

# Water Resource Management Plan

## Mid-Year Progress Report to the WV Joint Legislative Oversight Commission on State Water Resources

West Virginia Department of Environmental Protection

Division of Water and Waste Management

Water Use Section

Brian A. Carr, P.G.

May 16, 2012

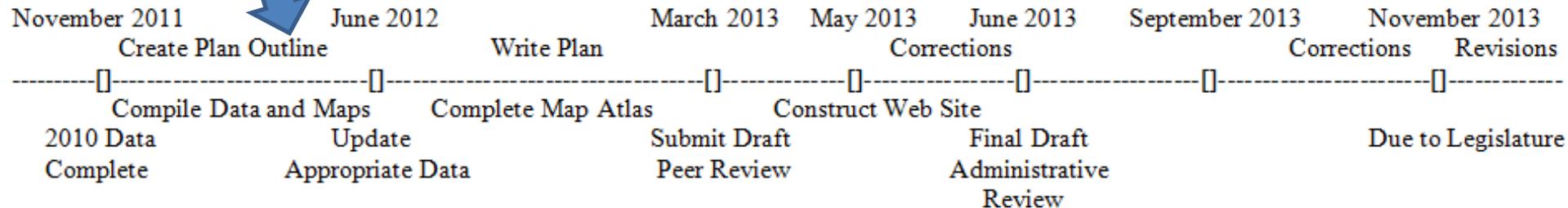


# Contents of Today's Report

- 2012-2013 Timeline
- Large Quantity User Survey
- Meetings with stakeholders update
- Groundwater Study and Mine Pool Atlas
- Water Withdrawal Guidance Tool update
- Small Stream Withdrawal Study
- Mine Pool Atlas Update
- Marcellus frac water tracking
- Oil and Gas House Bill 401 – WMP's
- Drought, Flood and Climate Change
- Water Use Section Challenges

# Water Management Plan Time Line

We are here



## Keep in mind:

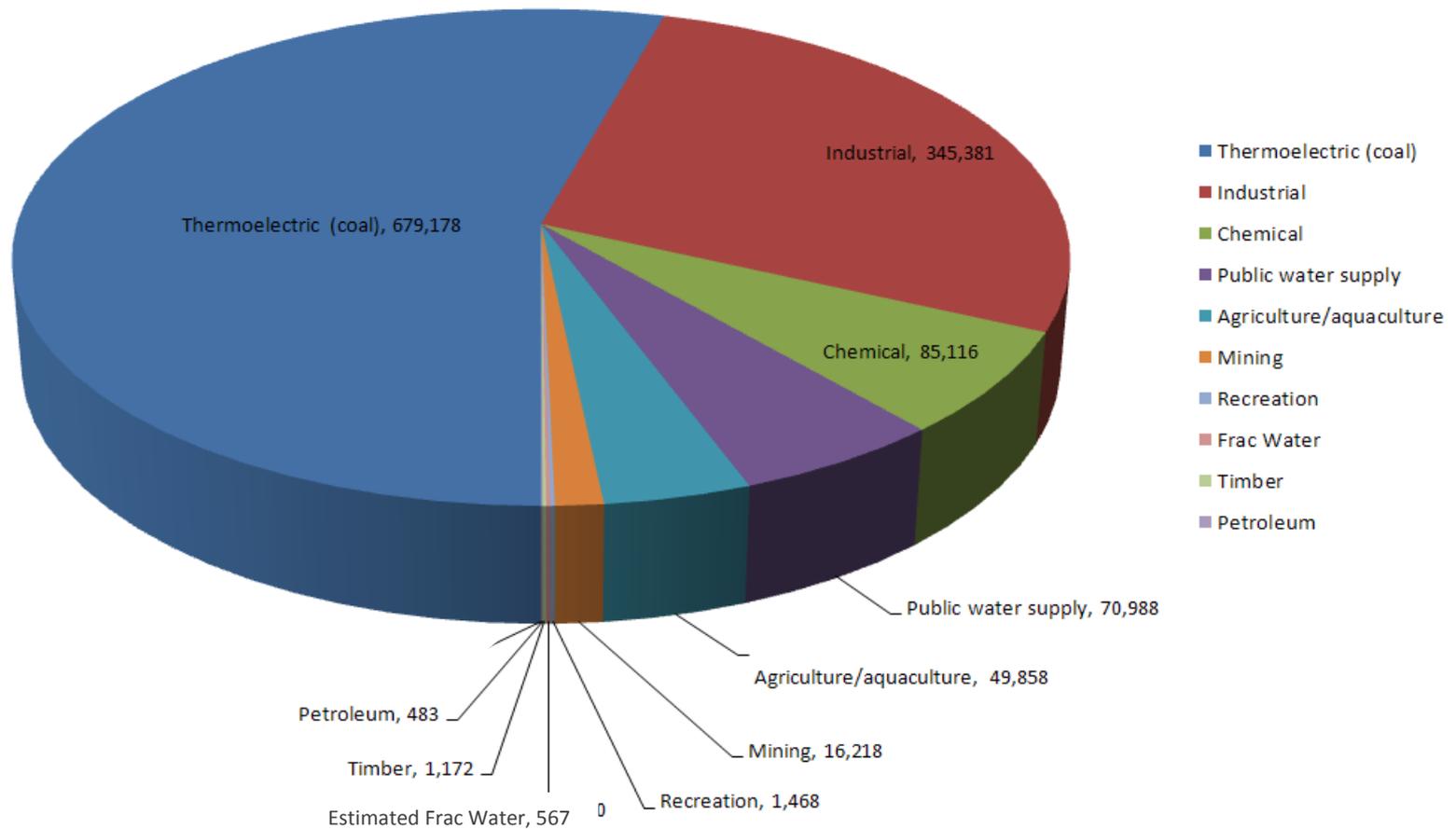
- The Water Management Plan will be a living document
- To be effective it will need to be continually monitored and updated regularly
- A great portion of the Plan will work symbiotically with an on-line web application

# Large Quantity User Survey

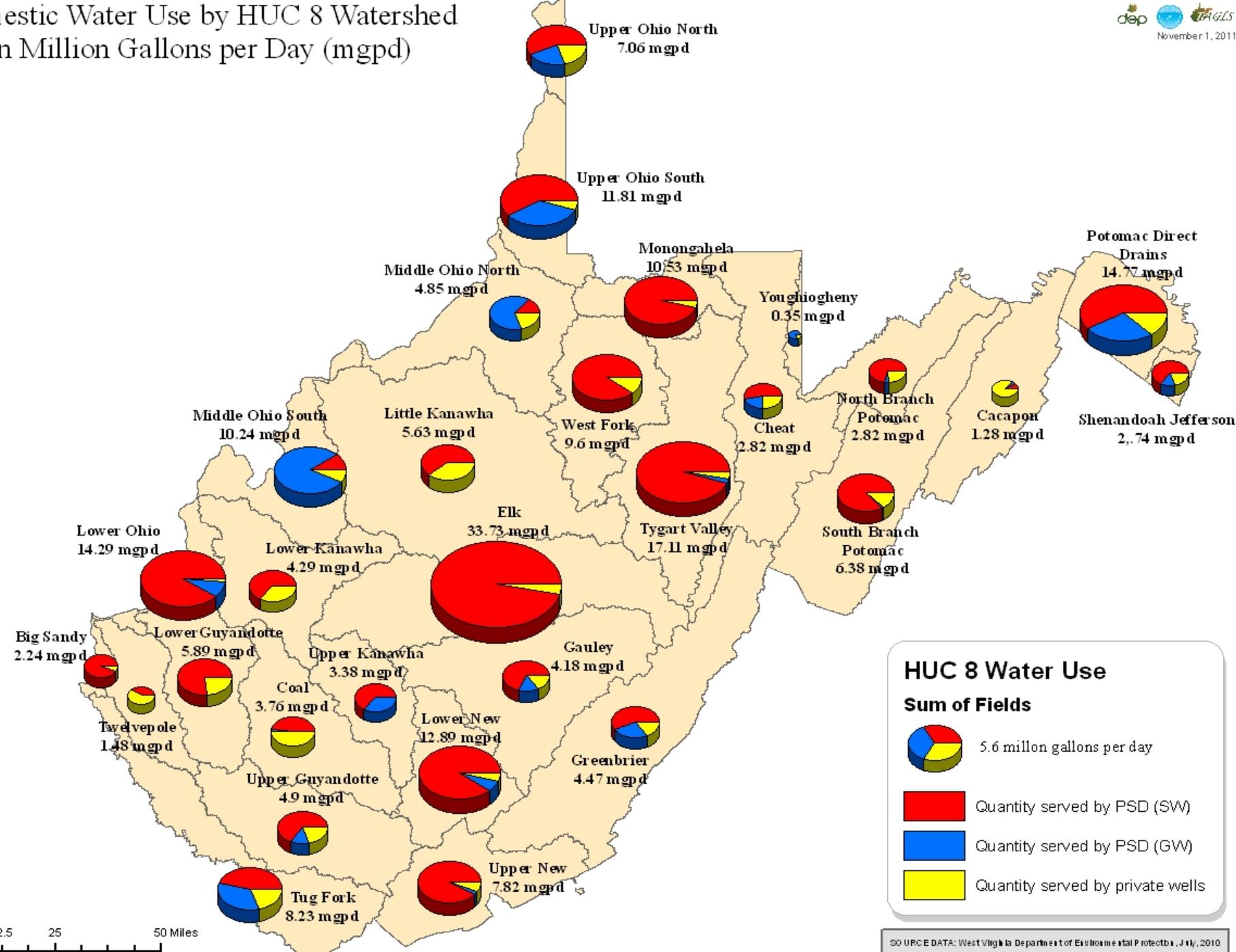
- We have received 100% of the 2011 surveys
- No NOV's issued = full compliance this year
- Now beginning data entry phase
- The results of the 2011 Survey will be reported to you as part of the annual report in November later this year

