

## Changes in water and habitat quality in the Patuxent River

2015 Patuxent River Conference  
June 18, 2015

Renee Karrh  
Maryland DNR

## Objective of this talk

- Summarize the water and habitat quality data collected in non-tidal and tidal long-term program and shallow water monitoring program

# In this talk...

- Landuse and Loadings information
- Current water and habitat quality conditions & trends  
Individual parameters:
  - Water Quality: Nutrients: Total N, Total P  
Sediments
  - Habitat Quality: Algal Levels (Chlorophyll *a*)  
Water Clarity (Secchi Depth),  
Summer Bottom Diss. Oxygen (June-Sept)
- Health of underwater grasses and  
Bottom-dwelling animals

# Basin Summary reports on DNR's Eyes on the Bay website [www.eyesonthebay.net](http://www.eyesonthebay.net)

The screenshot shows the Maryland Department of the Environment's 'Eyes on the Bay' website. The header includes the Maryland logo with the slogan 'Smart, Green & Growing' and the site title 'EYES ON THE BAY'. Navigation tabs include 'EOTB HOME', 'CURRENT CONDITIONS', 'STATUS & TRENDS', 'HARMFUL ALGAE', 'SATELLITE MAPS', and 'MORE'. A left sidebar menu contains various links, with 'Water Quality & Habitat Assessments' highlighted in a yellow box. The main content area is titled 'Tributary Water Quality and Habitat Assessments' and provides 'Detailed reports on the health of Bay tributaries'. It lists several reports with links to full reports and water quality updates for 2010-2012 and 2011-2013. A photograph of a sunset over water is visible at the bottom of the page.

Maryland.gov Phone Directory State Agencies Online Services

✉ Email Friend 🖨 print page

**MARYLAND** EYES ON THE BAY  
*Smart, Green & Growing*

EOTB HOME CURRENT CONDITIONS STATUS & TRENDS HARMFUL ALGAE SATELLITE MAPS MORE

## Tributary Water Quality and Habitat Assessments

Detailed reports on the health of Bay tributaries

- ▶ [Upper Western Shore Full Report](#)
  - ▶ [2010-2012 Water Quality Update](#)
  - ▶ [2011-2013 Water Quality Update](#)
- ▶ [Upper Eastern Shore Full Report](#)
  - ▶ [2010-2012 Water Quality Update](#)
  - ▶ [2011-2013 Water Quality Update](#)
- ▶ [Patapsco and Back Rivers Full Report](#)
  - ▶ [2010-2012 Water Quality Update](#)
  - ▶ [2011-2013 Water Quality Update](#)
- ▶ [Choptank, Little Choptank and Honga Rivers Full Report](#)
  - ▶ [2010-2012 Water Quality Update](#)
  - ▶ [2011-2013 Water Quality Update](#)
- ▶ [Lower Western Shore Full Report](#)
  - ▶ [2010-2012 Water Quality Update](#)
  - ▶ [2011-2013 Water Quality Update](#)
- ▶ [Lower Eastern Shore Full Report](#)
  - ▶ [2010-2012 Water Quality Update](#)
  - ▶ [2011-2013 Water Quality Update](#)
- ▶ [Potomac River Full Report](#)
  - ▶ [2010-2012 Water Quality Update](#)
  - ▶ [2011-2013 Water Quality Update](#)
- ▶ [Patuxent River Full Report](#)
  - ▶ [2010-2012 Water Quality Update](#)
  - ▶ [2011-2013 Water Quality Update](#)

How to Use This Site

Water Quality Alerts & Social Media

Monitoring Stories and Publications

\*\*\*NEW\*\*\*  
Water Quality & Habitat Assessments

What Does It Mean?

