centralizer per joint through the curve and one centralizer every other joint in the the vertical section

22) Describe all cement additives associated with each cement type.
Type I + 2% CaCl₂ + 1/4# Flake - Surface Cement mixed at 15.6 ppg
CaCl₂ (calcium chloride), Flake (cellophane flake)
Type I + 1% CaCl₂ + 1/4# Flake - Intermediate Cement mixed at 15.6 ppg
50:50 Class H .2%CD32 1.2%FL62 .1%ASA301 .4%SMS - Long String Lead mixed 14.5 ppg.
CD32 (cement dispersant), FL 62 (fluid loss), SMS (sodium metasilicate), ASA (minimizes free fluid)
50:50 TYPE 1 .4% R3 1%FL62 .15%ASA301 .3%CD32 - Long String Tail mixed at 14.5 ppg.

23) Proposed borehole conditioning procedures. Gastar will circulate the hole a minimum of 3 hours upon TD.
We will then pull out to the bottom of the curve and circulate for another 2 hours. Then come out of the hole.

*Note: Attach additional sheets as needed.

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GASTAR EXPLORATION USA, INC.

Location: Marshall County, WV
 Field: Marshall
 Facility: Hansen Unit

Slot: Slot #5
 Well: Hansen Unit 5H
 Wellbore: Hanse Unit 5H (PWB)

