

# **Water-Quality Trends and Yields in the Chesapeake Bay Watershed: 2012 updated**

**Presented by Joel Blomquist and Scott Phillips  
U.S. Geological Survey  
Dec 9, 2013**

**On behalf of: Doug Moyer, Mike Langland, Jeff  
Chanat, Ken Hyer, and Cassandra Ladino**

# Watershed Monitoring

- **Nutrients and Sediment:**
  - 125 watershed sites
  - States, EPA, USGS, SRBC
- **Used to provide...**
  - Loads to the Bay
  - Trends in nutrients and sediment
  - Yields
- **Assess progress toward TMDL and WQ standards**



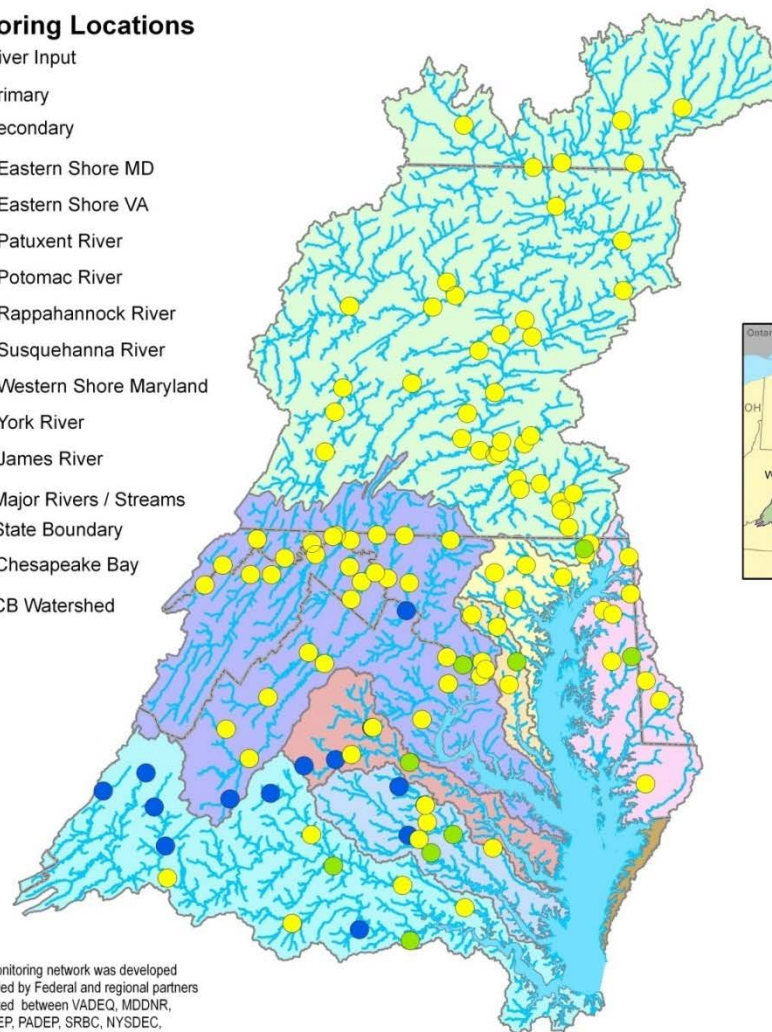
## Nontidal Water Quality Monitoring Network