Lesson Plans

Links

Partners

Ask an Expert

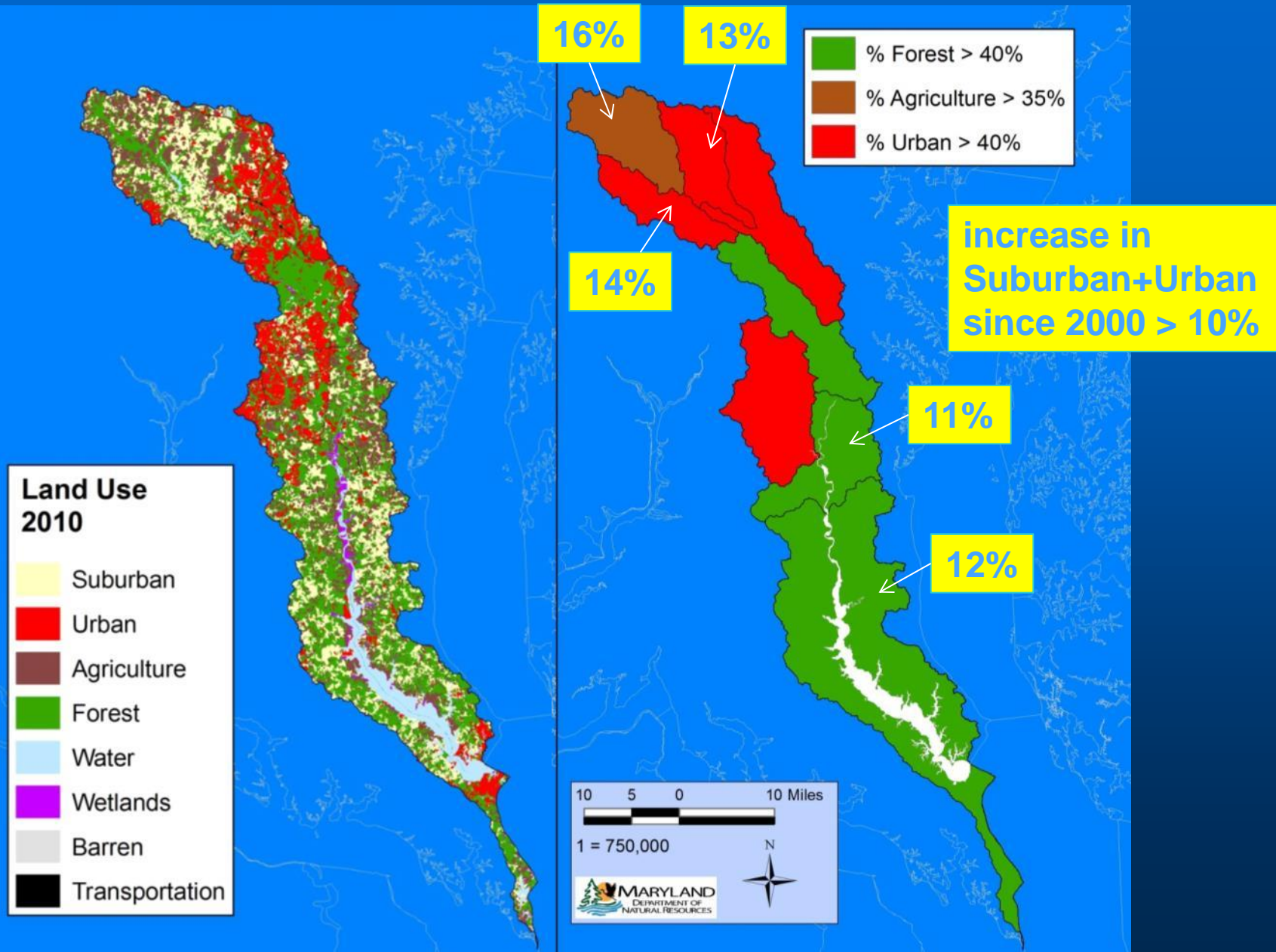
BayStat

Maryland StreamHealth

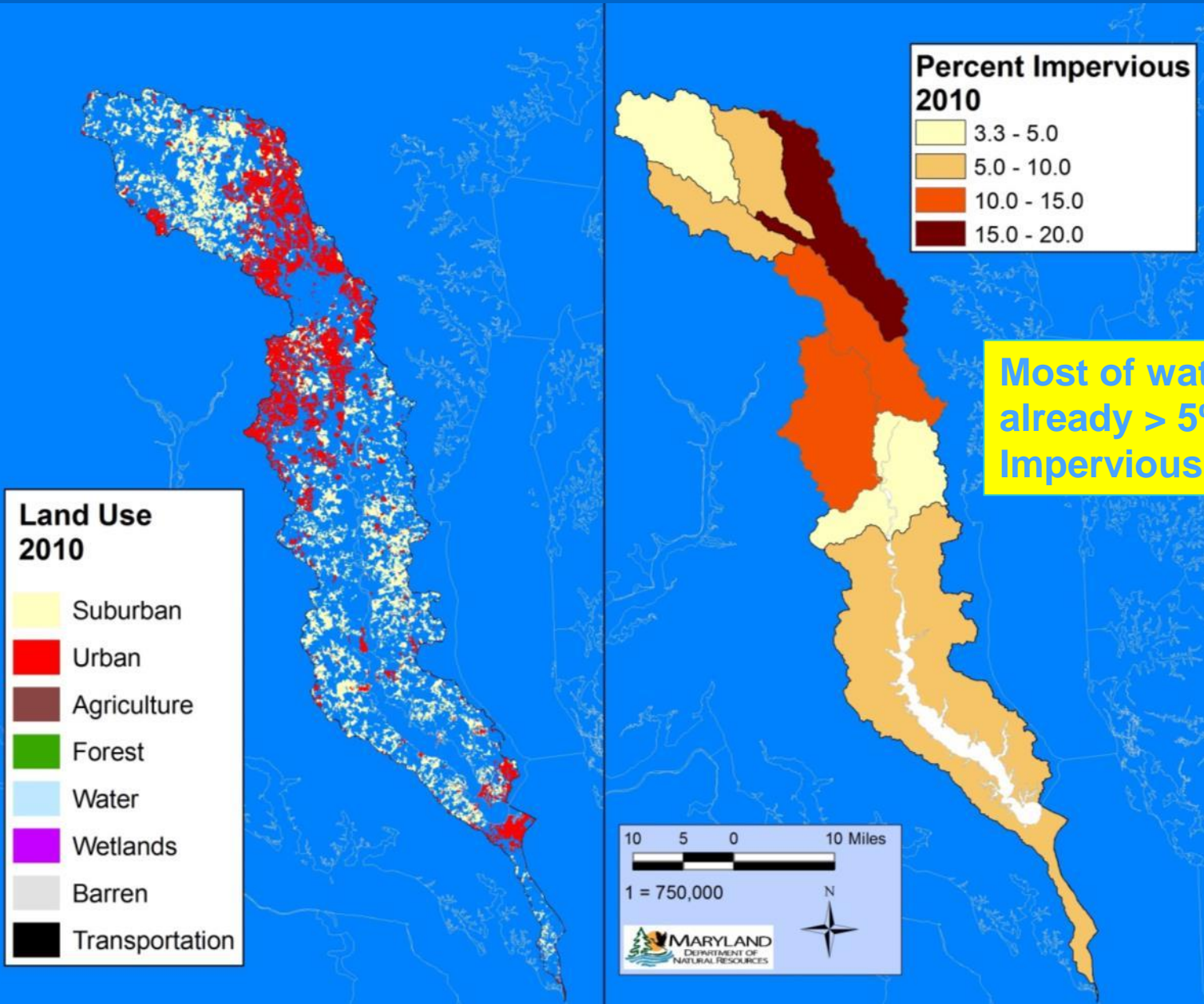
DNR Home Page

<http://mddnr.chesapeakebay.net/eyesonthebay/tribsums.cfm>

# 2010 Landuse data



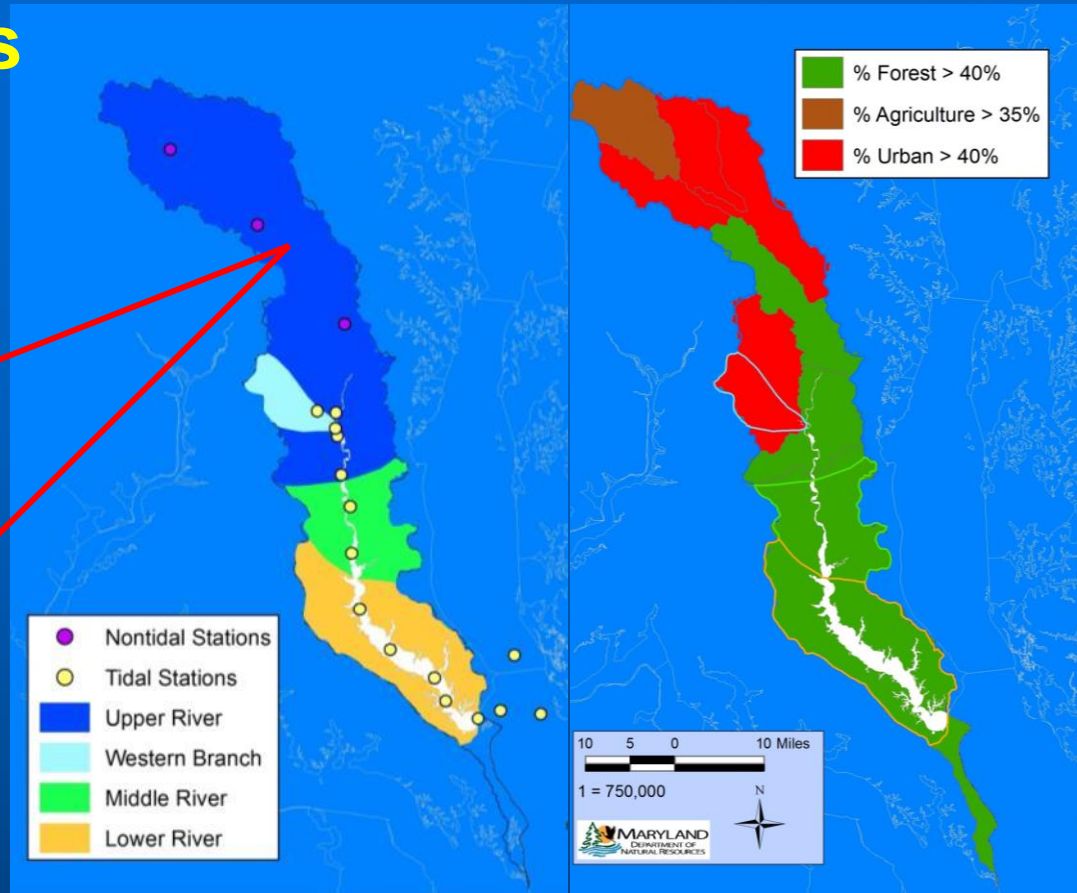
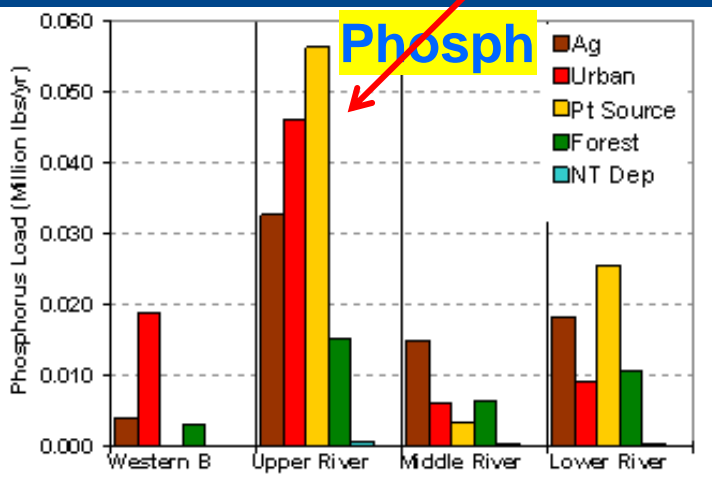
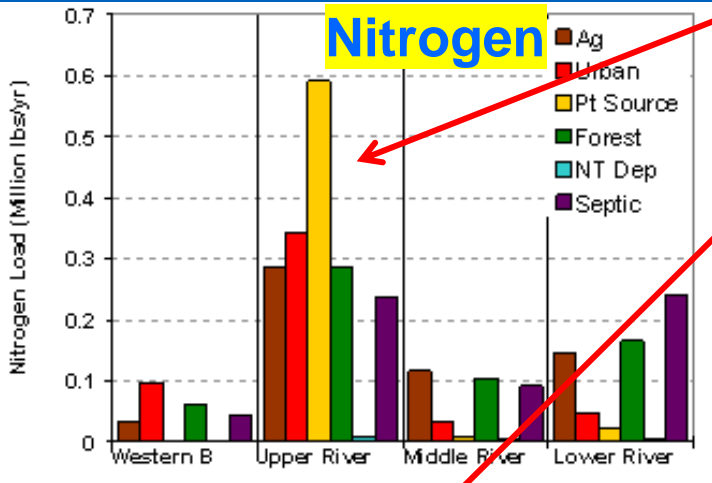
# 2010 Landuse data



Most of watershed  
already > 5%  
Impervious surfaces

# Nitrogen & Phosphorus Loadings per year

2009 Loadings  
Phase 5.3 2009 Progress Run 8/25/2010

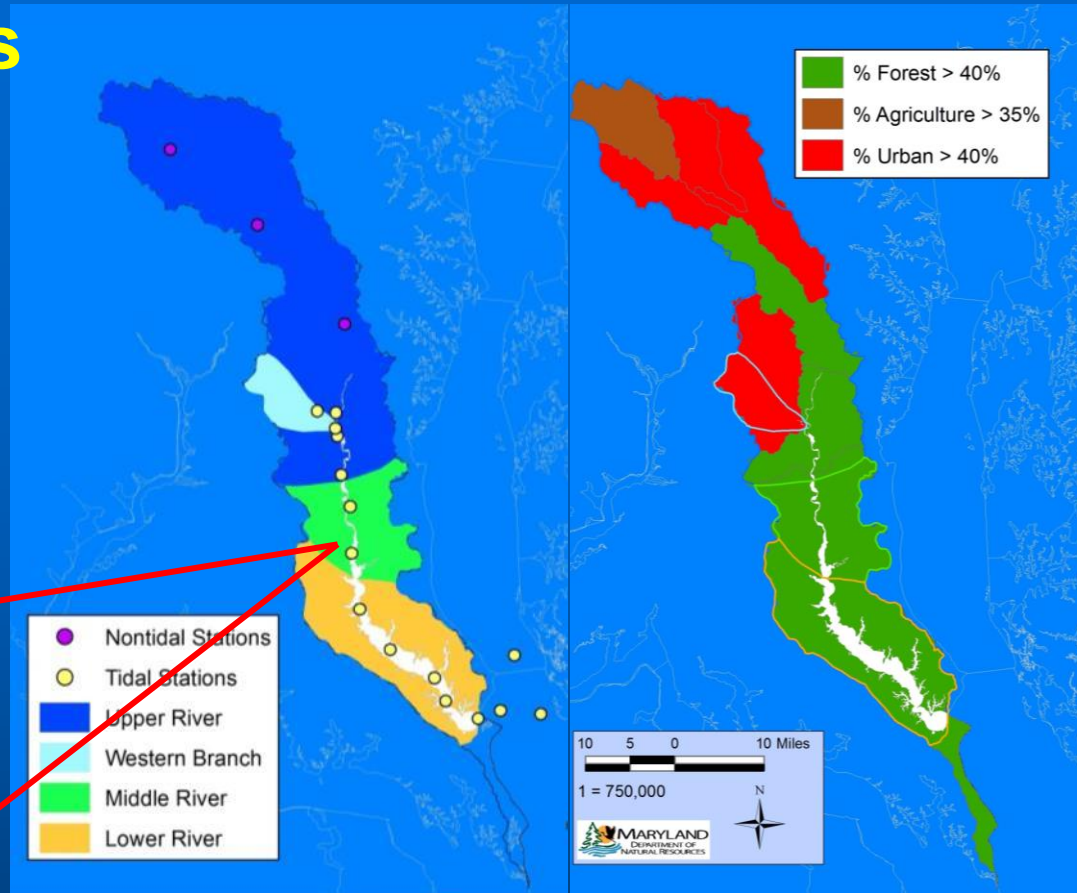
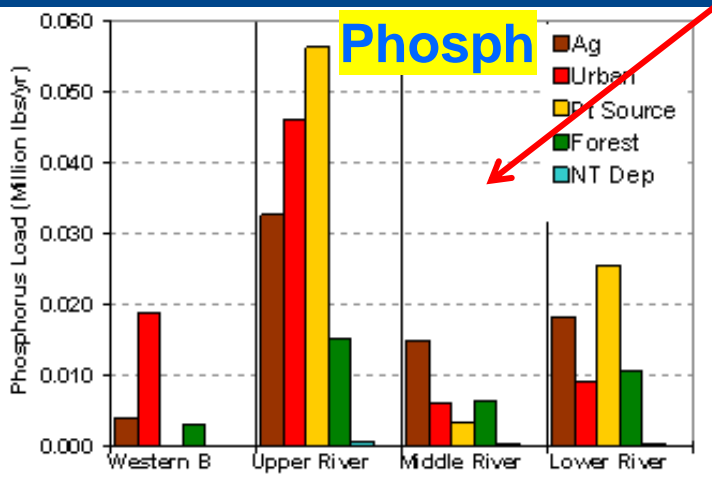
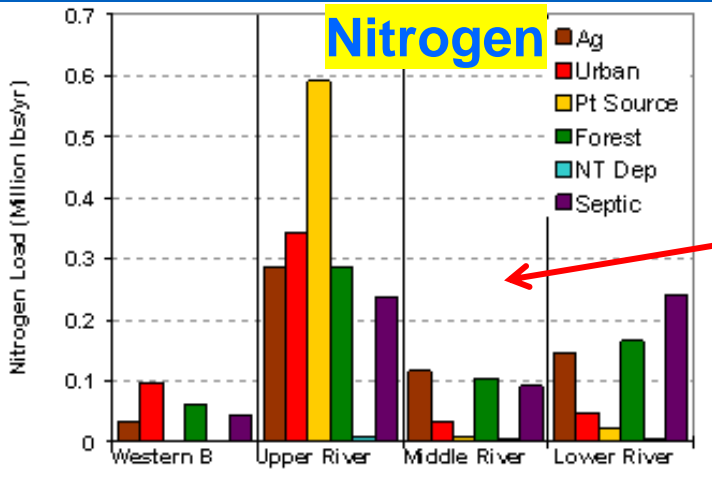


- Point Sources largest source in Upper River

■ Agriculture   
 ■ Urban Runoff   
 ■ Point Source   
 ■ Forest   
 ■ NT Dep   
 ■ Septic

# Nitrogen & Phosphorus Loadings per year

2009 Loadings  
Phase 5.3 2009 Progress Run 8/25/2010



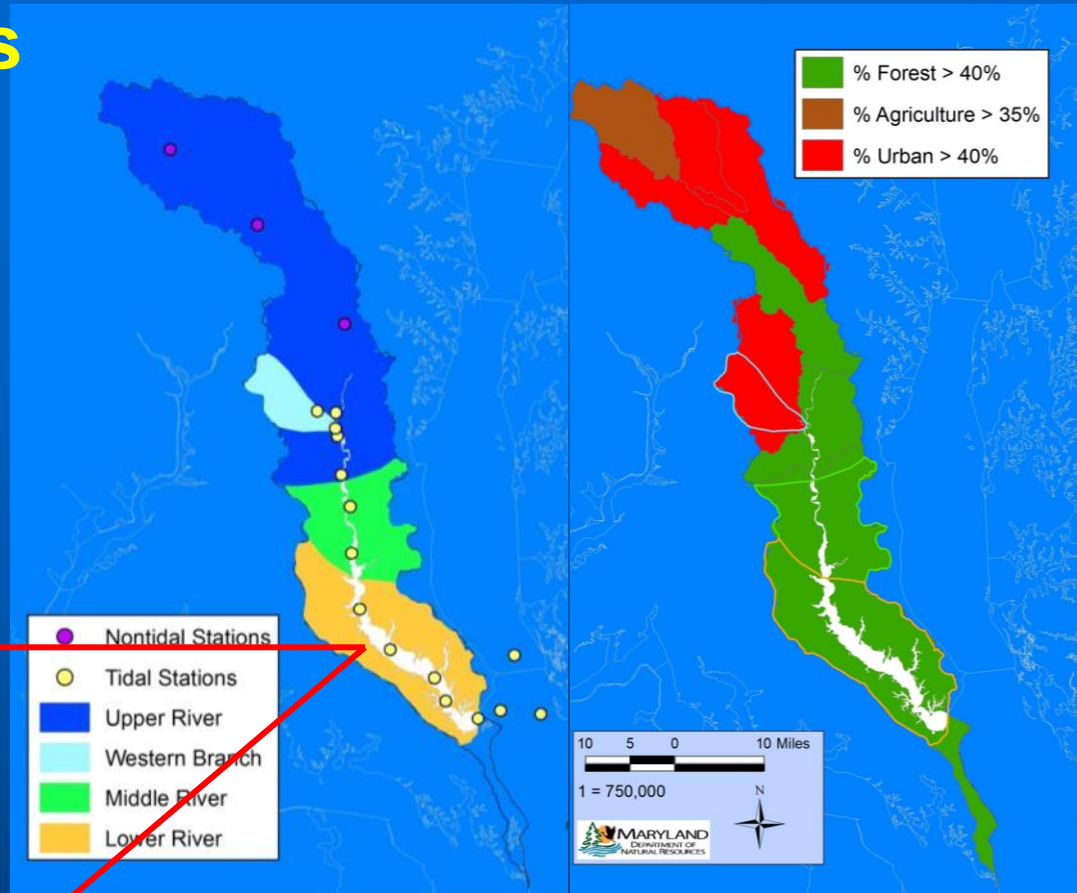
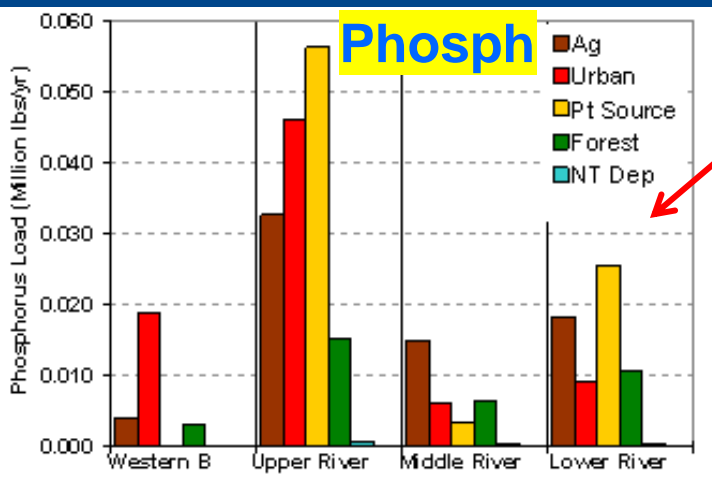
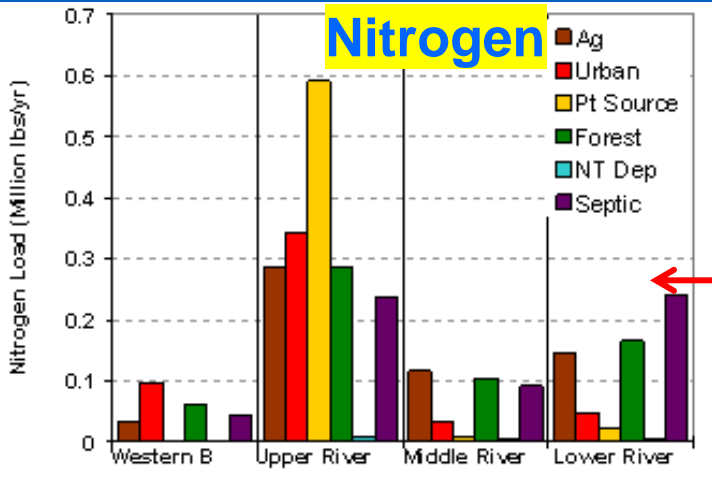
• Point Sources largest source in Upper River

