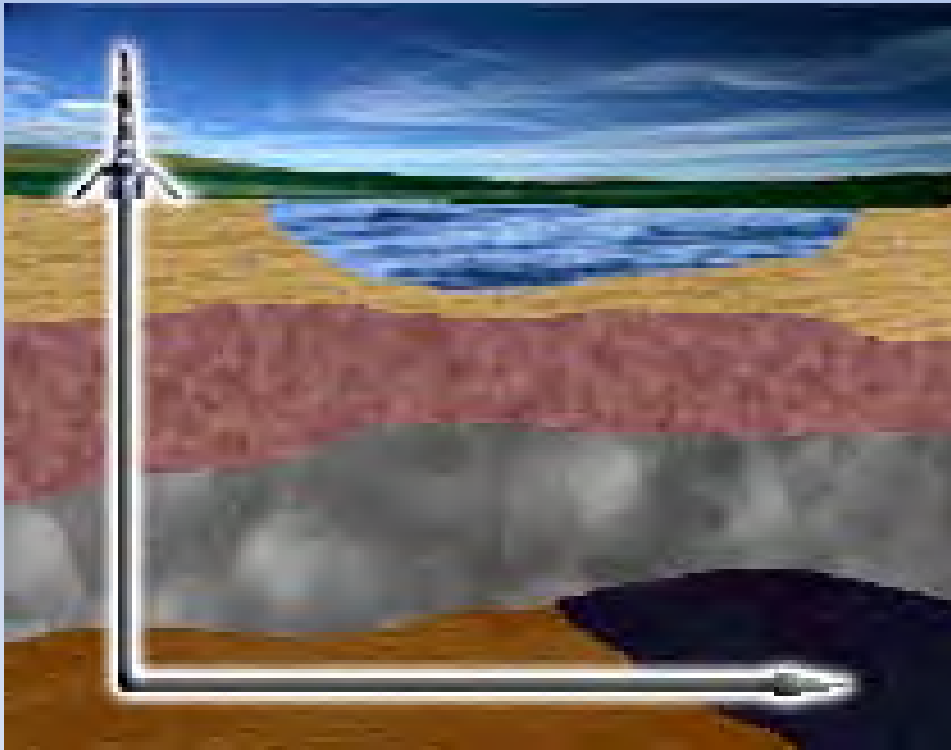




Delaware Riverkeeper Network – Fighting for the Rights of the River and All Communities Who Depend Upon It.

[www.delawareriverkeeper.org](http://www.delawareriverkeeper.org)

# Horizontal Drilling



- Well bore drilled vertically 5000 to 8000+ feet deep to the Marcellus Shale
- Well bore drilled horizontally several thousand feet
- Efficiently accesses horizontal shale formations



Roughly 200 tanker trucks deliver water for the fracturing process.

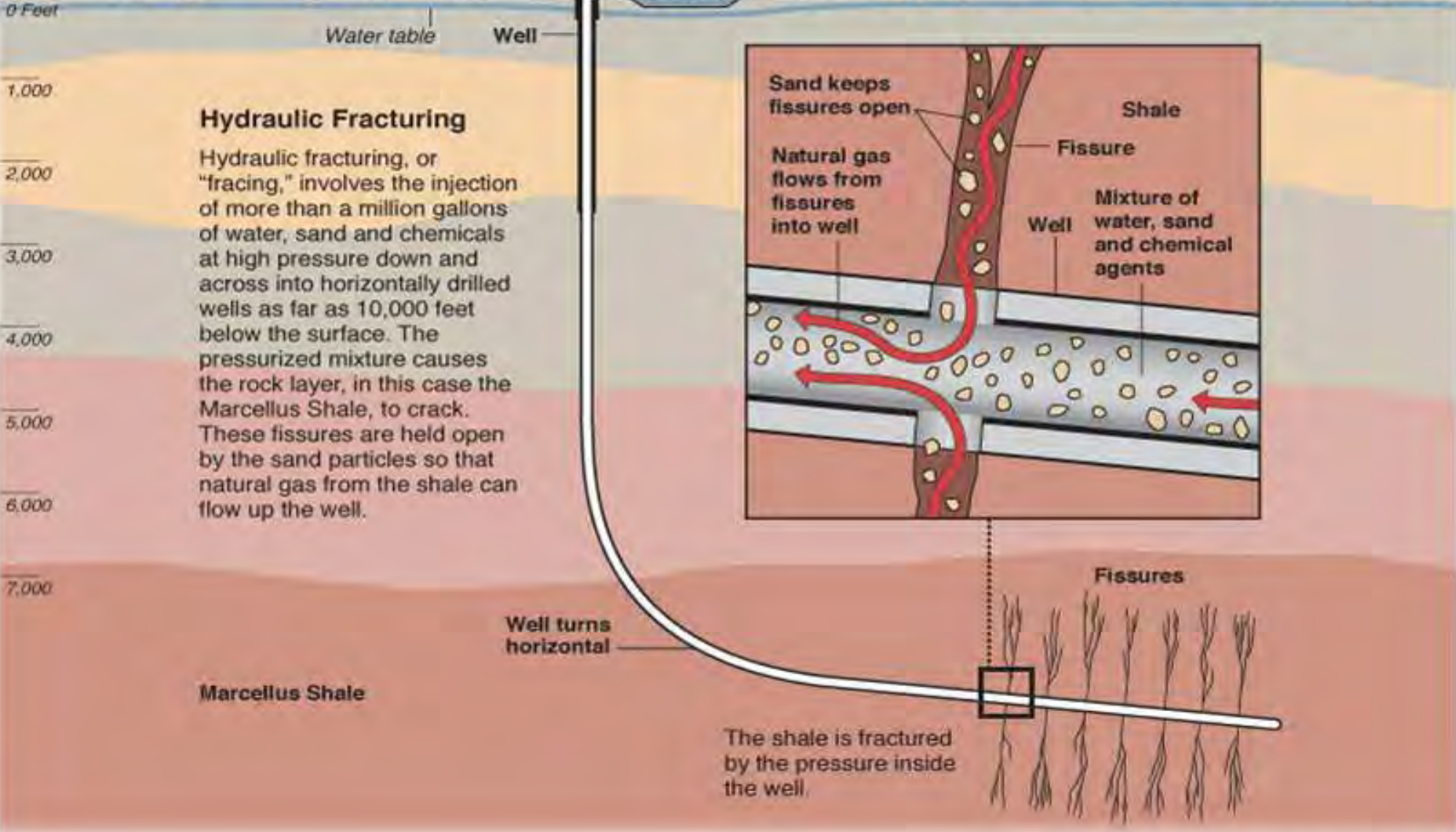
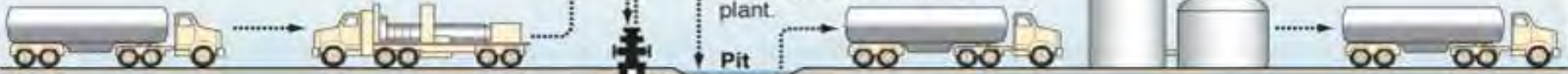
A pumper truck injects a mix of sand, water and chemicals into the well.