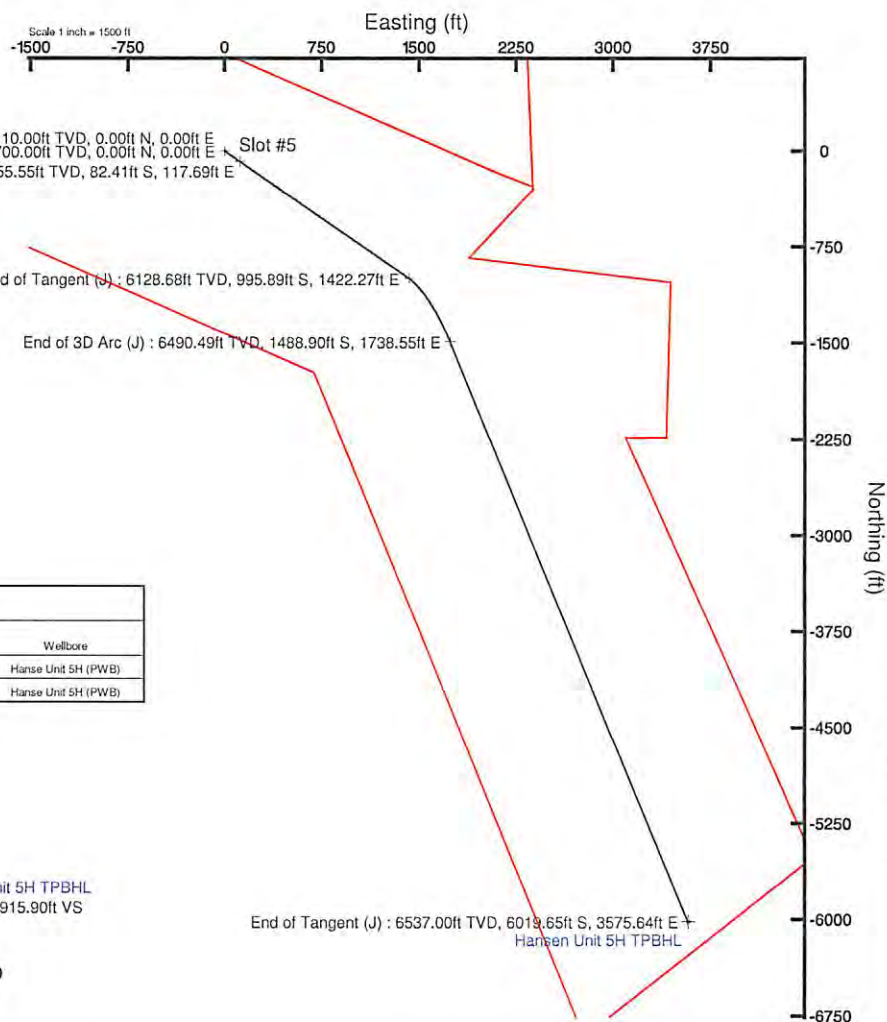
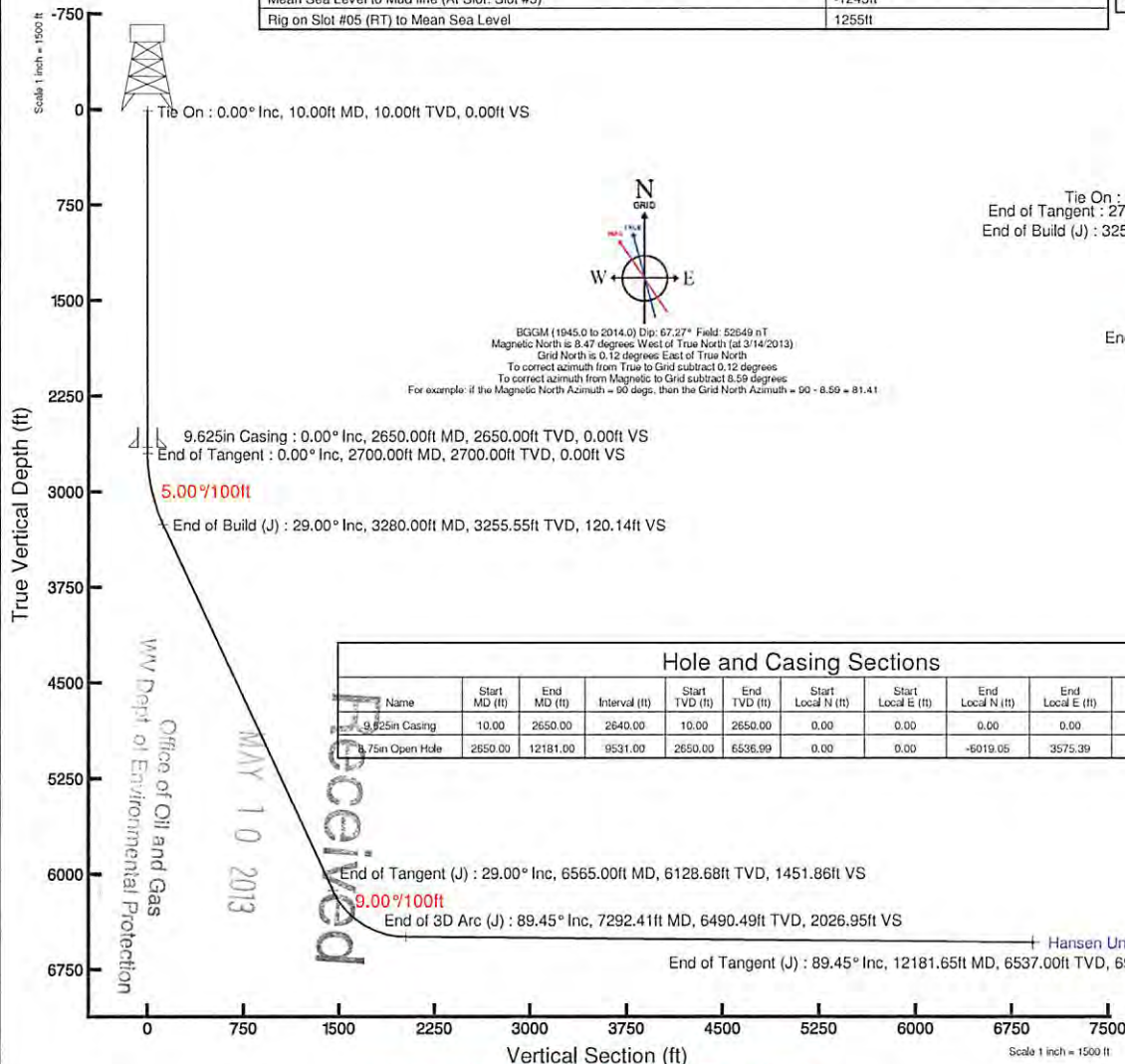


Plot reference wellpath is Hansen Unit 5H EX-00	
True vertical depths are referenced to Rig on Slot #05 (RT)	Grid System: NAD83 / UTM Zone 17 North, US feet
Measured depths are referenced to Rig on Slot #05 (RT)	North Reference: Grid north
Rig on Slot #05 (RT) to Mean Sea Level: 1255 feet	Scale: True distance
Mean Sea Level to Mud line (At Slot: Slot #5): -1245 feet	Depths are in feet
Coordinates are in feet referenced to Slot	Created by: edsaryar on 4/30/2013