# 2010 Water Usage + Thermo-electric

**2010 Water Use by SIC Group (millions of gallons)  
(excluding Hydroelectric Facilities)**



# Domestic Water Use by HUC 8 Watershed in Million Gallons per Day (mgpd)



### HUC 8 Water Use

**Sum of Fields**

-  5.6 million gallons per day
-  Quantity served by PSD (SW)
-  Quantity served by PSD (GW)
-  Quantity served by private wells

SO URCE DATA: West Virginia Department of Environmental Protection, July, 2010

# WV Bottled Water in Gallons per year

- SWEET SPRINGS VALLEY WATER COMPANY 2,000,000
- BERKELEY CLUB BEVERAGES INC. 1,139,800
- GREEN ACRES REGIONAL CENTER INC 700,000
- UNITED DAIRY, INC. (CHARLESTON) 475,000
- WEST VIRGINIA PRIDE OF THE MOUNTAINS CO 200,000
- TYLER MOUNTAIN WATER COMPANY, INC (POCA) 31,500?
- ALLEGHENY LODGE ENTERPRISES, LLC 26,000
- CAPON SPRINGS & FARMS, INC. 16,000

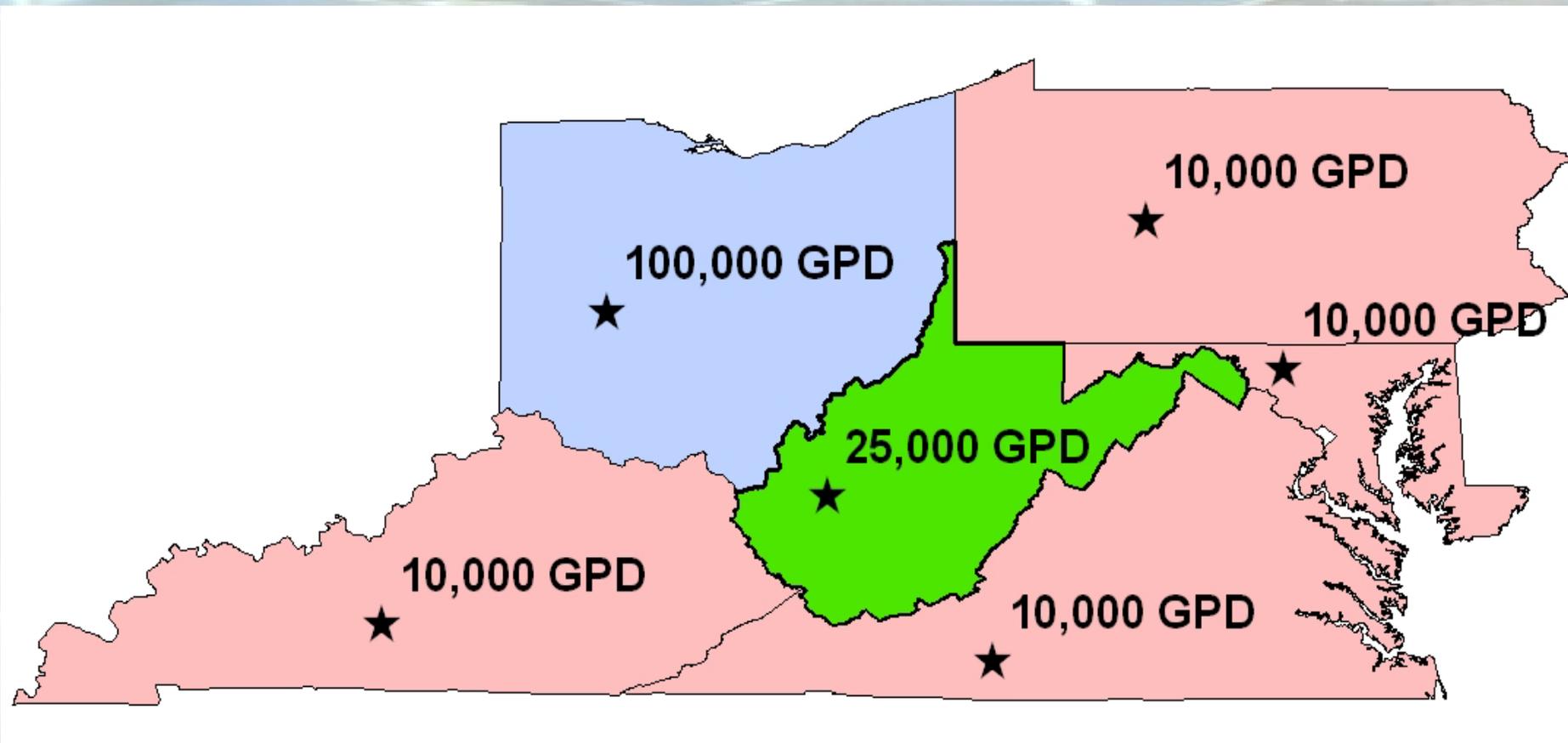
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Total 4,588,300