Natural gas flows out of well.

Recovered water is stored in open pits, then taken to a treatment plant.

Storage tanks

Natural gas is trucked to a pipeline for delivery.



### Hydraulic Fracturing

Hydraulic fracturing, or "fracing," involves the injection of more than a million gallons of water, sand and chemicals at high pressure down and across into horizontally drilled wells as far as 10,000 feet below the surface. The pressurized mixture causes the rock layer, in this case the Marcellus Shale, to crack. These fissures are held open by the sand particles so that natural gas from the shale can flow up the well.



Drilling rig at Dimock  
Township natural  
gas well  
Susquehanna County, PA  
Cabot Oil and Gas Co.



# Hydraulic Fracturing – “hydrofracking” at a natural gas well site



# Common Frack Fluid Additives

- (GPC and ALL (2009), Arthur et al (2008)
- Additive
- Common chemicals
- Diluted Acid
- Hydrochloric acid, muriatic acid
- biocide
- Glutaraldehyde
- Breaker
- Ammonium persulfate, sodium chloride
- Corrosion inhibitor
- N,n-dimethyl formamide
- Crosslinker
- Borate salts
- Friction reducer
- polyacrylamide, mineral oil, petroleum distillate
- Gel
- Guar gum, hydroxyethyl cellulose
- Iron control
- citric acid
- Carrier fluid
- Potassium chloride (KCl)
- Oxygen scavenger
- ammonium bisulfite
- ph adjustment
- sodium or potassium carbonate (NaCO<sub>3</sub> or KCO<sub>3</sub>)
- Proppant
- sand
- Scale inhibitor
- ethylene glycol
- Surfactant
- Isopropanol

***Courtesy of Dr. Tom Meyers Technical Draft  
Memo***



“Produced Water” or “Flowback”  
in PA, 87% remains underground, 13%  
comes back up to the surface



**Natural Gas Well pad and wastewater pit (PA)**

Source: ALL Consulting, September 2008 <http://www.all-llc.com/pdf/GWPCMarcellusFinal.pdf>

# Natural Gas Drilling Wastewater Disposal







- The McKeesport Sewage Treatment Plant, one of nine plants on the Monongahela River that has treated wastewater from Marcellus Shale drilling operations. (Joaquin Sapien/ProPublica)

Compliments of ProPublica

- Drilling wastewater contains so much TDS that it can be five times as salty [8] as sea water. (sea water ~ 30,000 – 40,000 ppm TDS)
- 2013 – projected completion of first plant -- And at its peak that plant would be able to treat only 400,000 gallons of wastewater a day [14]. The DEP would need 50 plants that size to process all the wastewater expected by 2011.

profit newsroom that produces investigative journalism in the public interest. We strive to foster change through exposing exploitation of the weak by the strong and the failures of those with power to vindicate the trust placed in them.

[More...](#)

Workers at a steel mill and a power plant were the first to notice something strange about the Monongahela River last summer. The water that U.S. Steel and Allegheny Energy used to power their plants contained so much salty sediment that it was **corroding their machinery**. Nearby residents saw something odd, too. Dishwashers were malfunctioning, and plates were coming out with spots that couldn't easily be rinsed off.

**2009** Pennsylvania's oil and gas wells currently produce **9** million gallons of wastewater a day.



**2011** This amount is estimated to rise to **19** million gal./day



**2013** The first treatment plant to treat "total dissolved solids" in wastewater won't be ready until 2013 and will have a peak capacity of only **0.4** million gal./day

Pennsylvania's Department of Environmental Protection soon **identified the likely cause** and came up with a quick fix. The Monongahela, a

drinking water source for 350,000 people, had apparently been contaminated by chemically tainted wastewater



2009



by Abra



2009



2009

Start



9 Mozilla Thunde...



Monitoring Natural ...



QA\_QC\_09Presentat...



2 Internet

Internet | Pro

# Major Investigative Reporting: NY Times

Feb. 26, 2011 by Ian Urbina

- Part 1:  
[http://www.nytimes.com/2011/02/27/us/27gas.html?\\_r=1&hp](http://www.nytimes.com/2011/02/27/us/27gas.html?_r=1&hp)
- Part 2:  
[http://www.nytimes.com/2011/03/02/us/02gas.html?\\_r=2&hp](http://www.nytimes.com/2011/03/02/us/02gas.html?_r=2&hp)
- Part 3:  
[http://www.nytimes.com/2011/03/04/us/04gas.html?\\_r=3&pagewanted=1&ref=us](http://www.nytimes.com/2011/03/04/us/04gas.html?_r=3&pagewanted=1&ref=us)

## Bradford County well water



Fractracker photo tool

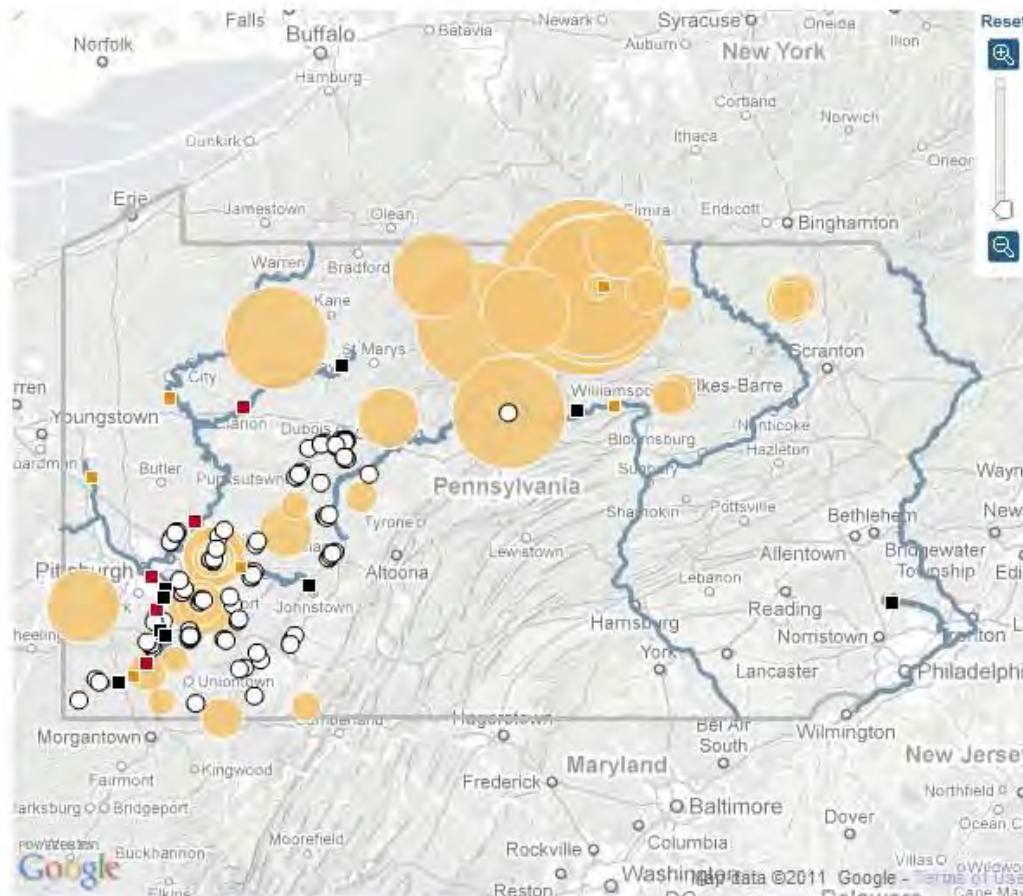


149 of the wells.