Chesapeake Bay Watershed



### Monitoring Locations

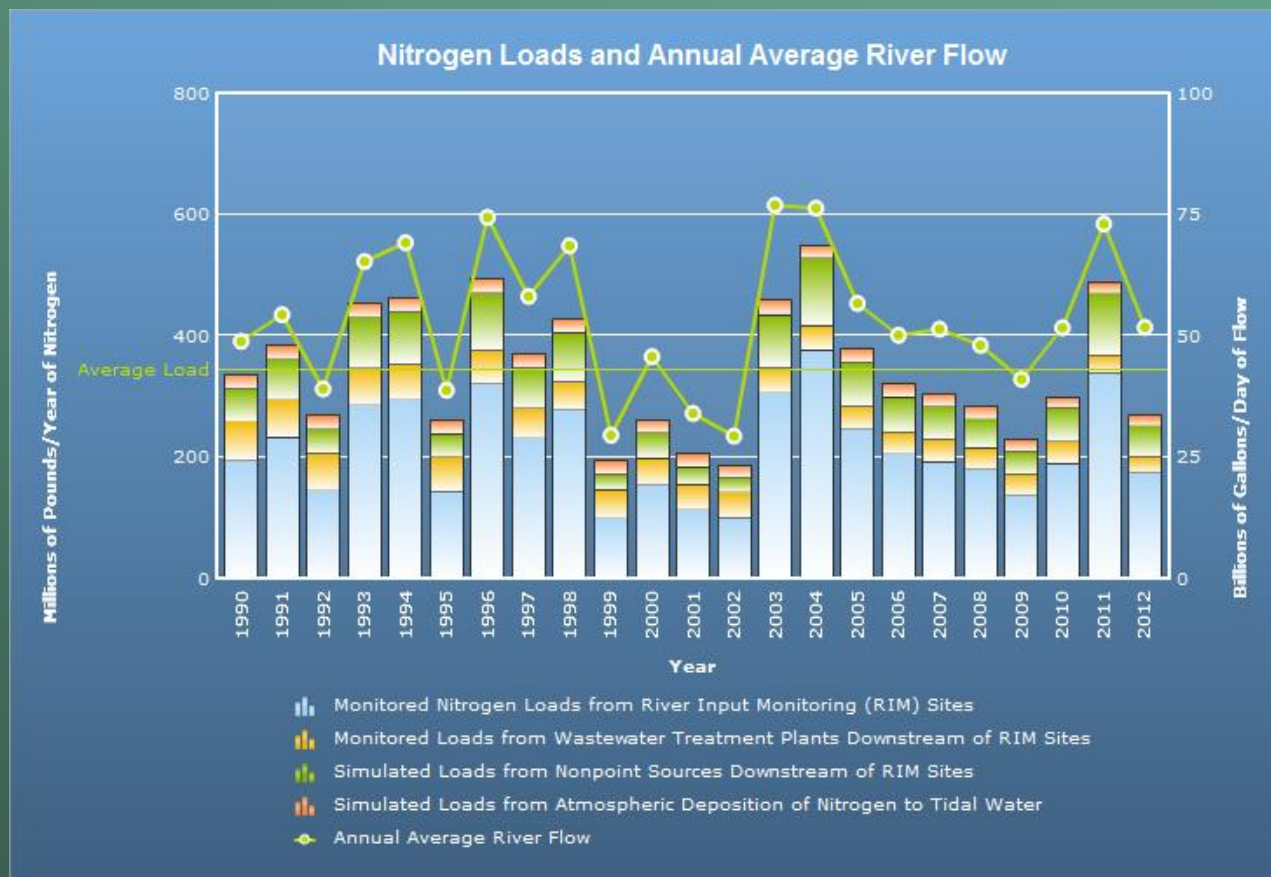
- River Input
- Primary
- Secondary
- Eastern Shore MD
- Eastern Shore VA
- Patuxent River
- Potomac River
- Rappahannock River
- Susquehanna River
- Western Shore Maryland
- York River
- James River
- Major Rivers / Streams
- State Boundary
- Chesapeake Bay
- CB Watershed



Note: This monitoring network was developed in 2004, funded by Federal and regional partners and coordinated between VADEQ, MDDNR, USGS, WVDEP, PADEP, SRBC, NYSDEC, and DNREC. Monitoring is conducted using standardized protocols; frequency depends on monitoring site type.

