Using Science to Convince 18 Million People to Go (and Stay) on a Pollution Diet

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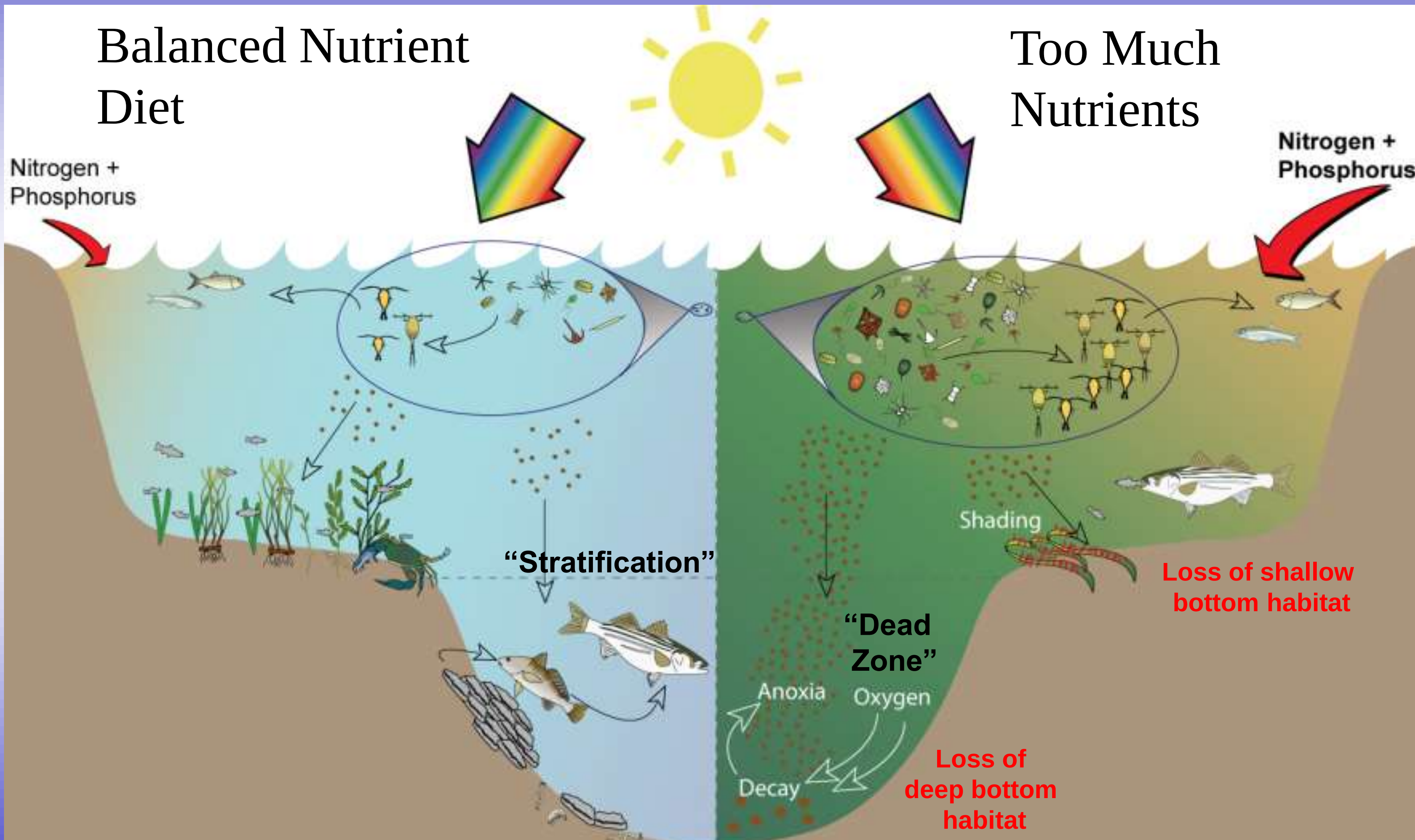
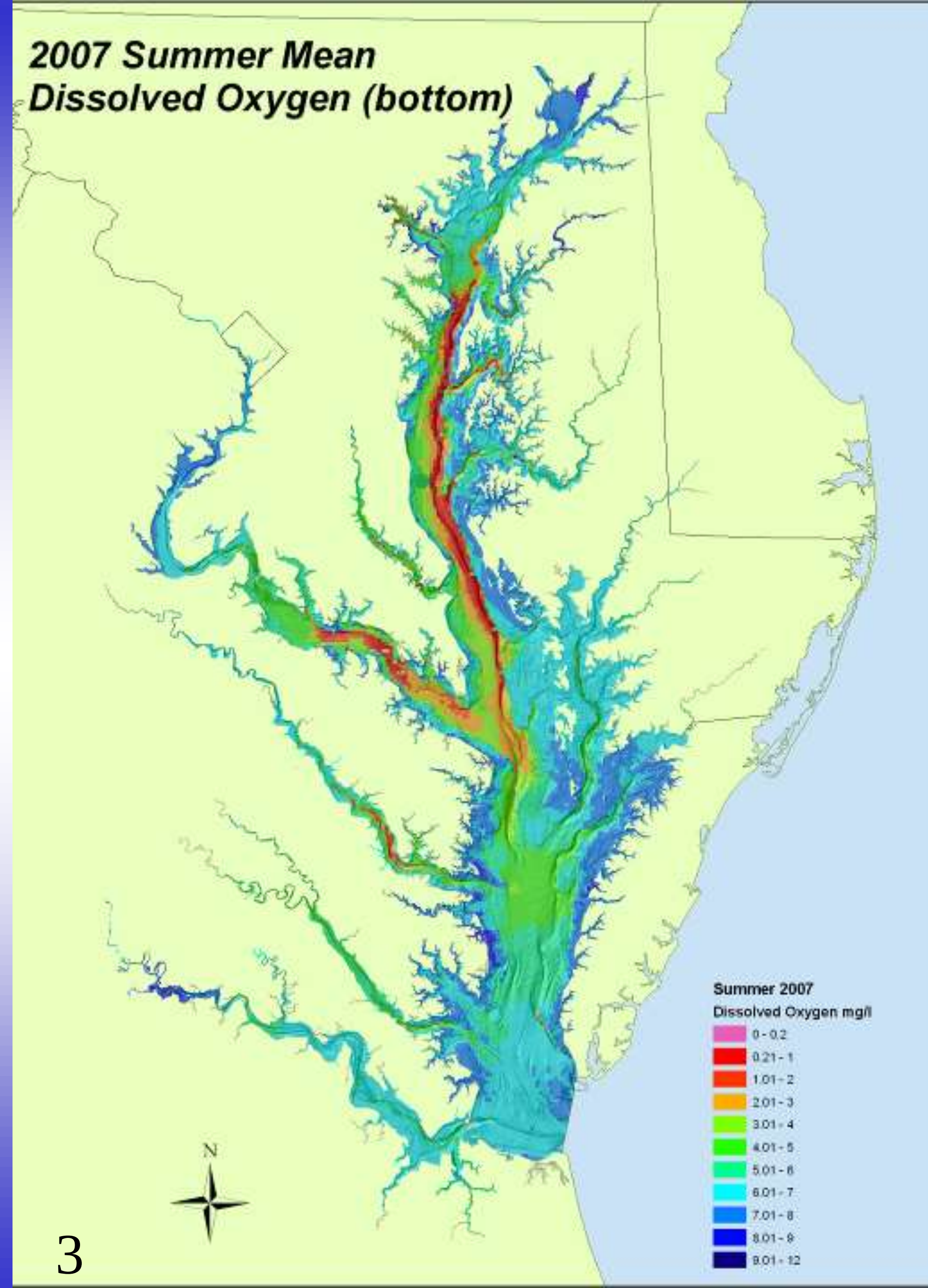
Chesapeake Bay Program
U.S. Environmental Protection Agency

September 25, 2015

How Too Much Nutrient Pollution Impacts the Chesapeake Bay Ecosystems

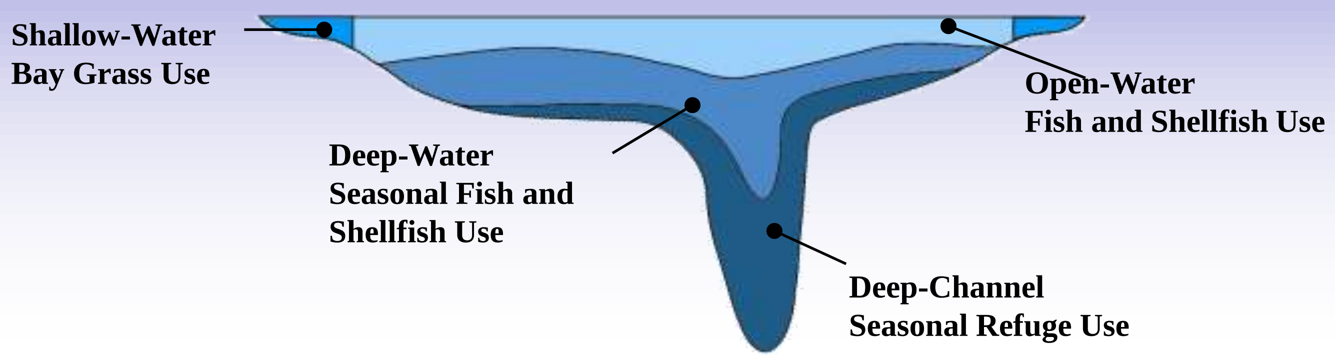


Low to no dissolved oxygen in the Bay and tidal rivers every summer

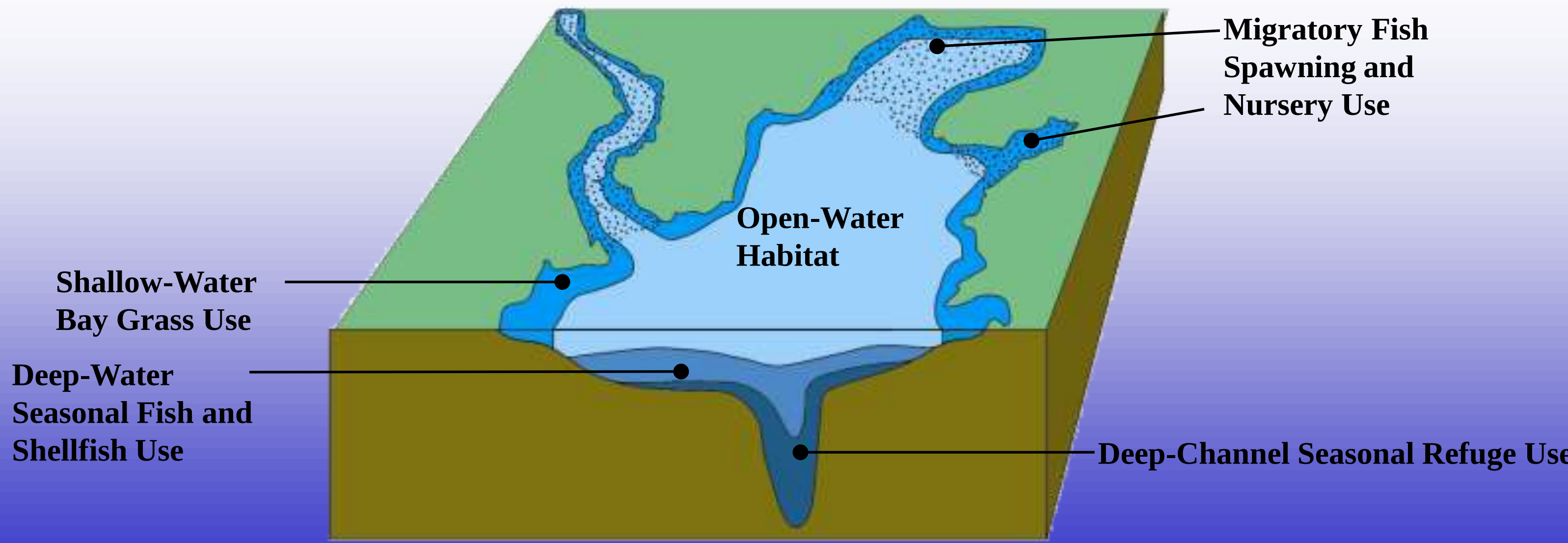


Refined Designated Uses for the Bay and Tidal Tributary Waters

A. Cross Section of Chesapeake Bay or Tidal Tributary

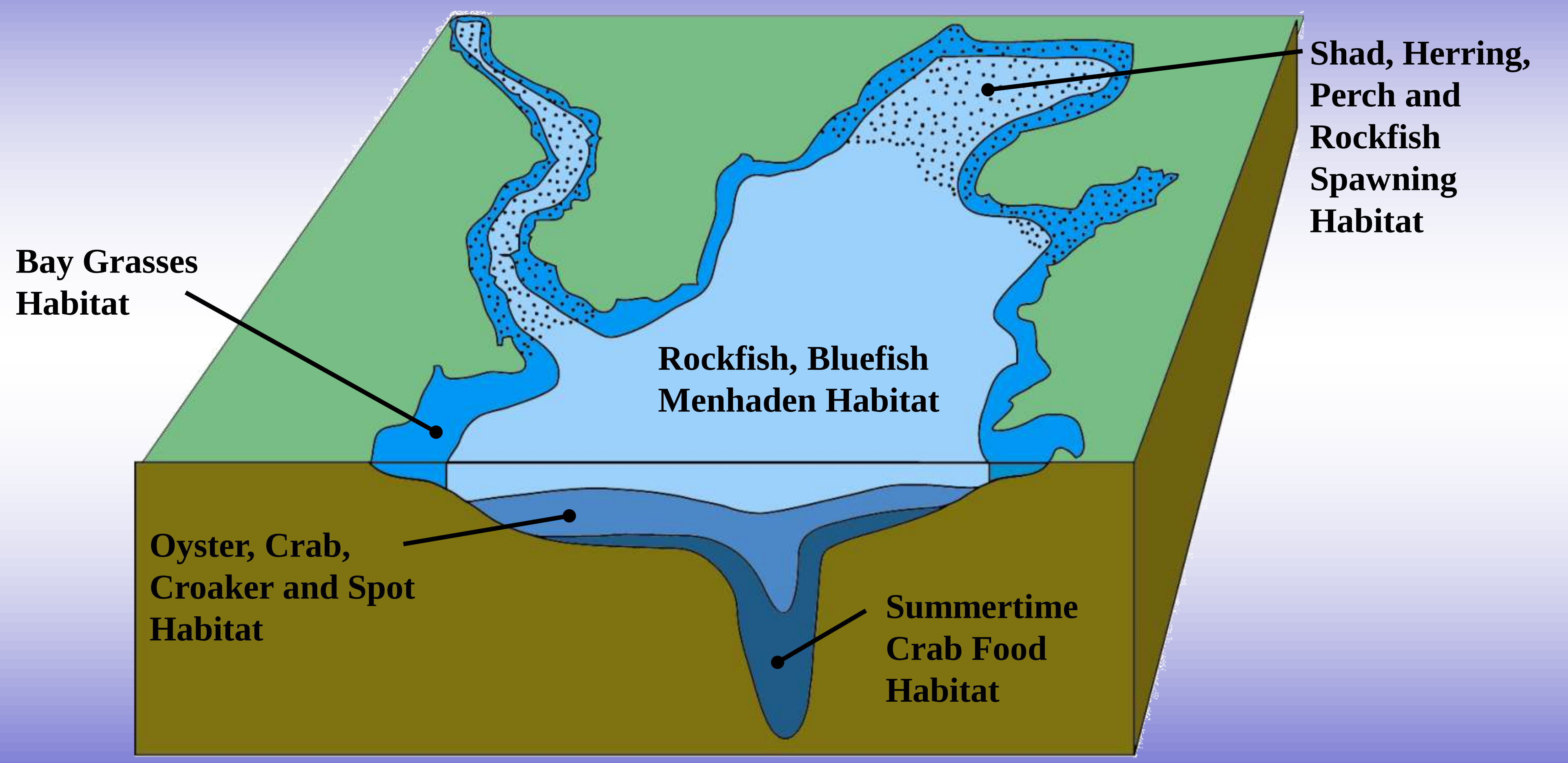


B. Oblique View of the “Chesapeake Bay” and its Tidal Tributaries

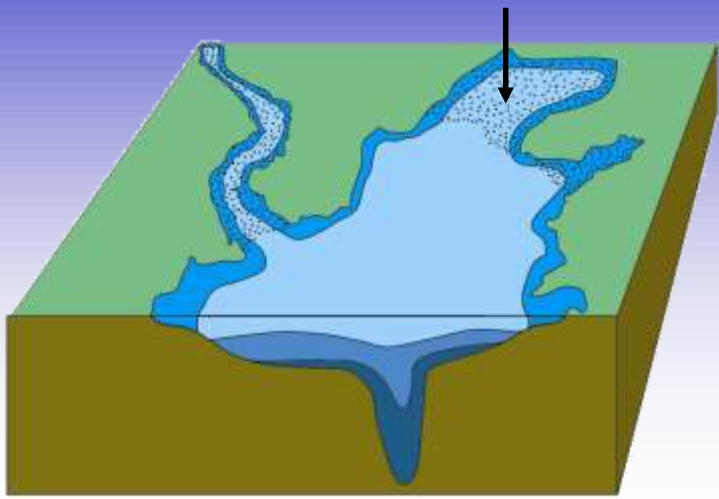


Source: U.S. EPA 2003

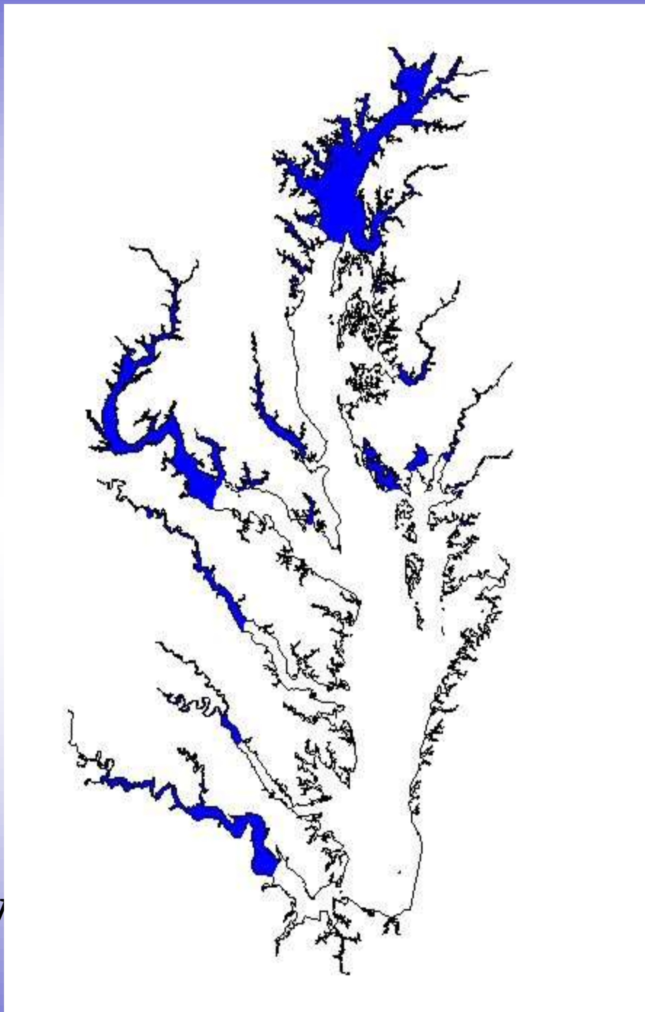
Local "Zoning" for Bay and Tidal River Fish, Crab and Grasses Habitats