Radium
Uranium
Gross Alpha
Benzene

42 wells exceeded the federal drinking water standard for radium.

AMOUNT OVER THE FEDERAL LIMIT FOR RADIUM



### How much toxic contamination was found in wastewater from each well

Colored circles on the map are scaled to show the amount of each contaminant found in wastewater from each well. The key to the left shows the amount over the federal limit.

- Under the limit or no data
- Public sewage treatment plant that accepted gas industry wastewater within the past four years
- Drinking water intake plant that drew in water downstream from wastewater discharge
- Water quality monitoring station that began testing for radioactivity in rivers in November 2010



Published: February 26, 2011

DRILLING DOWN

# Documents: Natural Gas's Toxic Waste

Over the past nine months, The Times reviewed more than 30,000 pages of documents obtained through open records requests of state and federal agencies and by visiting various regional offices that oversee drilling in Pennsylvania. Some of the documents were leaked by state or federal officials. Here, the most significant documents are made available with annotations from The Times.



Todd Heister/The New York Times

## Challenges of Handling Natural Gas Waste

- Confidential E.P.A. Draft Document
- E.P.A. Briefing on Hydrofracking
- Conference Call Between State and Federal Regulators



Todd Heister/The New York Times

## Disposal of Natural Gas Waste

- Internal E.P.A. Presentation
- Tracking Document for Gas Industry Wastewater
- Pennsylvania Fines Jersey Shore for Sewage Violations



Todd Heister/The New York Times

## Contaminants in Natural Gas Wastewater

- E.P.A. Scientist Discusses Radioactivity in Waste
- E.P.A. Draft Document for New York State
- Field Study of Radioactivity at Marcellus Shale Wells



Todd Heister/The New York Times

## Spills and Spill Plans in Pennsylvania

- Cabot Oil and Gas's Spill Plan
- E-mail on Suspected Illegal Dumping into Mine Void
- Federal Natural Gas Drilling Tip Line

Send Feedback

TWITTER



## Drinking Water Supplies at Risk

PREVIOUS NEXT

**private water wells, and surface water intakes, etc. If brine is taken to POTW's down stream drinking water intakes may receive unknown contaminants if POTW's are not aware of the oil field contaminants including high TDS, metals and chlorides.**

Karen Johnson of the E.P.A.'s Mid-Atlantic region begins the conference call by discussing the risks that using sewage treatment plants (called publicly owned treatment works or P.O.T.W.'s by regulators) to dispose of gas industry wastewater could pose to drinking water supplies. State and federal regulators, including several Pennsylvania state regulators, participated in this call.

**Misc. -Water quality concerns from long term disposal of produced water, transportation off- site v. onsite disposal options  
gas pipe lines for transport of gas, etc.**

**State program overview- states reporting on the current activities and regulatory authorities to cover environmental concerns**

### *NY Status*

**John Harmon-oil & gas reg. agency,  
The difference from other development is the water volumes in drilling. Governor has required them to develop a supplement to the environmental impact statement (EIS) to take into account the large volume of water used for horizontal drilling. Holding a hearing next month and preparing a draft EIS, and then a final by spring 2009. Not currently issuing any permits for horizontal wells. By early**

### ▼ Pennsylvania Tenmile Cre

- Overview
- Aquatic Life  
Outflow

### ▼ Letter from Clarksburg S

- Overview
- Inability to Tr
- Radioactive  
Waste

### ▼ Conference Federal Reg Shale, 2008

- Overview
- Drinking Wa
- Dilution Inad
- Radioactive
- Wastewater  
Plants
- Lessons fro

### ▼ E.P.A. Scien Radioactivit



## Benzene in Petroleum Distillates

◀ PREVIOUS NEXT ▶

- The Environmental Working Group published a report (January, 2010) discussing chemicals used in HF operations. EWG concluded that EPA does not adequately exercise its authority over use of diesel in fracking fluids and that the toxicity of other unregulated additives are equivalent to or in excess of that of diesel.

Here, the agency discusses the use of diesel fuel in hydrofracking. This is important for two reasons, one related to the law and the other focused on health risks. First, although hydrofracking is generally not covered by provisions of the Safe Drinking Water Act that deal with underground injection, Congress decided that the exclusion would not apply to hydrofracking conducted using diesel. In this passage of the document, E.P.A. officials say that a report by the Environmental Working Group, a nonprofit advocacy group, found that the E.P.A. was not adequately enforcing laws on hydrofracking with diesel. Second, diesel carries high levels of the so-called BTEX chemicals – benzene, toluene, ethylbenzene and xylenes – which are carcinogens. But E.P.A. authorities say here that diesel is not the only component of fracturing fluid that contains high levels of BTEX and other toxic materials. Indeed, companies have disclosed to the authorities in New York and Pennsylvania that they use other types of petroleum distillates that contain high levels of benzene, a human carcinogen that is considered unsafe in drinking water at levels above five parts per billion, the equivalent of a few drops in a swimming pool. Some of these petroleum distillates that the industry uses include kerosene, mineral spirits, petroleum naphtha and Stoddard solvent. According to scientific literature, these additives can contain up to 93 times the amount of benzene contained in diesel.

• In 2009, EPA conducted a study on HF in coalbed methane reservoirs. EPA determined the injection of HF fluids into CBM wells posed little to no direct threat to Underground Sources of Drinking Water.

- Since 2004, interest in HF in other unconventional gas-bearing formations has grown because they have become economically viable for production due to advances in drilling and hydraulic



## Overview

◀ PREVIOUS    NEXT ▶

In January 2010, the E.P.A. began the Natural Gas Drilling Tip Line for reports of dumping and other illegal or suspicious hauling and/or disposal activities. The tip line is run through the agency's Mid-Atlantic regional office and was created in response to increased concerns about drilling.

Using the Freedom of Information Act, The Times obtained the contents of the tip line from its inception to June 2010, which are provided in full here. A review by The Times found the following:

Total submissions: 194

Submissions relating to gas emissions from compressors and death of wildlife, especially fish: 19

Submissions relating generally to public health concerns: 10

Submissions that specifically mention burning eyes, respiratory or other health impacts: 5

Submissions relating to malfunctioning of trucks hauling waste or water: 14

Submissions relating to spilling or spraying of drilling fluids on roads: 5

Submissions relating more generally to spills, improper waste disposal or accidents: 49

Submissions that note fluids being spilled into lakes, ponds or creeks: 11

Submissions raising concerns about well water or other drinking water concerns: 15

Submissions noting noxious odors: 14

Submissions involving complaints of mistreatment by company officials: 14

Tip line number (toll free): 877-919-4372 (877-919-4EPA).