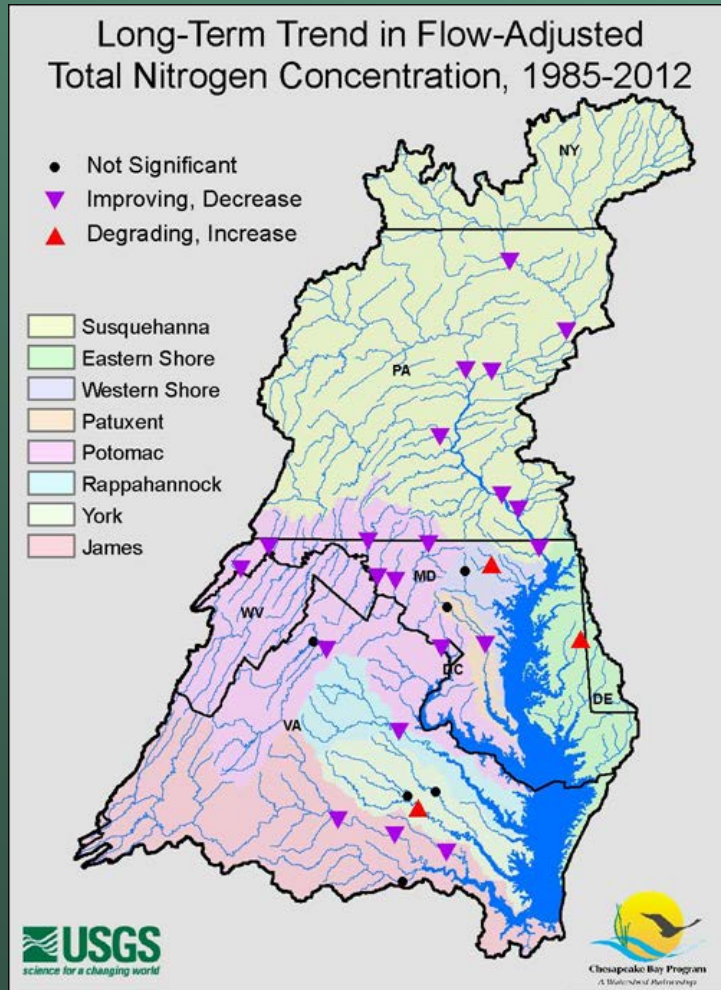
# Total Load to the Bay

- Streamflow
- Nitrogen
- Phosphorus
- Sediment



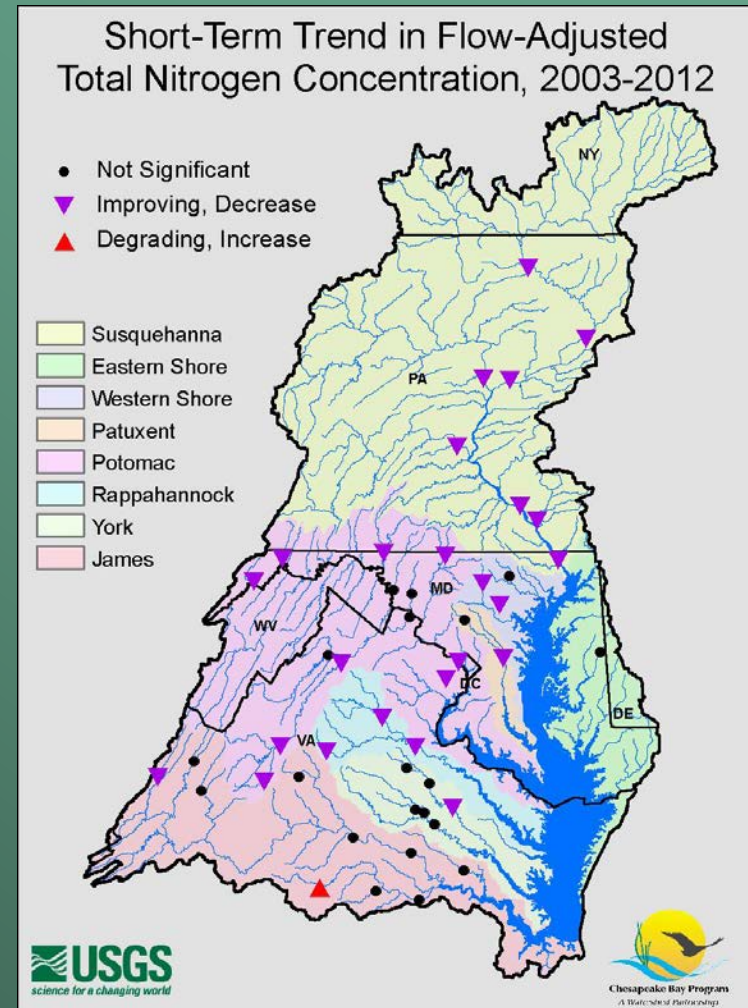


# Nontidal Indicators: Nitrogen



## Long Term

- 21 of 30 sites improving
- 3 sites degrading

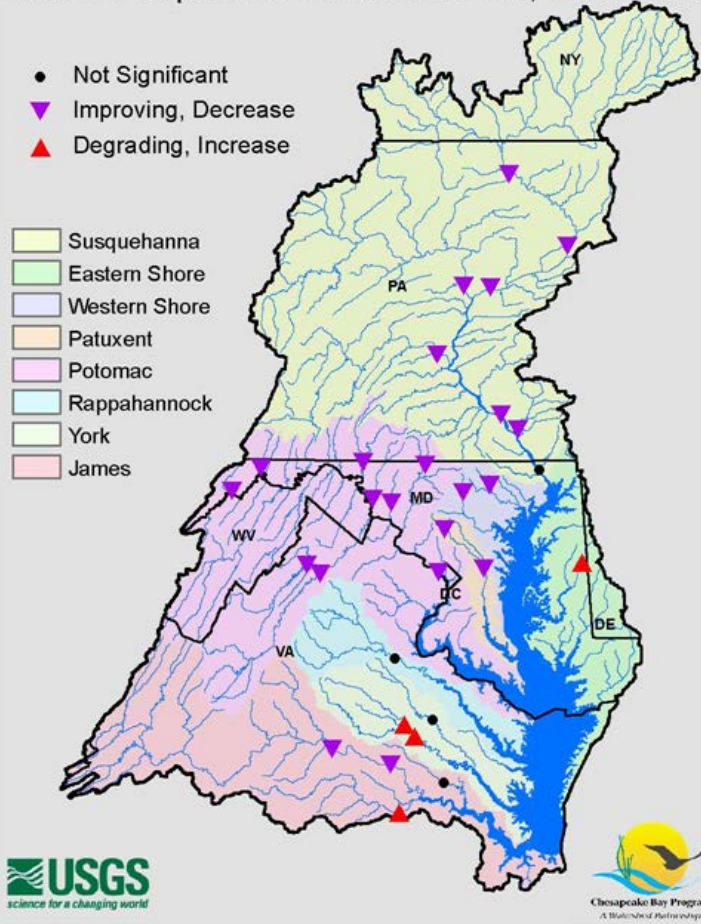


## Short Term

- 25 of 46 sites improving
- 1 sites degrading