■ Agriculture   
 ■ Urban Runoff   
 ■ Point Source   
 ■ Forest   
 ■ NT Dep   
 ■ Septic



# Nitrogen & Phosphorus Loadings per year

2009 Loadings  
Phase 5.3 2009 Progress Run 8/25/2010

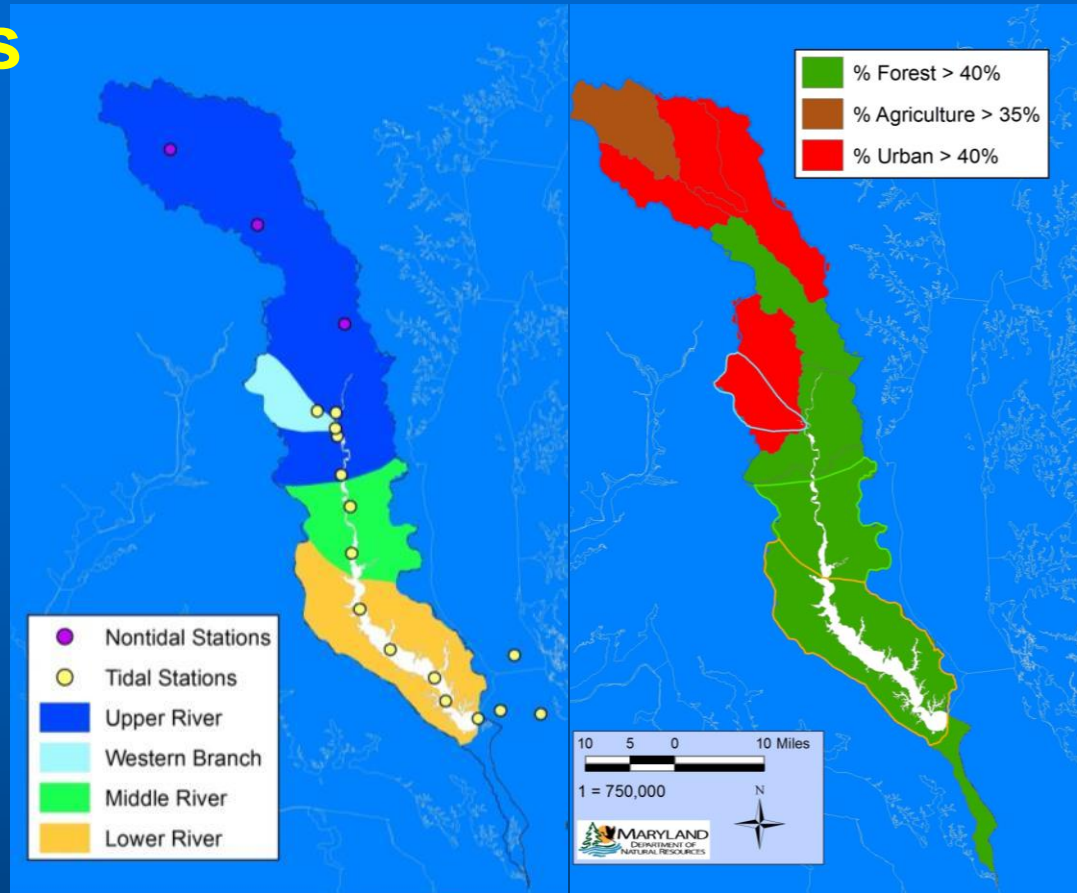
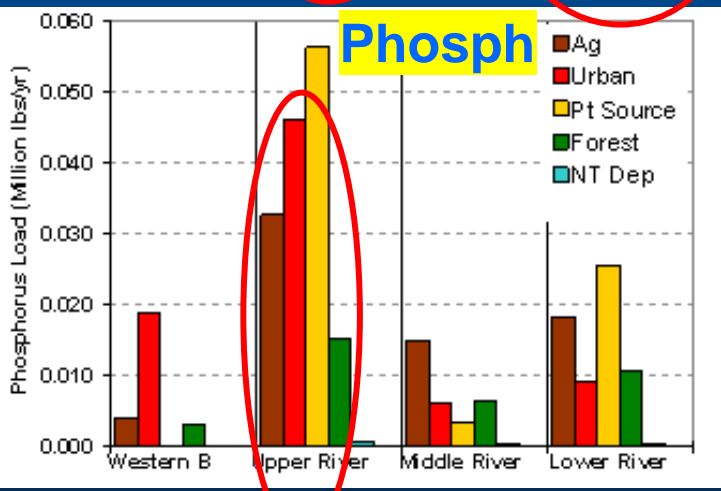
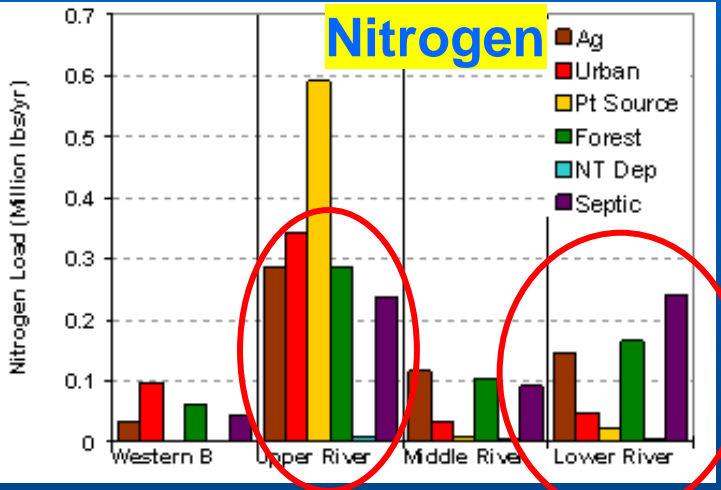


• Point Sources largest source in Upper River

■ Agriculture   
 ■ Urban Runoff   
 ■ Point Source   
 ■ Forest   
 ■ NT Dep   
 ■ Septic

# Nitrogen & Phosphorus Loadings per year

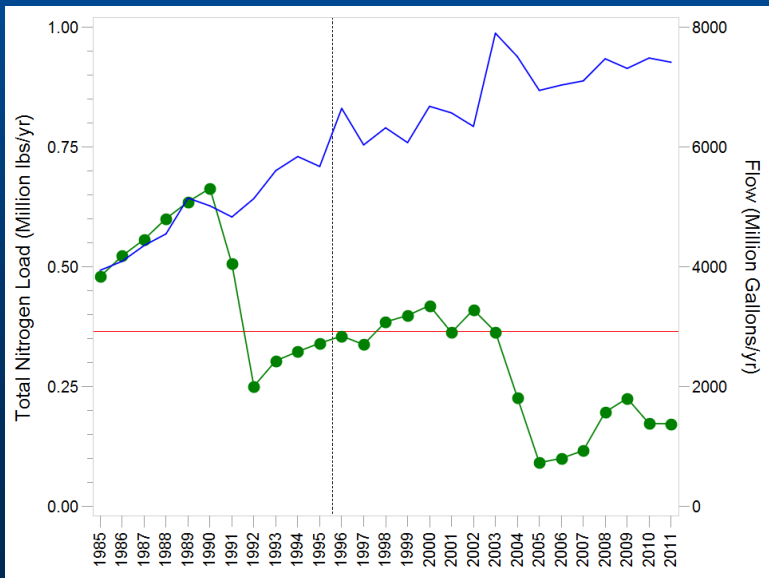
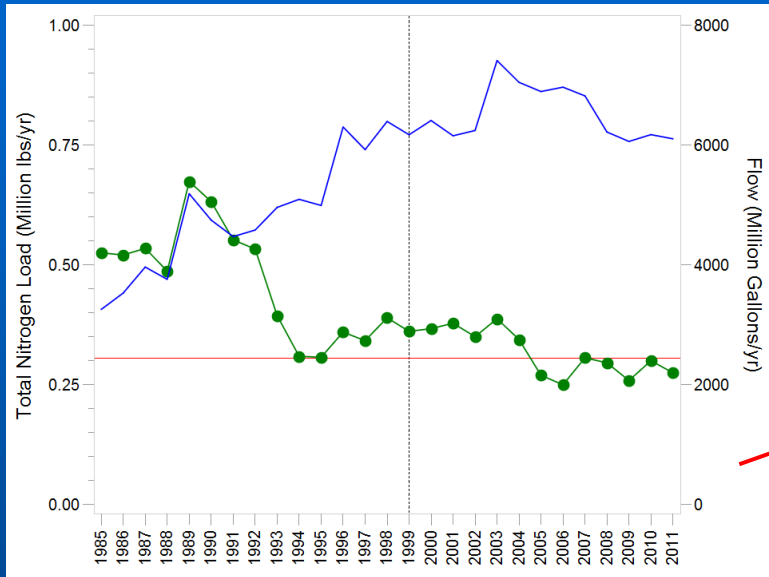
2009 Loadings  
Phase 5.3 2009 Progress Run 8/25/2010



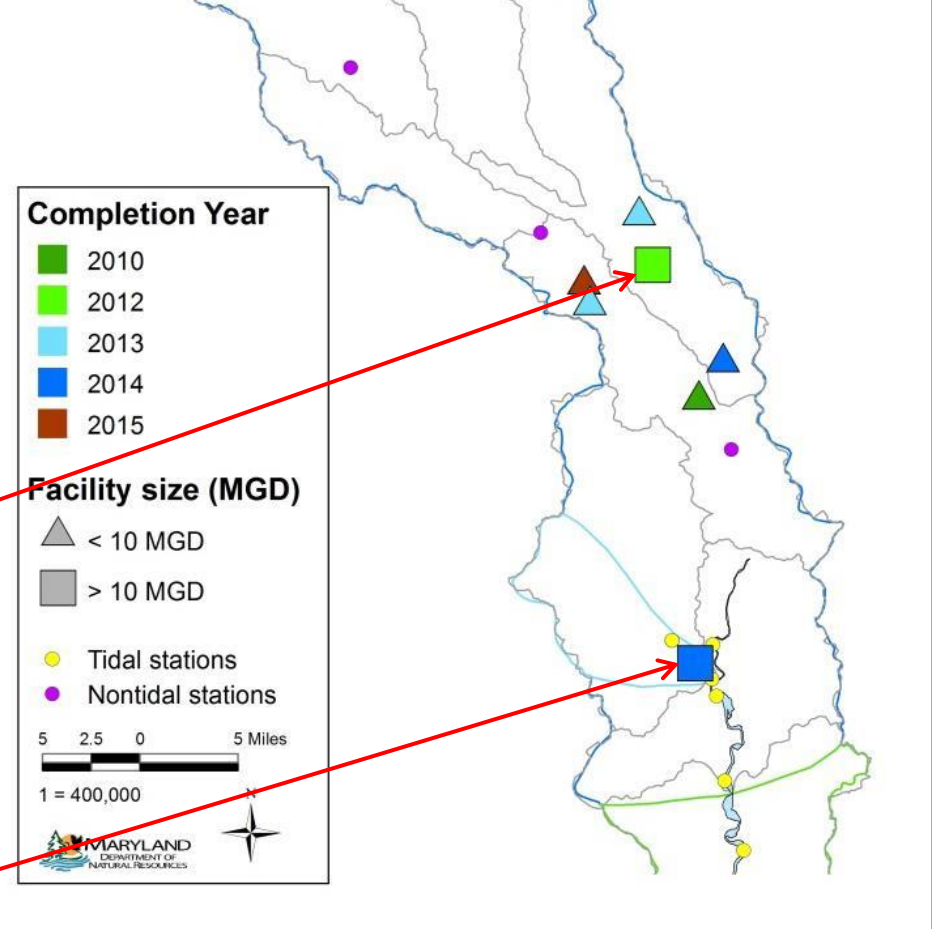
- Point Sources largest source in Upper River
- Septic important to Nitrogen loads
- Urban and Agriculture Sources