It also receives complaints by email at: [eyesondrilling@epa.gov](mailto:eyesondrilling@epa.gov) or by mail at:

EPA Region 3 1650 Arch Street (3CEOO) Philadelphia, PA 19103-2029



# FracTracker

Tracking the impacts of the natural gas industry - Piloting in the Marcellus Shale region

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Reporting Form

Resources

Calendar

PG Pipeline

Data Index

DataTool

Friday, March 11, 2011

## Groups Announce Legal Action to Stop Sewage Plants from Dumping Gas Drilling Wastewater in PA Rivers

CONTACT:

Myron Arnowitt, Clean Water Action, 412-592-1283

Ned Mulcahy, Three Rivers Waterkeeper, 412-589-4720

FOR IMMEDIATE RELEASE

### Groups Announce Legal Action to Stop Sewage Plants from Dumping Gas Drilling Wastewater in Pennsylvania Rivers

-- McKeesport and Franklin Twp. plants targeted --

(Pittsburgh) – Clean Water Action and Three Rivers Waterkeeper served legal notices today on two sewer authorities that have been discharging Marcellus Shale gas drilling wastewater into the Monongahela River watershed south of Pittsburgh. The notices detail violations of the federal Clean Water Act by the facilities, primarily for discharging wastewater without a permit. Both EPA and the Pennsylvania DEP were notified as well of the legal action. This is the first time a legal action has been filed to stop the current discharge of

### Recent Snapsho



### Welcome!

This site serves as a share natural gas d stories, pictures, & [DataTool](#) allows you download, & map g drilling data. FracTr being piloted in the [Shale](#) region.











June Overflow on Farm --- Fractracker







Fire in Hopewell Township PA - Atlas Energy drilling site 3-31-10 - Fracktracker



Steckman Ridge Gas Compressor Plant - Clearville, PA 2009 (Fractracker)





Spring water - Clearville, PA 2009  
Residents report it smells like motor oil (Fracktracker)





Leidy Township, PA Gas Fire



Allegheny National Forest, PA  
Forest fragmentation

08/11/2007

<http://picasaweb.google.com/AlleghenyDefenseProject/August112007LightHawkFlight#slideshow>