# Nontidal Indicators: Phosphorus

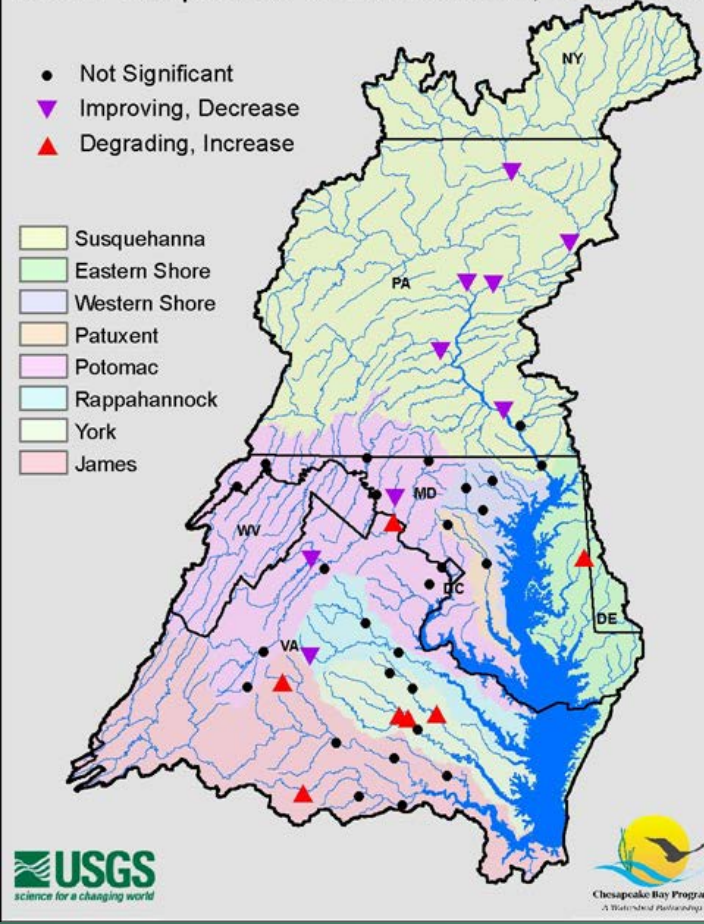
Long-Term Trend in Flow-Adjusted  
Total Phosphorus Concentration, 1985-2012



## Long Term

- 22 of 30 sites improving
- 4 sites degrading

Short-Term Trend in Flow-Adjusted  
Total Phosphorus Concentration, 2003-2012

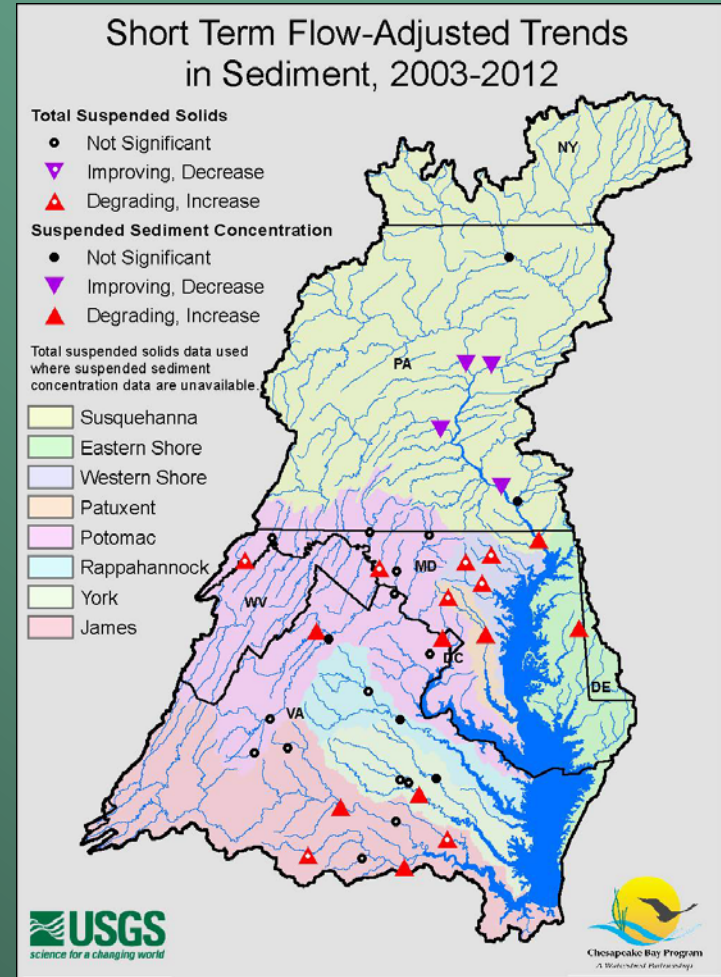
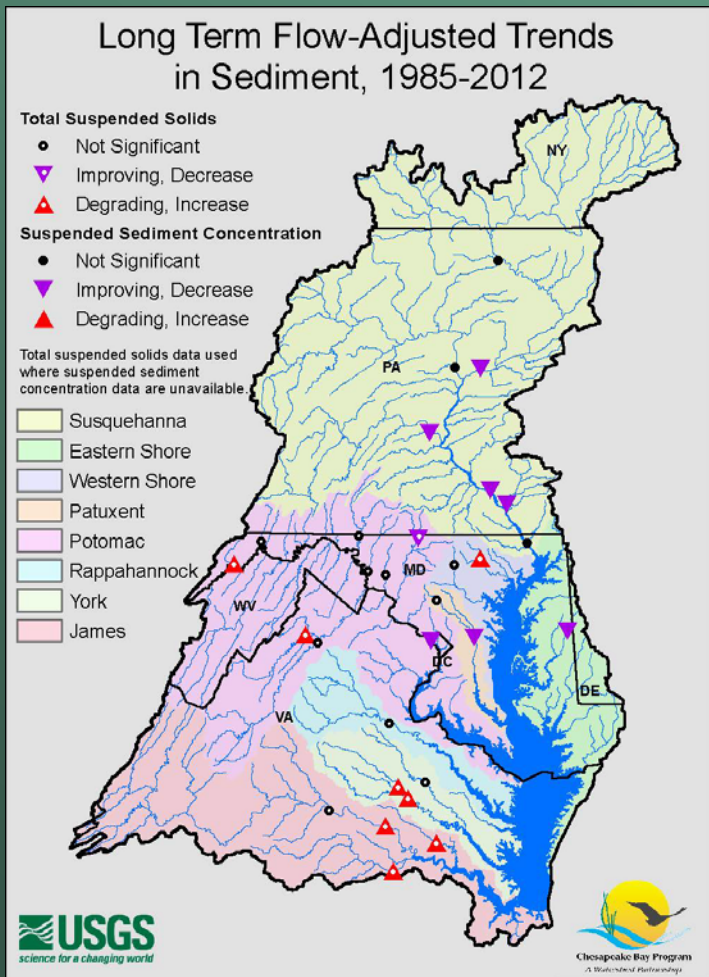