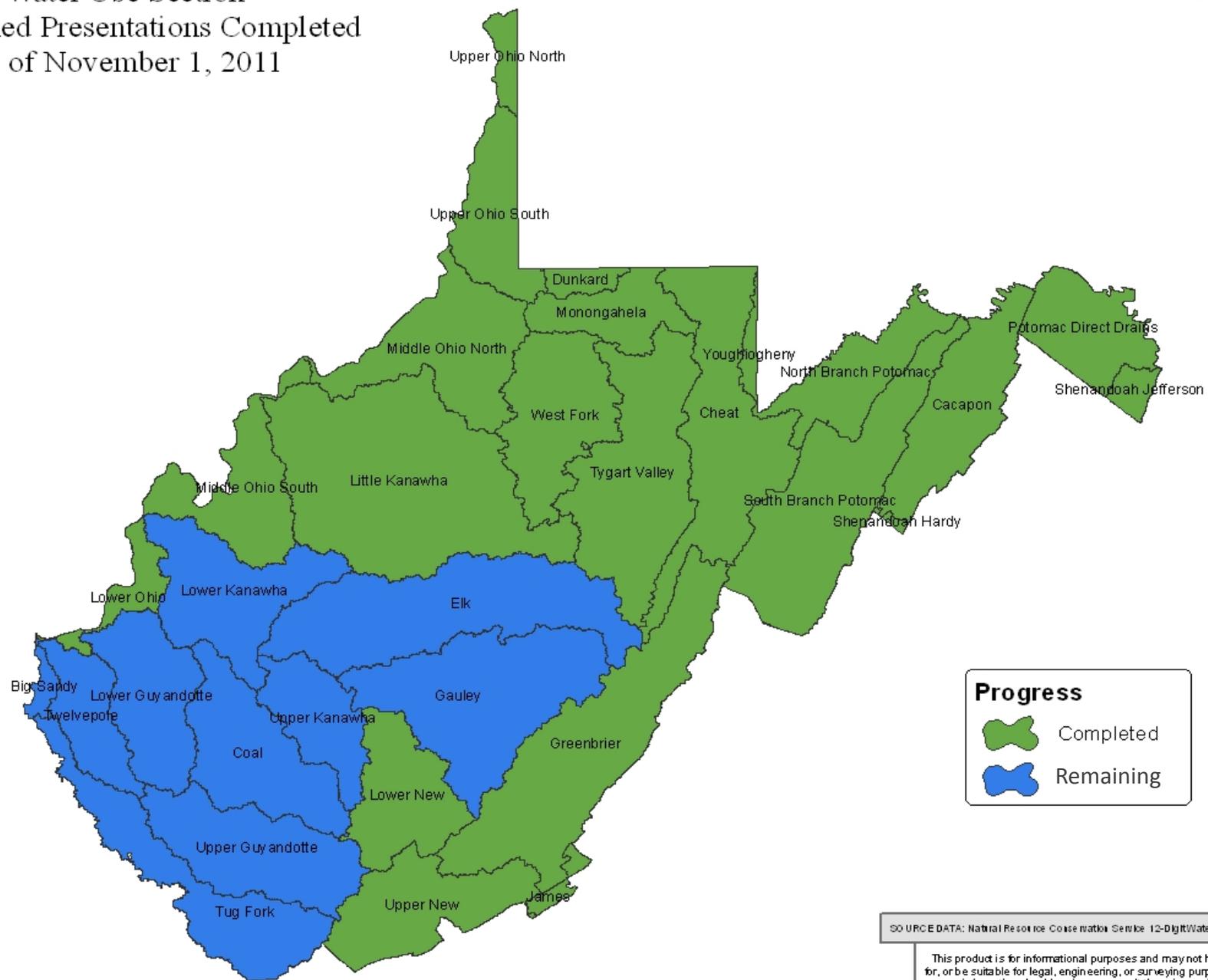




# Should we lower the limit?

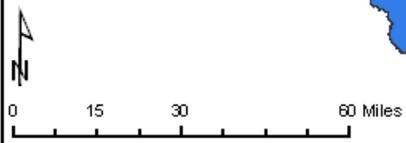


# Water Use Section Watershed Presentations Completed as of November 1, 2011



**Progress**

-  Completed
-  Remaining



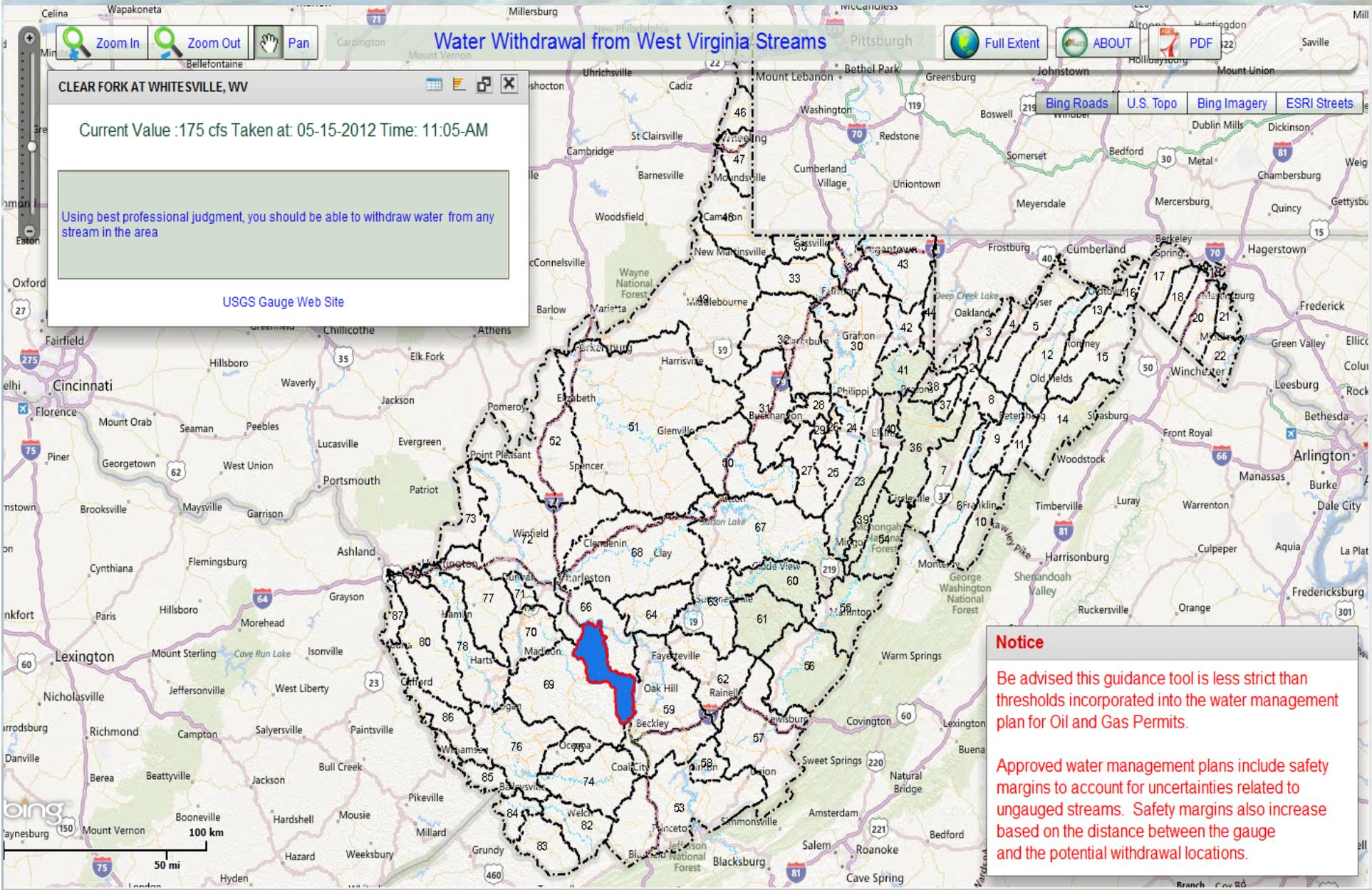
SOURCE DATA: Natural Resource Conservation Service 12-Digit Watersheds; 30 Jan 2009.

This product is for informational purposes and may not have been prepared for, or be suitable for, legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the appropriate usage of the information.

# Water Withdrawal Tool Updates

- We have Upgraded the tool
  - Thresholds equate to summer base flow
  - The tool is now more consistent with Marcellus Water Management Plans
- USGS small stream project
  - Will address the overall gauge network coverage
  - Determine gauges that are regionally representative
  - Address potential need for additional gauges