■ Agriculture   
 ■ Urban Runoff   
 ■ Point Source   
 ■ Forest   
 ■ NT Dep   
 ■ Septic

# Nitrogen & Phosphorus WWTP Loadings per year

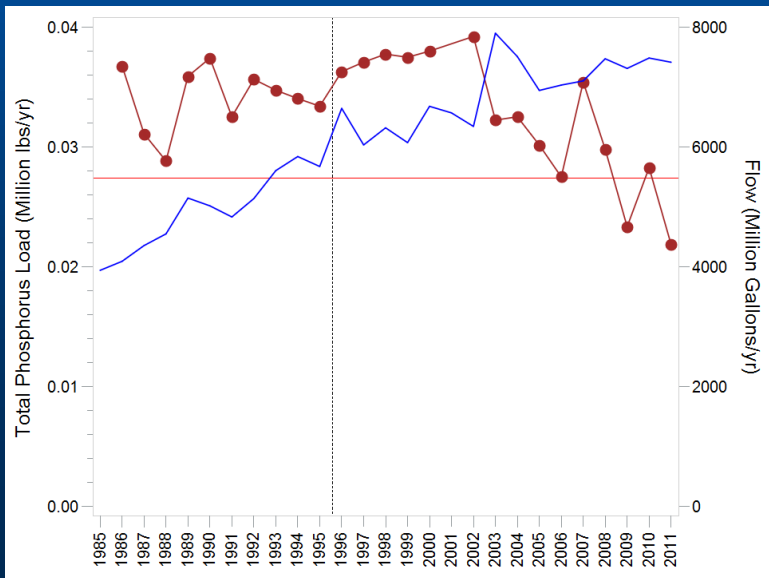
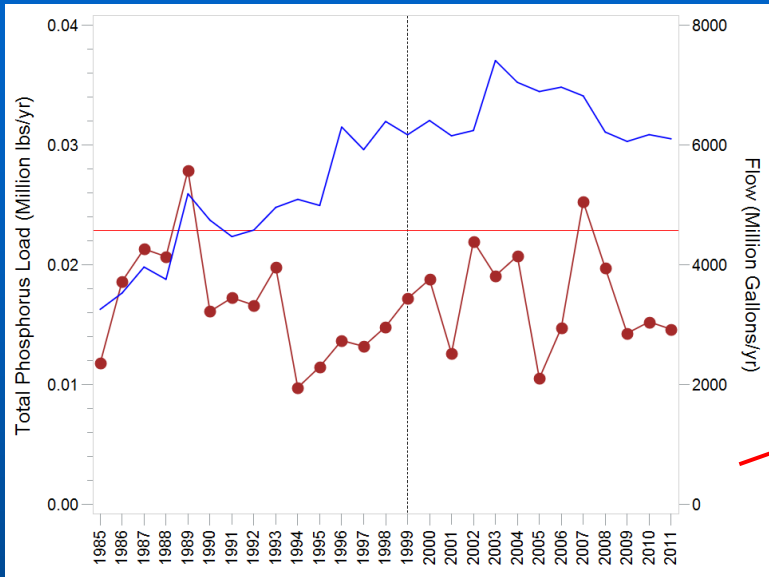


## ENR upgrades completion dates

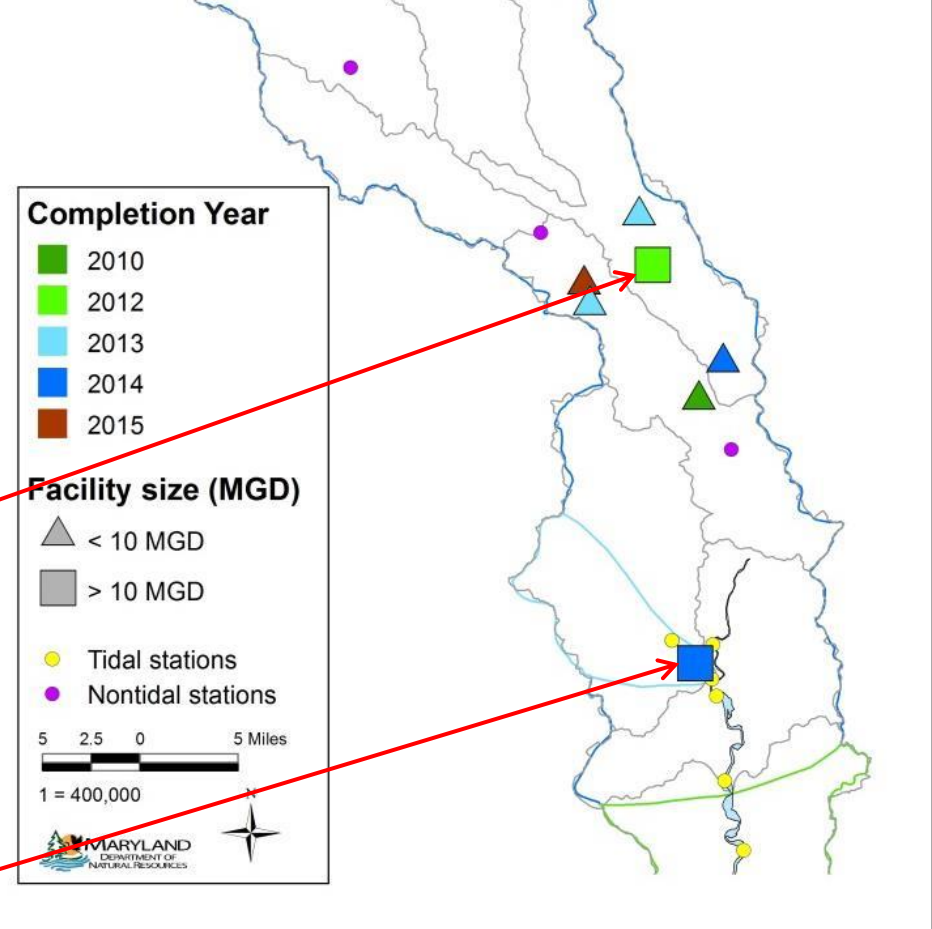


**Nitrogen (green)**  
**Flow (blue)**

# Nitrogen & Phosphorus WWTP Loadings per year



## ENR upgrades completion dates



Phosphorus (brown)  
Flow (blue)

# Current Conditions and Trends



Photo By L. Fabian



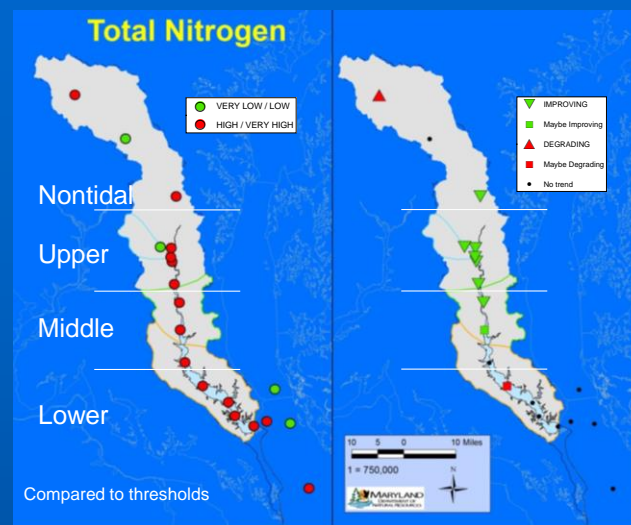
Photo By L. Fabian

# Current Conditions and Trends

## Maps showing results

Current conditions 2012-2014

Trends 1999-2013 (nontidal)  
or 1999-2014 (tidal)



**Just focus on the color:**

**Green is Good**  
**Red is Poor**

**Green is Improving**  
**Red is Degrading**

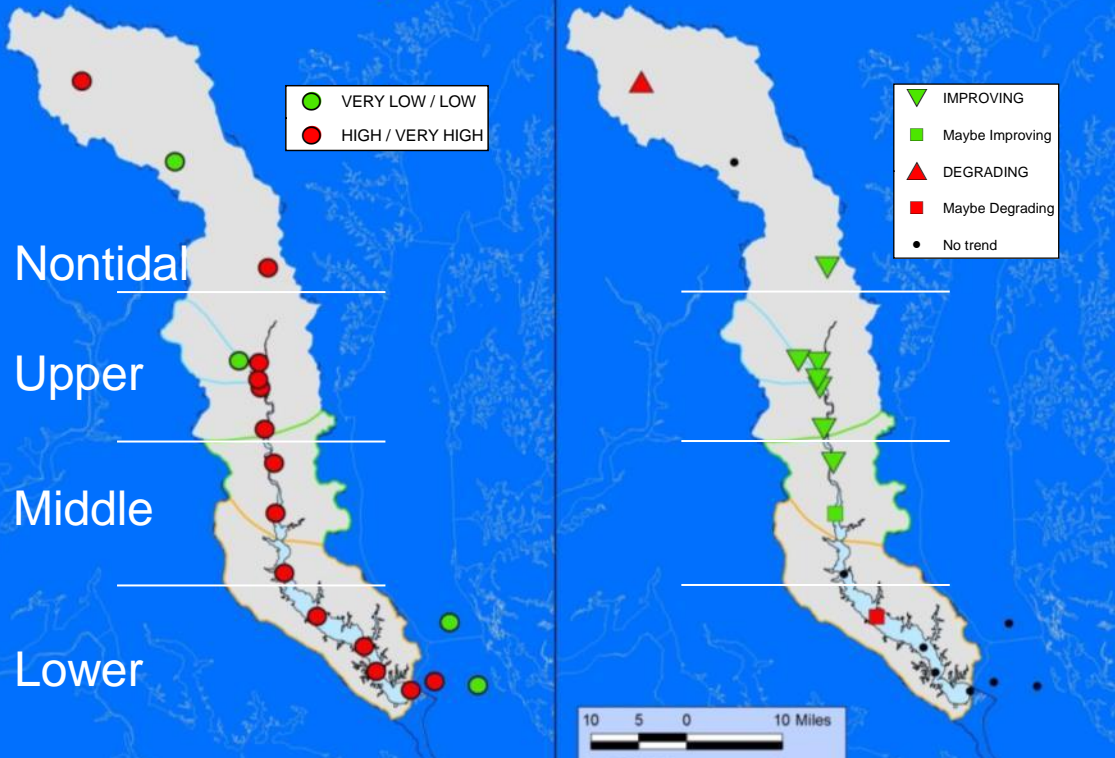
● VERY LOW / LOW  
● HIGH / VERY HIGH

● MEET  
● FAIL

▼ IMPROVING  
■ Maybe Improving  
▲ DEGRADING  
■ Maybe Degrading  
● No trend

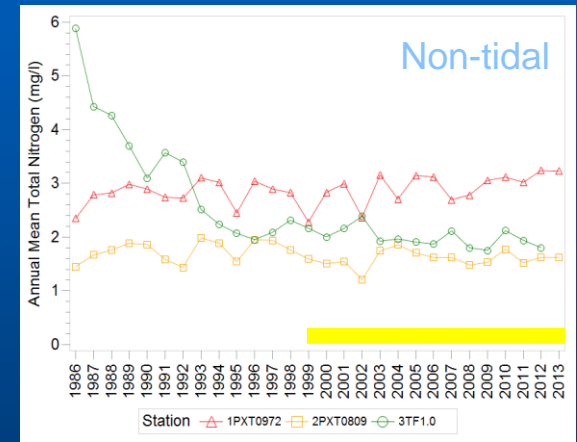
# Water Quality

## Total Nitrogen

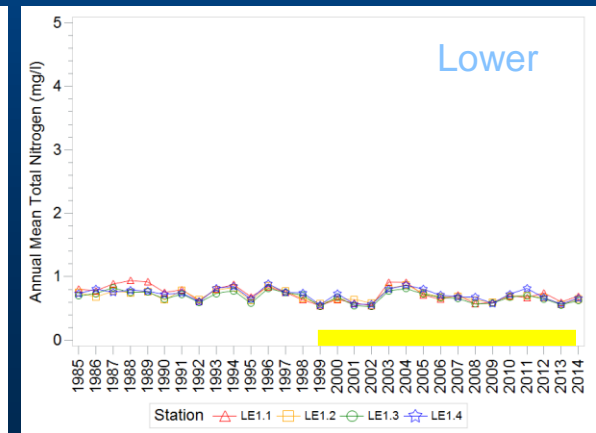
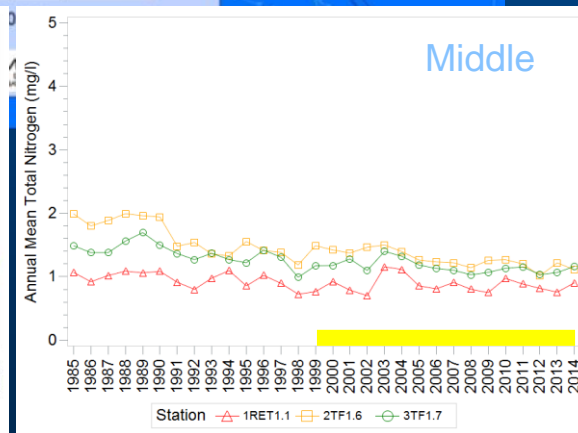
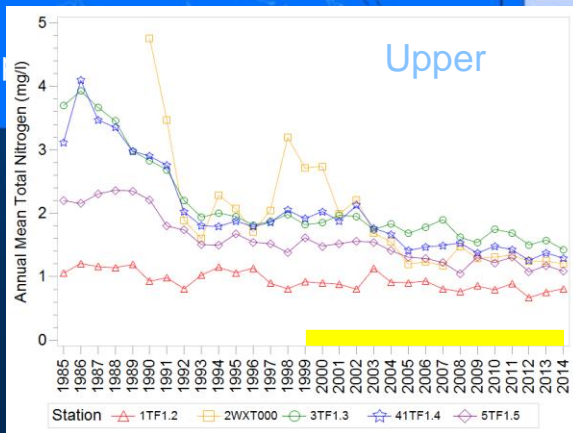