## Short Term

- 9 of 43 sites improving
- 7 sites degrading



# Nontidal Indicators: Sediment



## Long Term

- 8 of 29 sites improving
- 8 sites degrading

## Short Term

- 4 of 39 sites improving
- 16 sites degrading

# Relative-Yield Indicator

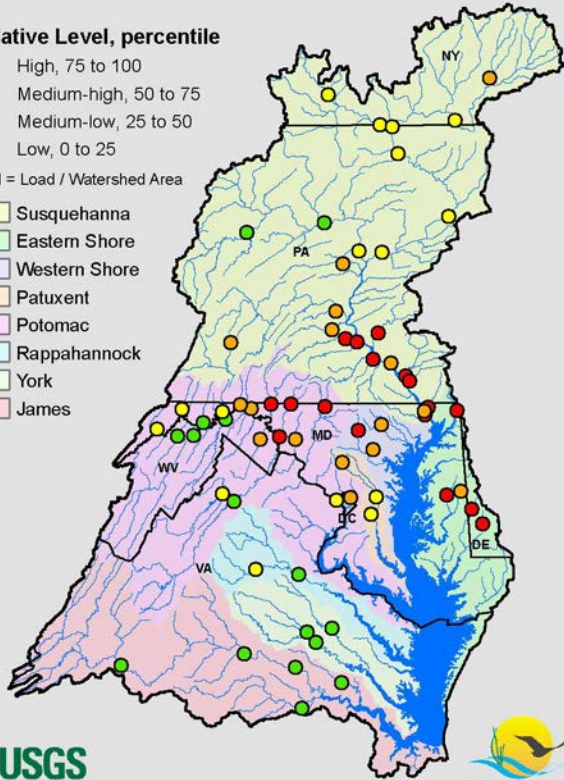
Total Nitrogen Yield, Mean 2008-2012

**Relative Level, percentile**

- High, 75 to 100
- Medium-high, 50 to 75
- Medium-low, 25 to 50
- Low, 0 to 25

Yield = Load / Watershed Area

- Susquehanna
- Eastern Shore
- Western Shore
- Patuxent
- Potomac
- Rappahannock
- York
- James



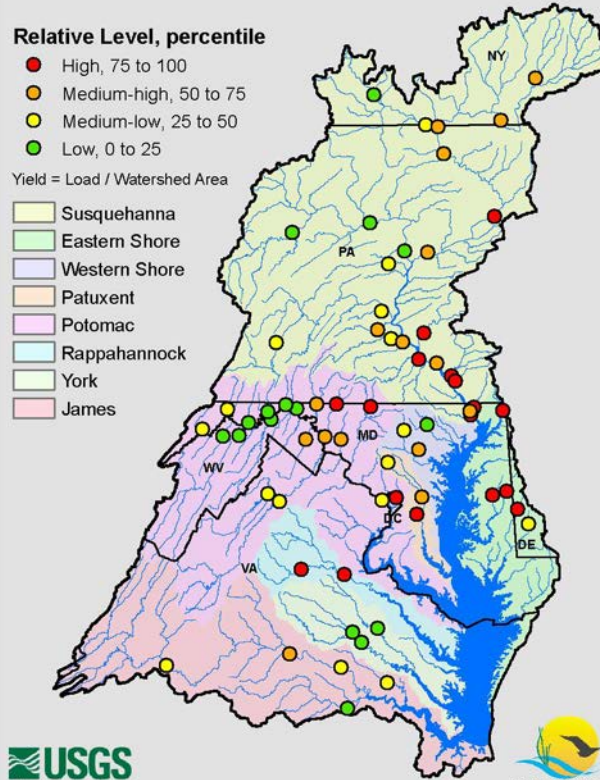
Total Phosphorus Yield, Mean 2008-2012

**Relative Level, percentile**

- High, 75 to 100
- Medium-high, 50 to 75
- Medium-low, 25 to 50
- Low, 0 to 25

Yield = Load / Watershed Area

- Susquehanna
- Eastern Shore
- Western Shore
- Patuxent
- Potomac
- Rappahannock
- York
- James