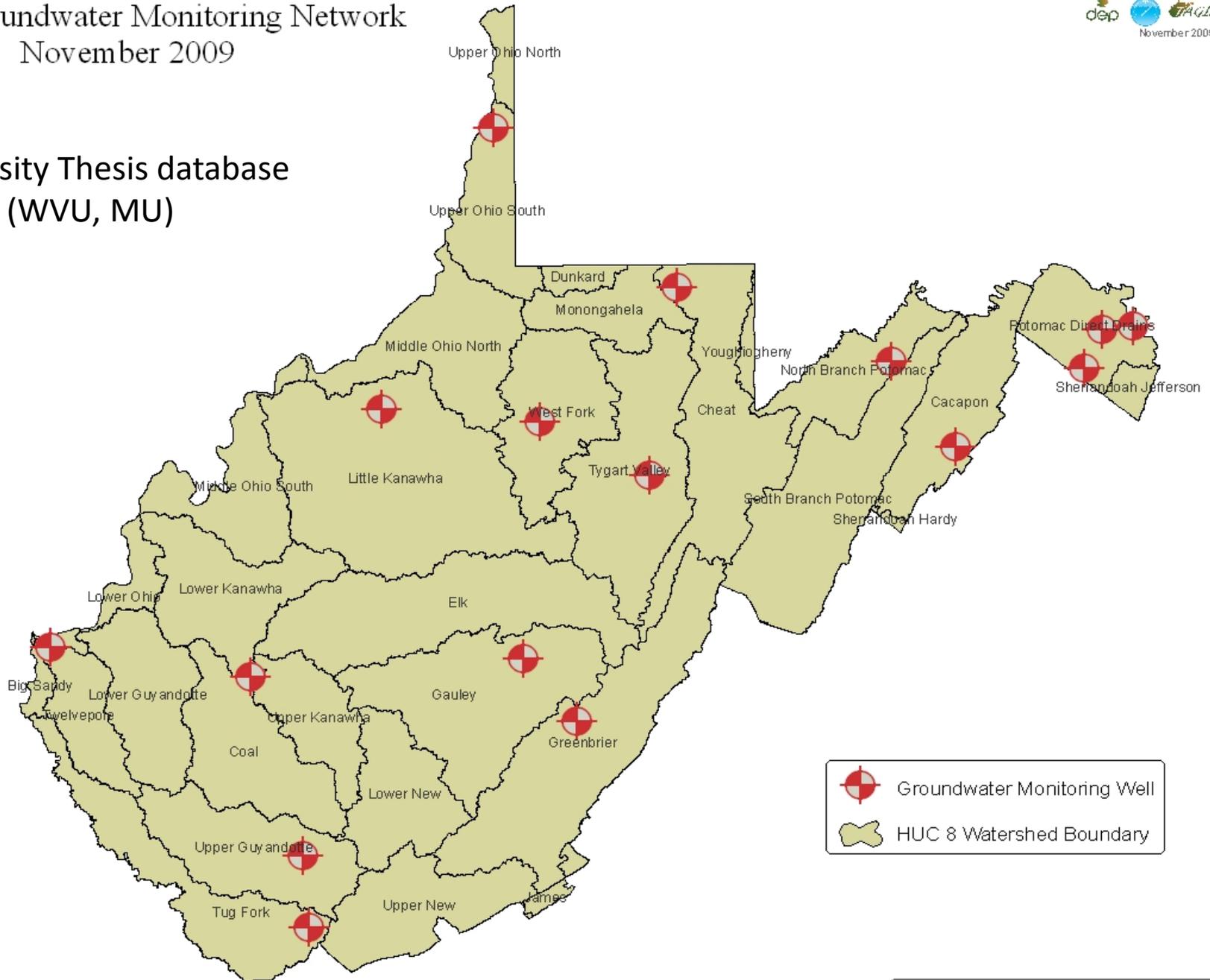
# Water Withdrawal Tool Updates

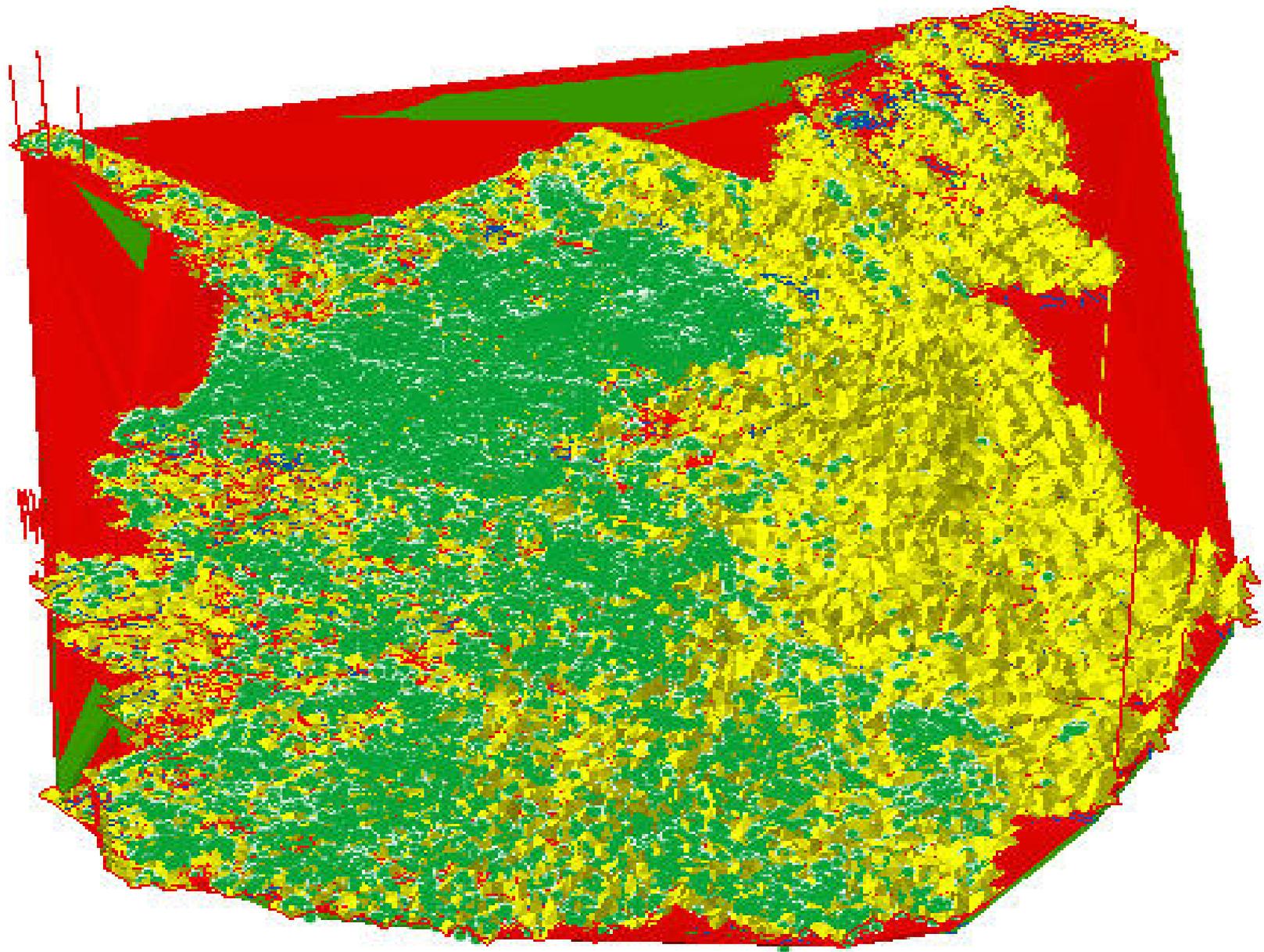


# Current Groundwater Monitoring Network

November 2009

- University Thesis database search (WVU, MU)





# Mine Pool Atlas



## SUMMARY OF POTENTIAL TOTALLY FLOODED UNDERGROUND MINING BY COAL SEAM\*

Group/Formation	Coal Seam	No. of Mines	Mean coal thickness (feet)	Min. footprint area (acres)	Max. footprint area (acres)	Mean footprint area (acres)	Median footprint area (acres)	Total footprint area (acres)	Estimated void volume (acre feet)	Max. potential storage (million gallons)
<b>DUNKARD GROUP</b>	Washington	0								
	Waynesburg A	0								
<b>MONONGAHELA GROUP</b>	Waynesburg	0								
	Uniontown	0								
	<b>Sewickley</b>	10	5.73	0.01	494.35	109.84	9.40	1,098.45	3,223.36	1,050.49
	<b>Redstone</b>	5	3.57	5.13	486.29	212.93	86.26	1,064.63	1,777.56	579.31
	<b>Pittsburgh</b>	46	6.38	0.92	20,204.27	3,933.91	641.06	180,959.81	625,388.68	203,814.17
<b>CONEMAUGH GROUP</b>	Elk Lick	0								
	Harlem	0								
	Bakerstown	0								
	Brush Creek	0								
	Mahoning	0								
<b>ALLEGHENY FORMATION</b>	<b>Upper Freeport</b>	3	5.27	17.38	1,592.89	582.25	136.47	1,746.75	3,621.87	1,180.37
	Lower Freeport	0								
	Upper Kittanning	1		402.06	402.06	402.06	402.06	402.06		
	<b>Middle Kittanning</b>	5	5.39	81.75	4,755.03	1,879.00	172.19	9,395.02	24,387.17	7,947.78
	Lower Kittanning	0								
	Number 6 Block	0								
	Upper Number 5 Block	0								
	Number 5 Block	0								
Little Number 5 Block	0									
<b>TOTAL</b>	<b>21 seams/14 with mines &gt; 500 acres</b>	<b>194</b>	<b>71.07</b>	<b>1,775.17</b>	<b>101,914.86</b>	<b>28,595.98</b>	<b>16,911.24</b>	<b>393,811.87</b>	<b>1,106,549.98</b>	<b>360,624.64</b>

\*Includes above, near, and below drainage underground mines — seams containing below drainage underground mines > 500 acres in area are highlighted and major seams are in boldface

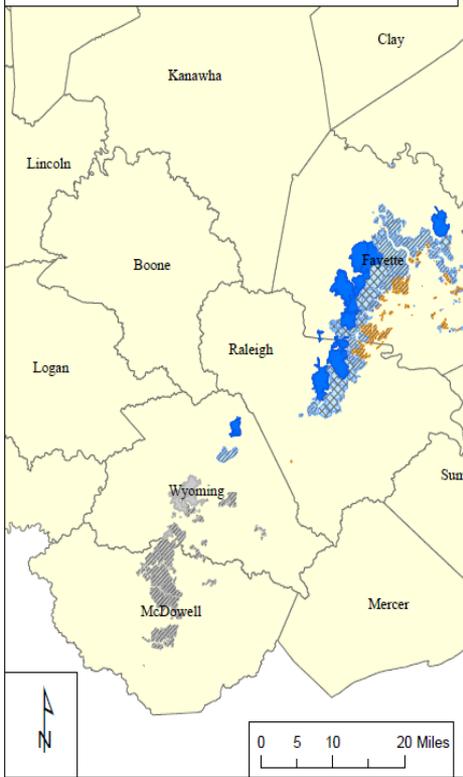
## SUMMARY OF POTENTIAL PARTIALLY FLOODED UNDERGROUND MINING BY COAL SEAM\*

Group/Formation	Coal Seam	No. of Mines	Mean coal thickness (feet)	Min. footprint area (acres)	Max. footprint area (acres)	Mean footprint area (acres)	Median footprint area (acres)	Total footprint area (acres)	Estimated void volume (acre feet)	Max. potential storage (million gallons)
DUNKARD GROUP	Washington	0								
	Waynesburg A	0								
MONONGAHELA GROUP	Waynesburg	4		0.47	30.97	17.74	19.76	70.95		
	Uniontown	0								
	<b>Sewickley</b>	<b>61</b>	<b>5.03</b>	<b>0.03</b>	<b>12,846.57</b>	<b>405.83</b>	<b>18.05</b>	<b>24,755.47</b>	<b>69,988.21</b>	<b>22,809.16</b>
	<b>Redstone</b>	<b>161</b>	<b>4.51</b>	<b>0.01</b>	<b>4,598.10</b>	<b>100.17</b>	<b>17.47</b>	<b>16,127.87</b>	<b>36,338.05</b>	<b>11,842.57</b>
	<b>Pittsburgh</b>	<b>564</b>	<b>6.06</b>	<b>0.01</b>	<b>14,923.99</b>	<b>350.55</b>	<b>22.44</b>	<b>197,712.71</b>	<b>673,947.07</b>	<b>219,639.35</b>
CONEMAUGH GROUP	Elk Lick	0								
	Harlem	0								
	<b>Bakerstown</b>	<b>54</b>	<b>3.24</b>	<b>0.17</b>	<b>1,952.97</b>	<b>122.52</b>	<b>24.26</b>	<b>6,616.09</b>	<b>14,114.95</b>	<b>4,600.06</b>
	Brush Creek	0								
	Mahoning	0								
ALLEGHENY FORMATION	<b>Upper Freeport</b>	<b>202</b>	<b>4.75</b>	<b>0.04</b>	<b>7,005.07</b>	<b>222.10</b>	<b>26.50</b>	<b>44,864.77</b>	<b>136,630.31</b>	<b>44,527.82</b>
	Lower Freeport	2		3.07	118.82	60.95	60.95	121.90		
	Upper Kittanning	1		58.09	58.09	58.09	58.09	58.09		
	<b>Middle Kittanning</b>	<b>16</b>	<b>5.05</b>	<b>0.06</b>	<b>6,191.64</b>	<b>643.78</b>	<b>2.99</b>	<b>10,300.50</b>	<b>23,692.48</b>	<b>7,721.38</b>
	Lower Kittanning	6		2.38	813.96	236.82	71.82	1,420.91		
	Number 6 Block	16		10.51	282.57	78.05	60.97	1,248.87		
	Upper Number 5 Block	71		0.60	547.03	83.64	32.08	5,938.39		
	<b>Number 5 Block</b>	<b>353</b>	<b>3.93</b>	<b>0.02</b>	<b>2,420.30</b>	<b>90.45</b>	<b>17.42</b>	<b>31,928.68</b>	<b>60,026.64</b>	<b>19,562.68</b>
Little Number 5 Block	11		11.48	713.54	136.54	53.18	1,501.90			

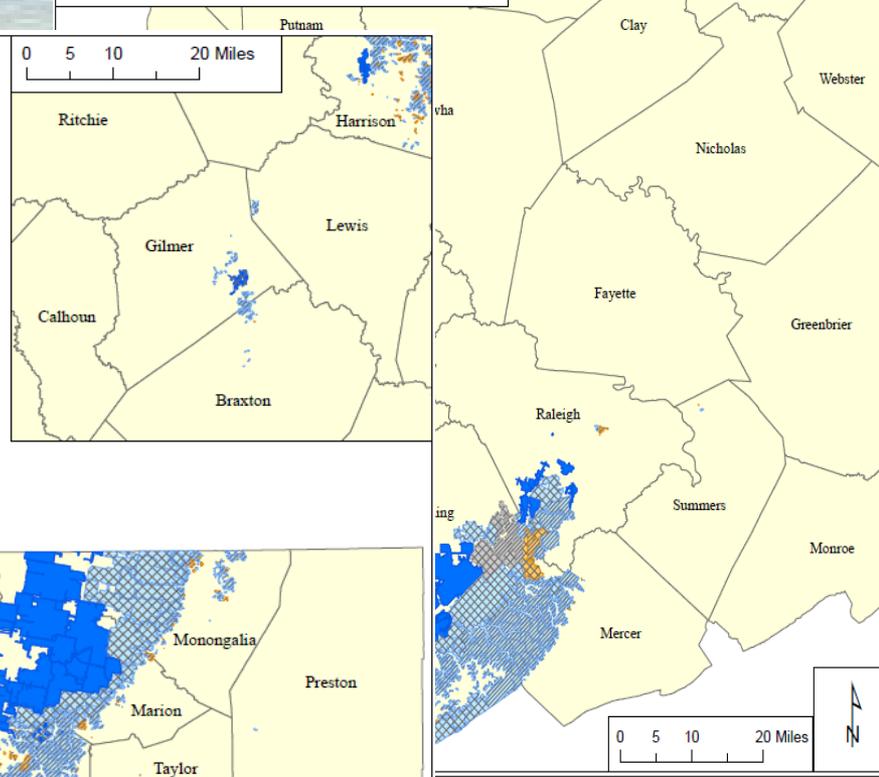
<b>TOTAL</b>	<b>58 seams/19 with mines&gt;500 acres</b>	<b>5,191</b>	<b>87.19</b>	<b>921.34</b>	<b>235,510.78</b>	<b>13,561.43</b>	<b>3,883.14</b>	<b>1,499,582.94</b>	<b>3,138,975.76</b>	<b>1,022,992.20</b>
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\*Includes above and near drainage underground mines — seams containing near drainage underground mines > 500 acres in area are highlighted and major seams are in boldface