Migratory Fish Spawning and Nursery Use

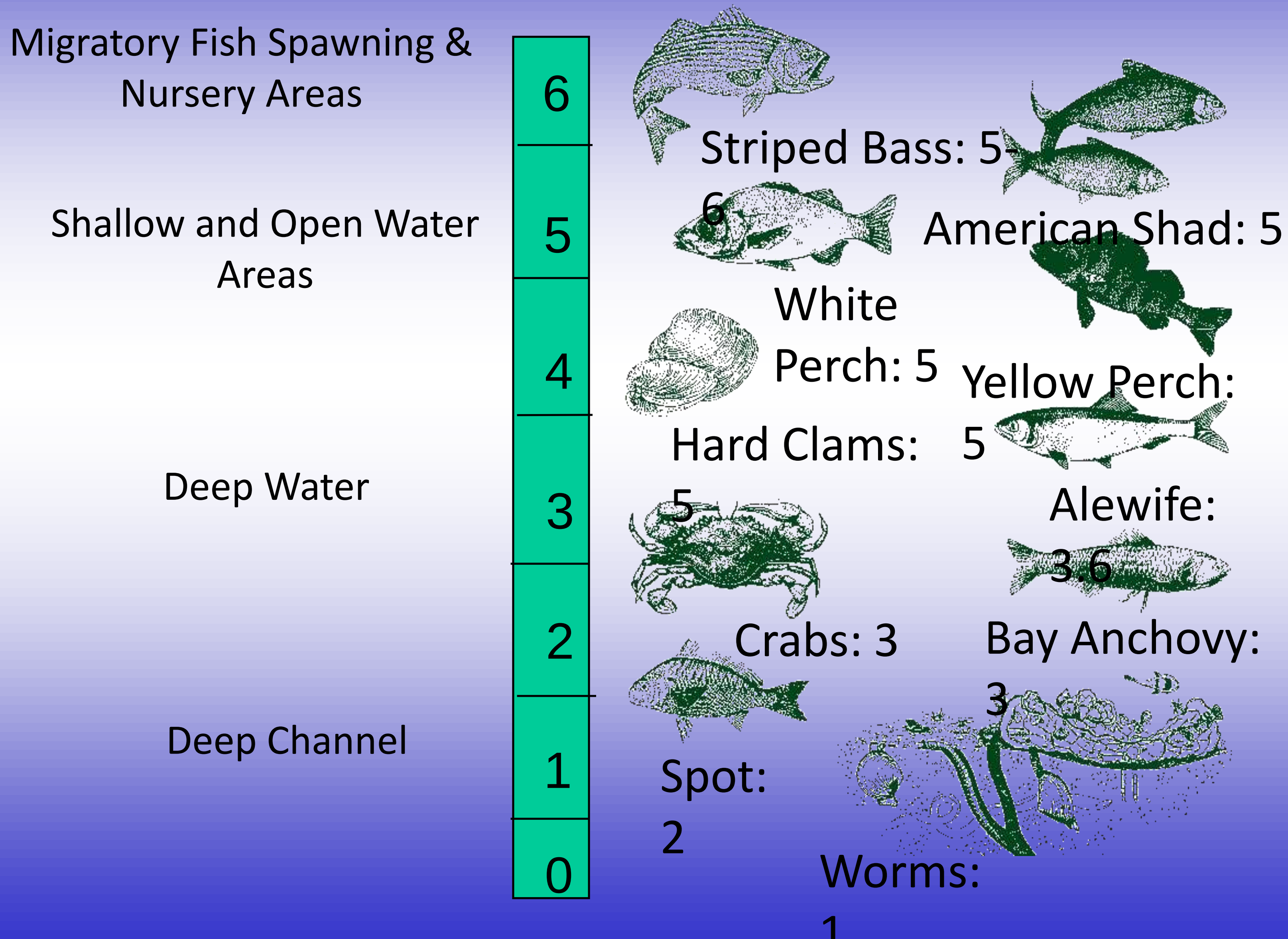


Supports early life stages of fish inhabiting the upper reaches of tidal waters and the upper mainstem used as spawning and nursery grounds by striped bass, shad, perch and other fish February - May

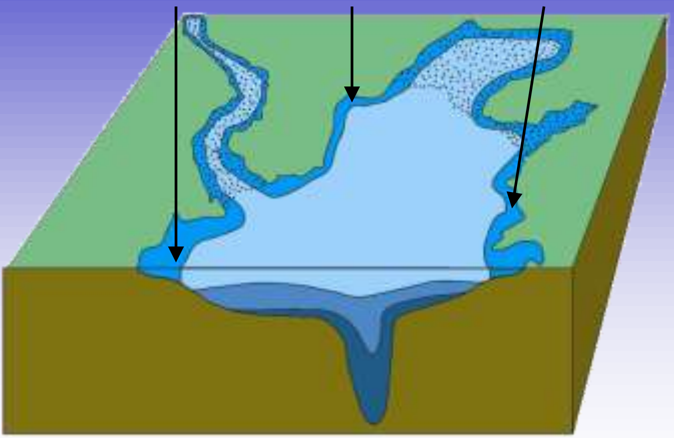


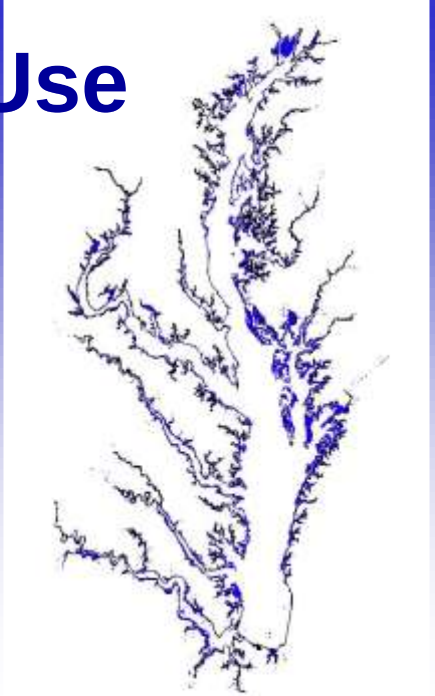
Bay Dissolved Oxygen Criteria

Minimum Amount of Oxygen (mg/L) Needed to Survive by Species



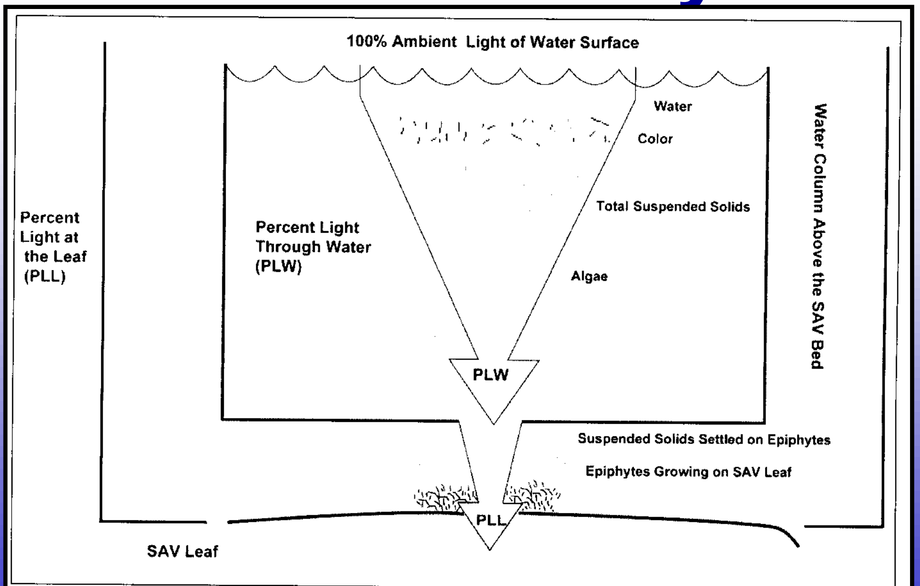
Shallow-Water Bay Grass Use



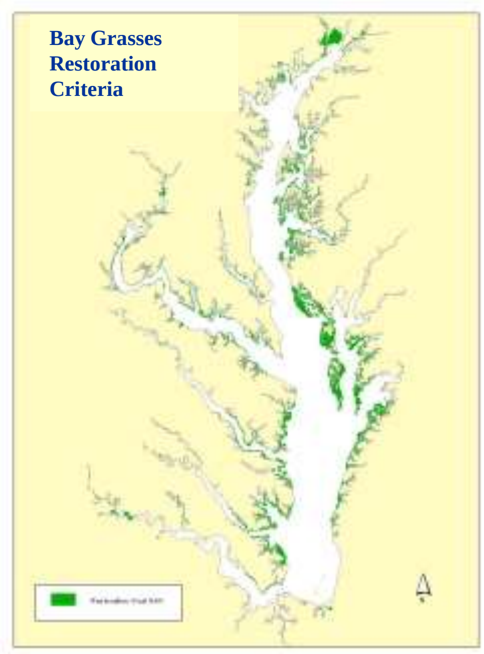


Shallow water use

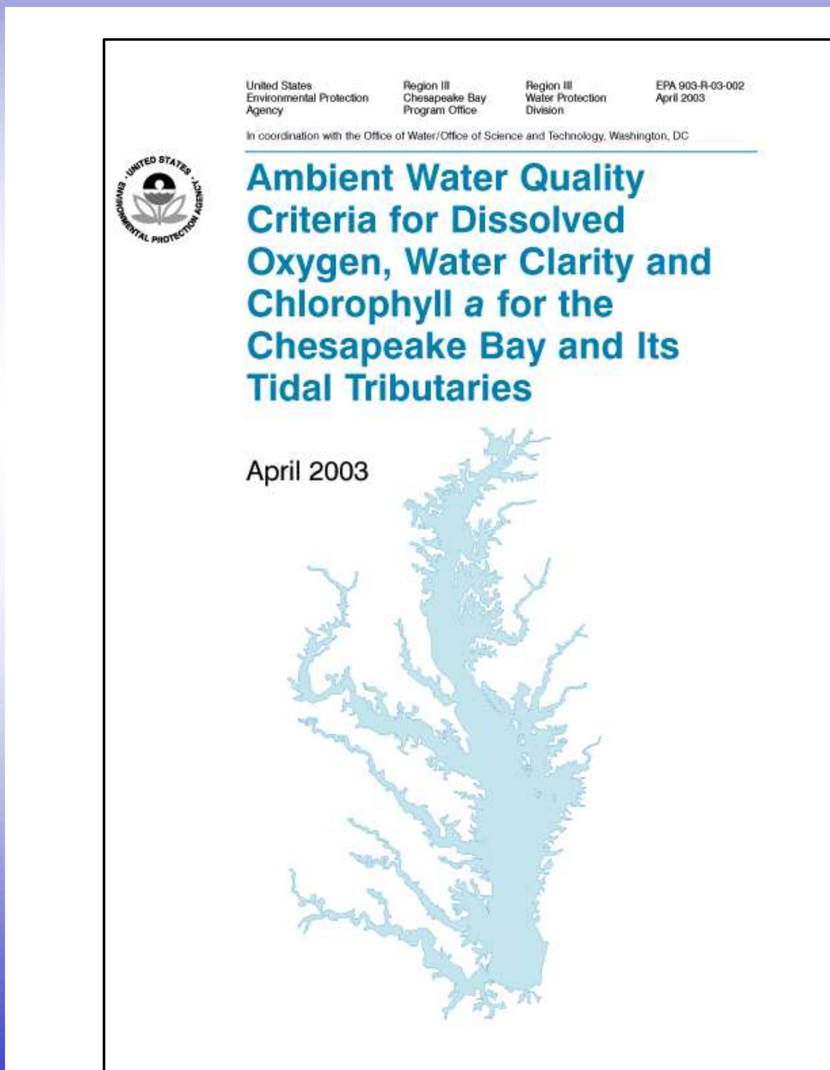
Water Clarity/SAV Criteria



Two Percent Light Parameters for Evaluating Ambient Conditions. Illustration of the relationship of the two percent light parameters and the water quality conditions influencing both of them.



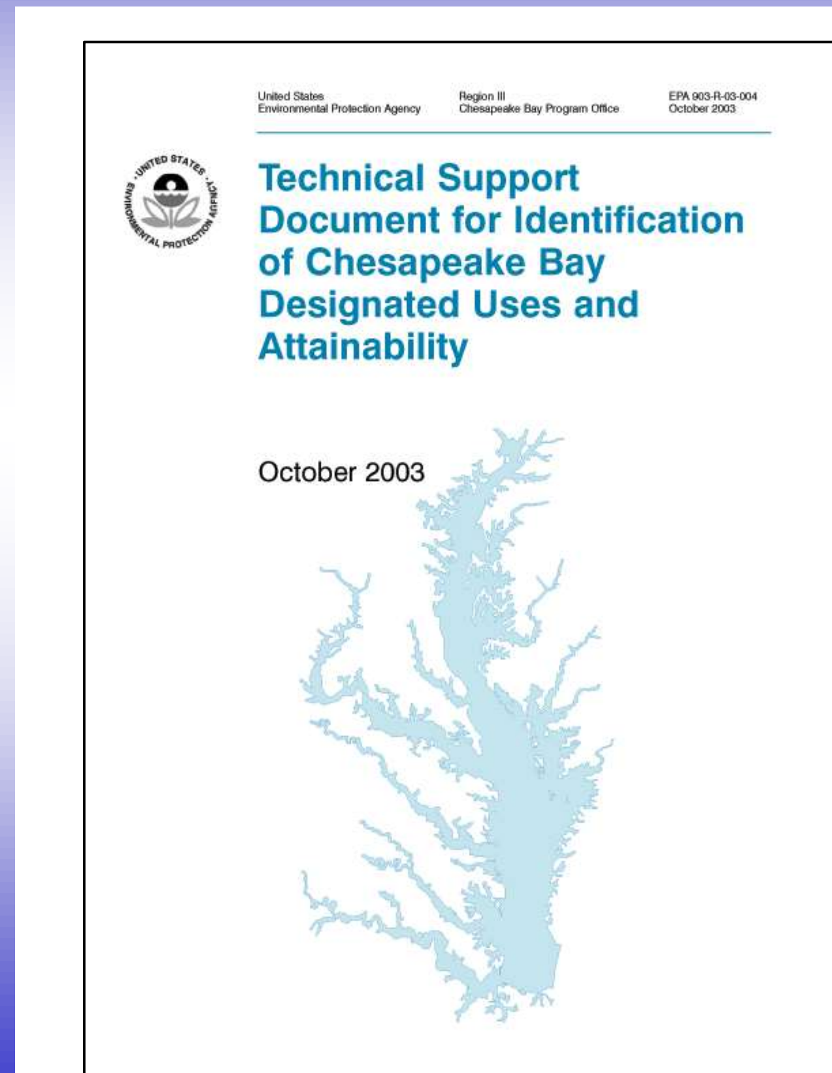
Scientific Basis for Decisions was Documented by the Partners


United States Environmental Protection Agency | Region III Chesapeake Bay Program Office | Region III Water Protection Division | EPA 903-R-03-002 April 2003

In coordination with the Office of Water/Office of Science and Technology, Washington, DC

Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll *a* for the Chesapeake Bay and Its Tidal Tributaries

April 2003


United States Environmental Protection Agency | Region III Chesapeake Bay Program Office | EPA 903-R-03-004 October 2003

Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability

October 2003

Four Pages of Acknowledgements from the 2003 EPA Chesapeake Bay Criteria Document

These Chesapeake Bay-specific water quality criteria were derived through the collaborative efforts, collective knowledge and applied expertise of the following four Chesapeake Bay criteria and standards coordinator teams.

Water Clarity Criteria Team
Richard Batiuk, U.S. EPA Chesapeake Bay Program Office; Peter Bergstrom, U.S. Fish and Wildlife Service; Arthur Butt, Virginia Department of Environmental Quality; Ifeyinwa Davis, U.S. EPA Office of Water; Frederick Hoffman, Virginia Department of Environmental Quality; Charles Gallegos, Smithsonian Environmental Research Center; Will Hunley, Hampton Roads Sanitation District; Michael Kemp, University of Maryland Horn Point Laboratory; Ken Moore,Virginia Institute of Marine Science; Michael Naylor, Maryland Department of Natural Resources; and Nancy Rybicki, U.S. Geological Survey.

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Dissolved Oxygen Criteria Team
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Chlorophyll *a* Criteria Team
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Water Quality Standards Coordinators Team
Richard Batiuk, U.S. EPA Chesapeake Bay Program Office; Jerusalem Bekele, District of Columbia Department of Health; Libby Chatfield, West Virginia Environmental Quality Board; Joe Beaman, Maryland Department of the Environment; Thomas Gardner, U.S. EPA Office of Water (Criteria); Jean Gregory, Virginia Department of Environmental Quality; Denise Hakowski, U.S. EPA Region III; Elaine Harbold, U.S. EPA Region III; Wayne Jackson, U.S. EPA Region II; James Keating, U.S. EPA Office of Water (Standards); Larry Merrill, U.S. EPA Region III; Garrison Miller, U.S. EPA Region III; Joel Salter, U.S. EPA Office of Water (Permits); John Schneider, Delaware Department of Natural Resources and Environmental Control; Mark Smith, U.S. EPA Region III; Scott Stoner, New York State Department of Environmental Conservation; and Carol Young, Pennsylvania Department of Environmental Protection.

Without the efforts of the Chesapeake Bay Tidal Monitoring Network Design Team, the development of the criteria attainment procedures contained in this document would not have been developed: Claire Buchanan, Interstate Commission on the Potomac River Basin; Paul Jacobson; Marcia Olson, NOAA Chesapeake Bay Office; Elgin Perry; Steve Preston, U.S. Geological Survey/Chesapeake Bay Program Office; Walter Boynton, University of Maryland Chesapeake Biological Laboratory; Larry Haas, Virginia Institute of Marine Science; Frederick Hoffman, Virginia Department of Environmental Quality; Bruce Michael, Maryland Department of Natural Resources; Jacqueline Johnson, Interstate Commission for the Potomac River Basin; Kevin Summers, U.S. EPA Office of Research and Development; Dave Jasinski, University of Maryland; Mary Ellen Ley, U.S. Geological Survey/ Chesapeake Bay Program Office; and Lewis Linker, U.S. EPA Chesapeake Bay Program Office.