Sediment Yield, Mean 2008-2012

**Suspended Solids Yield**

**Relative Level, percentile**

- High, 75 to 100
- Medium-high, 50 to 75
- Medium-low, 25 to 50
- Low, 0 to 25

**Suspended Sediment Yield**

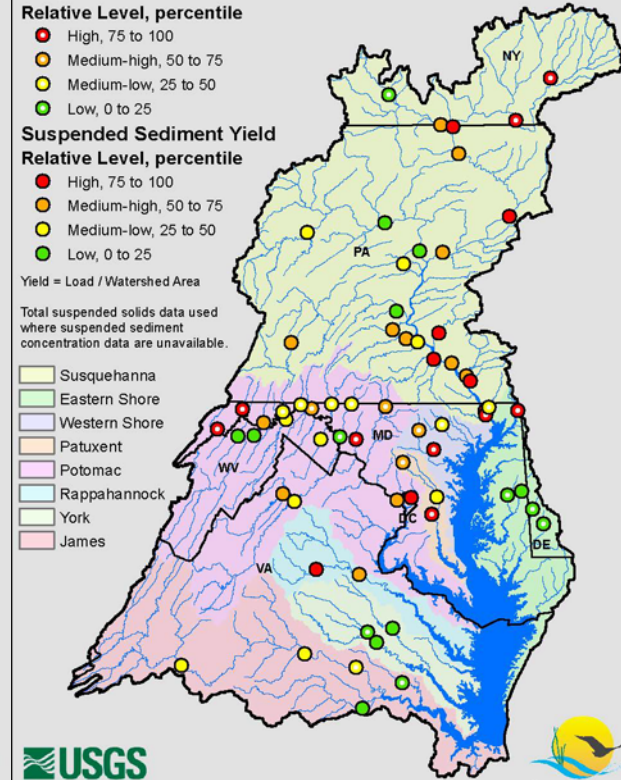
**Relative Level, percentile**

- High, 75 to 100
- Medium-high, 50 to 75
- Medium-low, 25 to 50
- Low, 0 to 25

Yield = Load / Watershed Area

Total suspended solids data used where suspended sediment concentration data are unavailable.

- Susquehanna
- Eastern Shore
- Western Shore
- Patuxent
- Potomac
- Rappahannock
- York
- James



## Nitrogen Yields

- Range: 0.33 to 9.87 tons per square mile
  - About (1-33 lb/Acre)
- High range greater than 3.4 T/mi<sup>2</sup>

## Phosphorus Yields

- Range: 0.036 to 0.57 tons per square mile
  - (.12 – 1.9 lb/Acre)
- High range greater than .19 T/mi<sup>2</sup>

## Sediment Yields

- Range: 9.3 to 648 tons per square mile
  - (31 – 2,200 lb/Acre)
- High range greater than 200 T/mi<sup>2</sup>



# Flow Adjusted Trend Summary

Constituent	Long Term Trend (1985-2012)			Short Term Trend (2003-12)		
	Improving	Degrading	Not Significant	Improving	Degrading	Not Significant
<b>Total Nitrogen (sites)</b>	21	3	6	25	1	20
<b>(% of sites)</b>	70%	10%	20%	54%	2%	43%
<b>Total Phosphorus (sites)</b>	22	4	4	9	7	27
<b>(% of sites)</b>	73%	13%	13%	21%	16%	63%
<b>Suspended Sediment and Solids (sites)</b>	8	8	13	4	16	19
<b>(% of sites)</b>	28%	28%	44%	10%	41%	49%



# WEB Updates

- Summaries of load, trends, and yields
- Static and interactive maps (loads, yields, and trends)
- Annual load download
- Monthly load download
- Trend and yield results
- Final review of web products still required
- Future:
  - Improved access to monitoring data
  - Flow-normalized Load results



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### Water Quality Loads and Trends at Nontidal Monitoring Stations in the Chesapeake Bay Watershed

#### Navigate Menu

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  - Introduction
  - Methods
  - Glossary
  - Related Publications
- Results and Maps**
  - Load Summary
  - Trend Summary
  - Yield Summary
  - Interactive Map
- Downloads**
  - Model Input Data
  - Load Table

Welcome to the USGS web site dedicated to providing water-quality trend and load results for the nontidal rivers of the Chesapeake Bay watershed.

The objectives of the Chesapeake Bay nontidal monitoring program are to:

- Quantify sediment and nutrient loads in the nontidal rivers of the Chesapeake Bay watershed.
- Estimate changes over time (trends) in sediment and nutrient concentrations that are related to the implementation of Best Management Practices, or other anthropogenic factors.

**The Data Provided**

The data utilized for these analyses are collected by numerous agencies through the nontidal monitoring partnership. Results are presented for the 2011 water year for a network of 80 water quality monitoring stations distributed throughout the Chesapeake Bay watershed.

Methods, data, results, and interpretations are available for:

- Sediment and nutrient loads
- Sediment and nutrient trends in concentration
- In-stream sediment and nutrient concentration data
- Stream discharge

Click on the image above to access the interactive map

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#### Retrieve Loads

Loads are provided individually for each parameter and station in a simple table format. Not all constituents are available for all sites.