# Department of Environmental Protection Bureau of Oil and Gas Management Marcellus Shale Formation

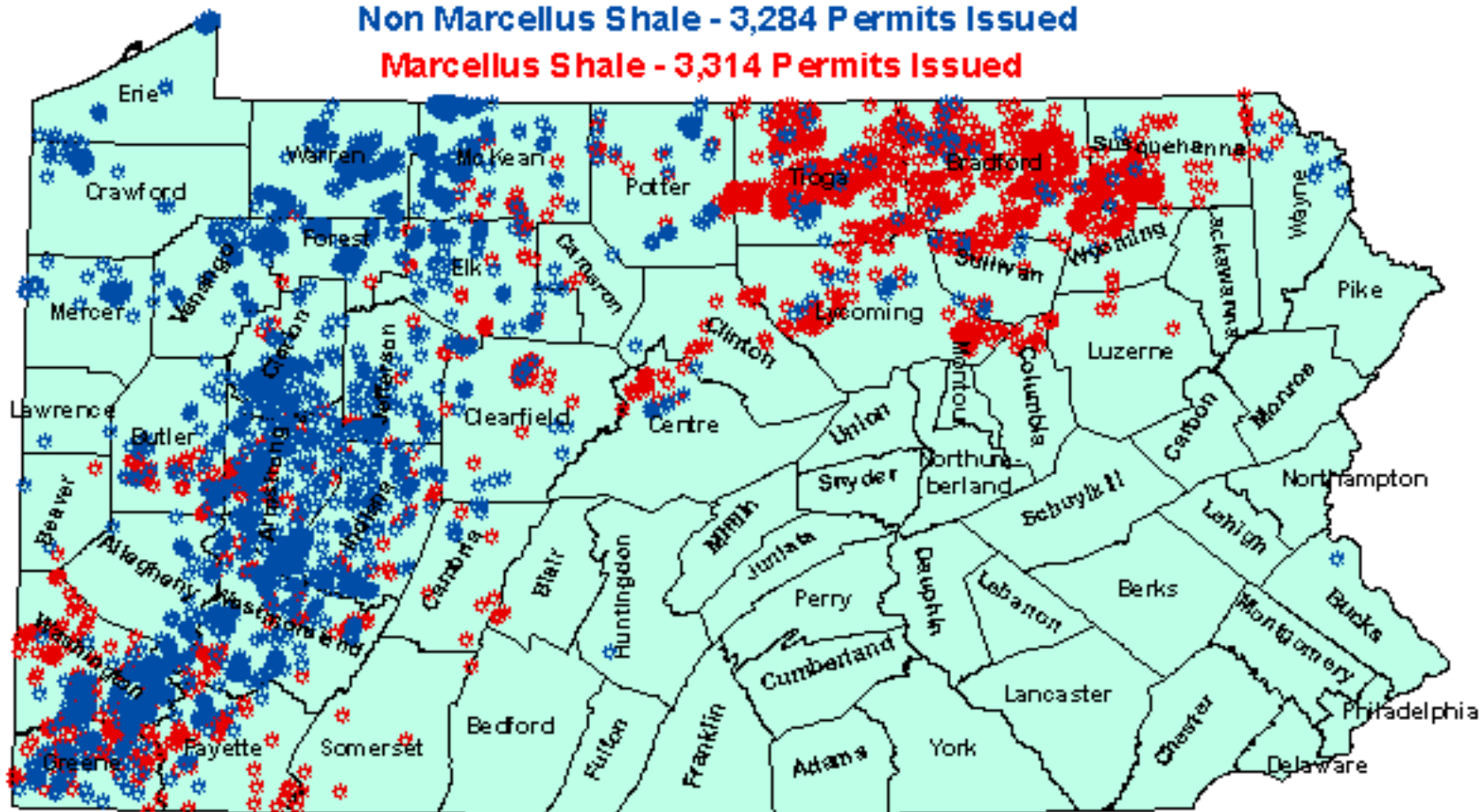


# Department of Environmental Protection Bureau of Oil and Gas Management Well Permits Issued

Total Permits Issued January thru December 2010 - 6,598

Non Marcellus Shale - 3,284 Permits Issued

Marcellus Shale - 3,314 Permits Issued



Updated 1/05/2011

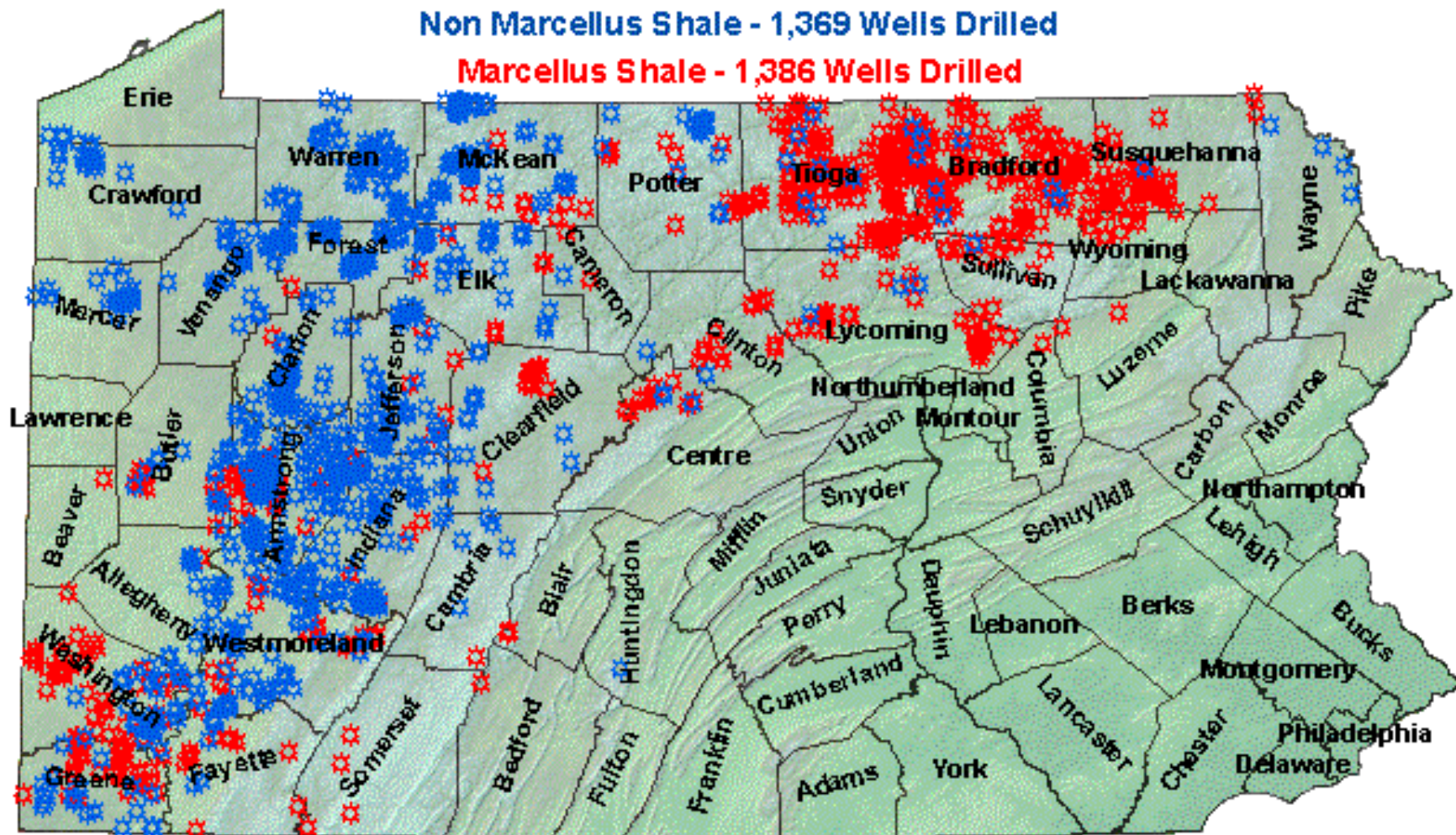


# Department of Environmental Protection Bureau of Oil and Gas Management Wells Drilled

2010 January-December Wells Drilled - 2,755

Non Marcellus Shale - 1,369 Wells Drilled

Marcellus Shale - 1,386 Wells Drilled



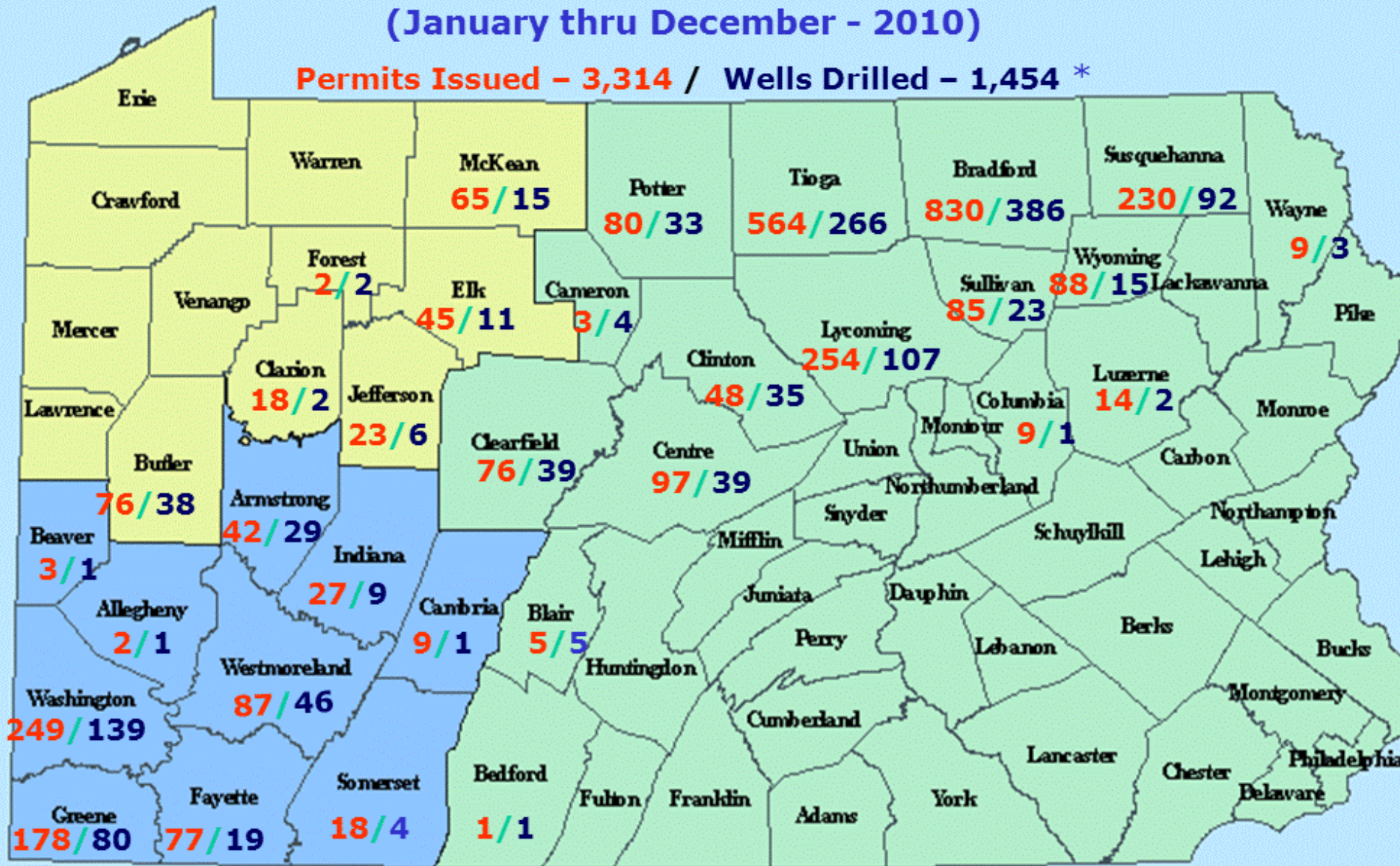
As Reported by Operators

Updated 01/05/2011



Department of Environmental Protection  
 Bureau of Oil and Gas Management  
 Marcellus Shale Permits Issued & Wells Drilled  
 (January thru December - 2010)