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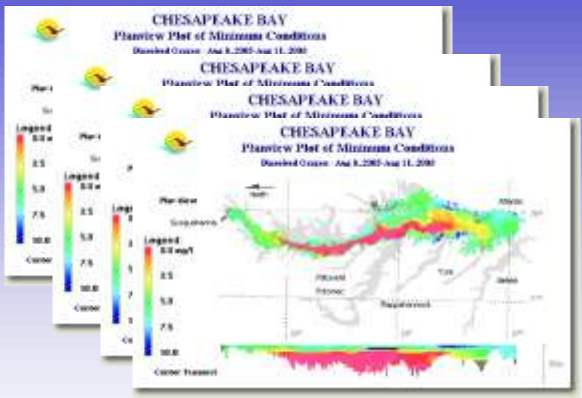
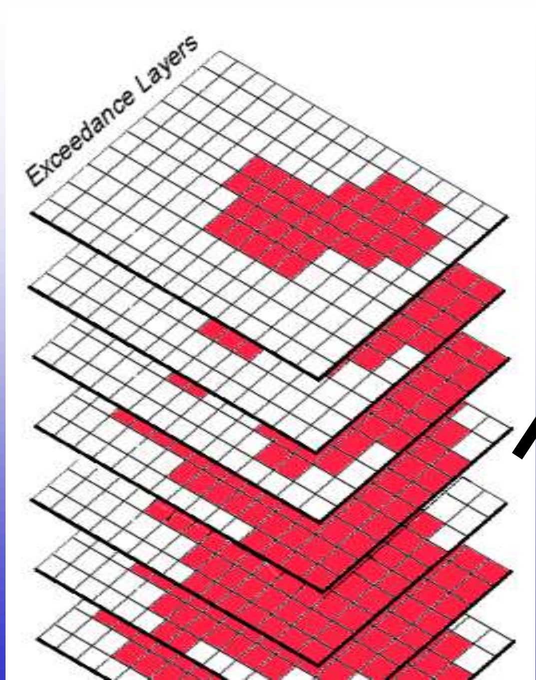
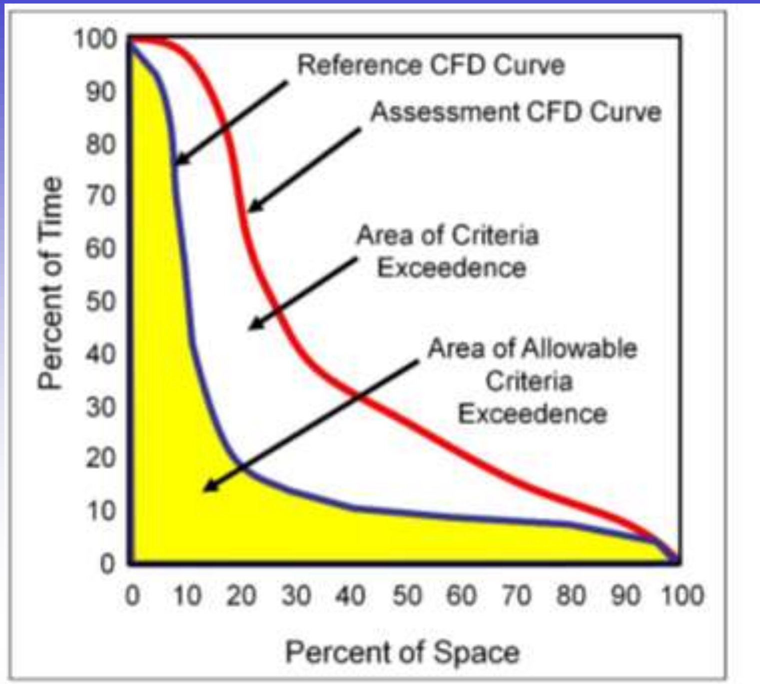
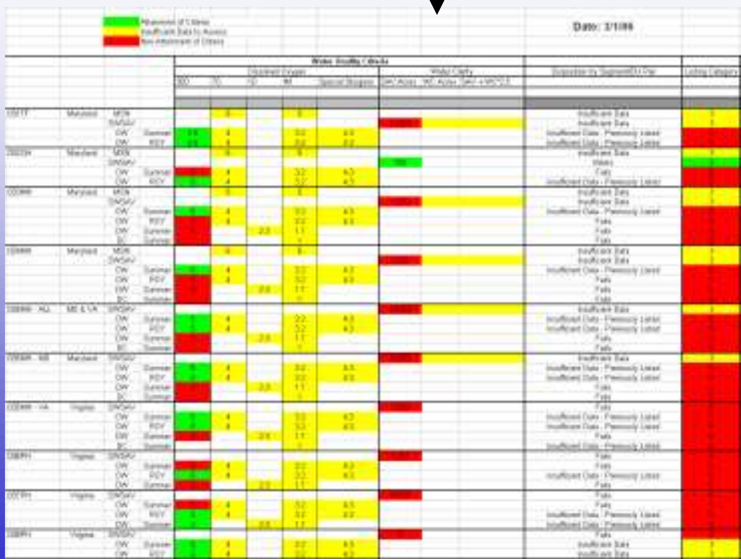
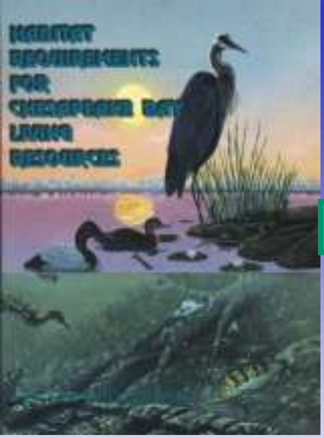
Criteria Assessment

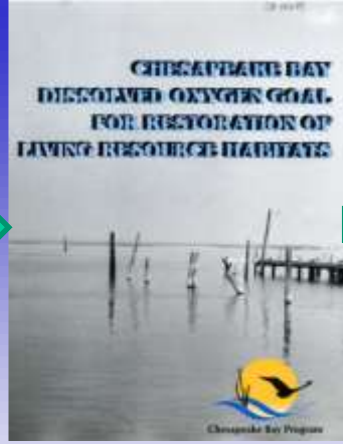












EPA/States agreement on DO, clarity, chlor as criteria; N, P, S as loads

Chesapeake
000 Agreem

1986-1991

1992-2000

1999

2000

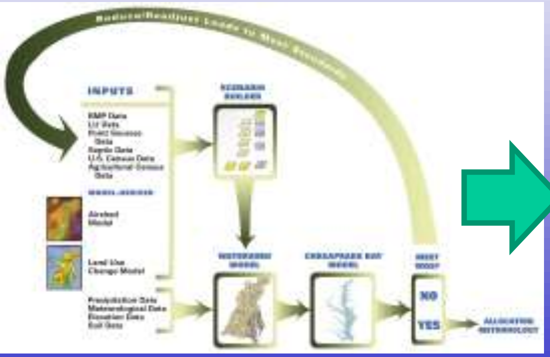
State WQS Adoption/ Amendment

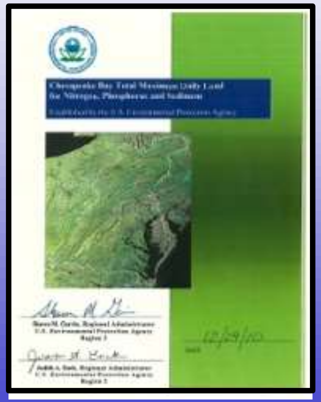
Addendum Documents Publication

2001-2003

2004-2010

2008 - Present





- 2010-2015 two federal court cases won
- 2015 Criteria Addendum
- 2016/2017 WQS amendments by states
- 2018 Phase III WIPs
- 2019 Possible Bay TMDL amendments

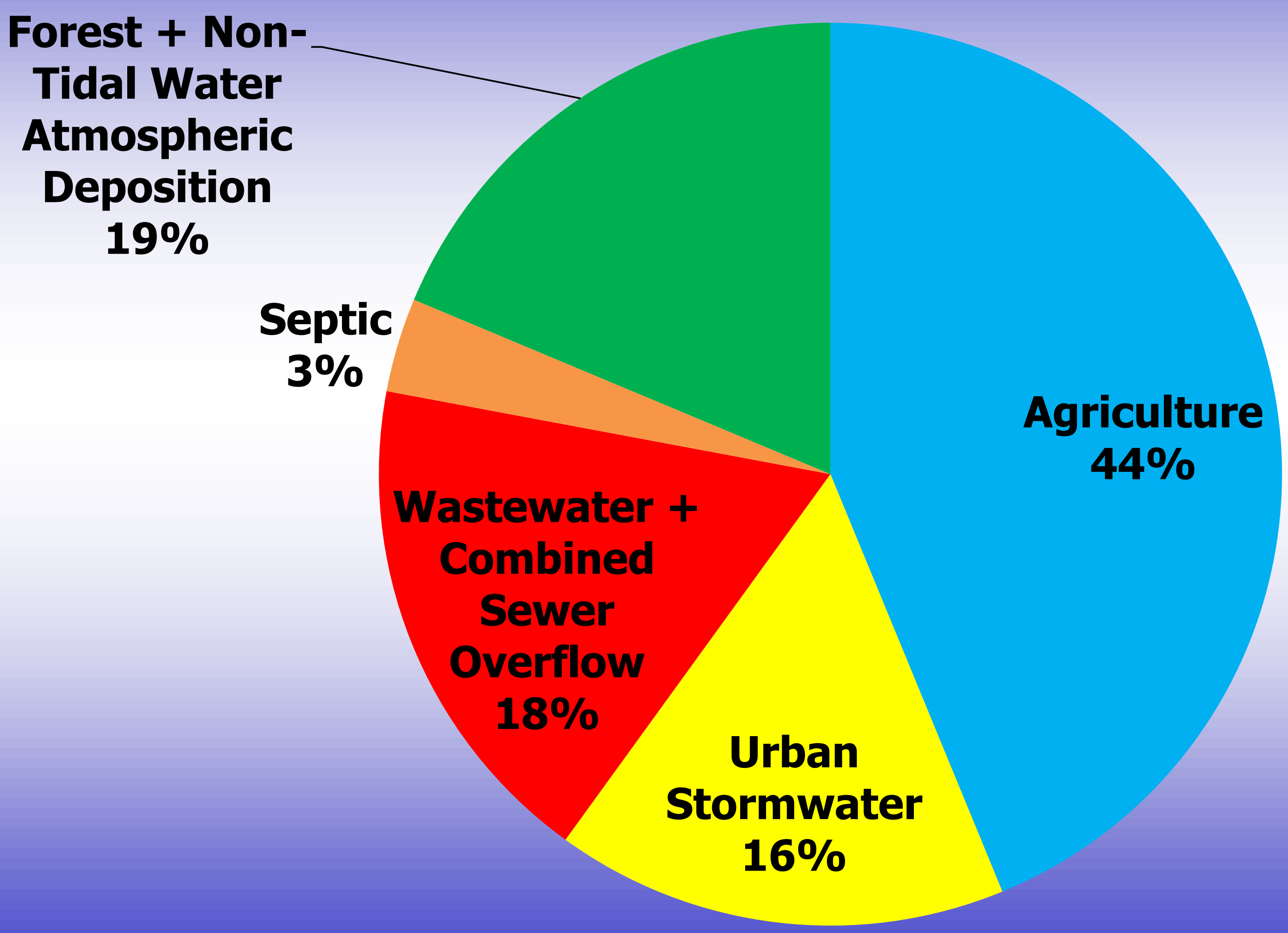
2008-2010

2010

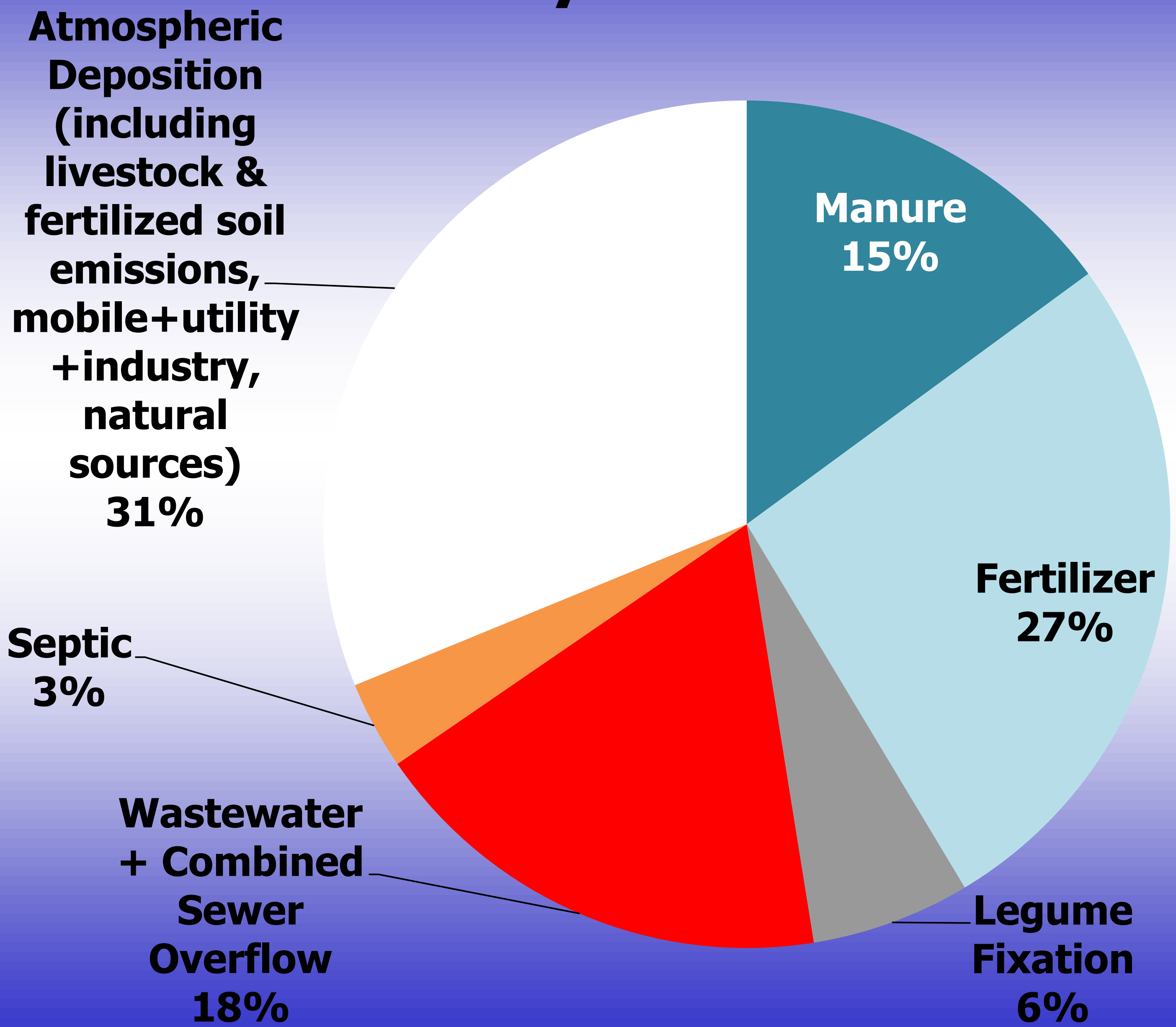
2012

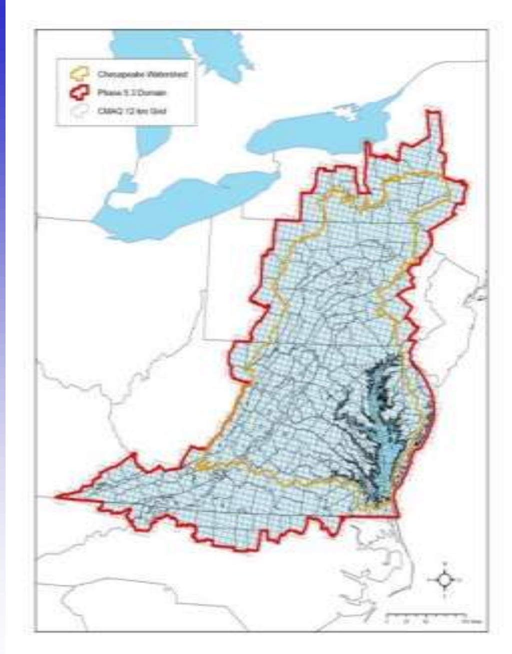
2013-2017

Nitrogen Loads to the Bay
by Source



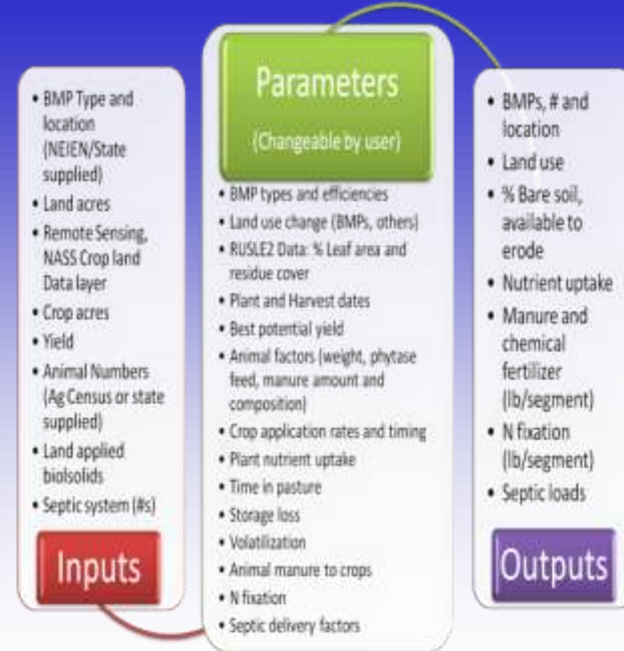
Nitrogen Loads to the Bay
by Root Source