Well Profile Data								
Design Comment	MD (ft)	Inc (°)	Az (°)	TVD (ft)	Local N (ft)	Local E (ft)	DLS (1/100ft)	VS (ft)
Tie On	10.00	0.000	125.000	10.00	0.00	0.00	0.00	0.00
End of Tangent	2700.00	0.000	125.000	2700.00	0.00	0.00	0.00	0.00
End of Build (J)	3290.00	29.000	125.000	3255.55	-82.41	117.69	5.00	120.14
End of Tangent (J)	6565.00	29.000	125.000	6128.68	-995.89	1422.27	0.00	1451.86
End of 3D Arc (J)	7292.41	89.455	157.929	6490.49	-1488.90	1738.55	9.00	2026.95
End of Tangent (J)	12181.65	89.455	157.929	6537.00	-6019.65	3575.64	0.00	6915.90

Location Information				
Facility Name	Grid East (US ft)	Grid North (US ft)	Latitude	Longitude
Hansen Unit	1692627.590	14427215.002	39°43'35.573"N	80°48'51.498"W
Slot	Local N (ft)	Local E (ft)	Grid East (US ft)	Grid North (US ft)
Slot #5	79.28	10.90	1692638.490	14427294.250
			Latitude	Longitude
			39°43'36.356"N	80°48'51.356"W
Rig on Slot #05 (RT) to Mud line (At Slot: Slot #5)	10ft			
Mean Sea Level to Mud line (At Slot: Slot #5)	-1245ft			
Rig on Slot #05 (RT) to Mean Sea Level	1255ft			

Targets								
Name	MD (ft)	TVD (ft)	Local N (ft)	Local E (ft)	Grid East (US ft)	Grid North (US ft)	Latitude	Longitude
Hansen Unit 5H TPBHL	12181.65	6537.00	-6019.65	3575.64	1692627.590	14421277.000	39°42'36.790"N	80°48'05.703"W
Hansen Unit 5H Target		6537.00	-1209.57	1602.65	1694240.50	14425995.20	39°43'23.480"N	80°48'30.880"W



Hole and Casing Sections										
Name	Start MD (ft)	End MD (ft)	Interval (ft)	Start TVD (ft)	End TVD (ft)	Start Local N (ft)	Start Local E (ft)	End Local N (ft)	End Local E (ft)	Wellbore
9.625in Casing	10.00	2650.00	2640.00	10.00	2650.00	0.00	0.00	0.00	0.00	Hansen Unit 5H (PWB)
7.75in Open Hole	2650.00	12181.00	9531.00	2650.00	6536.99	0.00	0.00	-6019.65	3575.39	Hansen Unit 5H (PWB)

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Azimuth 158.26° with reference 0.00 N, 0.00 E

51-01649

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

FLUIDS/ CUTTINGS DISPOSAL & RECLAMATION PLAN

Operator Name Gastar Exploration USA, Inc. OP Code 494487685

Watershed (HUC 10) French Creek - Ohio River (0503020110) Quadrangle New Martinsville 7.5'

Elevation 1245' County Marshall District Franklin

Do you anticipate using more than 5,000 bbls of water to complete the proposed well work? Yes X No _____

Will a pit be used for drill cuttings? Yes X No _____

If so, please describe anticipated pit waste: Various formation cuttings

Will a synthetic liner be used in the pit? Yes X No _____ If so, what ml.? 60

Proposed Disposal Method For Treated Pit Wastes:

- Land Application
- Underground Injection (UIC Permit Number 3416729685)
- Reuse (at API Number _____)
- Off Site Disposal (Supply form WW-9 for disposal location)
- Other (Explain _____)

Will closed loop system be used? Yes

Drilling medium anticipated for this well? Air, freshwater, oil based, etc. Air for vertical / oil for horizontal

-If oil based, what type? Synthetic, petroleum, etc. Synthetic Oil Base

Additives to be used in drilling medium? See attached page for all additives used in drilling medium

Drill cuttings disposal method? Leave in pit, landfill, removed offsite, etc. All drill cuttings will be disposed of in Wetzel County Landfill (Permit # SWF-1021)

-If left in pit and plan to solidify what medium will be used? (cement, lime, sawdust) _____

-Landfill or offsite name/permit number? Wetzel County Landfill (SWF-1021); Northwestern Landfill (SWF-1025); Arden Landfill (SWF-100172)

I certify that I understand and agree to the terms and conditions of the GENERAL WATER POLLUTION PERMIT issued on August 1, 2005, by the Office of Oil and Gas of the West Virginia Department of Environmental Protection. I understand that the provisions of the permit are enforceable by law. Violations of any term or condition of the general permit and/or other applicable law or regulation can lead to enforcement action.