Current N levels still too high throughout the river

Improving in lower non-tidal upper and middle river sections, degrading in upper watershed

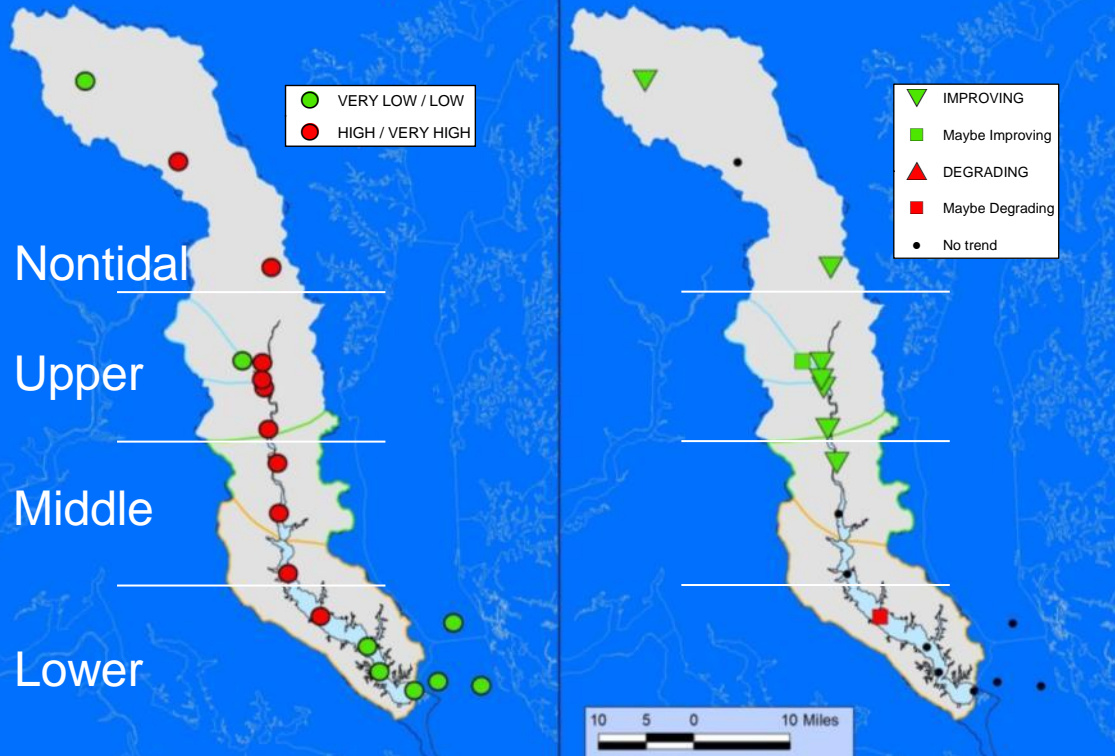


Com



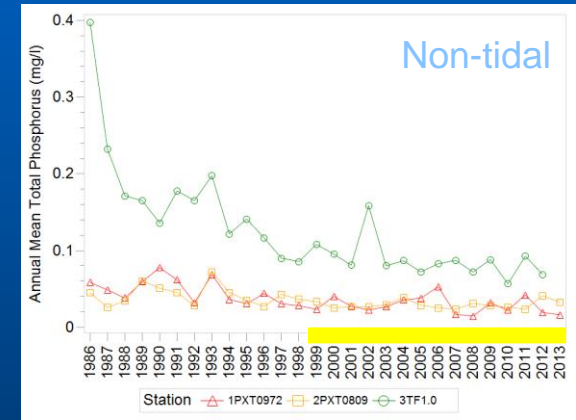
# Water Quality

## Total Phosphorus

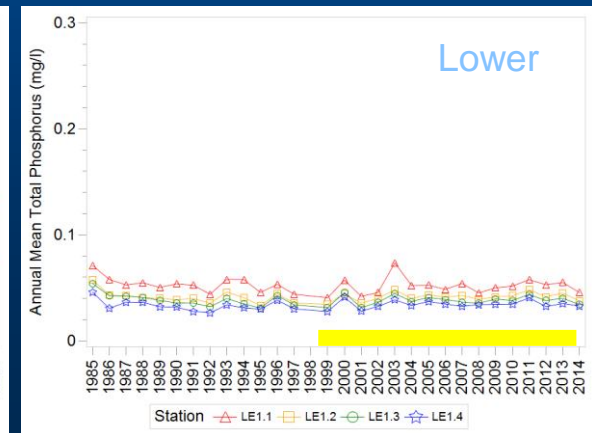
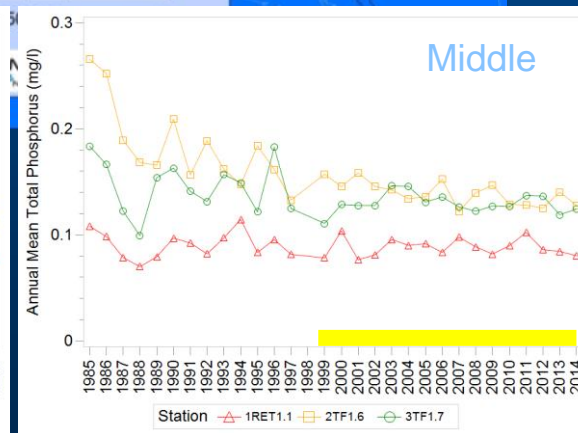
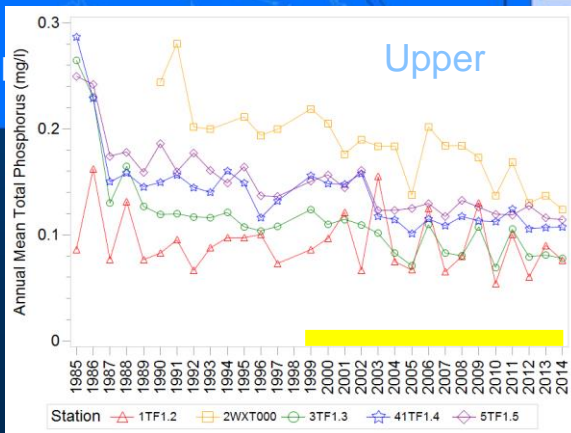


Current P levels still too high in lower non-tidal and upper and middle sections of river

Improving in non-tidal and upper river



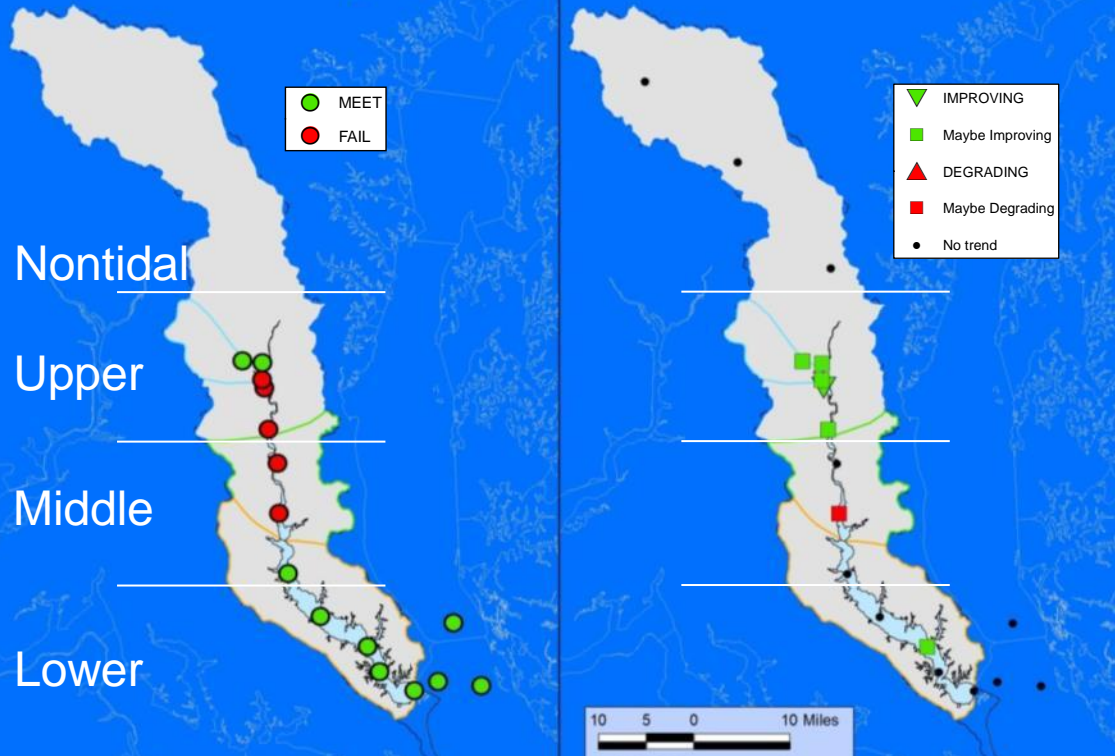
Com





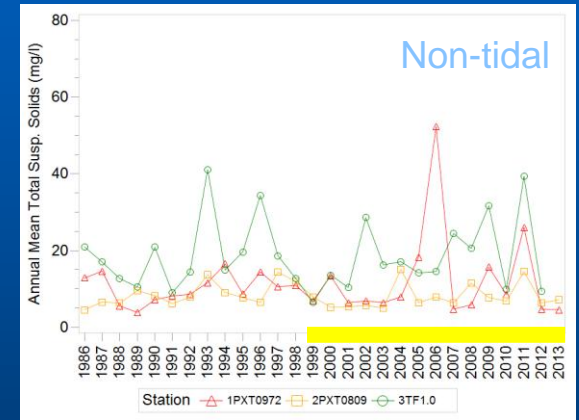
# Water Quality

## Total Suspended Solids

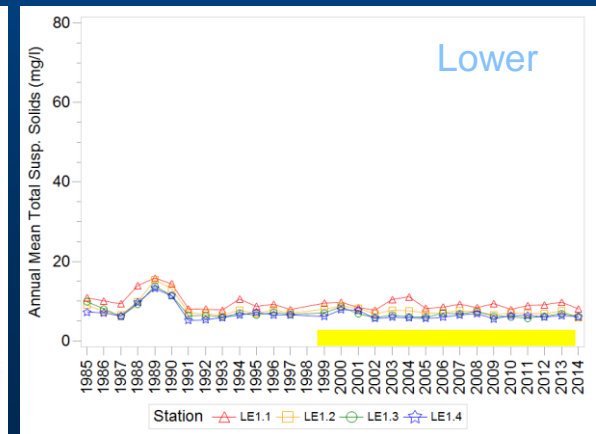
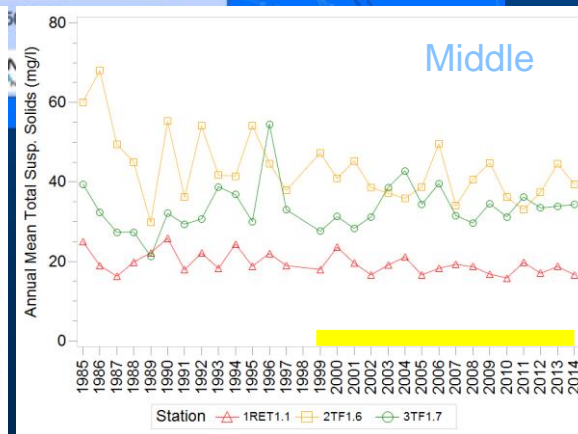
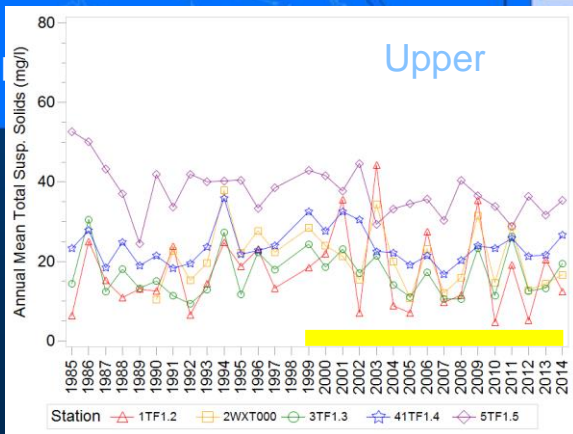