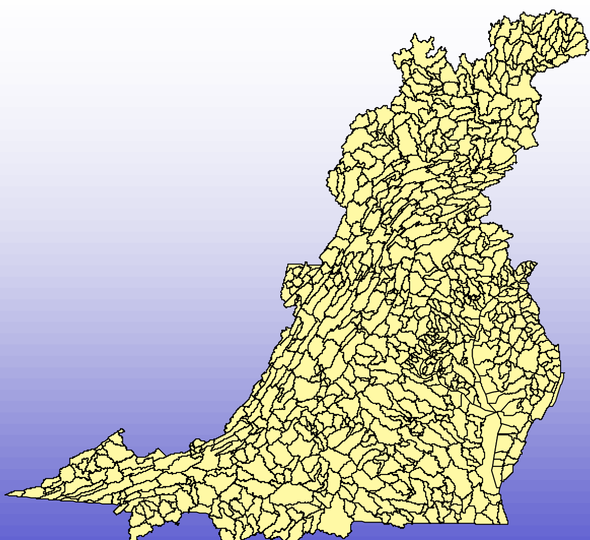


Chesapeake Bay Airshed Model

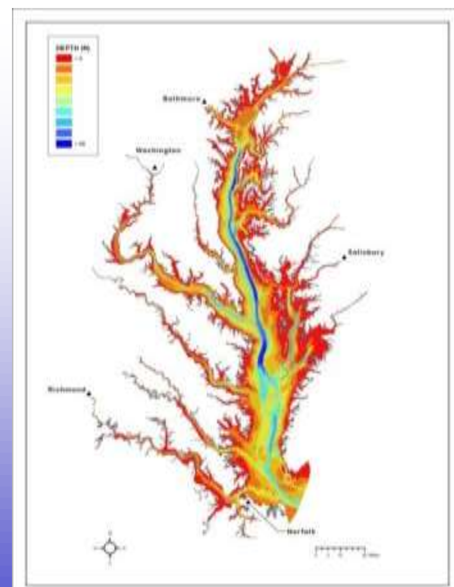
Chesapeake Bay Land Change Model



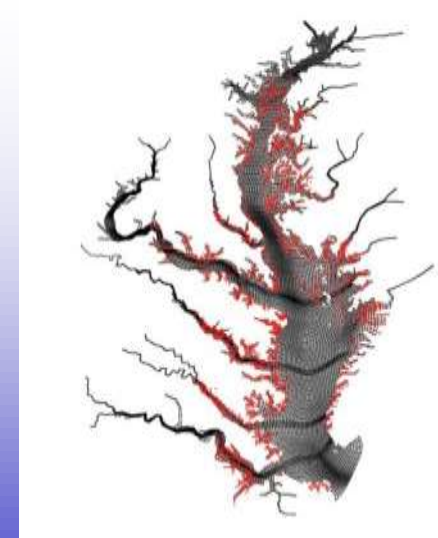
Chesapeake Bay Scenario Builder



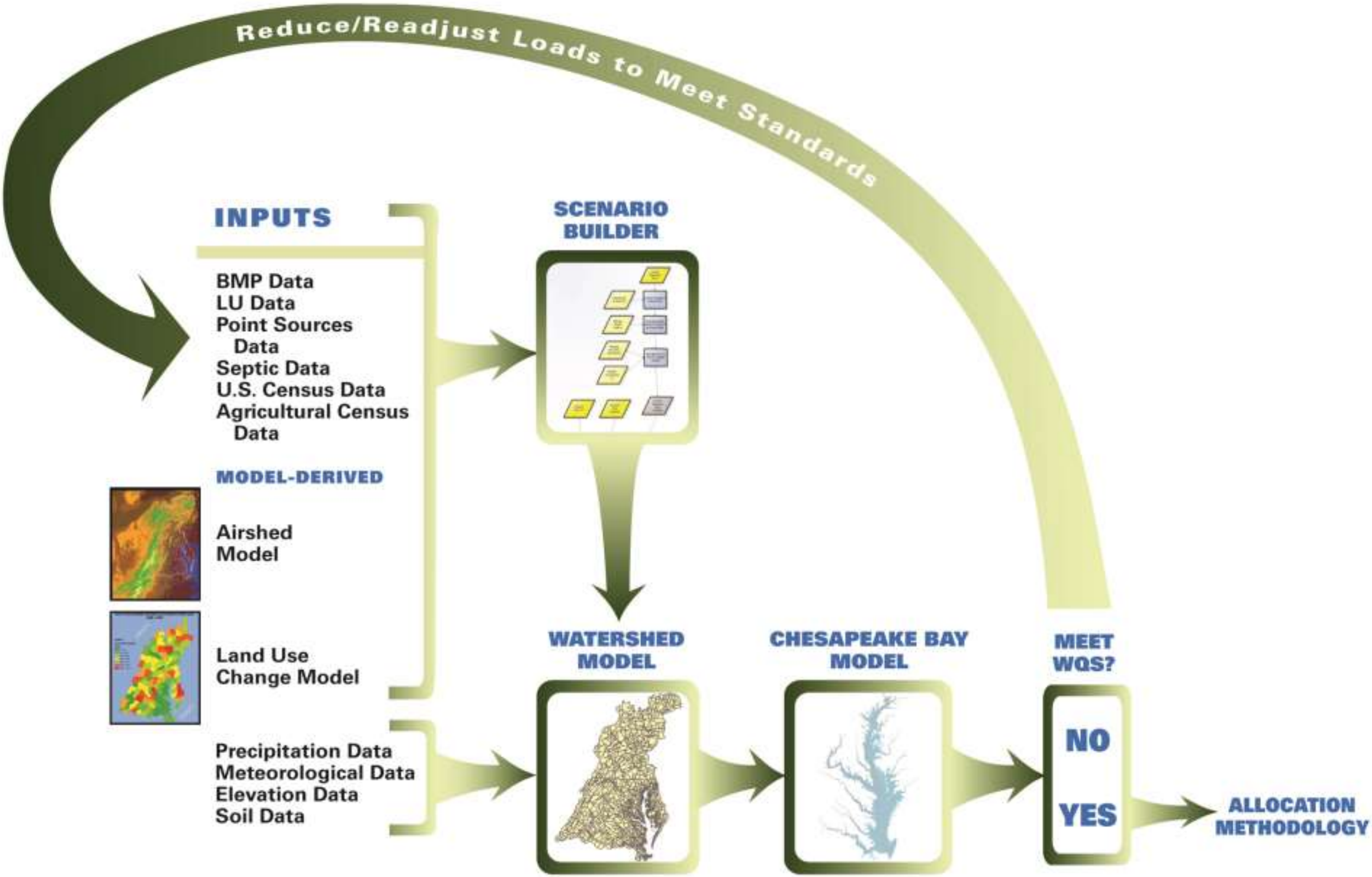
Chesapeake Bay Watershed Model



Chesapeake Bay Water Quality and Sediment Transport Model

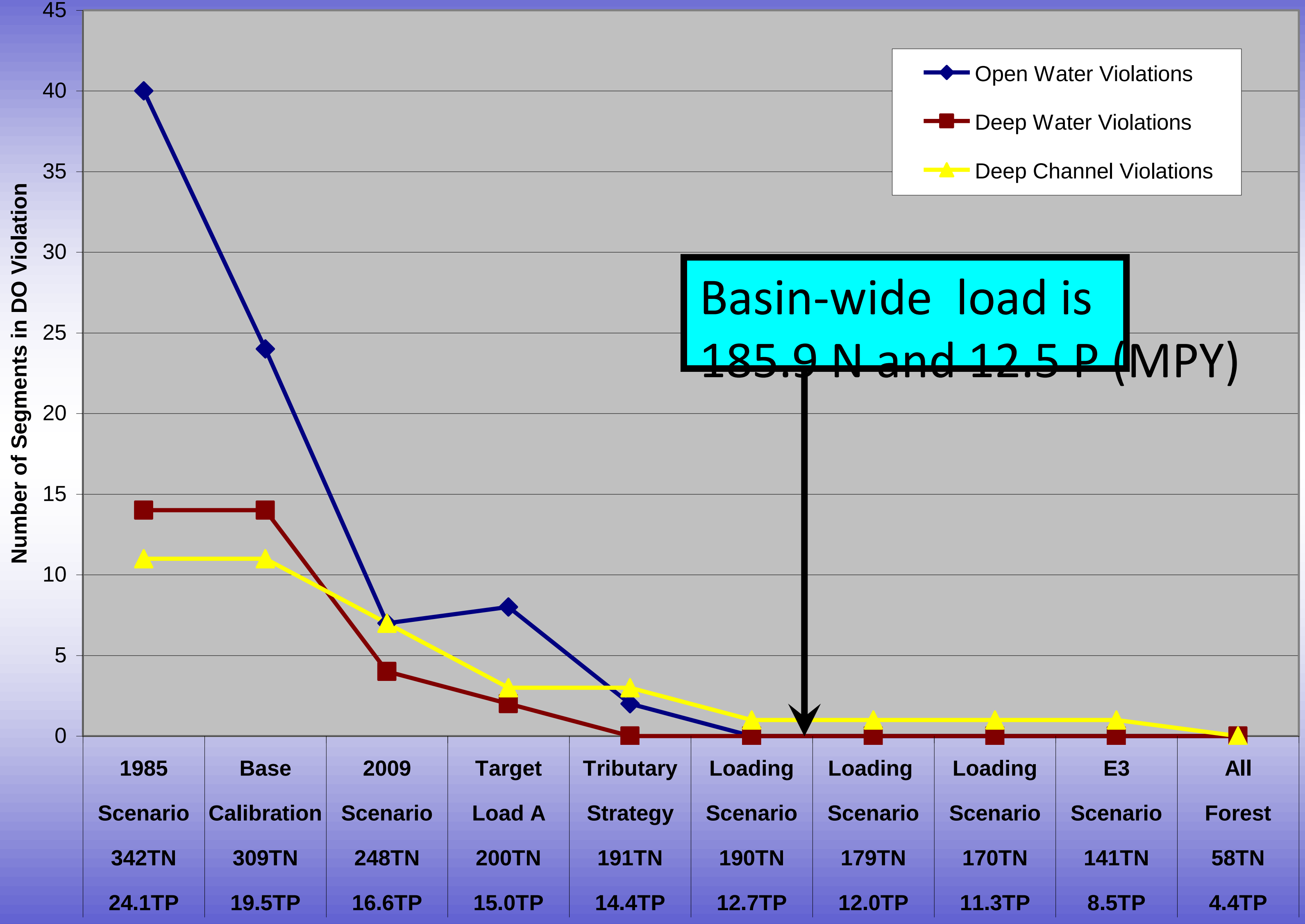


Chesapeake Bay Filter Feeder Model

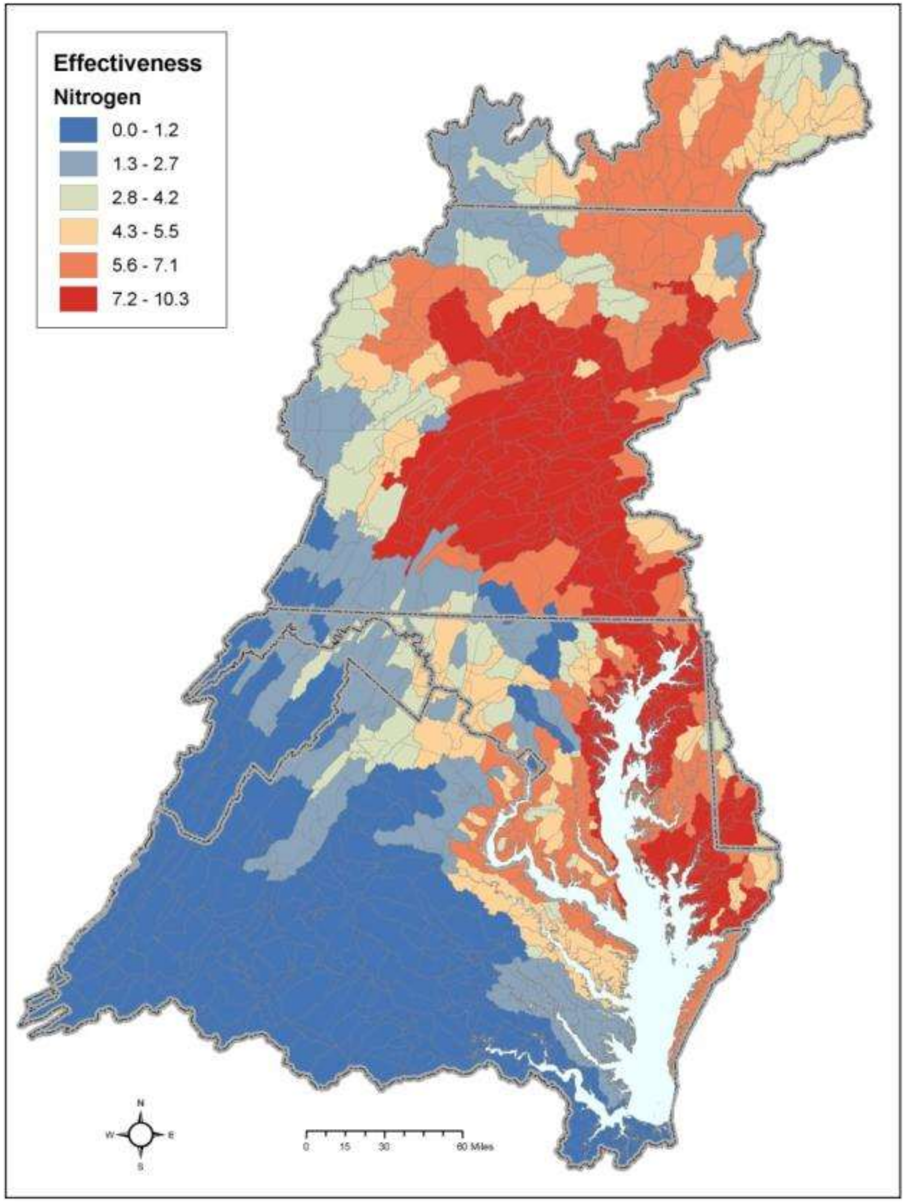


Reduce/Readjust Loads to Meet Standards
INPUTS
BMP Data
LU Data
Point Sources Data
Septic Data
U.S. Census Data
Agricultural Census Data
MODEL-DERIVED
Airshed Model
Land Use Change Model
Precipitation Data
Meteorological Data
Elevation Data
Soil Data
SCENARIO BUILDER
WATERSHED MODEL
CHESAPEAKE BAY MODEL
MEET WQS?
NO
YES
ALLOCATION METHODOLOGY

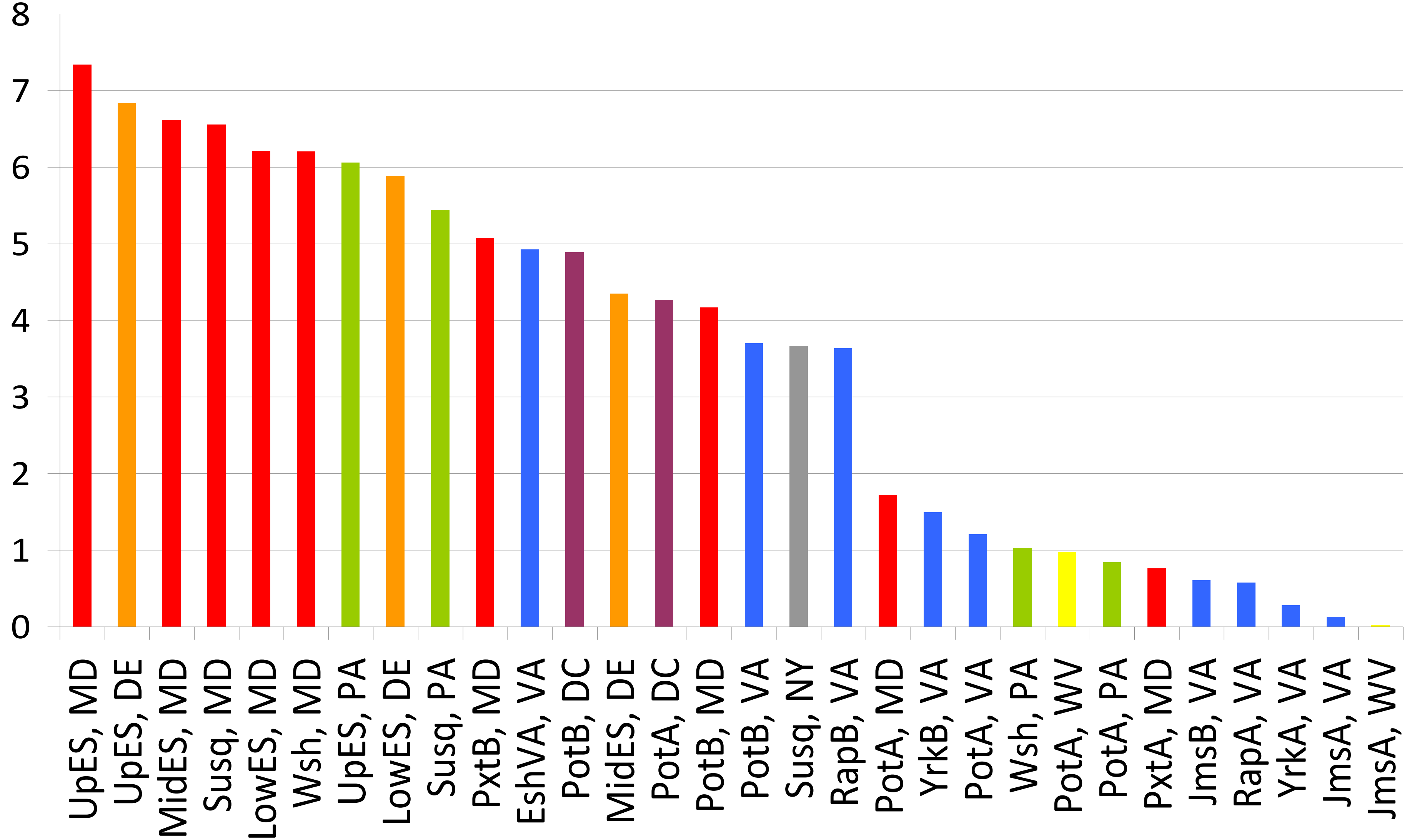
Dissolved Oxygen Criteria Attainment



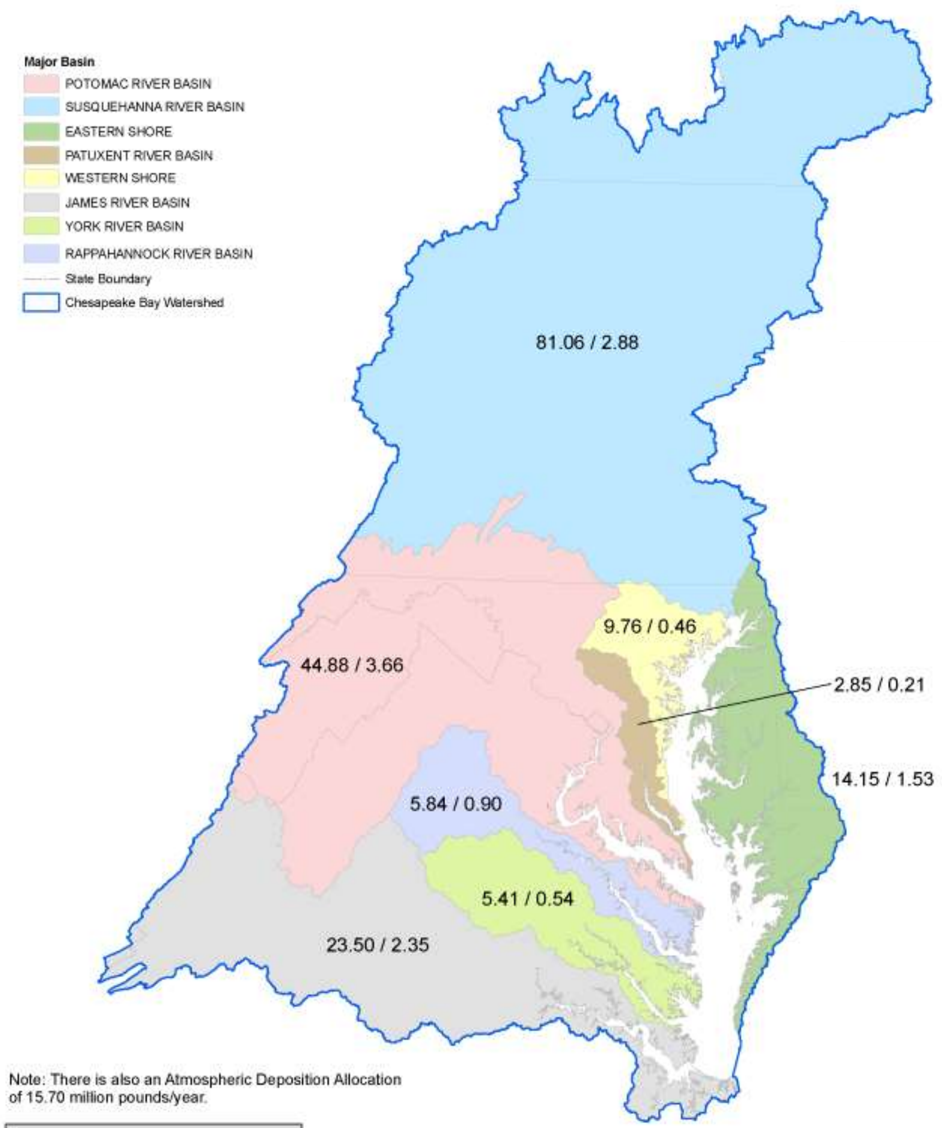
Relative Effect of a Pound of Pollution on Bay Water Quality