I certify under penalty of law that I have personally examined and am familiar with the information submitted on this application form and all attachments thereto and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment.

Company Official Signature Michael McCown

Company Official (Typed Name) Michael McCown

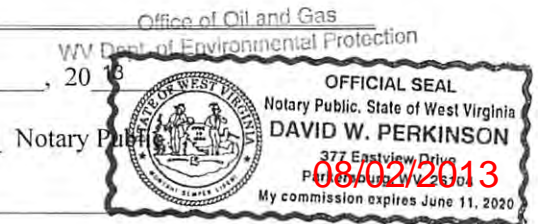
Company Official Title Vice President - Northeast

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Subscribed and sworn before me this 3rd day of May, 2013

David W. Perkinson
Notary Public



My commission expires 06/11/2020

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Form WW-9

Operator's Well No. Hansen No. 5H

Proposed Revegetation Treatment: Acres Disturbed 28.28 Prevegetation pH _____

Lime 3 Tons/acre or to correct to pH 6.5

Fertilizer (10-20-20 or equivalent) 1/3 ton lbs/acre (500 lbs minimum)

Mulch Hay 2 Tons/acre

Seed Mixtures

Seed Type	Area I lbs/acre	Seed Type	Area II lbs/acre
Meadow Mix	40	Orchard Grass	15
Alsike Clover	5	Alsike Clover	5
Annual Rye	15		

Attach:
Drawing(s) of road, location, pit and proposed area for land application.

Photocopied section of involved 7.5' topographic sheet.

Plan Approved by: *William Harkush*

Comments: _____

Title: Environmental Inspector Date: 5-7-13

Field Reviewed? Yes No

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Office of Oil and Gas
WV Dept. of Environmental Protection

08/02/2013



Water Management Plan: Primary Water Sources



WMP-01302

API/ID Number: 047-051-01649

Operator:

Gastar Exploration USA, Inc.

Hansen No. 5H

Important:

For each proposed primary water source (including source intakes for purchased water sources) identified in your water management plan, and summarized herein, DEP has made an evaluation concerning water availability over the specified date range. DEP's assessment is based on the following considerations:

- Statistical analysis of historical USGS stream gauge data (transferred to un-gauged locations as necessary);
- Identification of sensitive aquatic life (endangered species, mussels, etc.);
- Quantification of known existing demands on the water supply (Large Quantity Users);
- Minimum flows required by the Army Corps of Engineers; and
- Designated stream uses.

Based on these factors, DEP has provided, for each intake location (and origination point for purchased water), a reference gauge location and discharge flow reading which must be surpassed prior to withdrawals. Additionally, DEP has established a minimum passby flow at the withdrawal location which must also be surpassed prior to withdrawals. These thresholds are considered terms of the permit and are enforceable as such.

DEP is aware that some intake points will be used for multiple wells and well sites. In these cases, the thresholds set by the Water Management Plan are to be interpreted as total withdrawal limits for each location over the specified date range regardless of how many wells are supported by that intake.

For all purchased water intakes, determinations of water availability are made at the original source intake location. It is the responsibility of the Oil and Gas Operator, not the seller, to cease withdrawal of water from the seller when flows are less than the minimum gauge reading at the stream gauge referenced by the Water Management Plan in order to protect stream uses.

Note that the determinations made herein are based on the best available data, but it is impossible to predict water availability in the future. While the DEP has carefully established these minimum withdrawal thresholds, it remains the operator's responsibility to protect aquatic life at all times. Approval to withdrawal is contingent upon permission from the land owner. It is the responsibility of the operator to secure and maintain permission prior to any withdrawals.

The operator is reminded that 24-48 hours prior to withdrawing (or purchasing) water, DEP must be notified by email at DEP.water.use@wv.gov.