Current Sediment levels still too high in upper and middle sections river

Possibly improving in upper river



Com



# Habitat Quality



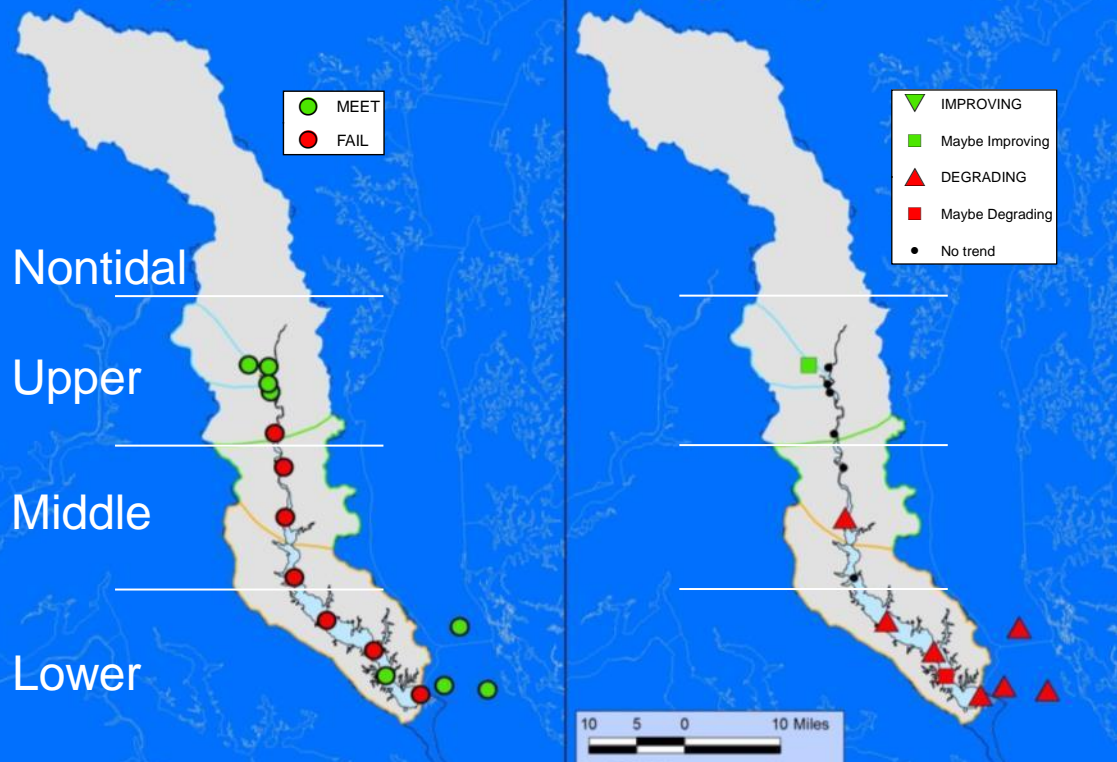
Photo from D. McKay



Photo by D. McKay

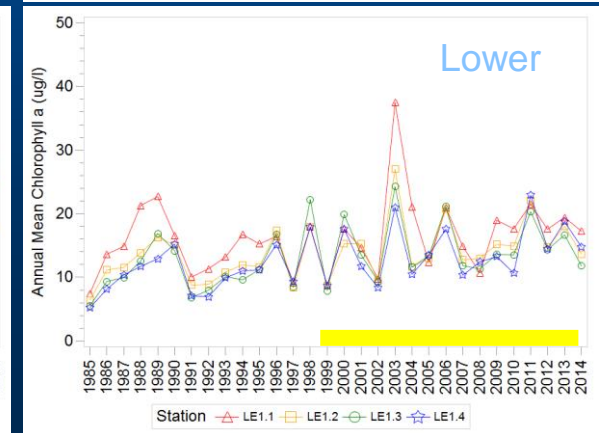
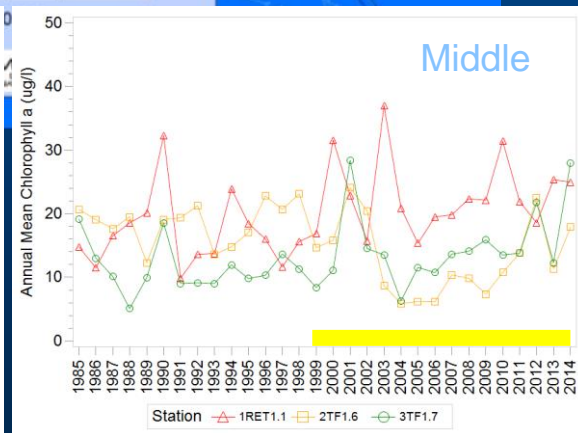
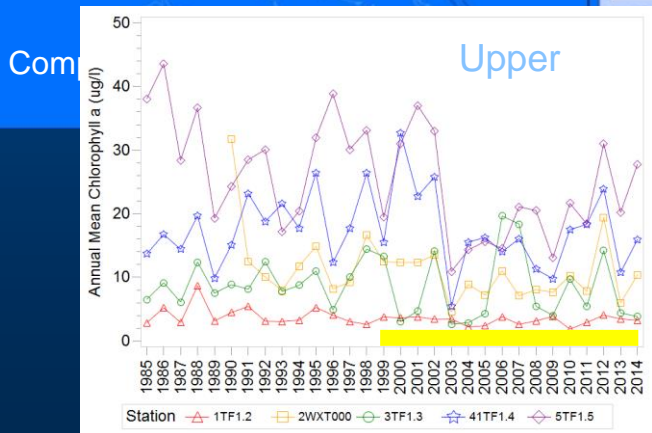
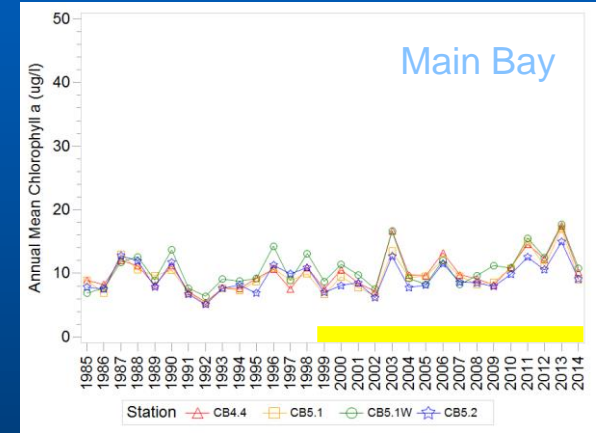
# Habitat Quality

## Algal Levels (Chlorophyll a)



Current Algal levels are too high in middle and lower river

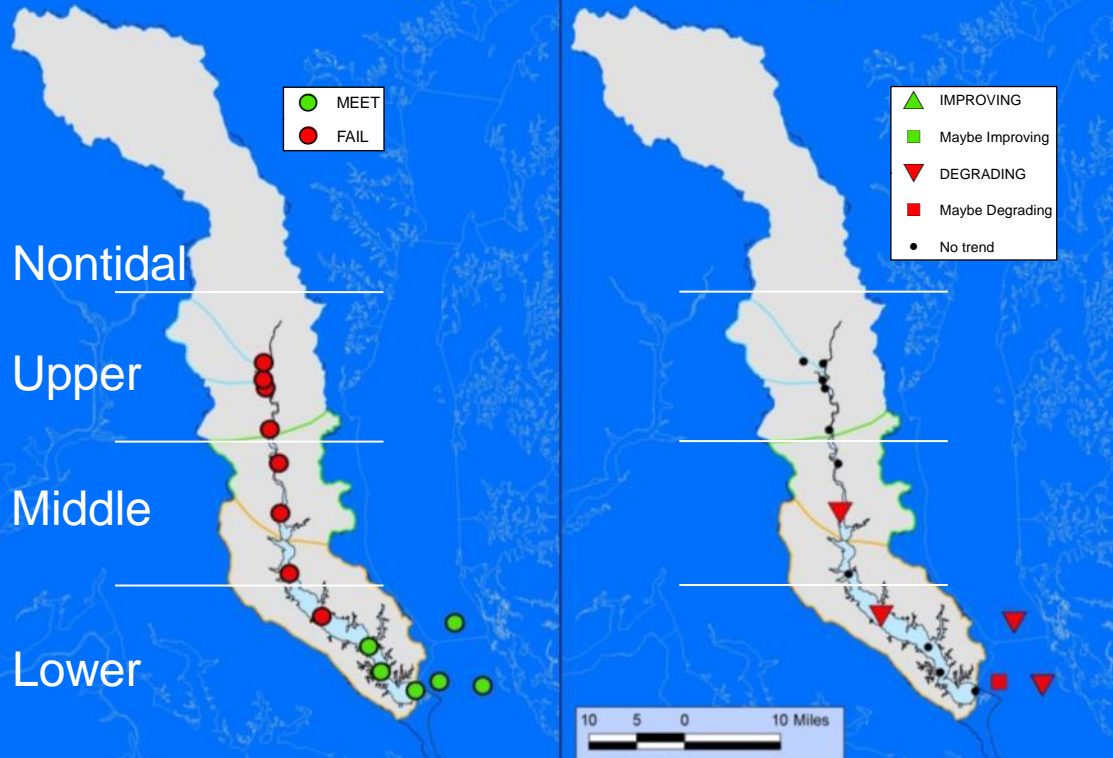
Degrading in middle and lower river and in Mainstem Bay



Com

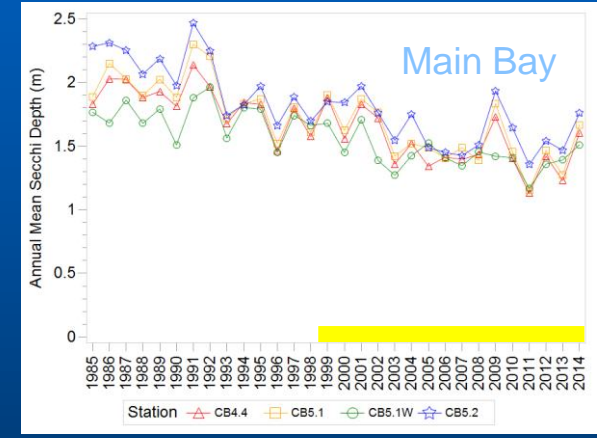
# Habitat Quality

## Water Clarity (Secchi Depth)

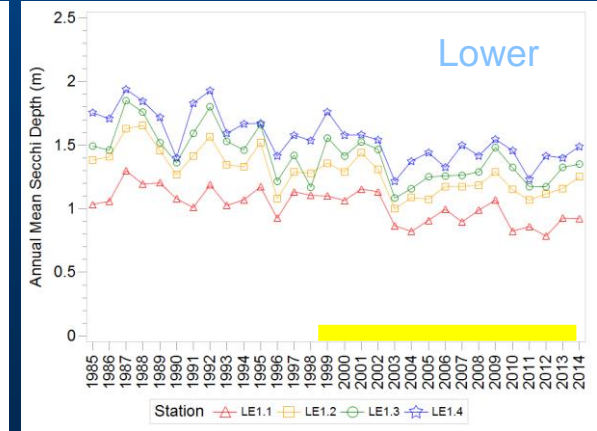
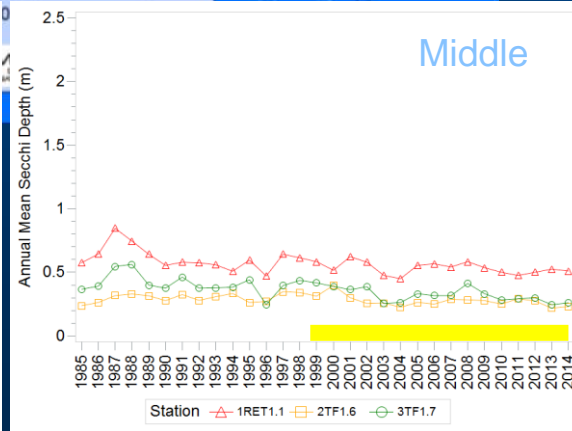
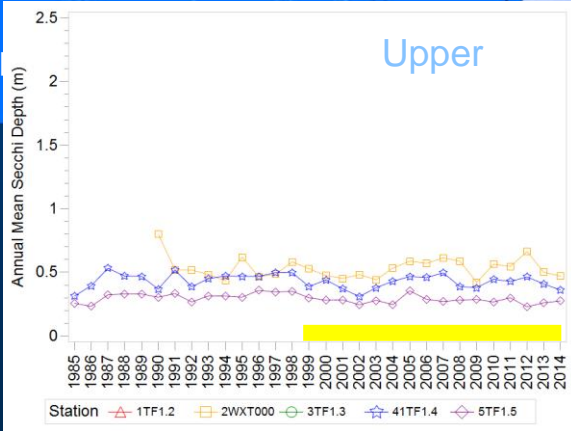