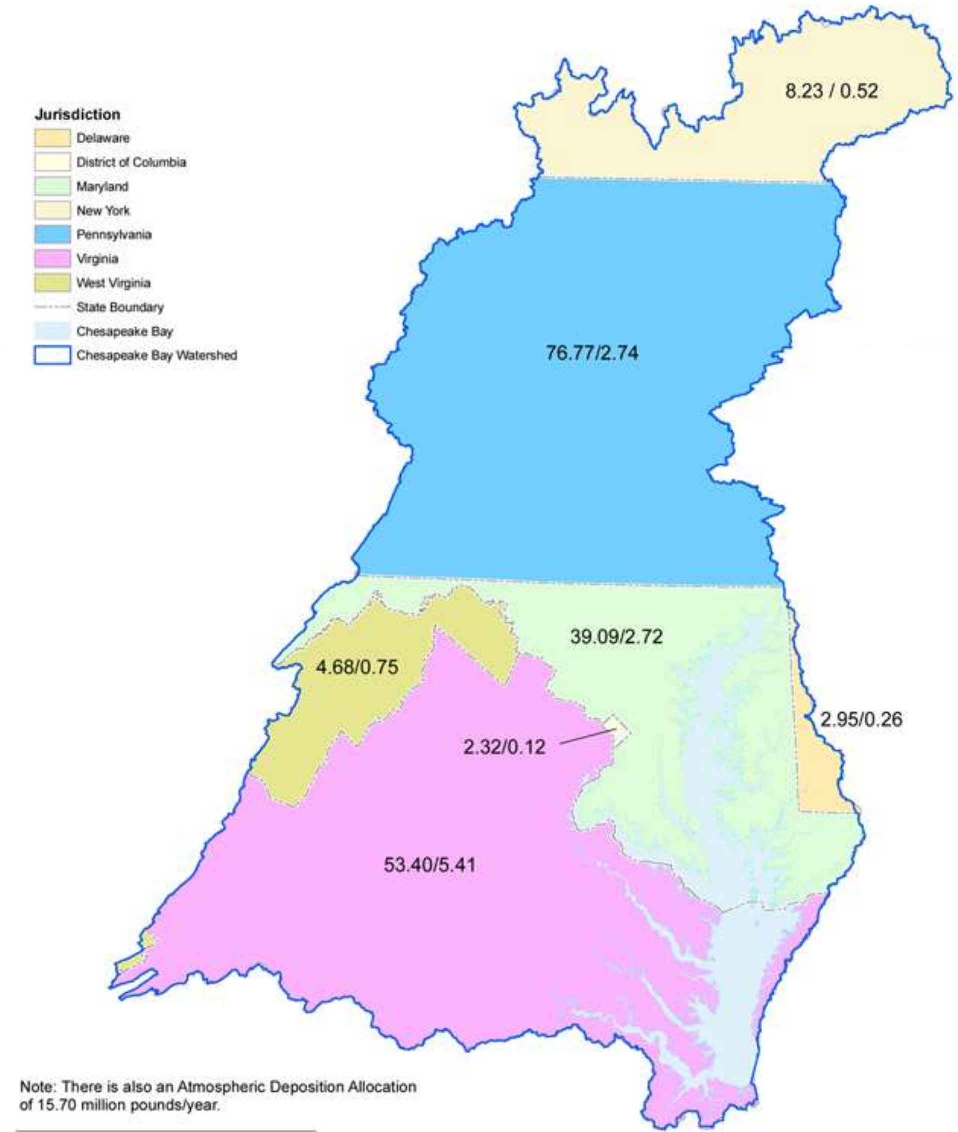
Major River Basin by Jurisdiction Relative Impact on Bay WQ



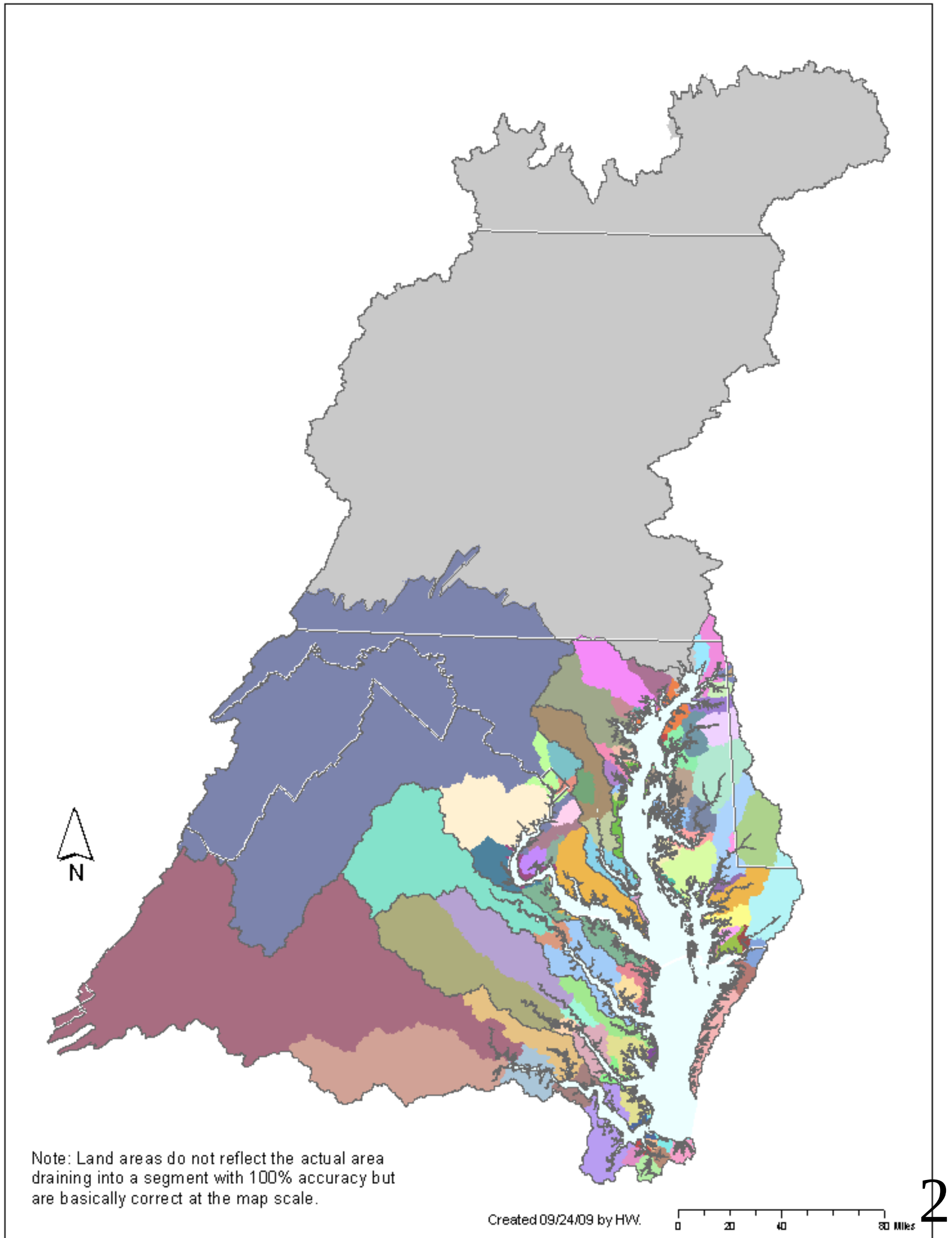
Pollution Diet by River

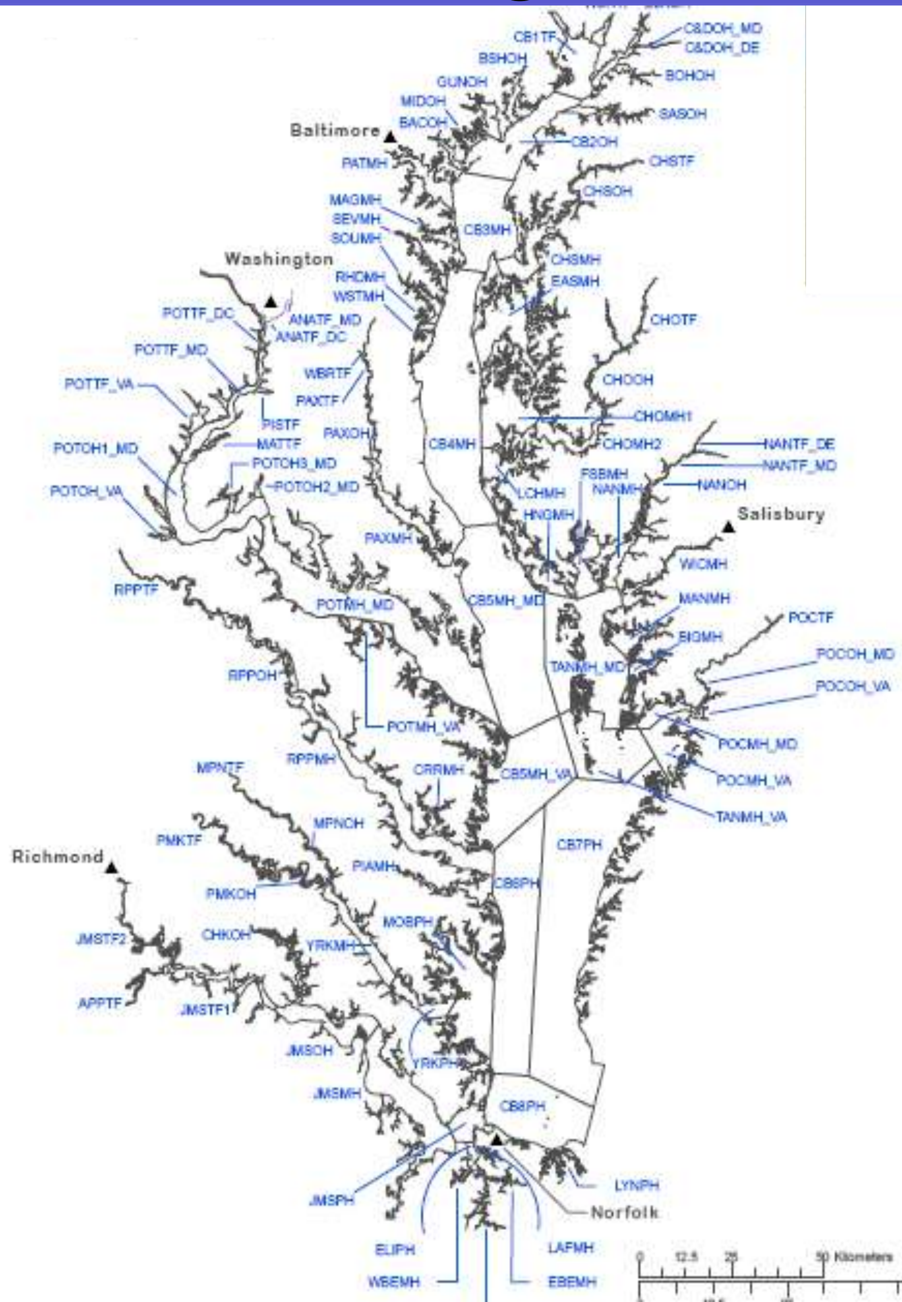


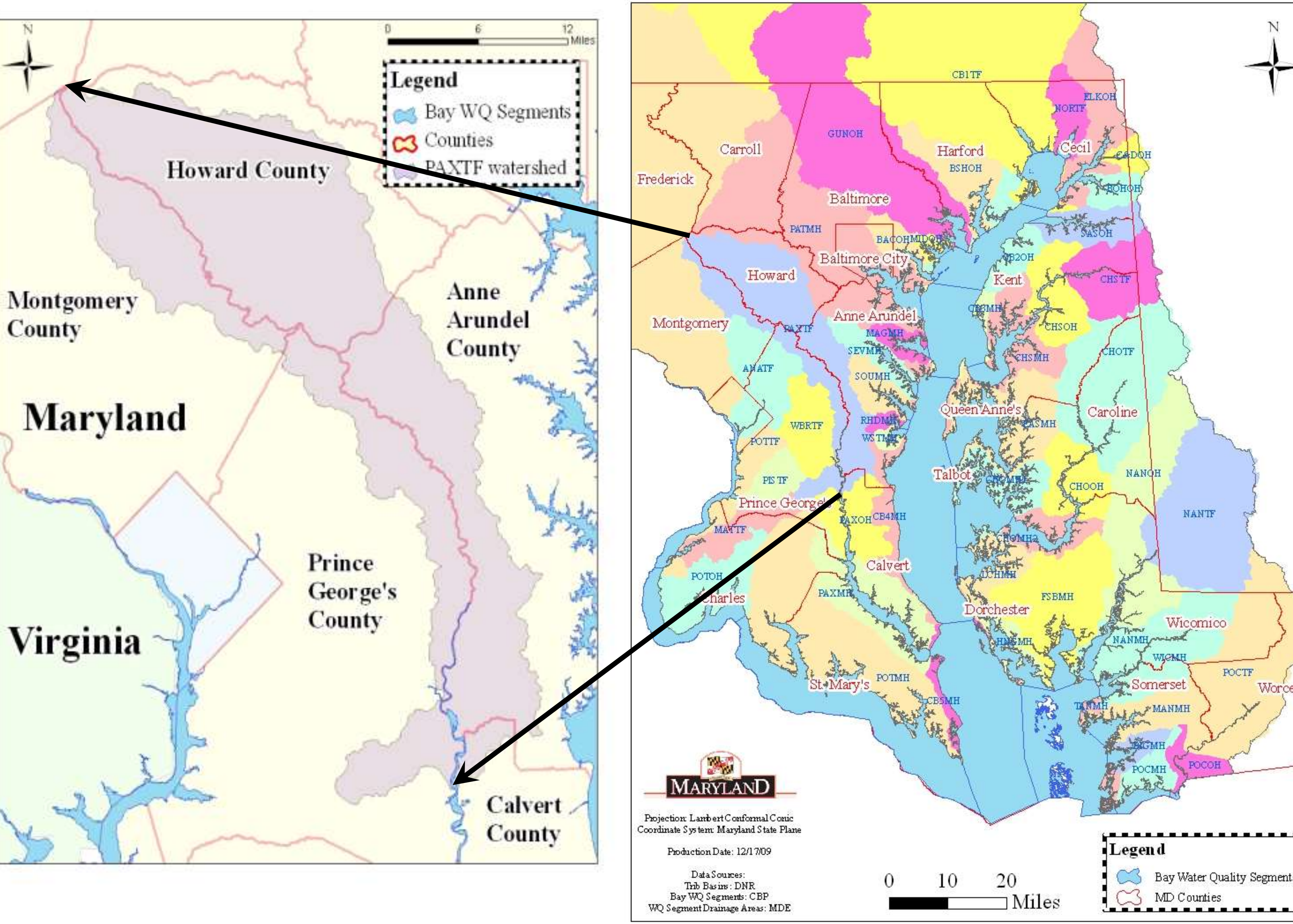
Pollution Diet by State



Pollution Diet for Each Tidal Water Segment







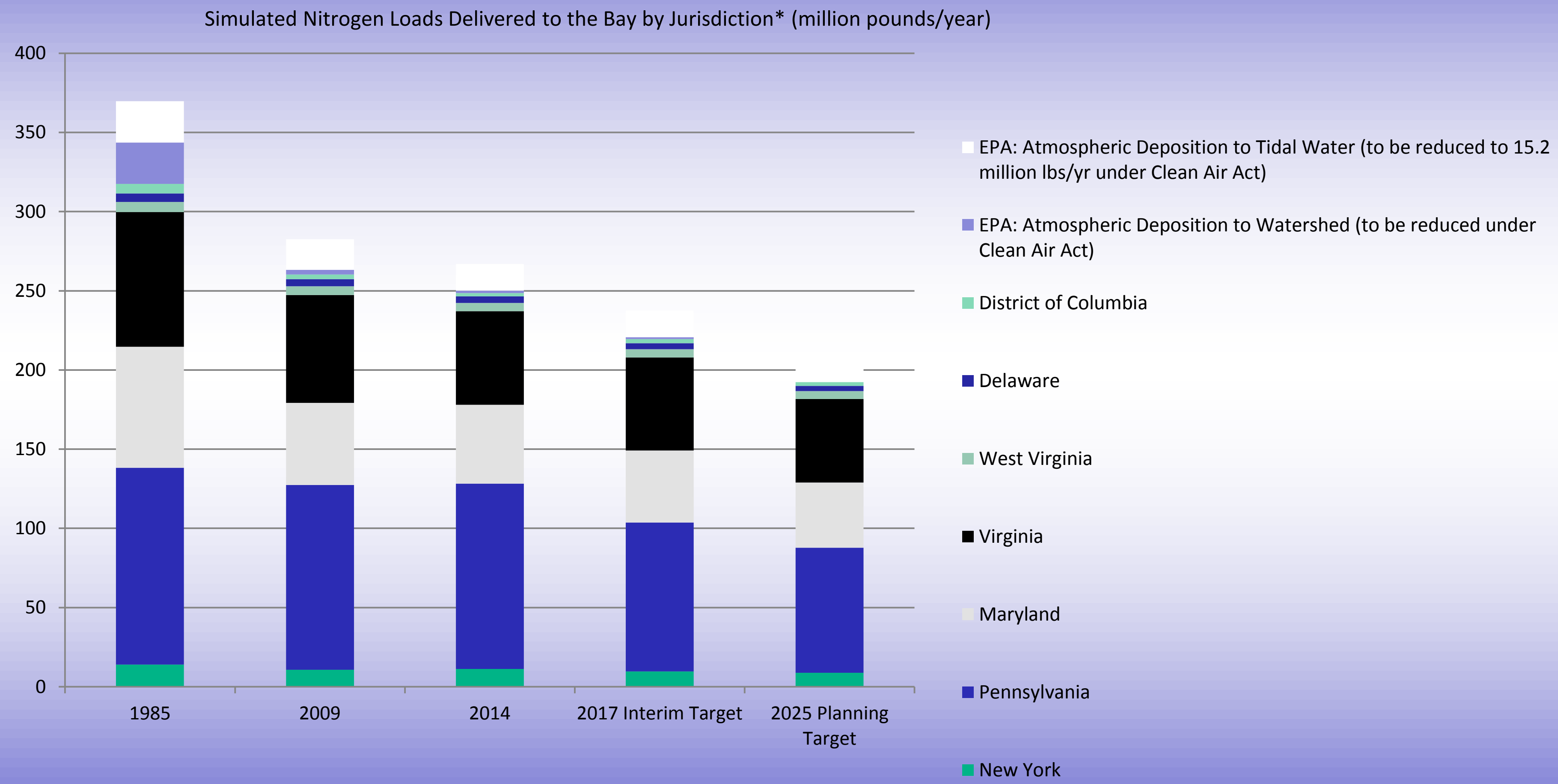
N
0 6 12 Miles
Legend
Bay WQ Segments
Counties
PAXTF watershed
Howard County
Montgomery County
Anne Arundel County
Maryland
Prince George's County
Virginia
Calvert County
CB1TF
ELKOH
NORTF
GUNOH
Carroll
Harford
Cecil
C&DOH
BSHOH
Frederick
Baltimore
BOHOH
SASOH
PATMH
BACOH
MIDOH
Baltimore City
CB2OH
Kent
CHSTF
Howard
CB3MH
Anne Arundel
Montgomery
PAXTF
MAGMH
CHSOH
SEVMH
CHSMH
CHOTF
ANATF
SOUMH
Queen Anne's
Caroline
WBRTF
RHDMH
EASMH
WSTMH
POTTF
Talbot
NANOH
PISTF
CHOOH
Prince George's
PAXOH
CB4MH
NANTF
MATTF
CHOMH2
Calvert
POTOH
LCHMH
Charles
PAXMH
FSBMH
Dorchester
Wicomico
HNGMH
NANMH
WICMH
POCTF
St. Mary's
POTMH
Somerset
CB5MH
TANMH
MANMH
BIGMH
POCOH
POCMH
MARYLAND
Projection: Lambert Conformal Conic
Coordinate System: Maryland State Plane
Production Date: 12/17/09
Data Sources:
Trib Basins: DNR
Bay WQ Segments: CBP
WQ Segment Drainage Areas: MDE
0 10 20 Miles
Legend
Bay Water Quality Segments
MD Counties