APPROVED JUL 01 2013

Source Summary

WMP- 01302

API Number:

047-051-01649

Operator:

Gastar Exploration USA, Inc.

Hansen No. 5H

Purchased Water

● Source **Bayer Material Science, LLC** Marshall Owner: **Bayer Material Science, LLC**

Start Date	End Date	Total Volume (gal)	Max. daily purchase (gal)	Intake Latitude:	Intake Longitude:
9/1/2014	9/1/2015	4,095,000	702,000	39.7218	-80.830231

Regulated Stream? Ohio River Min. Flow Ref. Gauge ID: 9999999 Ohio River Station: Willow Island Lock & Dam

Max. Pump rate (gpm): Min. Gauge Reading (cfs): **6,468.00** Min. Passby (cfs)

DEP Comments:

Source Detail

WMP- 01302

API/ID Number: 047-051-01649

Operator: Gastar Exploration USA, Inc.

Hansen No. 5H

Source ID: 20057 Source Name Bayer Material Science, LLC
Bayer Material Science, LLC

Source Latitude: 39.7218

Source Longitude: -80.830231

HUC-8 Code: 5030201

Drainage Area (sq. mi.): 25000 County: Marshall

Anticipated withdrawal start date: 9/1/2014

Anticipated withdrawal end date: 9/1/2015

Total Volume from Source (gal): 4,095,000

Endangered Species? Mussel Stream?

Trout Stream? Tier 3?

Regulated Stream? Ohio River Min. Flow

Proximate PSD? Grandview-Doolin PSD

Gauged Stream?

Max. Pump rate (gpm):

Max. Simultaneous Trucks:

Max. Truck pump rate (gpm)

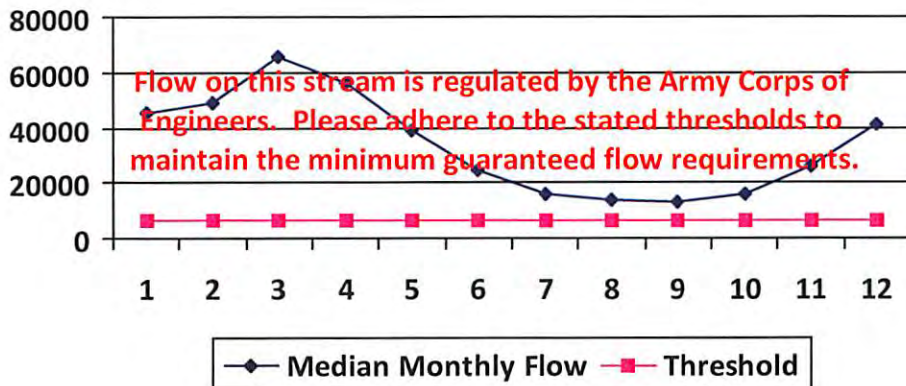
Reference Gaug 9999999 Ohio River Station: Willow Island Lock & Dam

Drainage Area (sq. mi.) 25,000.00

Gauge Threshold (cfs): 6468

Month	Median monthly flow (cfs)	Threshold (+ pump)	Estimated Available water (cfs)
1	45,700.00	-	-
2	49,200.00	-	-
3	65,700.00	-	-
4	56,100.00	-	-
5	38,700.00	-	-
6	24,300.00	-	-
7	16,000.00	-	-
8	13,400.00	-	-
9	12,800.00	-	-
10	15,500.00	-	-
11	26,300.00	-	-
12	41,300.00	-	-

Water Availability Profile



Water Availability Assessment of Location

Base Threshold (cfs):	-
Upstream Demand (cfs):	-
Downstream Demand (cfs):	-
Pump rate (cfs):	-
Headwater Safety (cfs):	0.00
Ungauged Stream Safety (cfs):	0.00
Min. Gauge Reading (cfs):	-
Passby at Location (cfs):	-