Select station:

Select Parameter:

Select Year:

[Download Entire Loads Table](#)

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

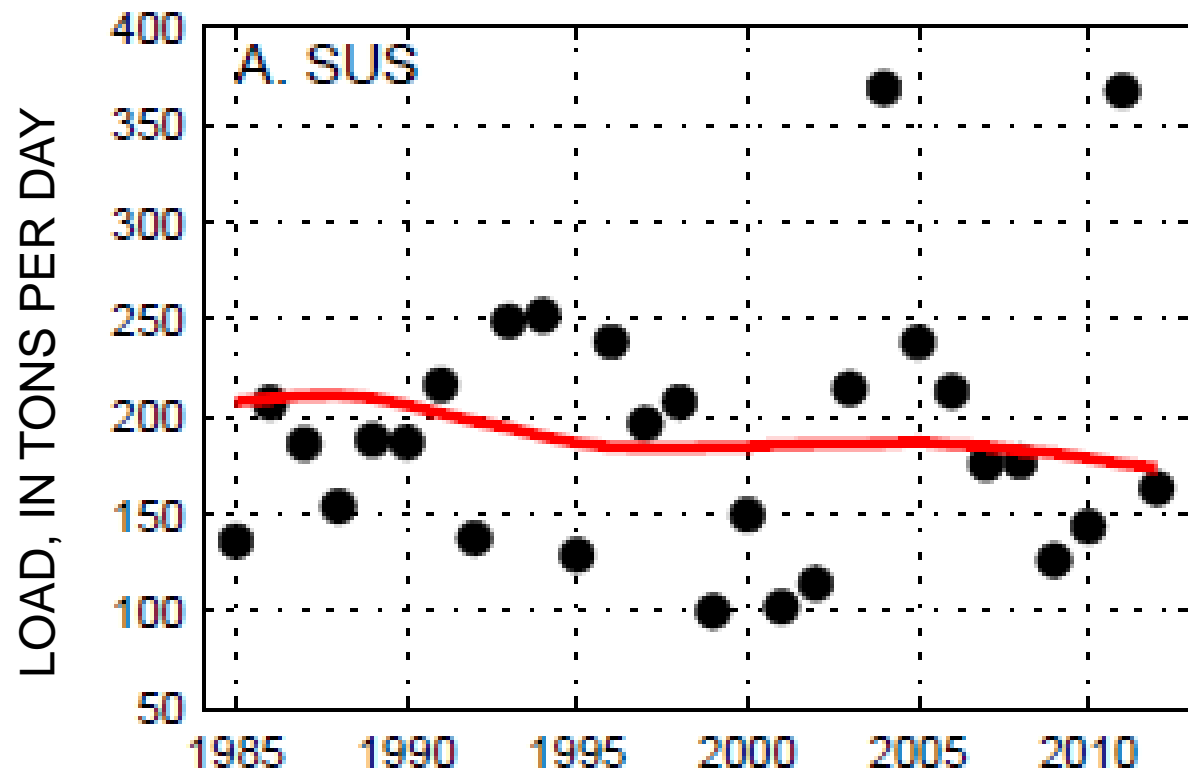
URL: [http://cbrim.er.usgs.gov/loads\\_query.html](http://cbrim.er.usgs.gov/loads_query.html)  
 Page Contact Information: [Web Administrator](#)  
 Page Last Modified: Tuesday, 18-Jun-2013 16:44:10 EDT

# Trends in Total Nitrogen Annual Load

Total Nitrogen Load:  
Susquehanna (RIM)

- Influence of year-to-year variation in flow

With WRTDS, we now can communicate how annual loads have changed once the year-to-year variation in Q has been removed



Trend in load for:

1985 to 2012 = Total reduction of 16%

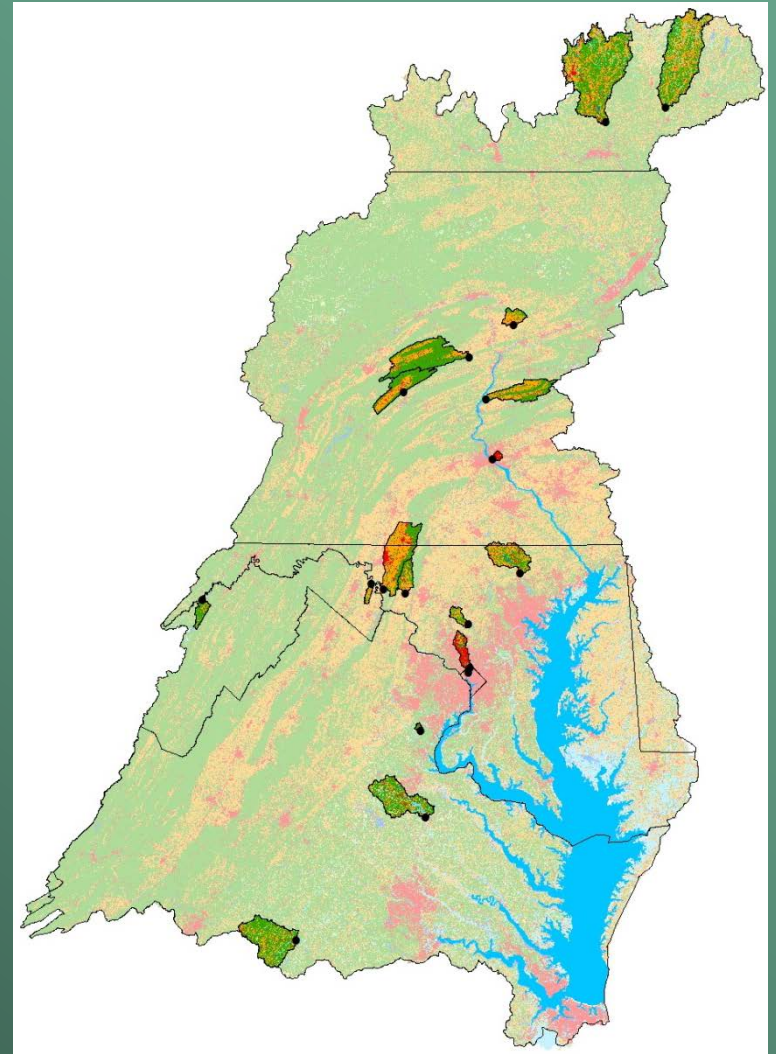
2002 to 2012 = Total reduction of 7%

Black Dots = Annual Load

Red Line = Flow Normalized Load

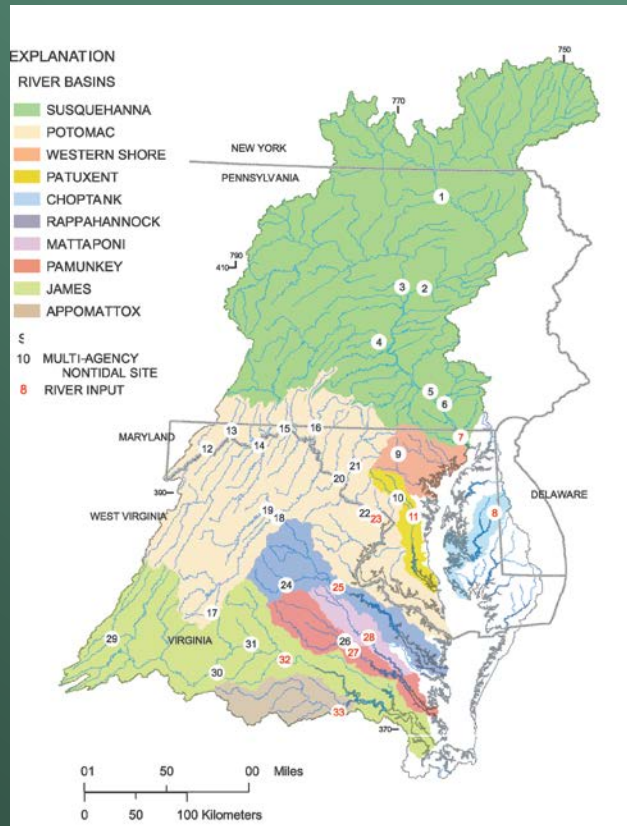
# Challenges for 2014: Monitoring Shortfalls

- 2013 funding shortfalls in monitoring
  - States, EPA, USGS, SRBC trying to maintain in 2014
- Evaluate future monitoring options
  - “BASIN” (STAR and STAC)
  - New Bay Agreement
- WQ GIT:
  - Objectives & priorities
    - TMDL, standards, improved understanding
  - Products



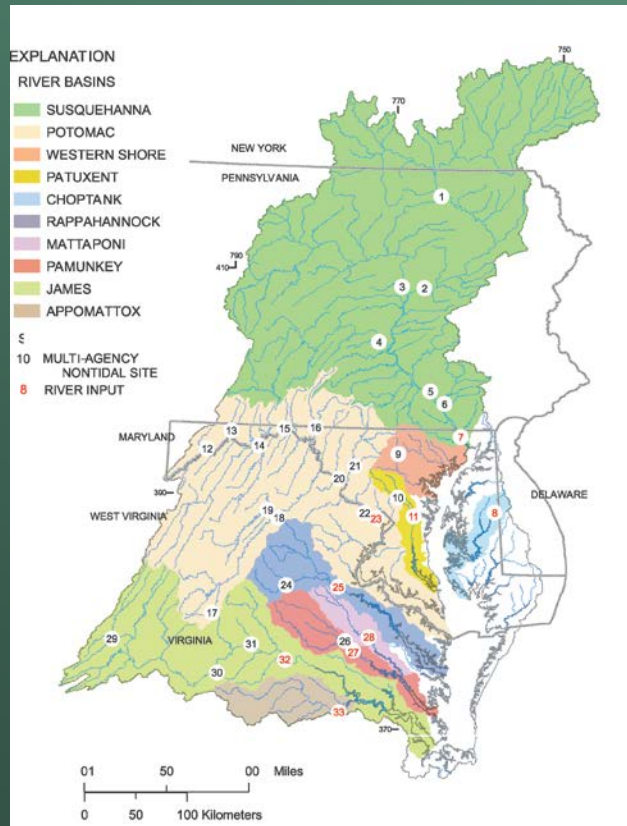


# Assess and Explain Trends for MPA



- Enhanced analysis to support decision making for TMDL and WQ standards attainment
  - WQ GIT decision framework
  - STAR (NTWG, TMAW, CBP Modeling team)
- Trends in N, P, sediment in watershed
- Attainment of water quality
- Explain water-quality trends
  - Watershed and Estuary
- Enhance CBP models
- Synthesize and communicate results

# Assess and Explain Trends for MPA: 2014



- Trends in N, P, sediment in watershed
  - Flow-normalized load to the Bay
- Attainment of water quality
  - Combined indicator/GAM approach
- Explain water-quality trends
  - Lessons learned report
  - Eastern Shore Report
  - Potomac
- Enhance CBP models
- Synthesize and communicate results
  - Joint product on BMP reporting, trends in watershed and tidal waters

## More info

- Trends and yields:  
<http://cbrim.er.usgs.gov/index.html>
- Bay Barometer
- Contacts:
  - J. Blomquist
  - D. Moyer
  - M. Langland