St.	Maj. Basin	Impaired Segment Drainage	Unique Code	Source Sector[b]	Type[c]	NPDES Permit
MD	W. Shor	PAXTF	MWPTF	Agriculture-CAFO	Agg. WLA	
				Agriculture-CAFO	Ind. WLA	MD356913
				Agriculture	LA	
				Subtotal: Agriculture		
				Wastewater: POTW#1	Ind. WLA	MD012452
				Wastewater: POTW#2	Ind. WLA	MD013943
				Wastewater: Indus #1	Ind. WLA	MD821672
				Wastewater: Indus #2	Ind. WLA	MD853653
				Subtotal: Wastewater		
				Onsite	LA	
				Urb/Suburb Runoff: MS4	Agg. WLA	MD546195
				Urb/Suburb Runoff: Non-MS4	LA	
				Urb/Suburb Runoff: MS4	Ind. WLA	MD892645
				Industrial Stormwater	Agg. WLA	
				Industrial Stormwater	Ind. WLA	MD246139
				Construction	Agg WLA	
				Subtotal: Urb/Suburb		
				Forest	LA	
MD	W. Shor	SEVMH	MWSeM	Agriculture-CAFO	Agg. WLA	MD382614
				Agriculture	LA	
				Subtotal: Agriculture		
				Wastewater: POTW#1	Ind. WLA	MD083699
				Wastewater: POTW#2	Ind. WLA	MD054732
				Wastewater: Indus #1	Ind. WLA	MD836679
				Wastewater: Indus #2	Ind. WLA	MD854469
				Subtotal: Wastewater		
				Onsite	LA	
				Urb/Suburb Runoff: MS4	Agg. WLA	MD588578
				Urb/Suburb Runoff: Non-MS4	LA	
				Subtotal: Urb/Suburb		
				Forest	LA	
	...					
MD	W. Shor			Reserve for Growth	WLA/LA	
MD	**W Shor**		**MW**	**Total**		

Extracted from "Appendix Q. Detailed Annual Chesapeake Bay TMDL WLAs and LAs"

U.S. EPA 2010 Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus, and Sediment.

Simulated Nitrogen Loads Delivered to Chesapeake Bay by Jurisdiction



*Loads simulated using 5.3.2 version of Watershed Model and wastewater discharge data reported by Bay jurisdictions..

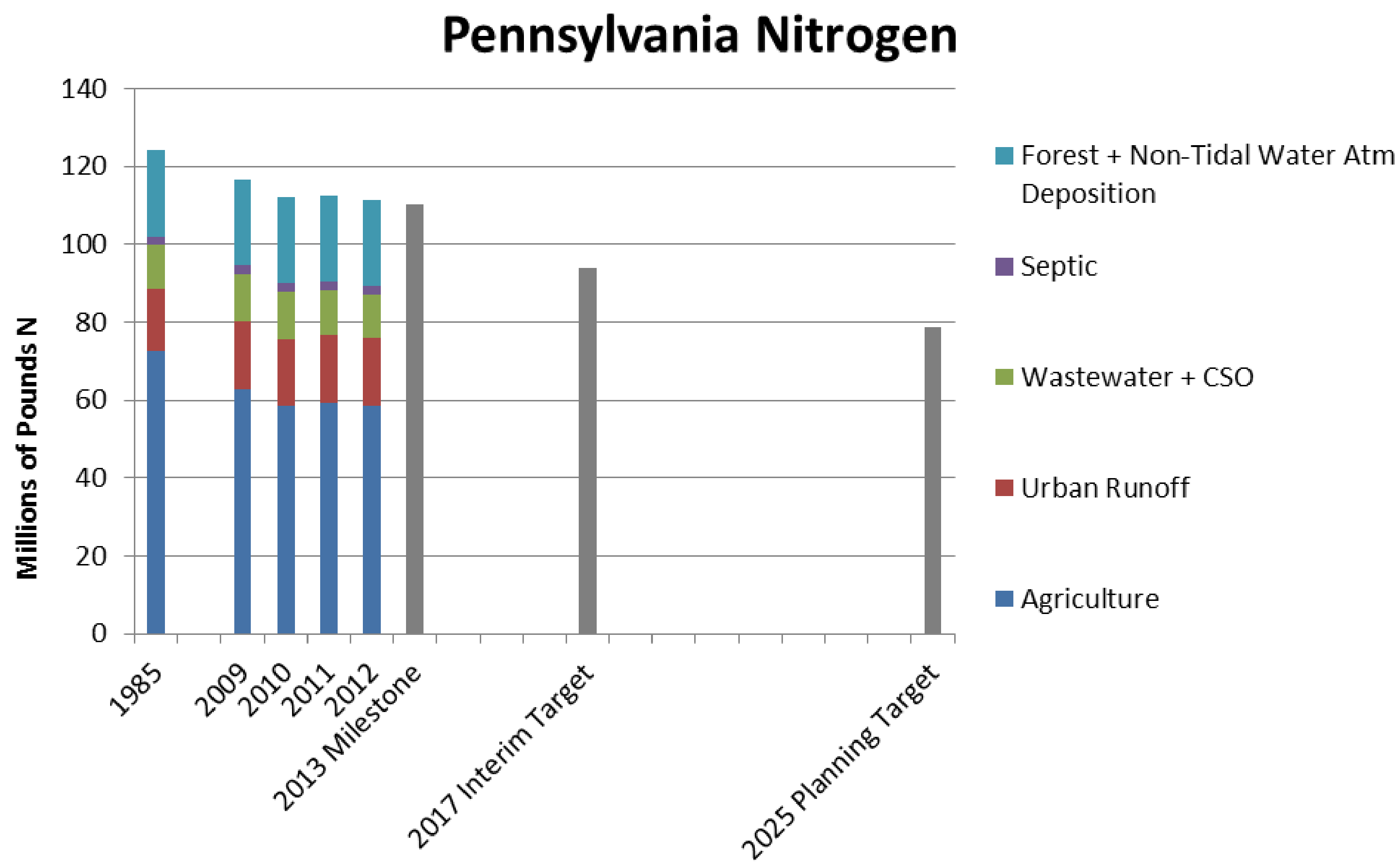
Status of Trajectory Towards Achieving 2017 Interim Targets: Nitrogen

	Agriculture	Wastewater	Stormwater	Septic	Overall
Delaware					
District					
Maryland					
New York					
Pennsylvania					
Virginia					
West Virginia					

2014-2015 EPA Oversight Status

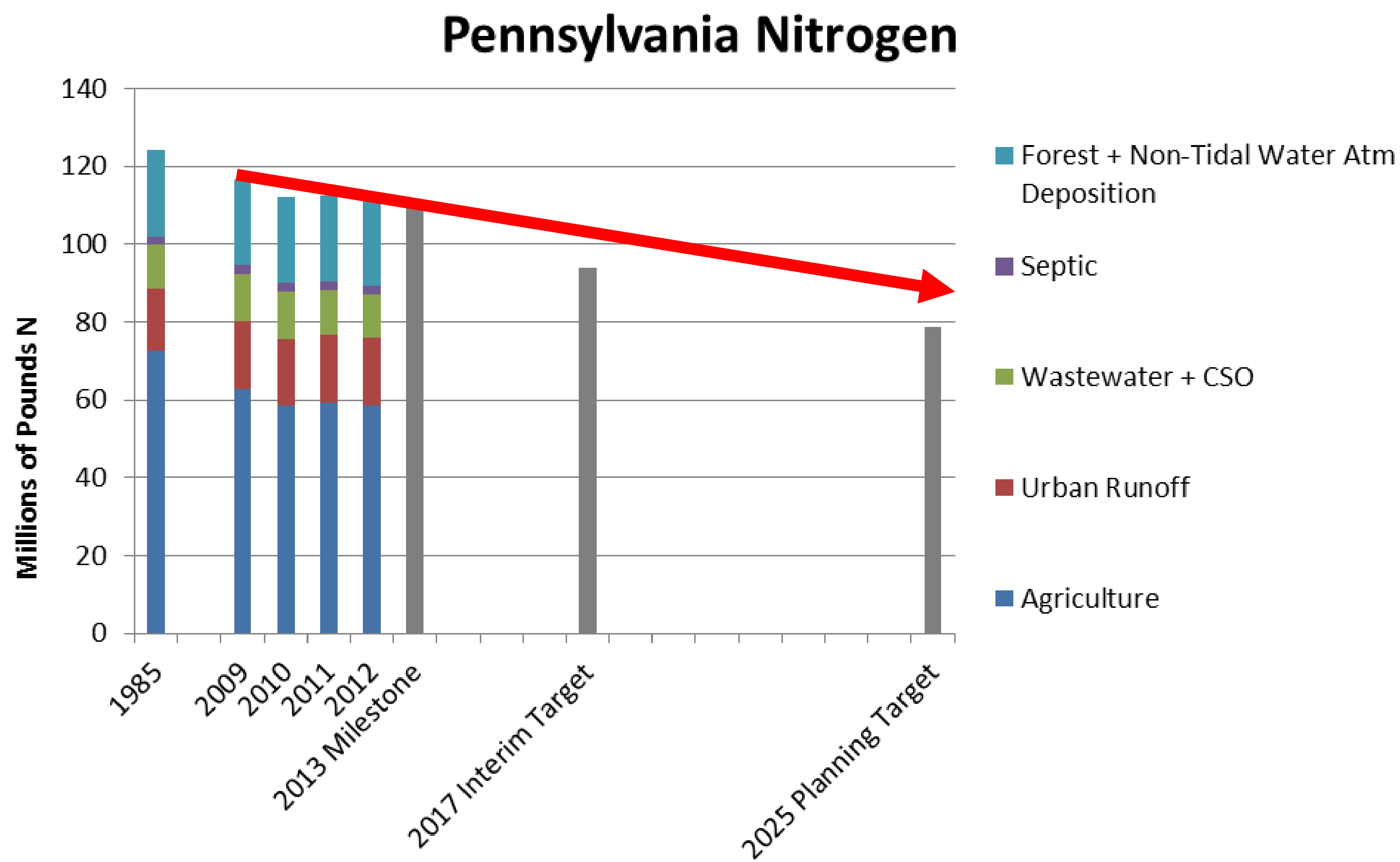
	Agriculture:	Urban/Suburban:	Wastewater:	Trading/Offsets:
DE	Ongoing Oversight	Ongoing Oversight	Ongoing Oversight	Ongoing Oversight
DC	Not Applicable	Ongoing Oversight	Ongoing Oversight	Ongoing Oversight
MD	Ongoing Oversight	Ongoing Oversight	Ongoing Oversight	Ongoing Oversight
NY	Ongoing Oversight	Ongoing Oversight	Enhanced Oversight	Ongoing Oversight
PA	Backstop Actions Level	Backstop Actions Level	Ongoing Oversight	Enhanced Oversight
VA	Ongoing Oversight	Enhanced Oversight	Ongoing Oversight	Ongoing Oversight
WV	Enhanced Oversight	Ongoing Oversight	Ongoing Oversight	Ongoing Oversight

2 Year Milestones



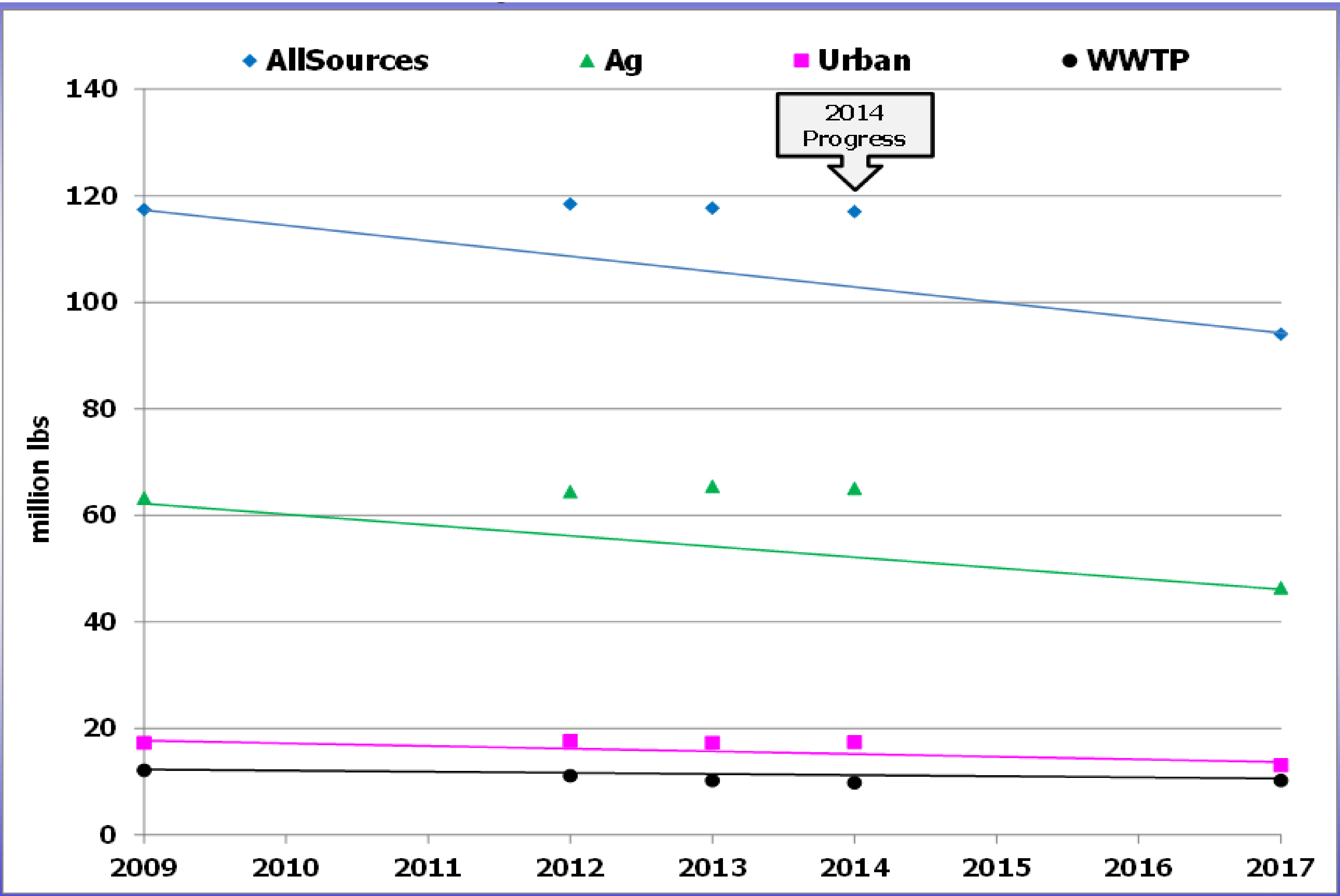
*Loads simulated using 5.3.2 version of Watershed Model and wastewater discharge data reported by Bay jurisdictions.

2 Year Milestones



*Loads simulated using 5.3.2 version of Watershed Model and wastewater discharge data reported by Bay jurisdictions.