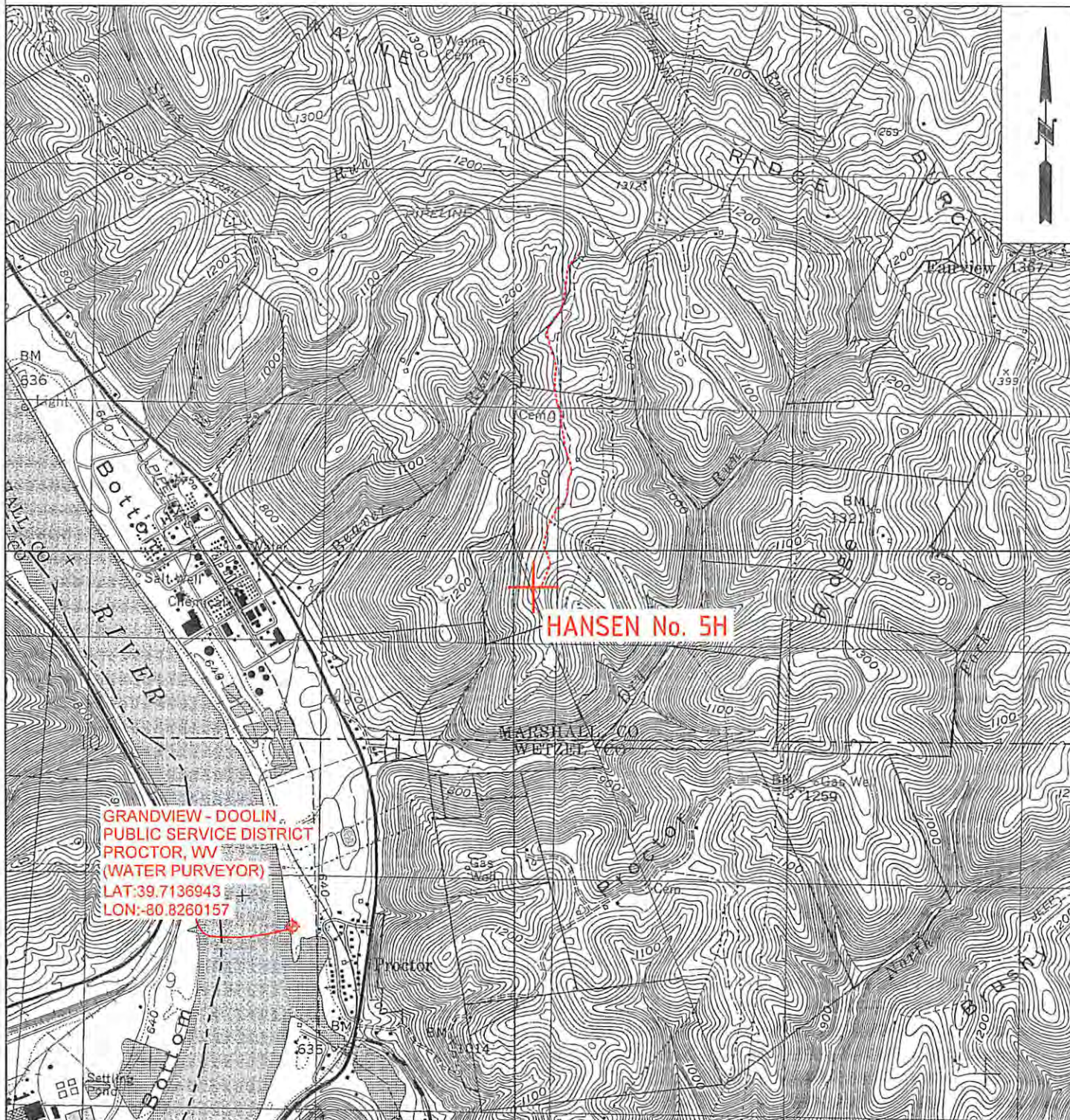
"Threshold", as depicted in the chart above is meant only to indicate the calculated base threshold at the proposed withdrawal location. This value does not include the proposed pump rate or existing demand on the stream. Refer to the monthly breakdown above for a more complete estimation of water availability by month.

51-01649

WW-9

PROPOSED HANSEN WELL No. 5H

SUPPLEMENT PG 2



GRANDVIEW - DOOLIN
PUBLIC SERVICE DISTRICT
PROCTOR, WV
(WATER PURVEYOR)
LAT: 39.7136943
LON: -80.8260157

HANSEN No. 5H

WRH
5-7-13

W0120318	OPERATOR	TOPO SECTION	LEASE NAME
	GASTAR EXPLORATION USA, Inc. 229 W Main Street, Suite 301 Clarksburg, WV 26301	NEW MARTINSVILLE 7.5'	HANSEN
	SCALE:	DATE:	
	1"=2000'	DATE: 03/25/13	

08/02/2013