Current water clarity is too low in most of river

Degrading in middle and lower river and in Mainstem Bay

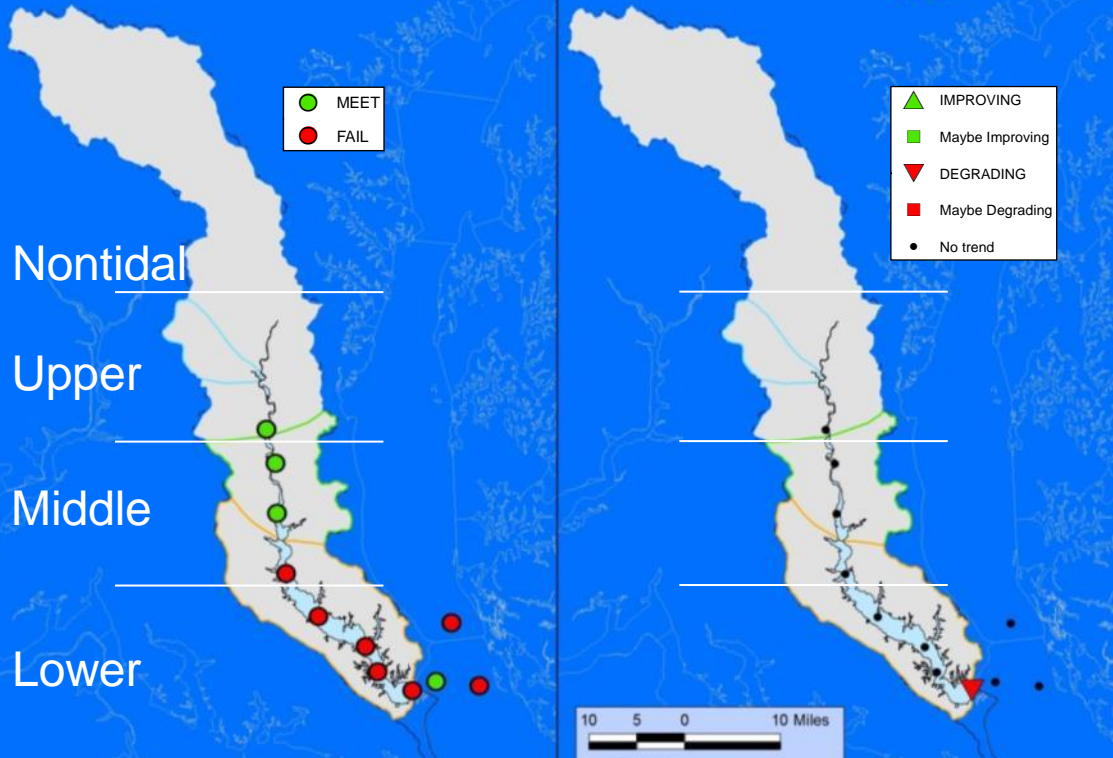


Com



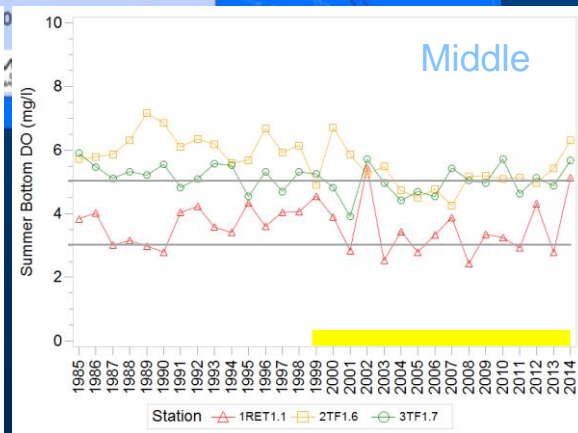
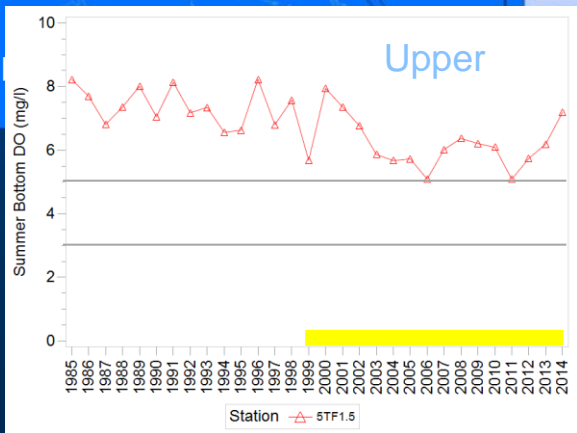
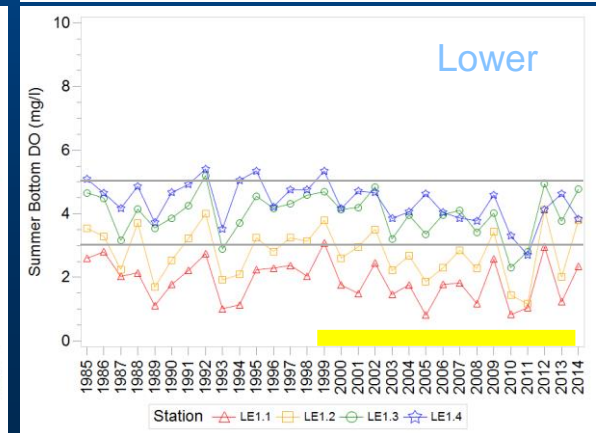
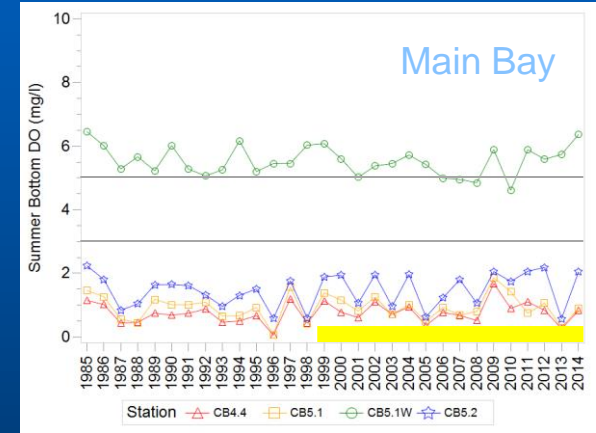
# Habitat Quality

## Summer Bottom Dissolved Oxygen



Current summer bottom Dissolved oxygen is too low in deeper portions of lower river

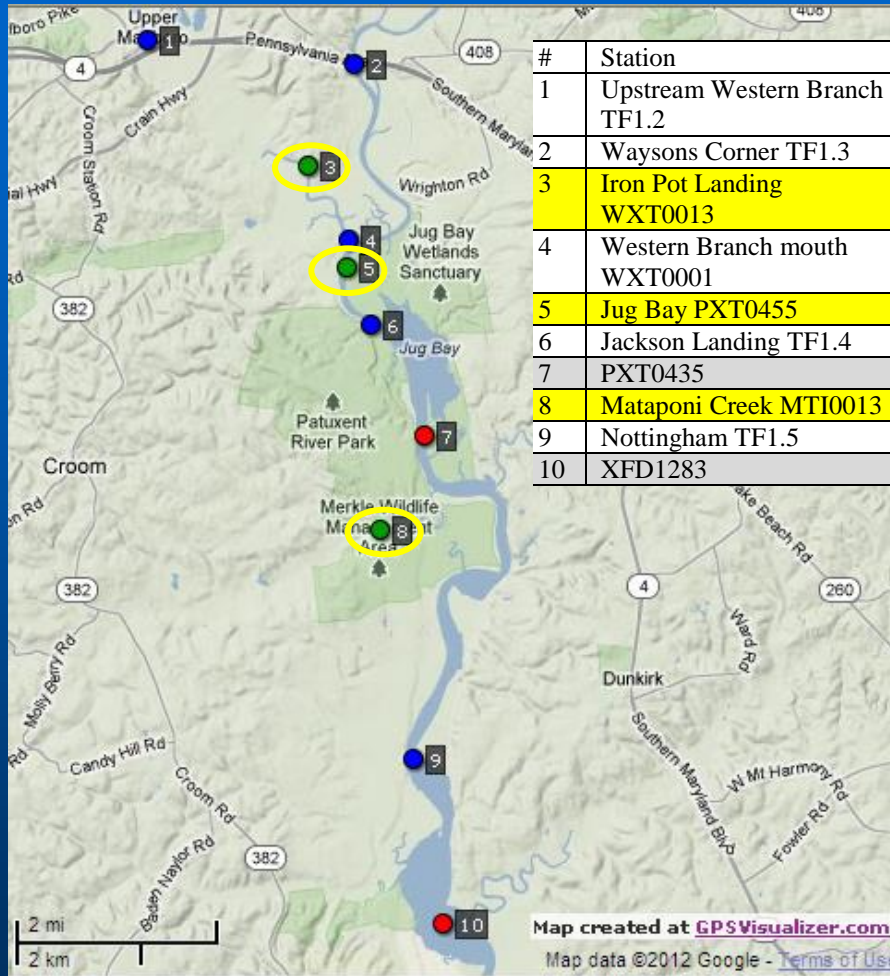
No consistent changes in most of river



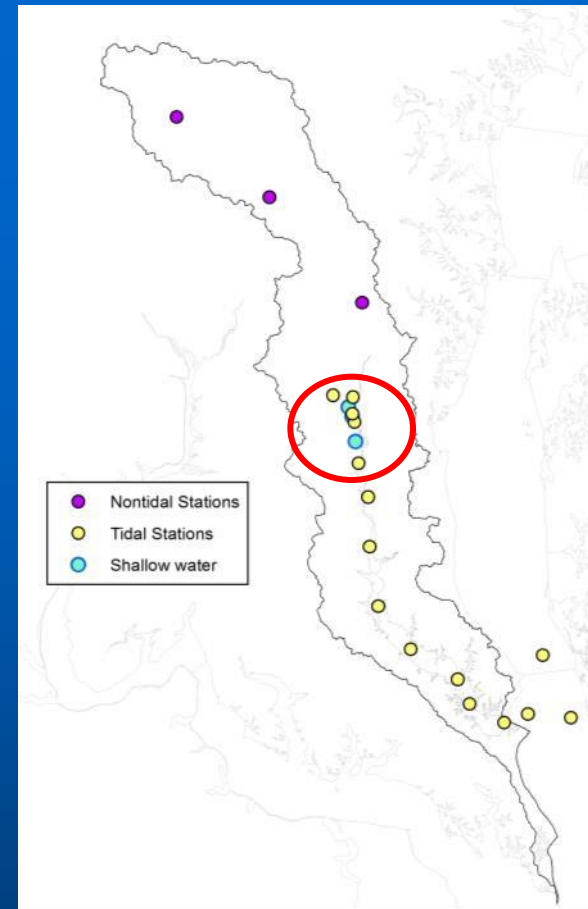
Com

# Shallow water quality

2003-present CBNERR/DNR

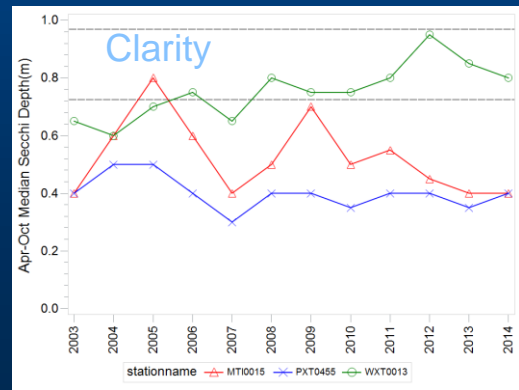
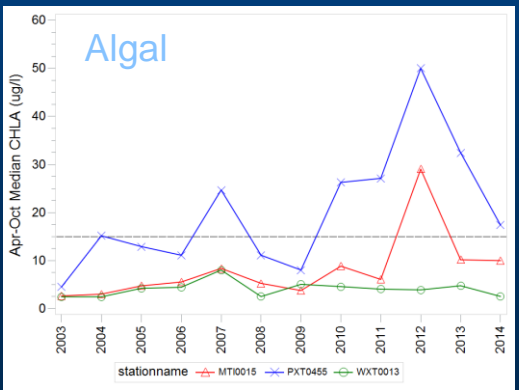
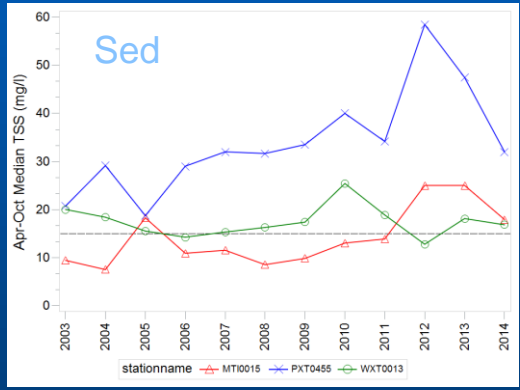
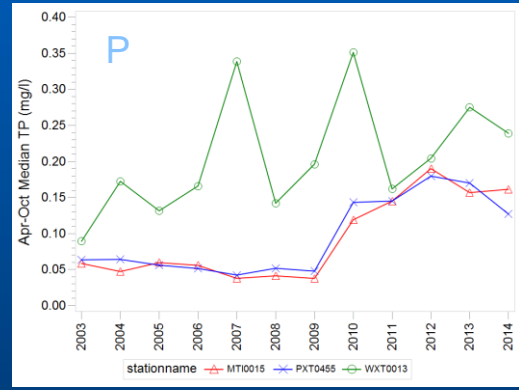
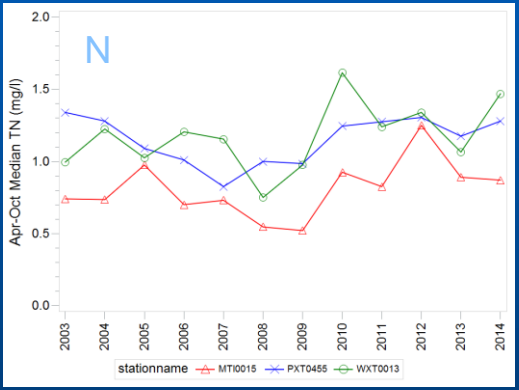