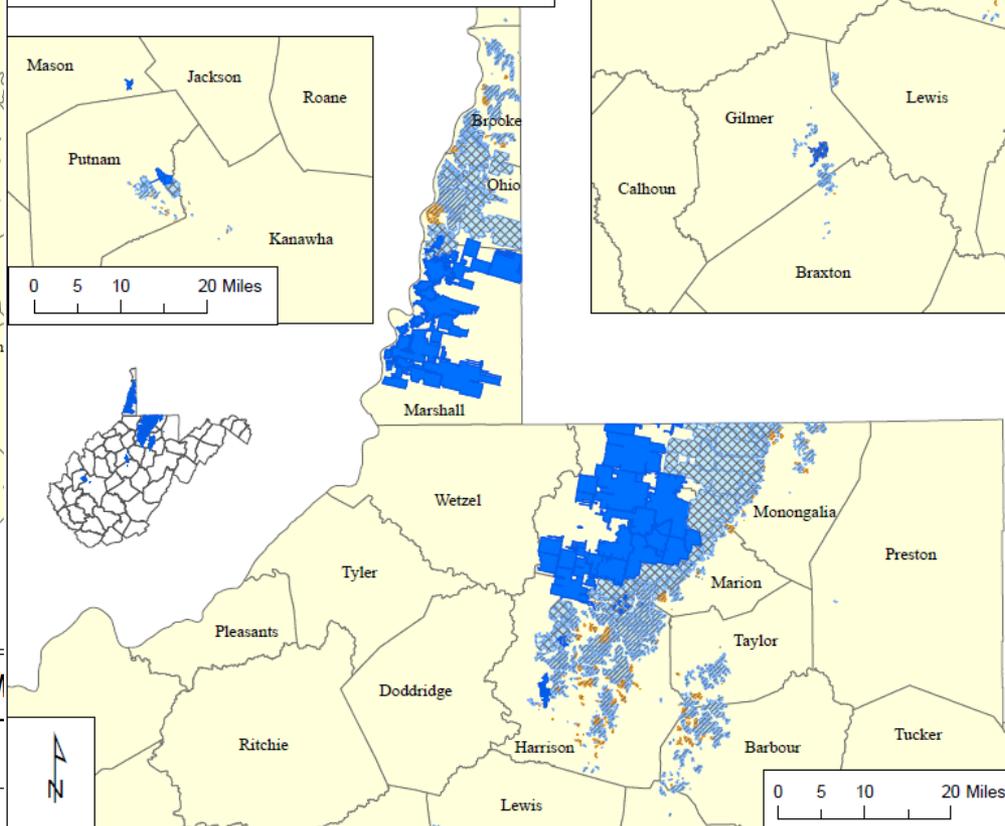
# Sewell Mine Pools Seam Overview



# Pocahontas No. 3 Mine Pools Seam Overview



# Pittsburgh Mine Pools Seam Overview



## Legend

- Position**
- Above Drainage
  - Near Drainage
  - Below Drainage

## Potential Extent of Flooding

- Undetermined
- Flooded areas unlikely
- Partially flooded
- Totally flooded

## Sewell M

No. of Mines	19
Mean coal thickness (feet)	3.63
Min. foot print area (acres)	1.00
Max. foot print area (acres)	7,469.50
Mean foot print area (acres)	990.66
Median foot print area (acres)	174.18
Total foot print area (acres)	18,822.60
Estimated void volume (acre feet)	37,037.88
Max. potential storage (million gallons)	12,070.64

## Legend

- Position**
- Above Drainage
  - Near Drainage
  - Below Drainage

## Potential Extent of Flooding

- Undetermined
- Flooded areas unlikely
- Partially flooded
- Totally flooded

## Pittsburgh Mine Pool Statistics

	Undetermined	Potentially flooded areas unlikely	Potentially partially flooded	Potentially totally flooded
No. of Mines	0	196	564	46
Mean coal thickness (feet)	0.00	5.61	6.06	6.38
Min. foot print area (acres)	0.00	0.01	0.01	0.92
Max. foot print area (acres)	0.00	652.31	14,923.99	20,204.27
Mean foot print area (acres)	0.00	42.05	350.55	3,933.91
Median foot print area (acres)	0.00	6.97	22.44	641.06
Total foot print area (acres)	0.00	8,242.18	197,712.71	180,959.81
Estimated void volume (acre feet)	0.00	28,227.65	673,947.07	625,388.68
Max. potential storage (million gallons)	0.00	9,199.39	219,639.35	203,814.17

## Pocahontas No. 3 Mine Pool Statistics

	Undetermined	Potentially flooded areas unlikely	Potentially partially flooded	Potentially totally flooded
No. of Mines	19	56	211	13
Mean coal thickness (feet)	3.63	4.27	4.72	4.10
Min. foot print area (acres)	1.00	0.02	0.03	23.38
Max. foot print area (acres)	7,469.50	4,312.28	24,666.84	21,361.85
Mean foot print area (acres)	990.66	142.19	771.26	3,350.77
Median foot print area (acres)	174.18	0.73	168.10	1,247.45
Total foot print area (acres)	18,822.60	7,962.37	162,736.63	43,560.05
Estimated void volume (acre feet)	37,037.88	13,978.94	396,114.19	98,167.56
Max. potential storage (million gallons)	12,070.64	4,555.74	129,093.61	31,992.81

# We have made updates to the Marcellus Frac Water Database

- Better reports
- Better search engine
- Improved instruction manual
- Beginning analysis of the data


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## Summary Frac Water Use Report

Start Date: 1/1/2011 End Date: 11/4/2011

Report generated: Tuesday, November 08, 2011 2:58:40 PM



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Water Use Volumes by Operator

Operator:	ActiveWell Sites*	Amount Withdrawn: (gal)	Amount Injected: (gal)	Amount Recovered: (gal)	Percent Recovered:	Amount Disposed: (gal)
Antero Resources	7	58,904,367	81,695,954	11,144,617	13.64%	10,175,856
Chesapeake Appalachia	10	83,599,376	106,786,008	4,535,242	4.25%	4,535,244
EQT Production Company	23	108,815,784	111,190,506	2,723,405	2.45%	2,915,955
Gastar Exploration USA Inc.	1	15,388,632	12,868,632	602,537	4.68%	602,537
Grenadier Energy Partners LLC	4	13,406,232	13,406,232	3,990,294	29.76%	964,053
Hunt Marcellus Operating Company	2	11,287,920	11,287,920	797,076	7.06%	524,902
Jay Bee Oil and Gas Inc	1	5,180,168	4,788,000	210,000	4.39%	210,000
Mark Adams Company	2	0	0	0	#Div/0!	0
Range Resources Appalachia LLC	3	37,983,456	38,551,212	2,110,686	5.48%	2,110,686
TRANS ENERGY INC.	3	18,101,454	18,101,454	1,719,102	9.50%	1,718,652
Triana Energy LLC	1	7,666,134	3,858,134	424,242	11.00%	479,514
WV Department of Environmental Protection	1	6,000,000	5,000,000	400,000	8.00%	400,000
XTO Energy Inc	6	25,335,399	25,213,524	1,764,462	7.00%	1,570,506

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Statewide Totals:	ActiveWell Sites*	Total Withdrawn: (gal)	Total Injected: (gal)	Total Recovered: (gal)	Percent Recovered:	Total Disposed: (gal)
	64	391,668,922	432,747,576	30,421,663	7.03%	26,207,905

\* Active well sites may contain more than one individual well; contact the DEP's Water Use Section for any questions regarding individual wells or the data contained herein (304) 926-0499 ext. 1271

west virginia department of environmental protection
Page 1 of 1
Summary Frac Water Use Report

# The Office of Oil and Gas reported that:

- 542 horizontal wells were permitted in 2011
- Expect 639 horizontal wells to be permitted in 2012

If all the permitted wells were drilled and used an average 5 million gallons per well:

- Total predicted water use in 2011 = 2.7 Billion Gallons
- Reported actual use was approximately 1.2 Billion Gallons  
(only ½ permitted wells were actually drilled)
- Total predicted water use in 2012 = 3.52 Billion Gallons
- Expect to see ½ the water use or 1.7 Billion Gallons  
(about the same water consumption as Parkersburg uses per year)

⚠ A gas company has 2 years to drill the well, and 1 more year to report their water use. So we can expect as much as a 3 year gray zone in our data.