Modeled Nitrogen Loads and Goals
Pennsylvania CB Watershed



PA Loads and Goals

		2009 Progress TOTN (M lbs/year)	2014 Progress TOTN (M lbs/year)	2017 Target TOTN (M lbs/year)	2025 Target TOTN (M lbs/year)	2009-2014 Loads Reduced TOTN (M lbs/year)	2014-2017 Additional Reductions Needed TOTN (M lbs/year)
Jurisdiction	Source						
PA	Agriculture	62.66	65.10	46.41	35.58	-2.44	18.69
PA	Urban Runoff	17.41	17.44	13.12	10.26	-0.03	4.32
PA	Wastewater+CSO	12.14	9.81	10.21	8.92	2.32	-0.39
PA	Septic	2.33	2.55	1.98	1.74	-0.22	0.57
PA	Forest+	22.10	22.11	22.33	22.49	-0.01	-0.22
PA	AllSources	116.64	117.01	94.05	79.00	-0.38	22.96

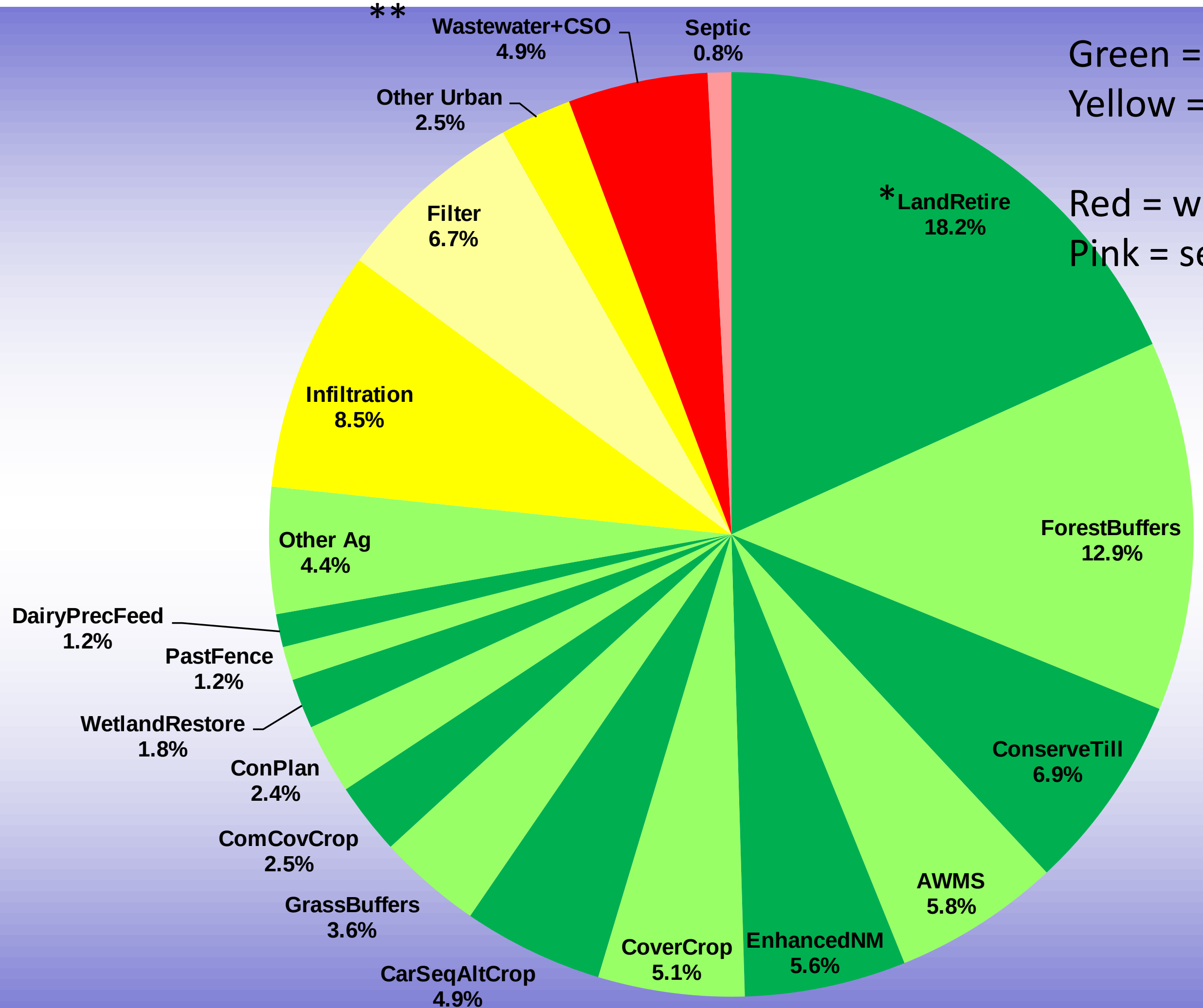
		2009 Progress TOTP (M lbs/year)	2014 Progress TOTP (M lbs/year)	2017 Target TOTP (M lbs/year)	2025 Target TOTP (M lbs/year)	2009-2014 Loads Reduced TOTP (M lbs/year)	2014-2017 Additional Reductions Needed TOTP (M lbs/year)
Jurisdiction	Source						
PA	Agriculture	2.716	2.564	2.176	1.816	0.152	0.388
PA	Urban Runoff	0.767	0.696	0.561	0.424	0.071	0.135
PA	Wastewater+CSO	1.071	0.758	0.966	0.897	0.313	-0.209
PA	Forest+	0.431	0.421	0.433	0.435	0.010	-0.012
PA	AllSources	4.984	4.438	4.136	3.571	0.546	0.302

		2009 Progress TSS (M lbs/year)	2014 Progress TSS (M lbs/year)	2017 Target TSS (M lbs/year)	2025 Target TSS (M lbs/year)	2009-2014 Loads Reduced TSS (M lbs/year)	2014-2017 Additional Reductions Needed TSS (M lbs/year)
Jurisdiction	Source						
PA	Agriculture	1,677	1,695	1,326	1,092	-19	369
PA	Urban Runoff	560	519	391	278	41	128
PA	Wastewater+CSO	21	25	121	187	-4	-95
PA	Forest+	386	379	388	389	8	-9
PA	AllSources	2,644	2,618	2,225	1,945	26	393

Loads meet 2014 trajectory target

Loads don't meet 2014 trajectory target

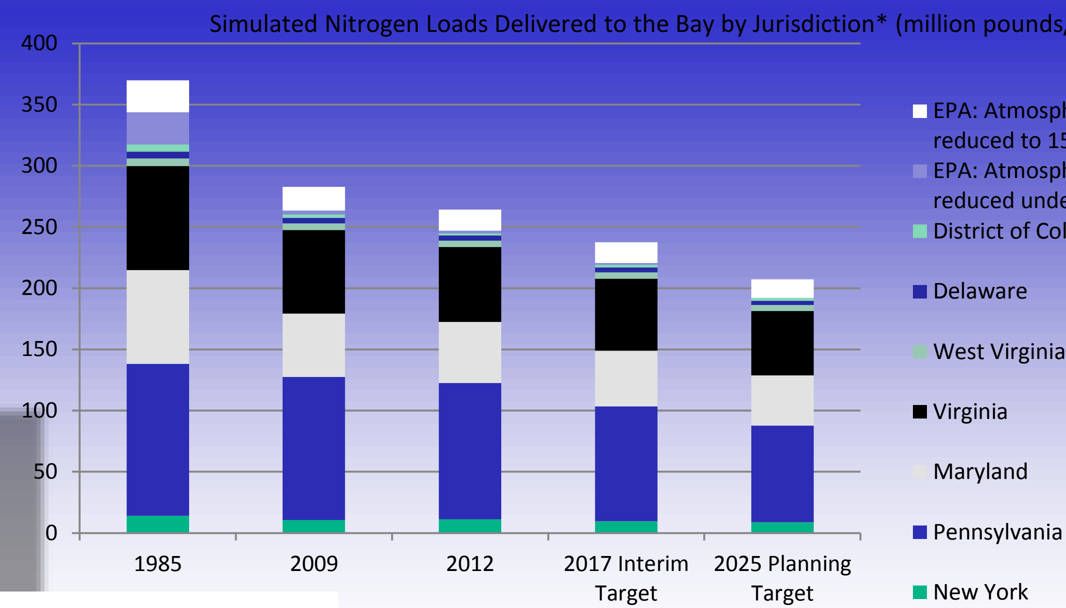
Where are the Planned Nitrogen Load Reductions Coming From?



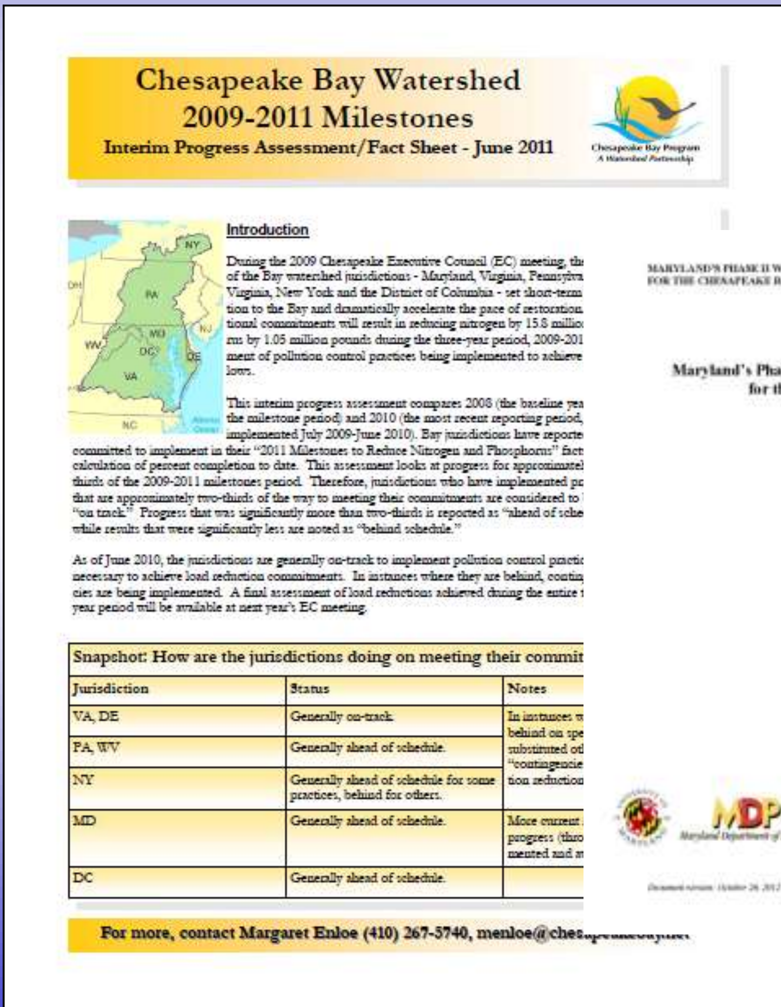
Green = agricultural practices
Yellow = urban/suburban stormwater practices
Red = wastewater controls
Pink = septic practices

* Agricultural land retirement takes marginal and highly erosive cropland out of production by planting permanent vegetative

BayTAS
Chesapeake Bay TMDL Tracking and Accounting System



* Watershed Model and wastewater discharge data reported by Bay jurisdictions..



Chesapeake Bay Watershed 2009-2011 Milestones

Interim Progress Assessment/Fact Sheet - June 2011

Chesapeake Bay Program
A Watershed Partnership

Introduction

During the 2009 Chesapeake Executive Council (EC) meeting, th of the Bay watershed jurisdictions - Maryland, Virginia, Pennsylva Virginia, New York and the District of Columbia - set short-term tion to the Bay and dramatically accelerate the pace of restoration tional commitments will result in reducing nitrogen by 15.8 millio rus by 1.05 million pounds during the three-year period, 2009-201 ment of pollution control practices being implemented to achieve lows.

This interim progress assessment compares 2008 (the baseline yea the milestone period) and 2010 (the most recent reporting period, implemented July 2009-June 2010). Bay jurisdictions have reporte committed to implement in their "2011 Milestones to Reduce Nitrogen and Phosphorus" fact calculation of percent completion to date. This assessment looks at progress for approximatel thirds of the 2009-2011 milestones period. Therefore, jurisdictions who have implemented pr that are approximately two-thirds of the way to meeting their commitments are considered to "on track." Progress that was significantly more than two-thirds is reported as "ahead of sche while results that were significantly less are noted as "behind schedule."

As of June 2010, the jurisdictions are generally on-track to implement pollution control practic necessary to achieve load reduction commitments. In instances where they are behind, contin cies are being implemented. A final assessment of load reductions achieved during the entire t year period will be available at next year's EC meeting.

Snapshot: How are the jurisdictions doing on meeting their commit		
Jurisdiction	Status	Notes
VA, DE	Generally on-track.	In instances w behind on spe substituted ot "contingencie tion reduction
PA, WV	Generally ahead of schedule.	
NY	Generally ahead of schedule for some practices, behind for others.	
MD	Generally ahead of schedule.	More current progress (thro mented and m
DC	Generally ahead of schedule.	

For more, contact Margaret Enloe (410) 267-5740, menloe@ches

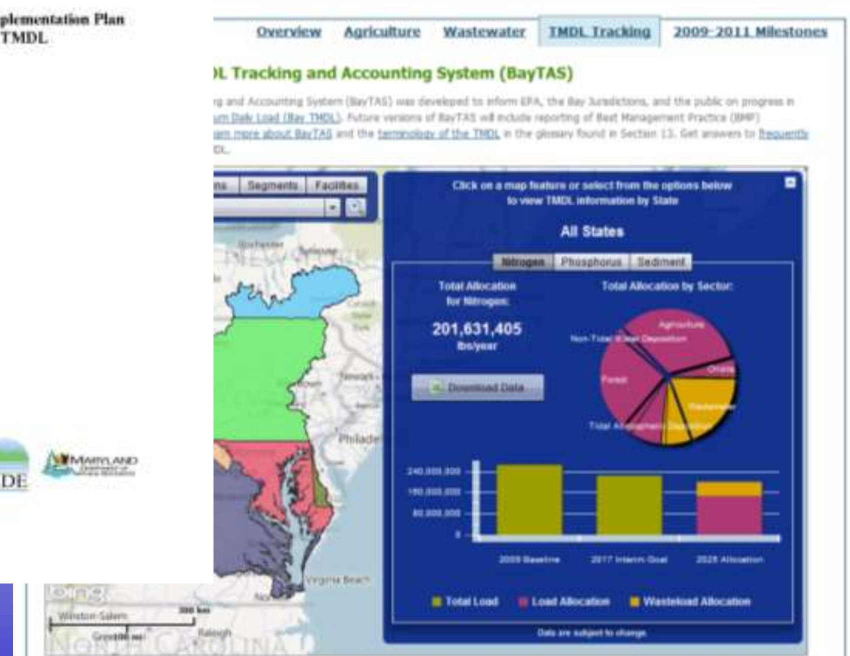
MARYLAND'S PHASE II WATERSHED IMPLEMENTATION PLAN FOR THE CHESAPEAKE BAY TMDL

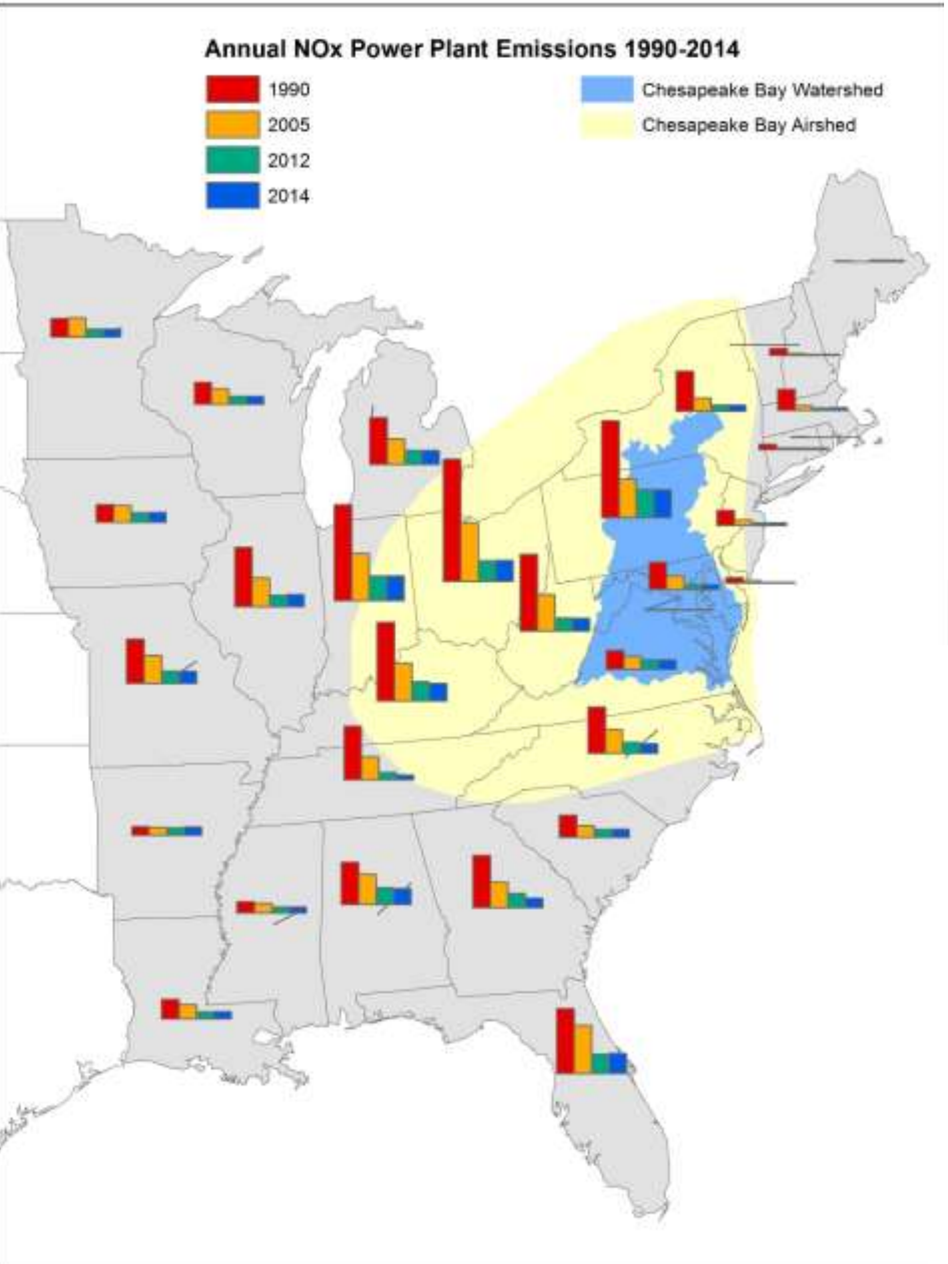
Maryland's Phase II Watershed Implementation Plan for the Chesapeake Bay TMDL