#	Station	Type
1	Upstream Western Branch TF1.2	LT
2	Waysons Corner TF1.3	LT
3	Iron Pot Landing WXT0013	CM
4	Western Branch mouth WXT0001	LT
5	Jug Bay PXT0455	CM
6	Jackson Landing TF1.4	LT
7	PXT0435	WQM
8	Mataponi Creek MTI0013	CM
9	Nottingham TF1.5	LT
10	XFD1283	WQM



# Shallow water quality 2003-present CBNERR/DNR

	Water Quality			Habitat Quality	
Station	N	P	Sed	Algal	Clarity
Iron Pot Landing			↑	●	● ↑
Jug Bay			↑	● ↑	●
Mataponi	↑		↑	● ↑	●



# Summary- Nontidal

- N & P levels have dropped dramatically since the 1980s in lower watershed (WWTP upgrades), but N Degraded in upper watershed
- N & P levels still too high
- Sediment levels – no trends

		Water Quality			Habitat Quality		
	Station	N	P	Sed	Algal	Clarity	Sum BDO
Nontidal	PXT0972	● ↑	● ↓				
	PXT0809	●	●				
	TF1.0	● ↓	● ↓				



# Summary- Upper River

- N & P levels improved – but still too high to limit algal growth or to provide healthy habitat for underwater grasses
- Sediment levels may have improved – but still too high
- Algal abundance –no trends but currently meet the SAV habitat requirements, lots of variability between years
- Water clarity –no trends but too low for healthy SAV habitat
- Summer Bottom dissolved oxygen levels currently good

		Water Quality			Habitat Quality			
	Station	N		P	Sed	Algal	Clarity	Sum BDO
Upper River	TF1.2	●	↓	●	●	●		
	WXT0001	●	↓	●	↓	●	●	
	TF1.3	●	↓	●	↓	●	●	
	TF1.4	●	↓	●	↓	●	↓	●
	TF1.5	●	↓	●	↓	●	●	●

# Summary- Middle River

- N & P levels improved at the upper station but still too high throughout section
- Sediment levels too high at the two upstream stations
- Algal densities degraded at the middle station, current levels too high
- Water clarity degraded at the middle station and too low
- Summer bottom dissolved oxygen levels marginal and often fell to unhealthy levels and at the lower station were dangerously low in many of the most recent years

		Water Quality			Habitat Quality		
	Station	N	P	Sed	Algal	Clarity	Sum BDO
Middle River	TF1.6	● ↓	● ↓	●	●	●	●
	TF1.7	●	●	●	● ↑	● ↓	●
	RET1.1	●	●	●	●	●	●

# Summary- Lower River

- N levels too high
- P & Sediment levels low enough for healthy underwater grasses habitat
- Algal abundance degraded in Lower River and in Mainbay at mouth of river, levels too high for healthy underwater grasses habitat
- Water clarity degraded at the upstream and too low for healthy underwater grass habitat, meets habitat requirements in lower section
- Since 1980s water clarity has dropped at all stations, same pattern in Mainbay
- Summer bottom dissolved oxygen levels were dangerously low at the two upstream stations in most years. Two downstream summer bottom dissolved levels were higher but still too low.
- Summer bottom dissolved oxygen also degraded at the downstream station

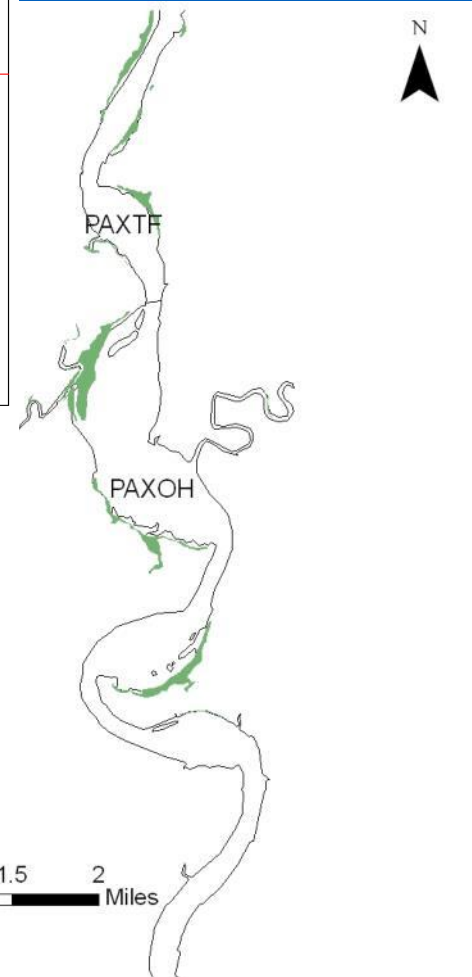
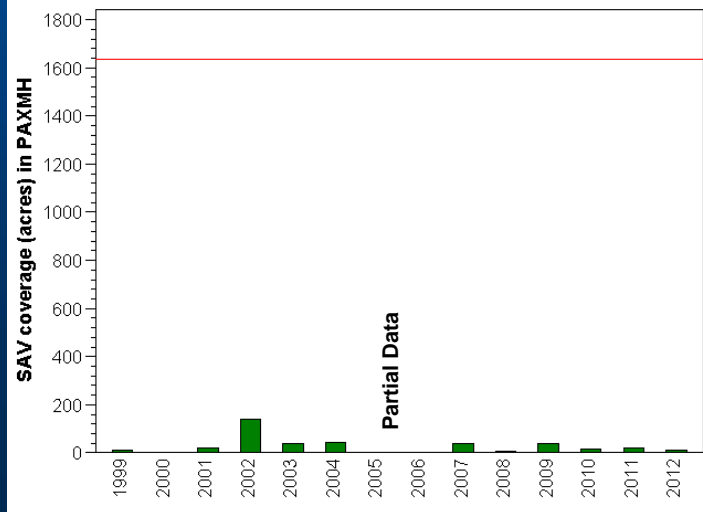
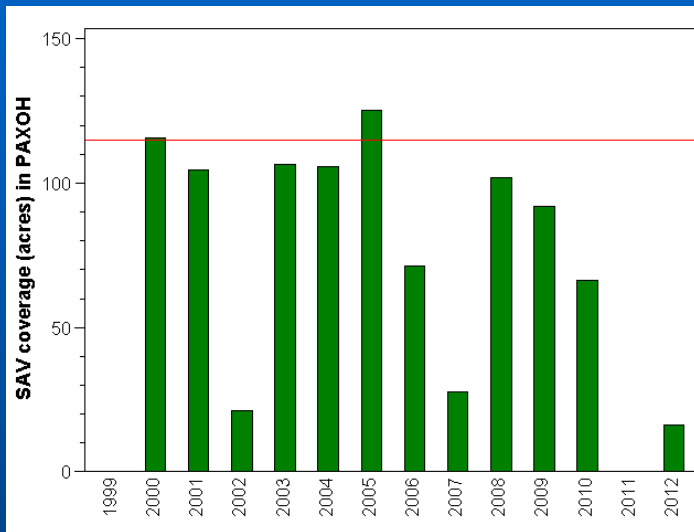
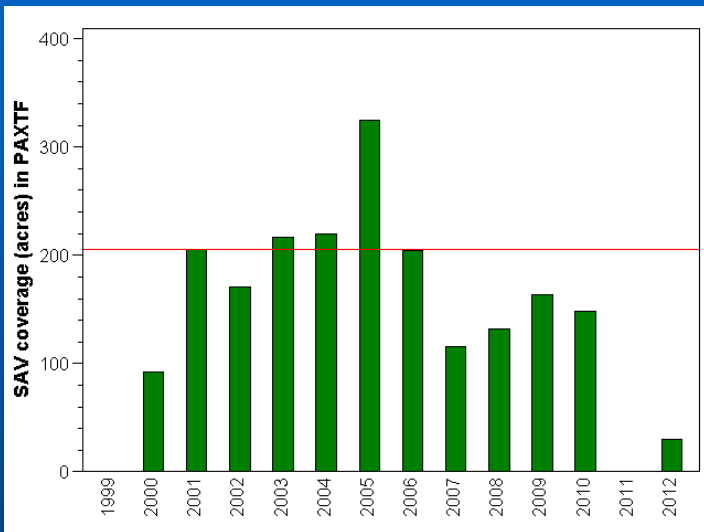
		Water Quality			Habitat Quality		
	Station	N	P	Sed	Algal	Clarity	Sum BDO
Lower River	LE1.1	●	●	●	● ↑	● ↓	●
	LE1.2	●	●	●	● ↑	●	●
	LE1.3	●	●	●	●	●	●
	LE1.4	●	●	●	● ↑	●	● ↓



# Underwater grasses (SAV)

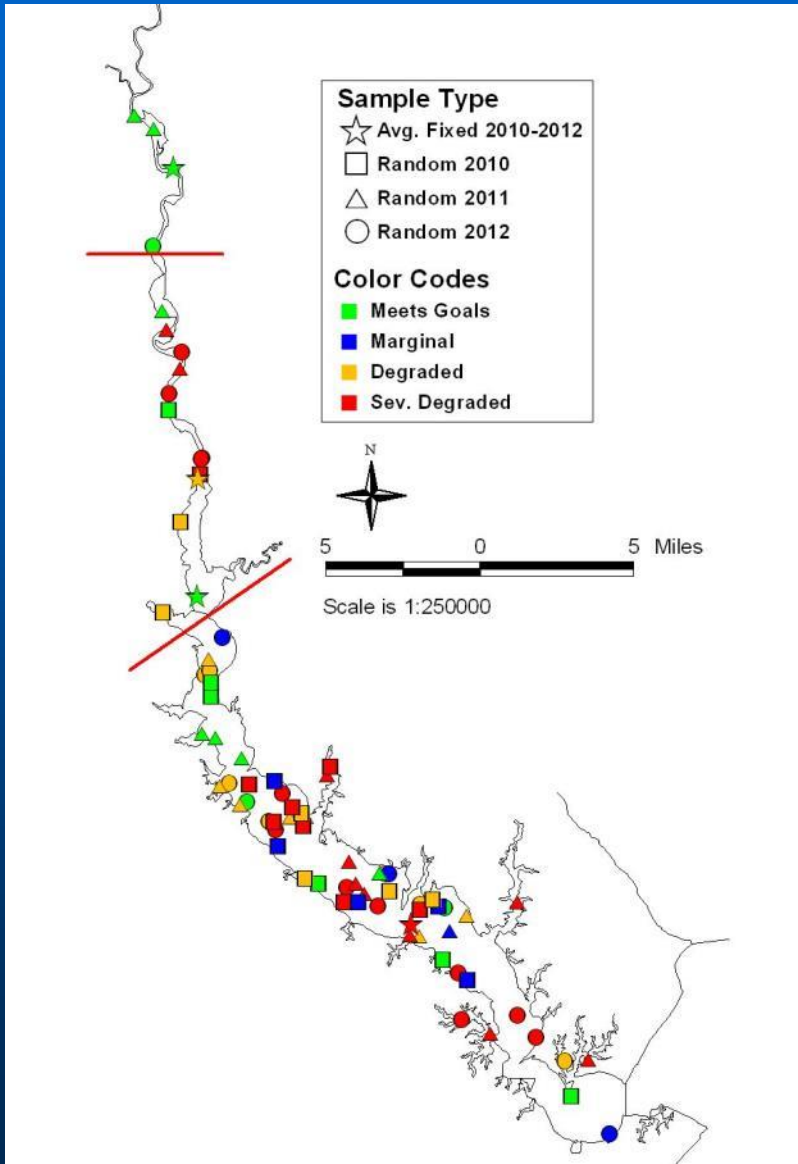
SAV acres by Bay Program segment 1999-2012

SAV coverage maps 2010\* used 2010 because of large decrease in 2012



# Bottom-dwelling animals (Benthos)

## Benthic Index of Biotic Integrity



For 1996-2012:

Degraded /Severely degraded 57%

For 2010-2012:

Severely degraded/Degraded 65%

Most of the severely degraded locations were within the deep channel of the lower river, where dissolved oxygen is almost always depleted (hypoxic or anoxic) during the summer months.

Total Area with degraded conditions

2010 was 56%

2011 was 64%

2012 was 76%.

**Questions?**