Permits Issued - 3,314 / Wells Drilled - 1,454 \*





# Total 2010 Totals According to PADEP

- 1,500 total inspections by DEP
- 2,721 total violations found by DEP
- 721 total enforcements
- **Source:**<http://www.dep.state.pa.us/dep/deputate/minres/oilgas/OGInspectionsViolations/OGInspviol.htm>

# Pollution problems cited by DEP

- Pit has holes in liner
- Cuttings/oil/grease on ground
- 5 barrels of frac fluid escaped due to valve malfunction
- Failure to notify DEP of spill
- Drilling mud waste discharged to stream
- Fluid level exceeded freeboard in pit leaking fluid on ground
- Failure to adopt pollution prevention measures



# DEP Permits Issued in 2011

January 2011 --- 508 drilling permits approved

February 2011 – 448 drilling permits approved

956 Wells approved

2011 Wells Drilled By County as of 3/10/2011

County	Non Marcellus	Marcellus	Total
Adams	6		6
Armstrong	4	4	8
Berks	1		1
Bordley		75	75
Brederick	1	7	8
Carroll	2		2
Cecil		4	4
Chesapeake	10		10
Clinton		11	11
Columbia		6	6
Dorchester	2		2
Franklin	7	1	8
Fulton	1		1
Gaillard	18		18
Greene	5	7	12
Harford	12	4	16
Harrison	3	4	7
Howard	16	27	43
Jefferson	19		19
Johns	12		12
King		7	7
Lancaster		7	7
Lebanon	1	21	22
Lincoln	4	61	65
Maryland	5		5
Morgan	12		12
Newington	5	34	39
Northland	5	16	21
Pratt	1	5	6
<b>Total</b>	<b>152</b>	<b>301</b>	<b>453</b>



The Upper Delaware River...the source for 15 million people's drinking water



Wild and Scenic  
Delaware River and  
Special Protection  
Waters  
in the  
Delaware River  
Watershed  
NY, PA and  
New Jersey





## Delaware River Watershed by State

New York State = 18.5% of land mass  
Pennsylvania = 50.3% of land mass

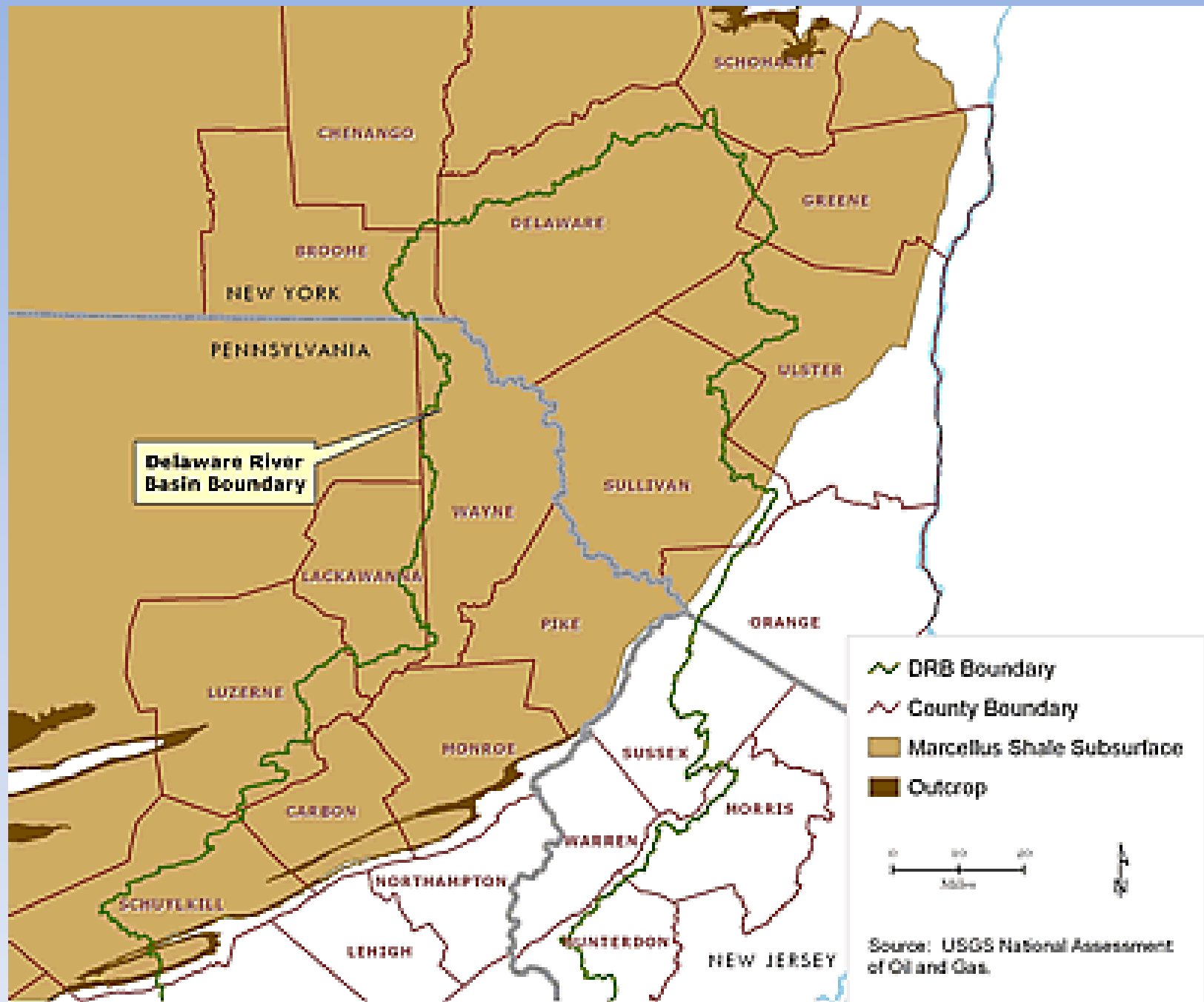
New York (including NYC) –  
largest water user

Pennsylvania – next largest user









# SPW Waters (2000-2004 dataset)

TDS readings (ppm)

- N= 1028 samples on main stem and 15 trib streams
- MINIMUM 10
- MAXIMUM 618
- MEDIAN 160
- AVERAGE 183
- DRBC dataset