# Water Management Plans In Accordance With the Horizontal Well Act



west virginia department of environmental protection

2010/07/06

# Water Management Plans

- ✓ Location
- ✓ Volume
- ✓ Months
- ✓ Disposal
- ✓ Additives

05/31/2011

# Goals

- **Easy for companies to submit plans**
- **Searchable, transparent and consistent**
- **Easy for enforcement by inspectors**
- **Minimize truck traffic while protecting our waters**

# Underlying Theme

- **At X location we believe there will be this much available water. At Y pump rate you will be protective of Aquatic Life**



west virginia department of environmental protection  
 601 57th Street SE  
 Charleston, WV 25304

**WATER MANAGEMENT PLAN/  
 WATER ADDENDUM**  
**For Horizontal Oil and Gas Well Permits**  
 Office of Oil and Gas  
 Phone: (304) 926-0499

DEP Office Use only	
Date Received by Oil & Gas:	
Administratively Complete – Oil & Gas: <input type="checkbox"/> Yes <input type="checkbox"/> No:	
Date Received by Water Use:	
Complete – Water Use: <input type="checkbox"/> Yes <input type="checkbox"/> No	

**Section I - Operator Information**

API: 47 - \_\_\_\_\_ - \_\_\_\_\_  Modification?  
County Permit

Operator Name	
Operator ID	*Registered in the Frac Water Reporting Website? Yes <input type="checkbox"/> No <input type="checkbox"/>
Mailing Address	Contact Name/Title (Water Resources Manager)
Contact Phone	Contact Email

\*If no, the operator will be required to register with the WVDEP Water Use Section, contact [dep.water.use@wv.gov](mailto:dep.water.use@wv.gov)

**Section II - Well Overview**

Operator's Well Number			
Anticipated Frac Date	Location (decimal degrees, NAD 83)		
	Latitude	Longitude	County

**Section III – Source Water Overview (check all that apply)**

Streams/Rivers <input type="checkbox"/>	Lakes/Reservoirs <input type="checkbox"/>	Ground Water <input type="checkbox"/>	Purchased Water (PSD) <input type="checkbox"/>
Purchased Water (Private) <input type="checkbox"/>	Recycled Frac Water <input type="checkbox"/>	Multi-Site Impoundment <input type="checkbox"/>	
Other (describe):			
Total anticipated water volume to be used (gal):			

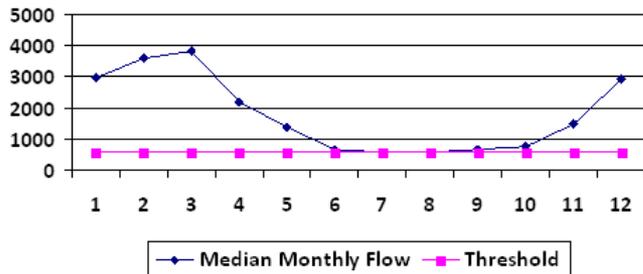
### Intake Detail

API Number:  Operator:

Source ID:  Source Name:  Source Latitude:   
HUC\_8\_Code:  County:  Source Longitude:   
Drainage Area (sq. mi.):  Anticipated withdrawal start date:   
Anticipated withdrawal end date:   
Total Volume from Source (gal):   
Max. Pump rate (gpm):   
 Endangered Species?  Mussel Stream?  
 Trout Stream?  Tier\_3?  
 Regulated Stream?   
 Proximate PSD?   
 Gauged Stream?  
Reference Gauge:    
Drainage Area (sq. mi.):  Gauge Threshold (cfs):

Month	Median monthly flow (cfs)	Threshold	Estimated Available water (cfs)
<input type="text"/>	<input type="text"/>	#Type!	#Type!

### Water Availability Profile



### Water Availability Assessment of Location

Base Threshold (cfs)  #Type!  
Demand on Stream (cfs):   
Pump rate (cfs):   
Headwater Safety (cfs):   
Ungauged Stream Safety (cfs):   
Final Threshold (cfs)  #Type!  
Min. Gauge Reading (cfs)  #Type!  
Passby at Location:  #Type!

## General intake information

- Flags for sensitive aquatic life
- Location details
  - Basin area
- Reference Gauge Information
  - Basin area
  - Statistically-based threshold (point where withdraws must stop)

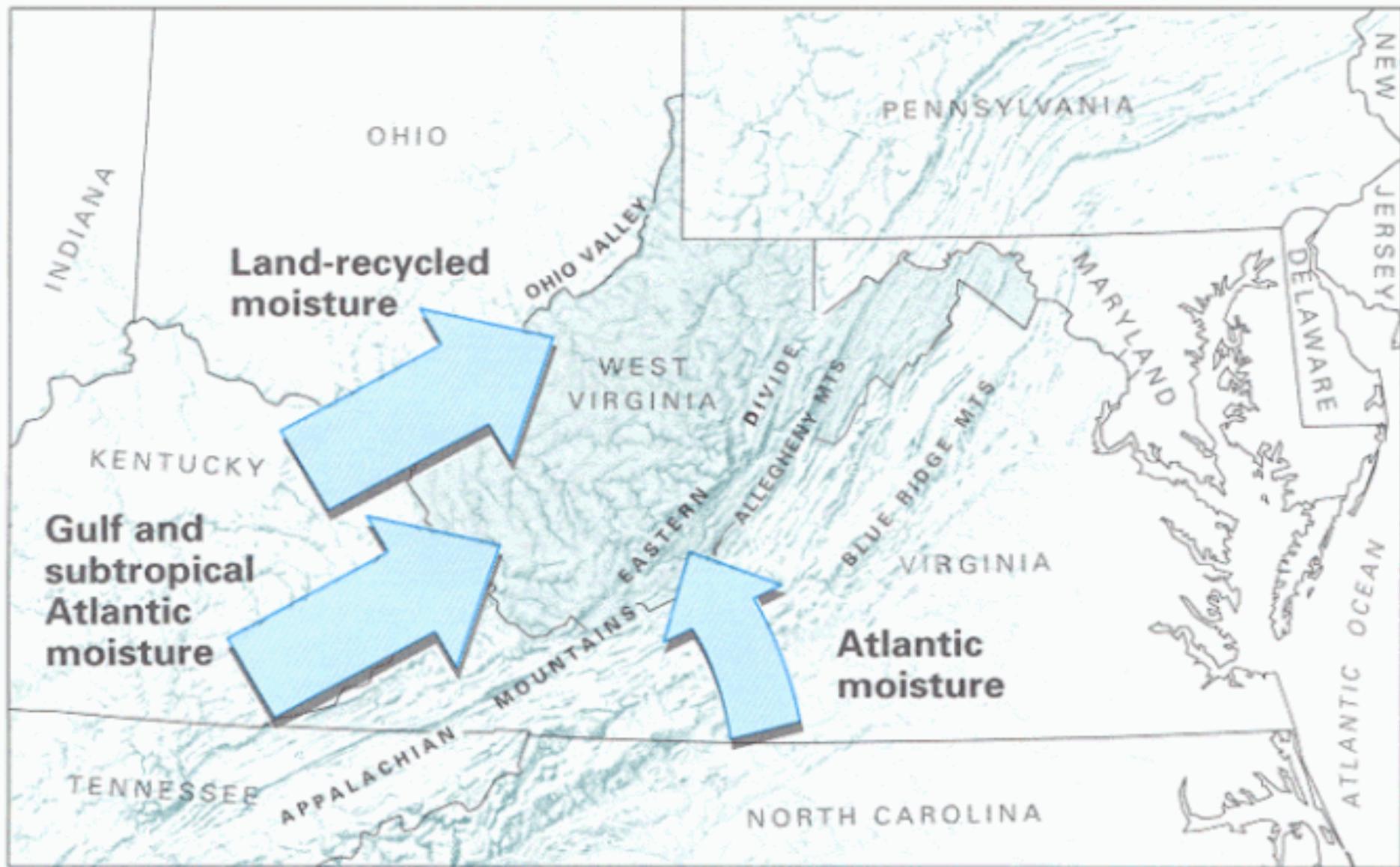
## Water Availability Information

- Estimated median monthly flow
- Known water demands
  - LQU
  - Marcellus
- Safety factors (where appropriate)

**Minimum required flow @ Gauge**  
**Minimum pass-by flow @ location**

# Drought and Climate Change

- Droughts are less of a problem in WV than floods
- Short-term droughts can be detrimental to local agricultural communities and can limit surface-water supply.
- The drought of 1929-32 was the most severe in West Virginia's recorded history. Some streams that have drainage areas greater than 900 mi<sup>2</sup> (square miles) had periods of zero flow during the summer and fall of 1930.
- At some precipitation stations, annual precipitation was about one-half of normal.
- Extended, severe droughts such as that of 1929-32 occur in West Virginia about every 25 years on average according to Water Supply Paper 2375.



**Figure 1.** Principal sources and patterns of delivery of moisture into West Virginia. Size of arrow implies relative contribution of moisture from source shown. (Sources: Moisture delivery data from Douglas R. Clark and Andrea Lage, Wisconsin Geological and Natural History Survey.)