Secondary drinking water standard – 500 ppm





*Ephemerella*

E. Fleek, NC DWQ



Heptageniidae  
*Epeorus*

NABS ([www.benthos.org](http://www.benthos.org))

Mayflies represent ~25-50% of Abundance; ~1/3<sup>rd</sup> biodiversity  
In natural, undegraded Appalachian streams



Heptageniidae  
*Heptagenia*

NABS ([www.benthos.org](http://www.benthos.org))



Ephemerellidae

NABS ([www.benthos.org](http://www.benthos.org))

# (Partial) Moratorium on gas drilling still holds in the Delaware River Basin

- Exception of 11 exploratory wells that have been allowed to move forward
- DRN & DCS filed an appeal to exploratory wells & stone energy water withdrawal
- Expert reports drafted & finalized on exploratory wells (avail on DRN website)





# Timeline cont'd

- DRBC throws out case at December 9<sup>th</sup> meeting and releases draft gas drilling regulations with 90-day comment period
- Advocacy to extend comment period on draft regulations beyond March 16<sup>th</sup>
- March 3- DRBC announces 30 day extension until April 15, 2011 (PA only no vote, NJ would not vote for 45 day extension)

# Teeple – “exploratory” well

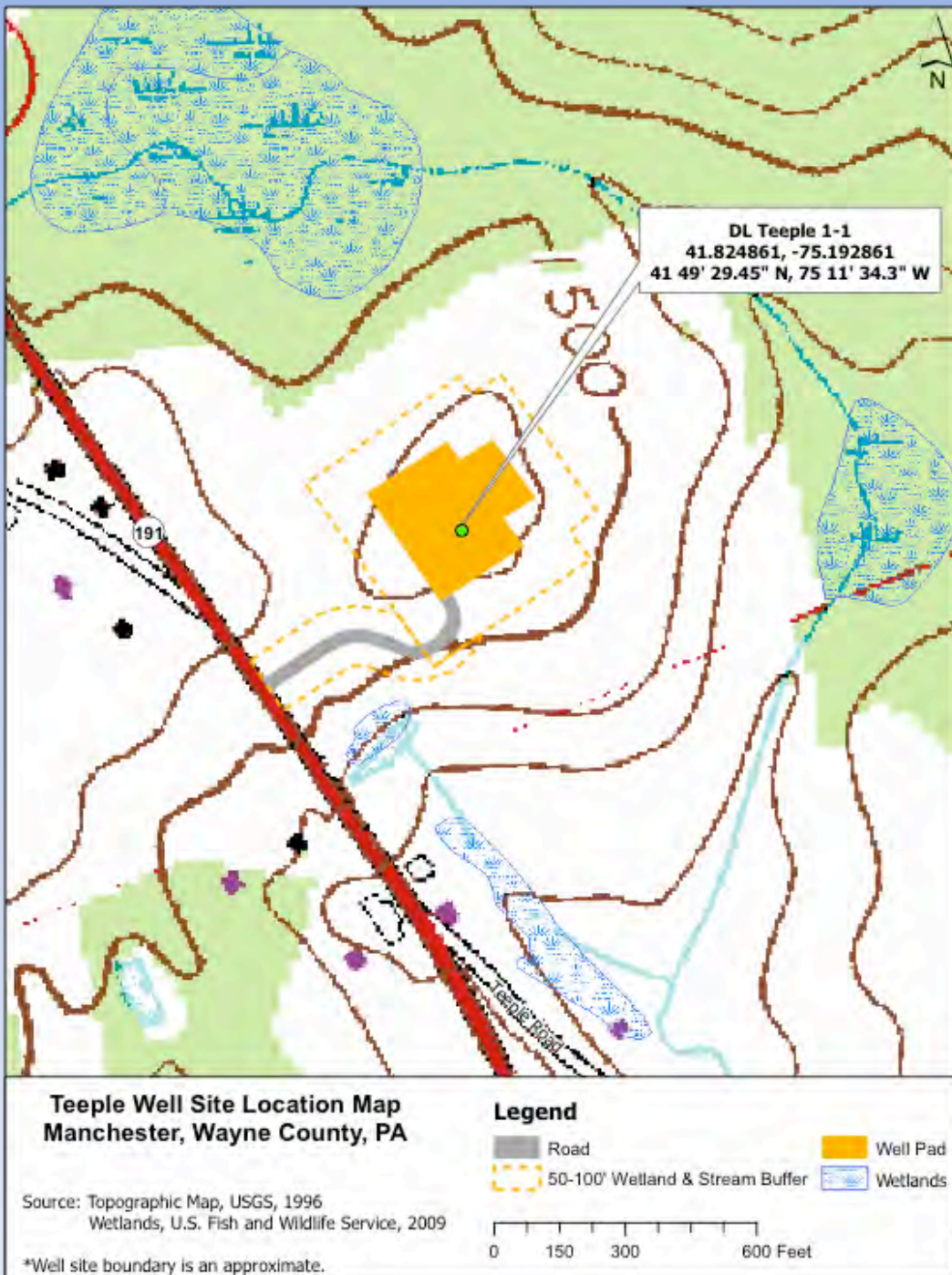


Teeple Test Well – May, 2010



DL Teeple 1 1 well plat  
geo-referenced and  
overlaid on USGS topo  
quad.

- HQ watershed
- Surrounded on 3 sides by water
- Cited for E&S failures 1 month after permit issued.



# Crum exploratory well





# Inadequate DRBC gas drilling regulations released Dec 9, 2010

- draft regulations do not address cumulative impacts, do not set limits on gas development, do not institute high enough standards to protect streams and communities and rely heavily on flawed state regulations that are filled with exemptions and loopholes.

# Time to flood DRBC with comments...

- The DRBC's draft rules are available at [http://www.state.nj.us/drbc/notice\\_naturalgas-draftregs.htm](http://www.state.nj.us/drbc/notice_naturalgas-draftregs.htm). Comment can be submitted now electronically at <http://parkplanning.nps.gov/projectHome.cfm?projectId=33467>
- Please comment by April 15<sup>th</sup>!

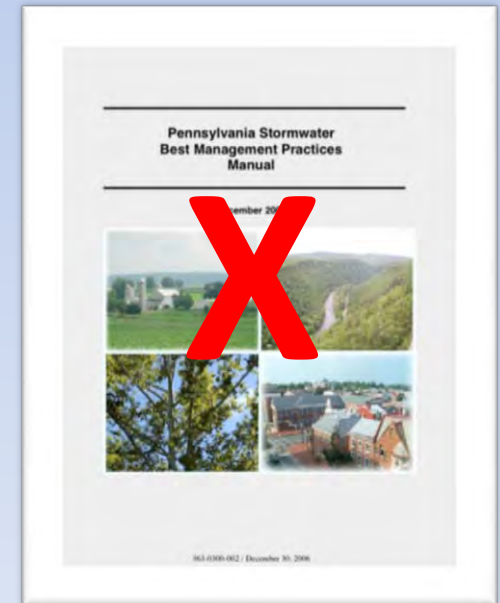


# DRBC Draft Regulations rely on state laws and permit requirements

---

*" compliance with state laws and permit requirements relating to natural gas and exploratory well construction and operation shall constitute satisfaction of project sponsor's obligation"*

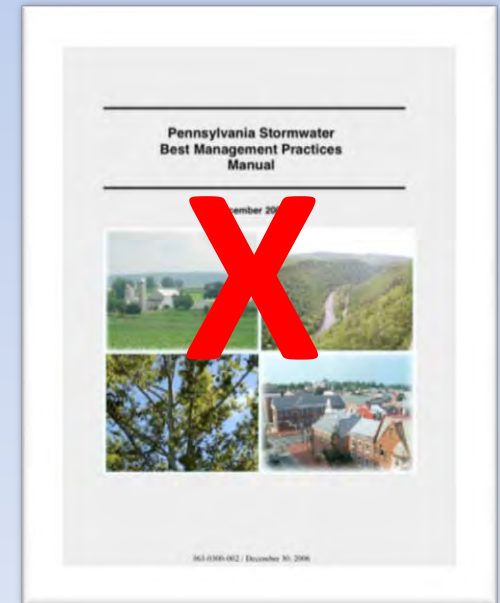
- NY Article 23
- 25 PA Code Chapter 78 – Oil and Gas
- BUT in PA Chapter 78 does NOT provide the same requirements for erosion & sediment control and stormwater as applied to other construction sites.



# PA Requirements

---

- Few requirements and submissions for sites under 5 acres.
- For sites over 5 acres, many exemptions and exceptions that are not available to other disturbance activities.
- Little review or oversight, instead self-monitoring.





# Additional Exemptions

---

Pa 25 Code Chapter 102.14 requires a 150 foot riparian buffer in Special Protection Waters...

Oil and gas activities are given an exemption **“so long as any existing riparian buffer is undisturbed to the greatest extent possible.”**

There are NO...

1. Regulatory processes or safeguards in place to assure that stormwater management measures are adequate.
2. Safeguards or consideration of factors such as:
  - Slopes
  - Soil types
  - Amount of vegetation and Protection of existing vegetation
  - Protection of water bodies
  - Adequate recharge for baseflow....



# PA Erosion & Sediment Requirements

---

Gas Exploration and Extraction facilities < 5 acres

- Are NOT required to obtain an E&S Control Permit.
- Must prepare an Erosion and Sediment Control Plan, but are NOT required to submit the Plan to PaDEP for review.
- PPC Plan (storage of chemicals, etc.) not required under 5 acres and can be general:

*“this PPC Plan applies to all well sites in Wayne County”*

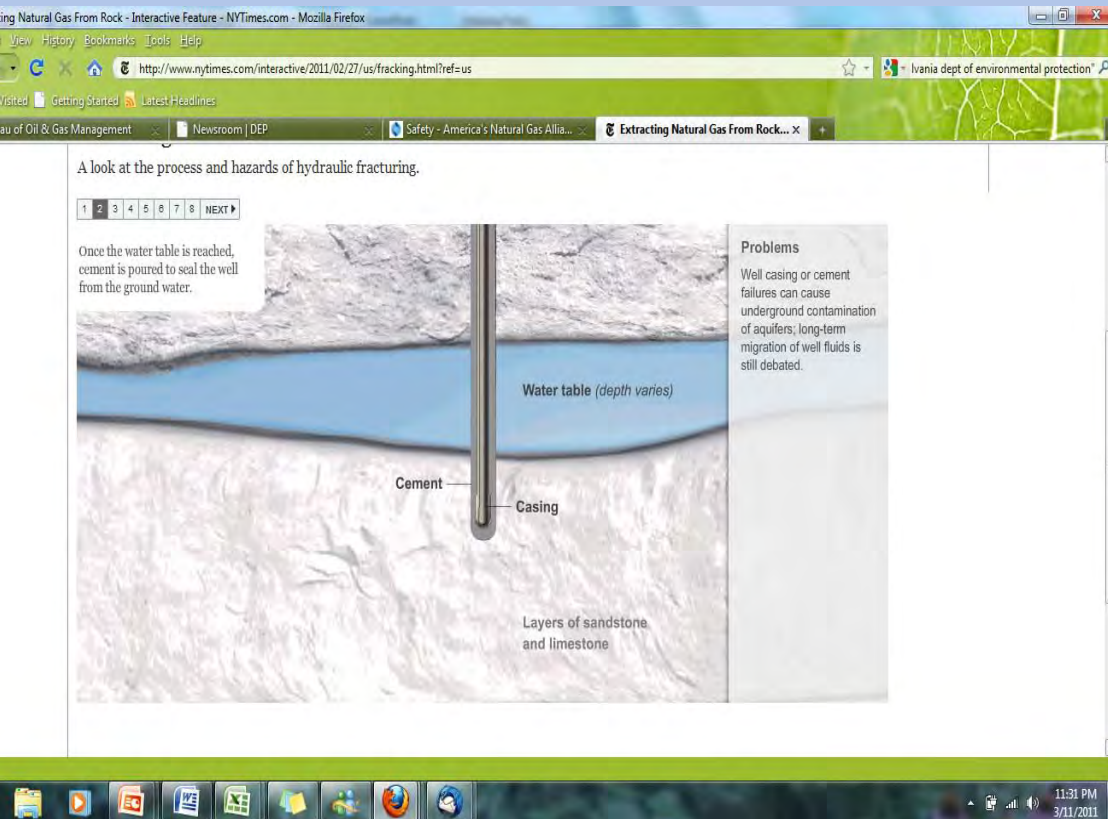
Woodland 1-1 Example





# Other Problems with DRBC regulations

- DRBC defers to PA's inadequate state standards for drilling, cementing, and casing construction (substandard Chap. 78 requirements)



- Air pollution from gas wells and wastewater impoundments is not addressed at all by the DRBC regulations, despite human health, air, and water impacts.



- Barnett Shale region: Air quality - Fort Worth, TX 4/05/2010

- Buffers and setbacks that DRBC proposes are not adequate enough – 500 foot setback a start but setbacks along the entirety of the borehole is needed





Rules would allow for fast-track approvals (approval by rule) with streamlined ED review without public input for much gas drilling & some withdrawals



DRBC is allowing centralized wastewater impoundments and allowing weak state standards to regulate them (PA 100 ft setback from waterbody)



# OTHER UPDATES



Three public hearings brought out hundreds to comment

Unauthorized hearing in Philly held March 8<sup>th</sup>





- NJ env committee in Senate just passed a ban on gas drilling and wastewater acceptance for the state of NJ – March 10<sup>th</sup>, 2011



- State of MD announced a two year moratorium on any gas drilling in the state

- Vitali introduces moratorium bill on drilling in PA state forests
- NY still has moratorium until Summer 2011



[www.delawariverkeeper.org](http://www.delawariverkeeper.org)



Faith Zerbe

Delaware Riverkeeper  
Network

215-369-1188 ext 110

[faith@delawariverkeeper.org](mailto:faith@delawariverkeeper.org)















Over 77 groups involved – DRN alone counted >10,000+ comments to DRBC this summer – meetings packed