6 Climate Zones of WV

# Droughts and Floods on Record

**Table 1.** Chronology of major and other memorable floods and droughts in West Virginia, 1877-1988

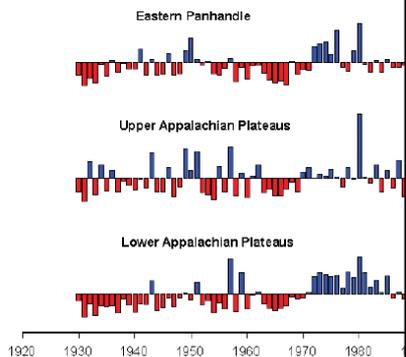
[Recurrence interval: The average interval of time within which streamflow will be greater than a particular value for floods or less than a particular value for droughts. Source: Geological Survey, State and local reports, and newspapers]

Flood or drought	Date	Area affected ( <a href="#">fig. 2</a> )	Recurrence interval (years)
Flood	1877-88	Potomac and Monongahela River basins.	>50
Flood	1912	Big Sandy Creek and Tygart Valley River.	25 to >50
Flood	1918	Greenbrier and Cheat Rivers	>50
Drought	1929-32	Statewide	>25
Flood	1932	Gauley, Greenbrier, and Tygart Valley Rivers.	>50
Flood	Mar. 9-22, 1936	Potomac River basin and Cheat River.	25 to >100
Drought	1940-42	Regional drought	>25
Flood	1949	Potomac River basin	>50
Flood	June 25, 1950	West Fork River, Middle Island Creek, and Little Kanawha River.	25 to >50
Drought	1952-54	Statewide	10 to >25
Flood	Mar. 6-19, 1963	Tug Fork, Guyandotte, Big Sandy, Little Kanawha, Cheat, and Greenbrier River basins.	25 to 100
Drought	1963-70	Statewide	>25
Flood	Mar. 7, 1967	Kanawha and Monongahela River basins.	25 to >50
Flood	Feb. 26, 1972	Buffalo Creek	Unknown
Flood	Apr. 4-5, 1977	Tug Fork and Guyandotte River.	25 to >100
Flood	1980	Lost and Little Grave Creeks	>100
Flood	1984	Tug Fork and Guyandotte River.	25 to >50
Flood	Nov. 4-5, 1985	North-central and eastern areas of State.	25 to >100
Drought	1987-88	Statewide	Unknown

In cooperation with the West Virginia Department of Environmental Protection,  
Division of Water and Waste Management

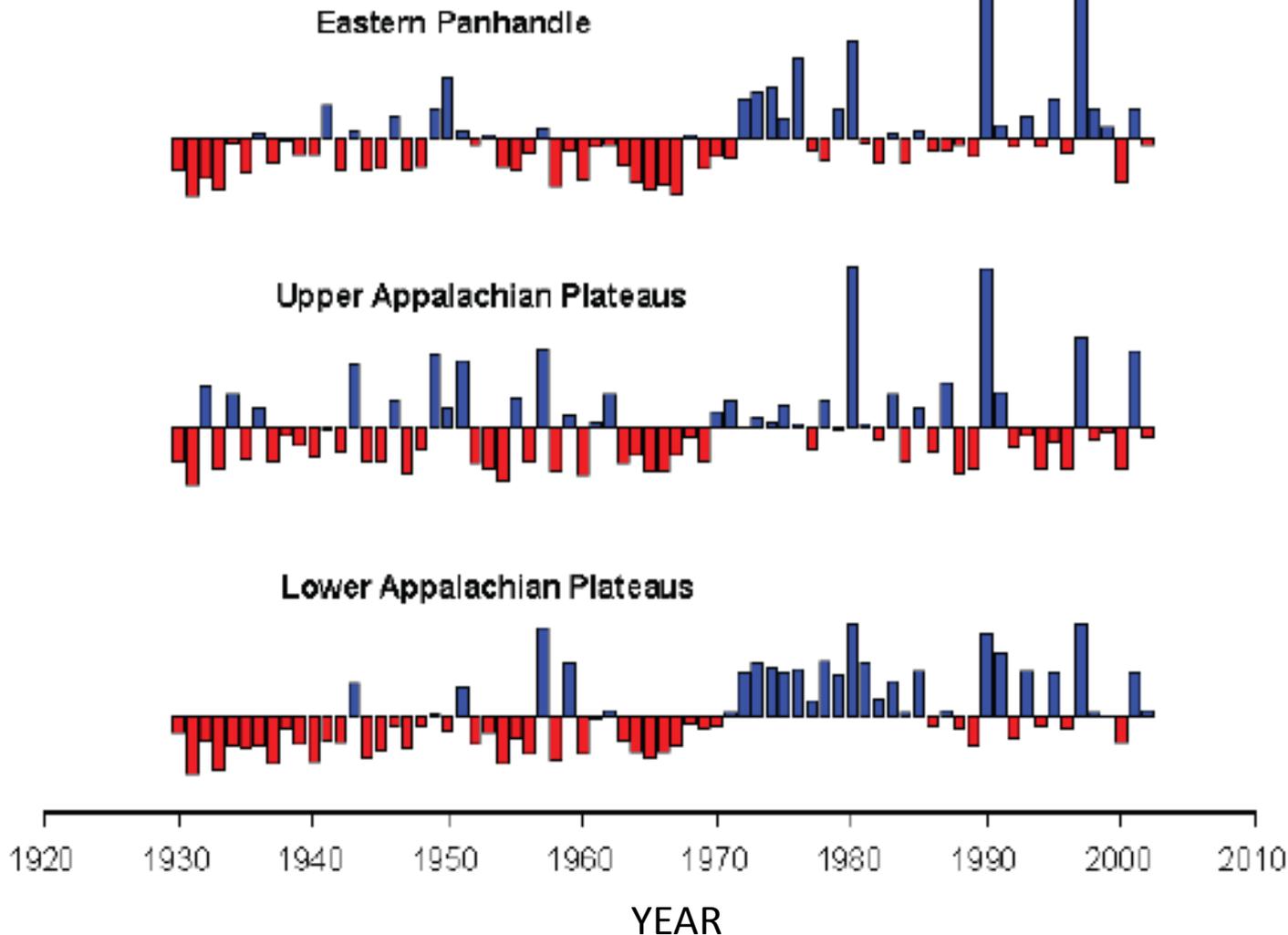
**Low-Flow Analysis and Selected Flow Statistics  
Representative of 1930–2002 for Streamflow-Gaging  
Stations In or Near West Virginia**

**Red** bars = drought like conditions  
**Blue** bars  $\geq$  normal conditions

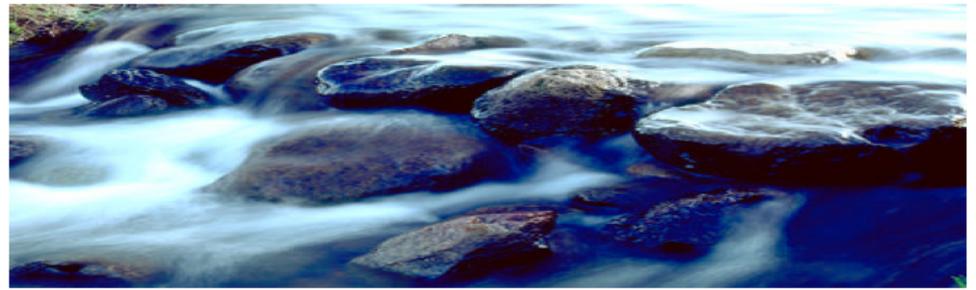


Scientific Investigations Report 2006–500

U.S. Department of the Interior  
U.S. Geological Survey



WV Conservation Agency and the Army Corps of Engineers created a task force who produced the WV Flood Protection Plan in 2003



## WEST VIRGINIA FLOOD PROTECTION PLAN

### 1. Introduction

**a. Authority for the Study.** West Virginia has endured years of uncoordinated efforts to reduce flood damages by numerous Federal and State agencies. In 1991, the West Virginia Conservation Agency (previously known as the West Virginia Soil Conservation Agency) was directed to prepare a Flood Damage Assessment and Mitigation Plan for West Virginia in an attempt to understand and control flood damages.

Chapter 19-21A of the State Code establishes the State Conservation Committee and Conservation Districts. The Conservation Agency, as an agent of the State Committee, is charged to conserve natural resources, control floods, prevent impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, conserve wildlife, protect the tax base, protect public lands, and protect and promote the health, safety, and general welfare of the people. The Conservation Agency coordinates these activities with the State's Conservation Districts.

All State and Federal agencies having responsibilities related to floodplain management and flood mitigation activities in the State were invited to participate. An interim draft of this plan

entitled "West Virginia Statewide Flood Damage Assessment and Mitigation Plan" was prepared in 1993. A final version of the plan was never produced.

In 1998, Senator Robert C. Byrd obtained funding for the Corps of Engineers (USACE) to formulate a comprehensive strategy for reducing economic, property, and personal losses due to flooding in West Virginia. Those funds were provided to match State funds and in-kind resources to complete the 1993 Plan. Due to the time lapse since completion of the interim draft plan in 1993, portions of the current Plan would be updated with new chapters added.

The West Virginia Conservation Agency and the Corps of Engineers have developed a partnership with numerous Federal and State agencies to formulate a comprehensive strategic plan for reducing flood damages in the State. The first step in that process was the creation of a Task Force composed of Federal, State, and quasi-public organizations that have participated in

# Current WV Drought Response Plan

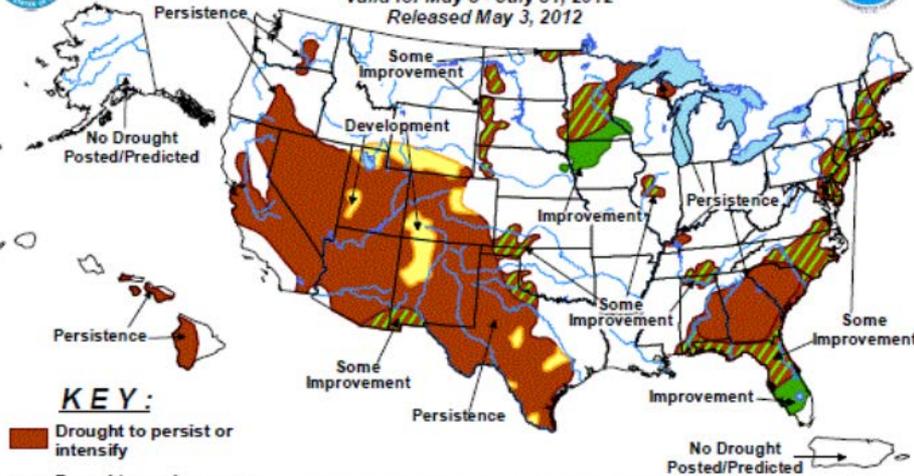
## Annex U – Drought

- Enacted around 2008, some signing issues slowed process
- Is the go to document for drought emergency according to DHSEM
- Lead agency is WV Department of Agriculture
- The Lead contact is WVDHSEM Duty Officer , based on the Annex U - Checklist
- A reaction based plan triggered by agricultural losses
- This system needs updated

# U.S. Seasonal Drought Outlook

## Drought Tendency During the Valid Period

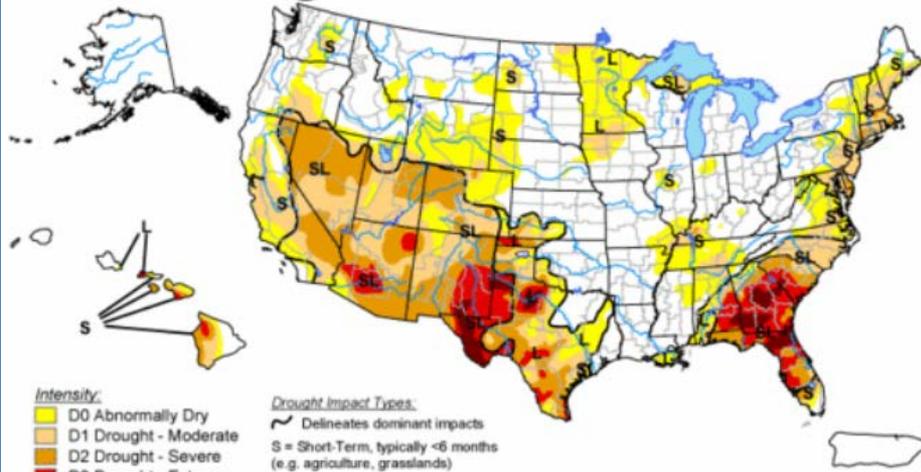
Valid for May 3 - July 31, 2012  
Released May 3, 2012



Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events – such as individual storms – cannot be accurately forecast more than a few days in advance. Use caution for applications – such as crops – that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 Intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

# U.S. Drought Monitor

May 8, 2012  
Valid 7 a.m. EDT



**Intensity:**  
 D0 Abnormally Dry  
 D1 Drought - Moderate  
 D2 Drought - Severe  
 D3 Drought - Extreme  
 D4 Drought - Exceptional

**Drought Impact Types:**  
 S = Short-Term, typically <6 months (e.g. agriculture, grasslands)  
 L = Long-Term, typically >6 months (e.g. hydrology, ecology)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



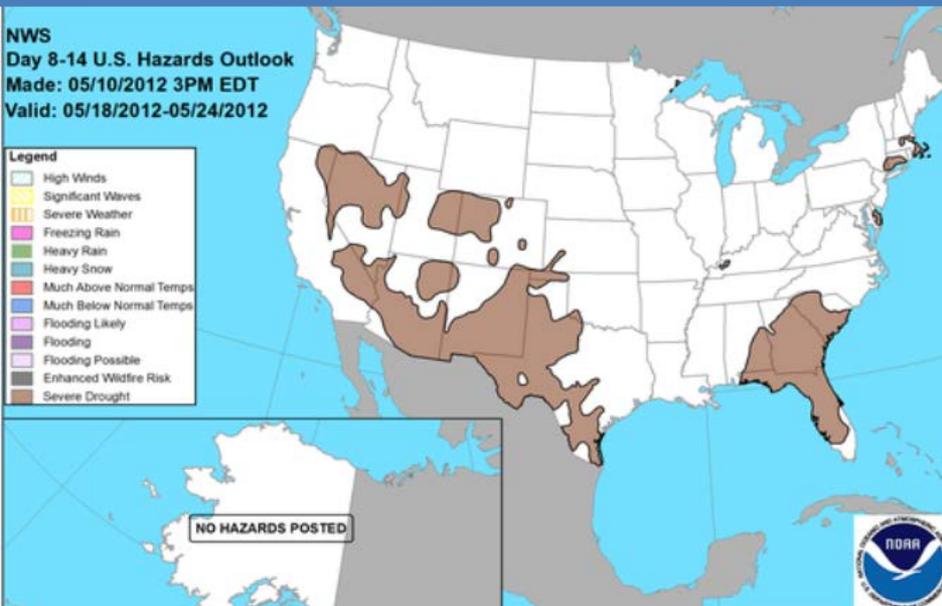
Released Thursday, May 10, 2012  
Author: Matthew Rosencrans, NOAA/NWS/NCEP/CPC

<http://droughtmonitor.unl.edu/>

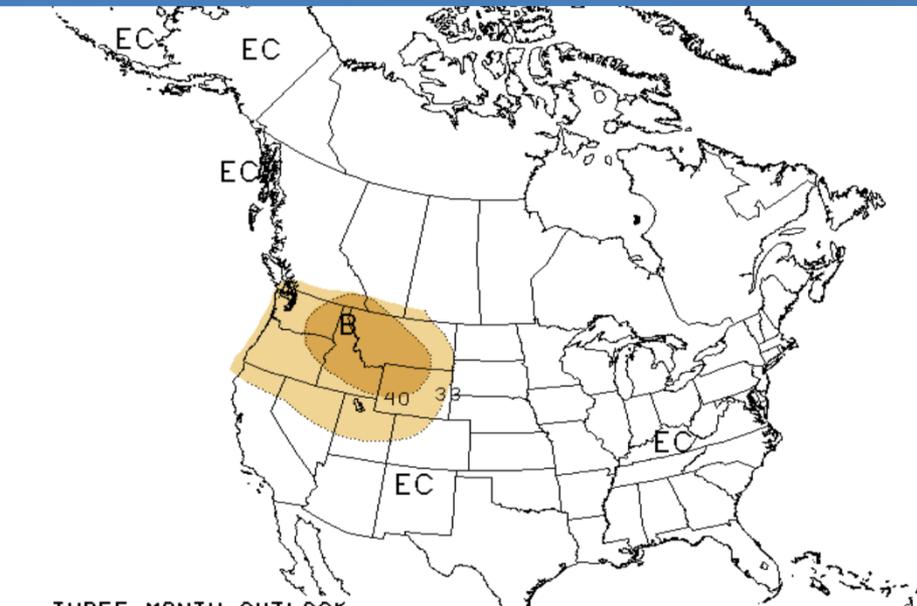
## NWS Day 8-14 U.S. Hazards Outlook

Made: 05/10/2012 3PM EDT  
Valid: 05/18/2012-05/24/2012

- Legend**
- High Winds
  - Significant Waves
  - Severe Weather
  - Freezing Rain
  - Heavy Rain
  - Heavy Snow
  - Much Above Normal Temps
  - Much Below Normal Temps
  - Flooding Likely
  - Flooding
  - Flooding Possible
  - Enhanced Wildfire Risk
  - Severe Drought



Disclaimer: This image uses transparencies to enable viewing of features on multiple layers at the same time. Because colors of overlapping images blend together, the colors you see in overlapping images may be different from those on the legend, unless you view each layer separately. To view the Hazards Outlook using KMLs with Google Maps, please go to: <http://www.cpc.ncep.noaa.gov/products/forecasts/threats/threats.php>



THREE-MONTH OUTLOOK  
PRECIPITATION PROBABILITY  
0.5 MONTH LEAD  
VALID MJJ 2012  
MADE 19 APR 2012

EC MEANS EQUAL CHANCE FOR A, N, B  
A MEANS ABOVE  
N MEANS NORMAL  
B MEANS BELOW

# WV Water Management Plan Climate Change

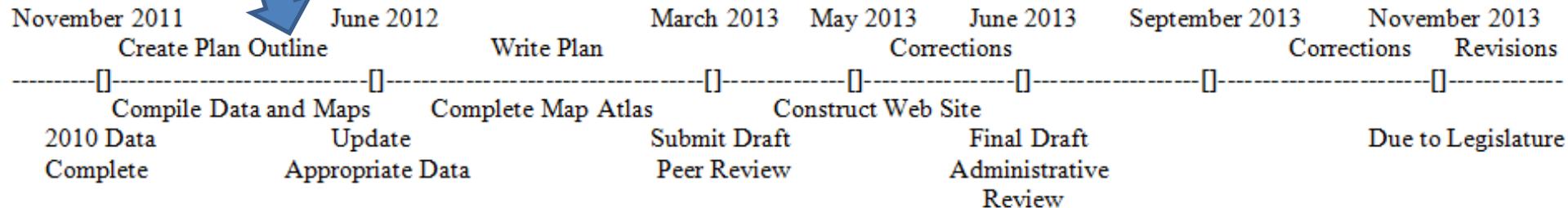
- Tap ICPRB and ORSANCO Knowledge
- Utilize the data USGS and NWS are currently collecting
- Propose Green Infrastructure and the MS4 Program as components of the Drought Management Plan
- Review and reference WV Flood Protection Plan and Annex-U Drought Plan
- More work needs to be done relative to climate change

# Water Use Section Challenges

- November of 2010 We Were Fully Staffed with a Program Manager, Geologist, GIS Tech & Database Tech
- Dec. 2010 – Database Tech **Retired (-1)**
- Dec. 2010 – Hired new Database Tech (Full Staff)
- April 2011 – GIS Tech **Resigned (-1)**
- May 2011 – Program Manager **Retired (-2)**
- June 2011 – Hired new GIS Tech **(-1)**
- Sept. 2011 – Hired Program Manager from w/in **(-1)**
- April 2012 – ERA -1 position OOG WMP (lateral move) **(-2)**
- May 2012 – Hired ERS-1 **(-1)**
- **?Summer 2012?** – Hire Technical writer = (Full Staff)
- Today we are still down 1 FTE and our workload has increased significantly due to the WMP Requirements but we are still on track.

# Water Management Plan Time Line

We are here



## Keep in mind:

- The Water Management Plan will be a living document
- To be effective it will need to be continually monitored and updated regularly
- A great portion of the Plan will work symbiotically with an on-line web application

# Questions?



Thank you.