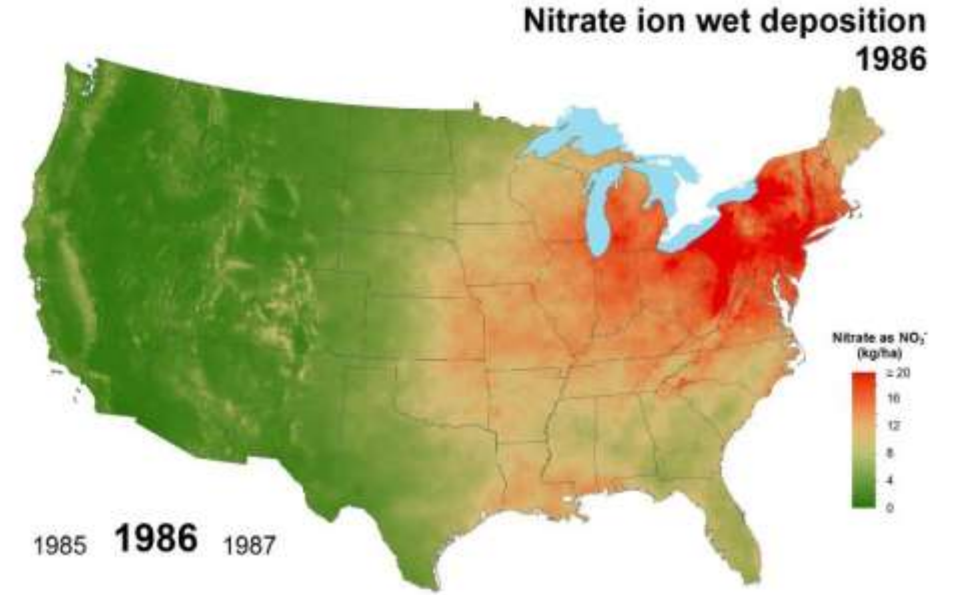
October 2012

MDP Maryland Department of Planning
MDE
Maryland

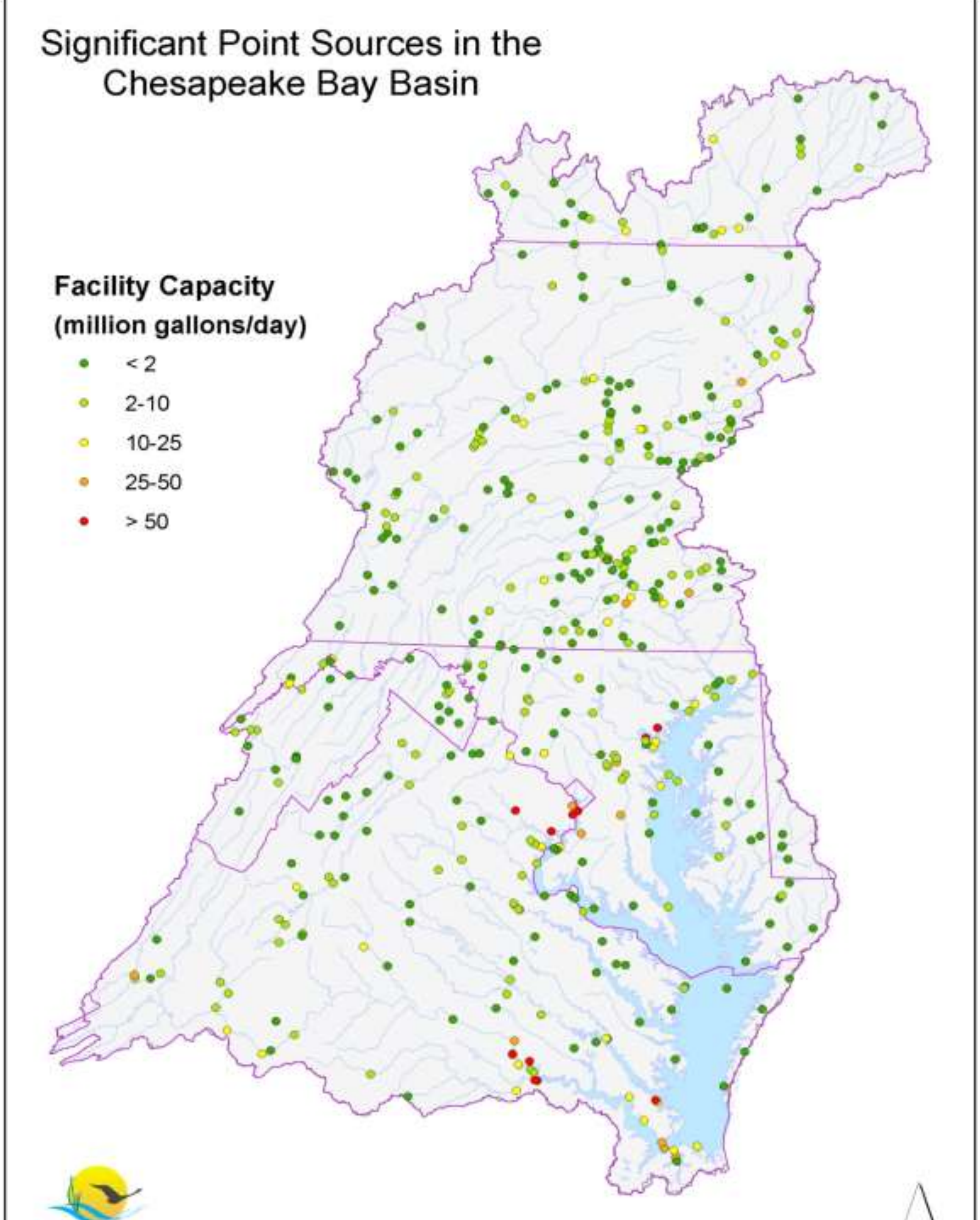
Document version: October 26, 2012



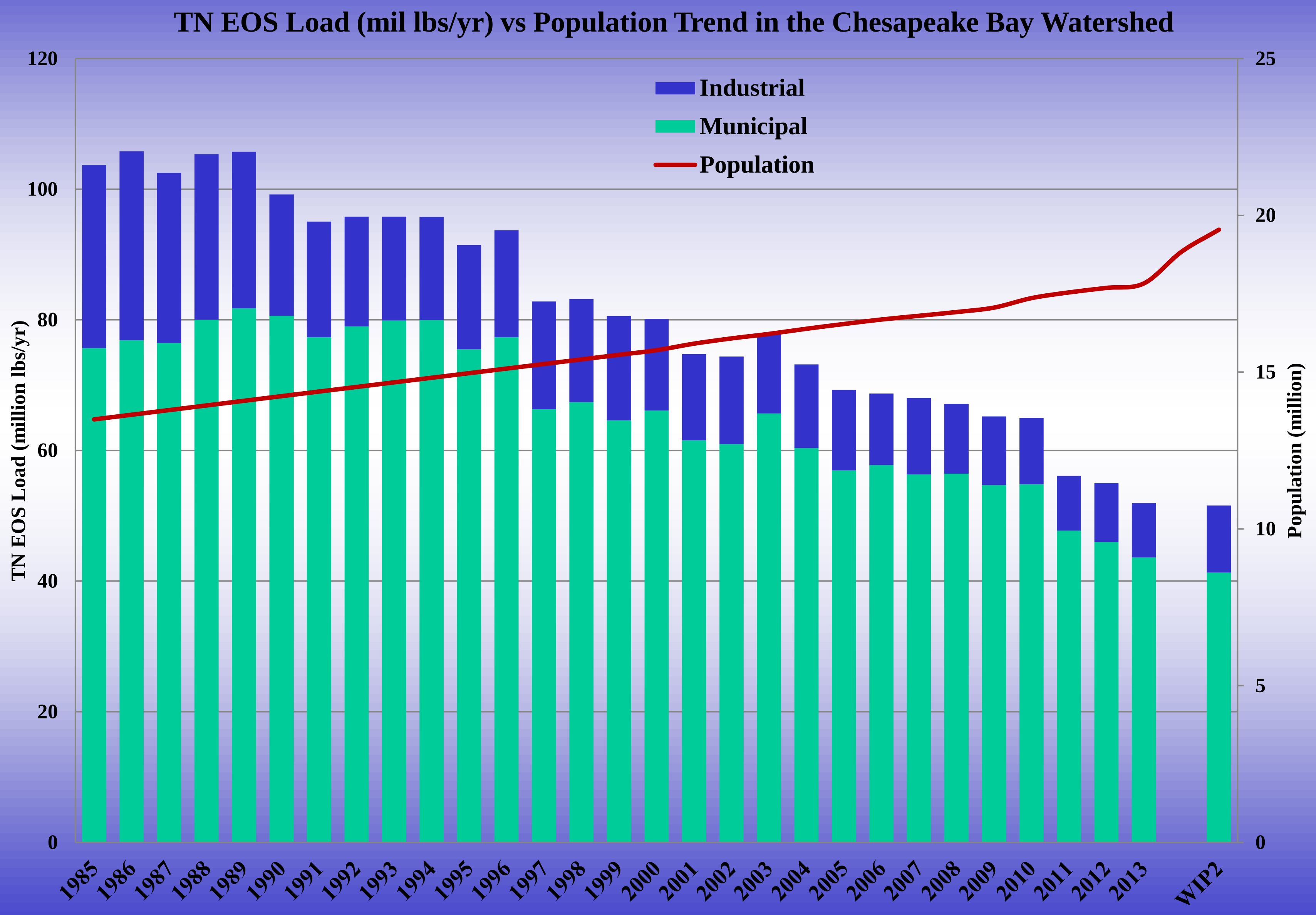

Annual NOx Power Plant Emissions 1990-2014
1990
2005
2012
2014
Chesapeake Bay Watershed
Chesapeake Bay Airshed


Nitrate ion wet deposition
1986
1985
1986
1987


Nitrate ion wet deposition
2011
2010
2011
2012

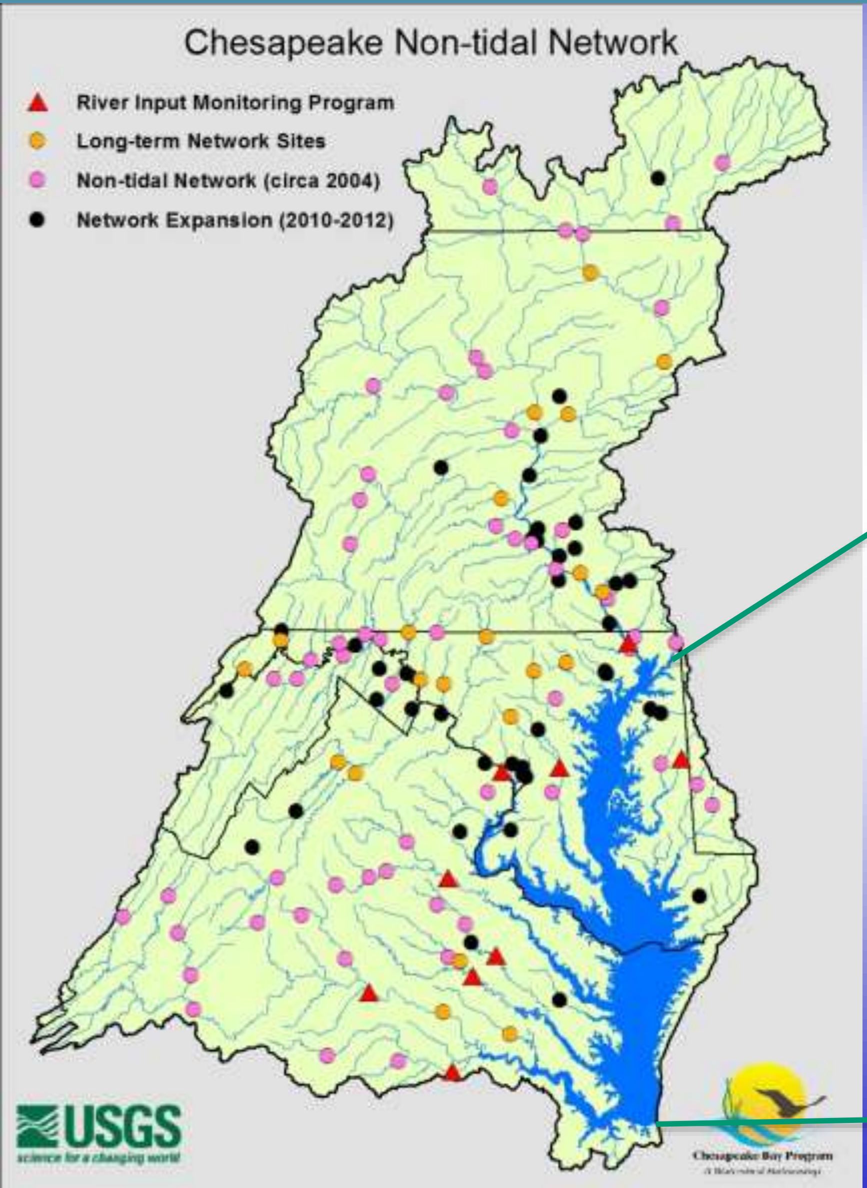

Significant Point Sources in the Chesapeake Bay Basin
Facility Capacity
(million gallons/day)
< 2
2-10
10-25
25-50
> 50

Wastewater TN Load Reduction Progress

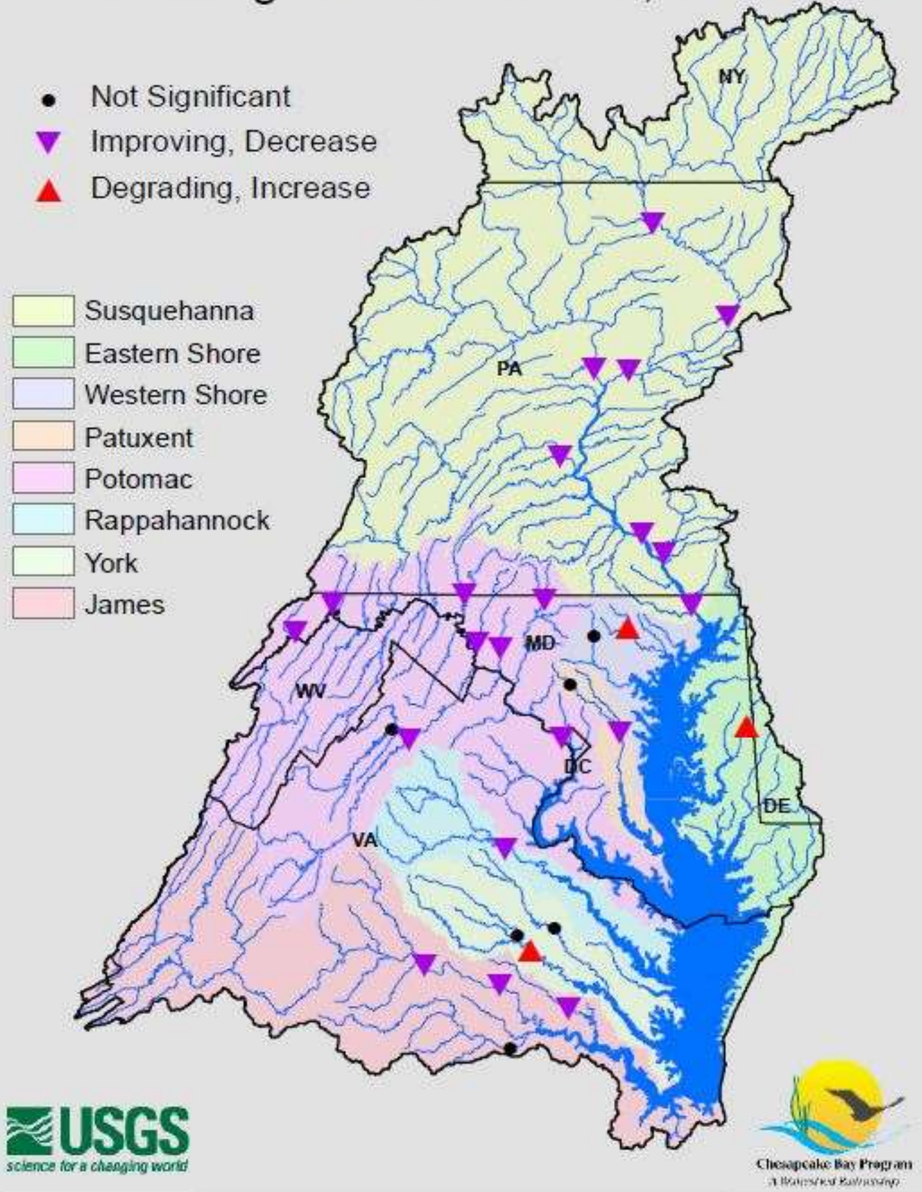


Using Monitoring Data To Measure Progress and Explain Change

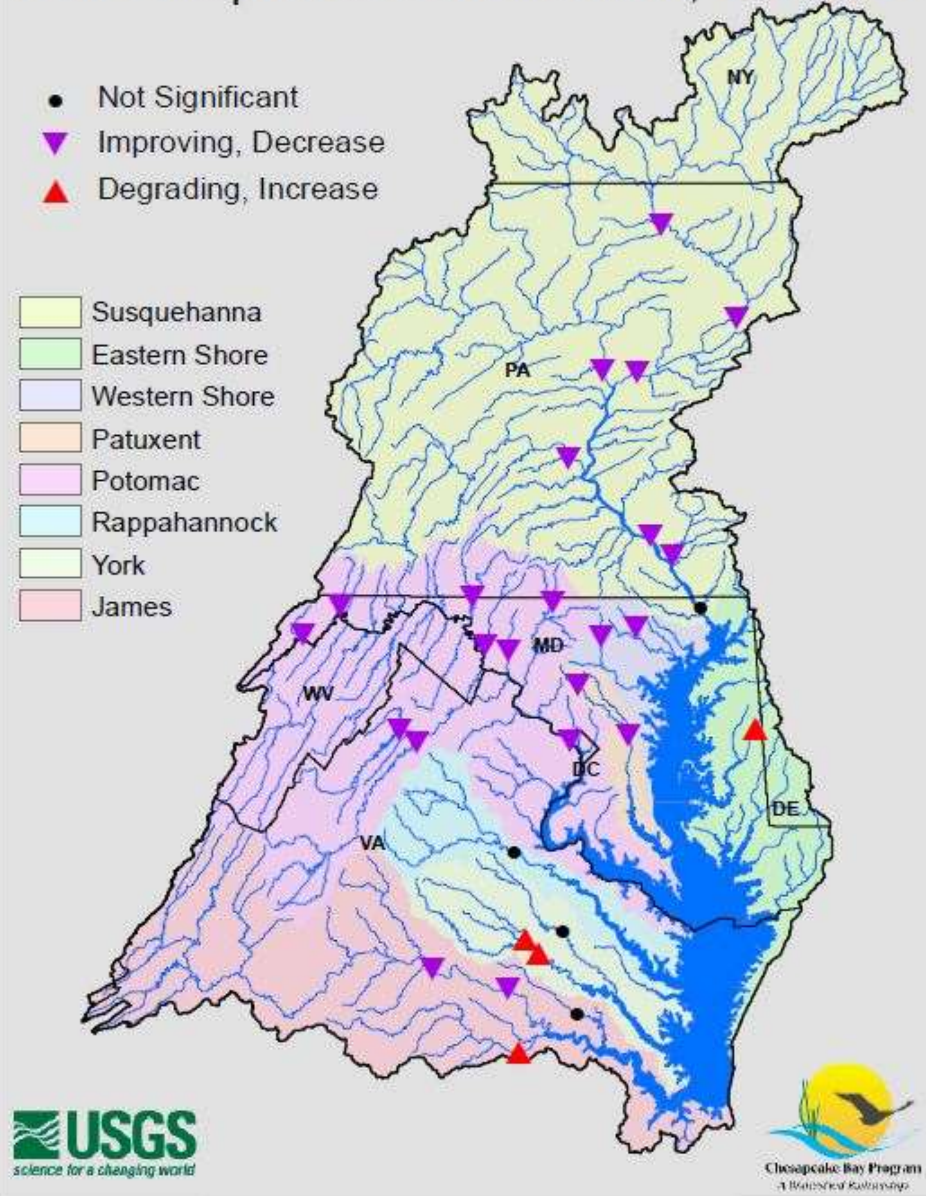
Foundation: Monitoring networks



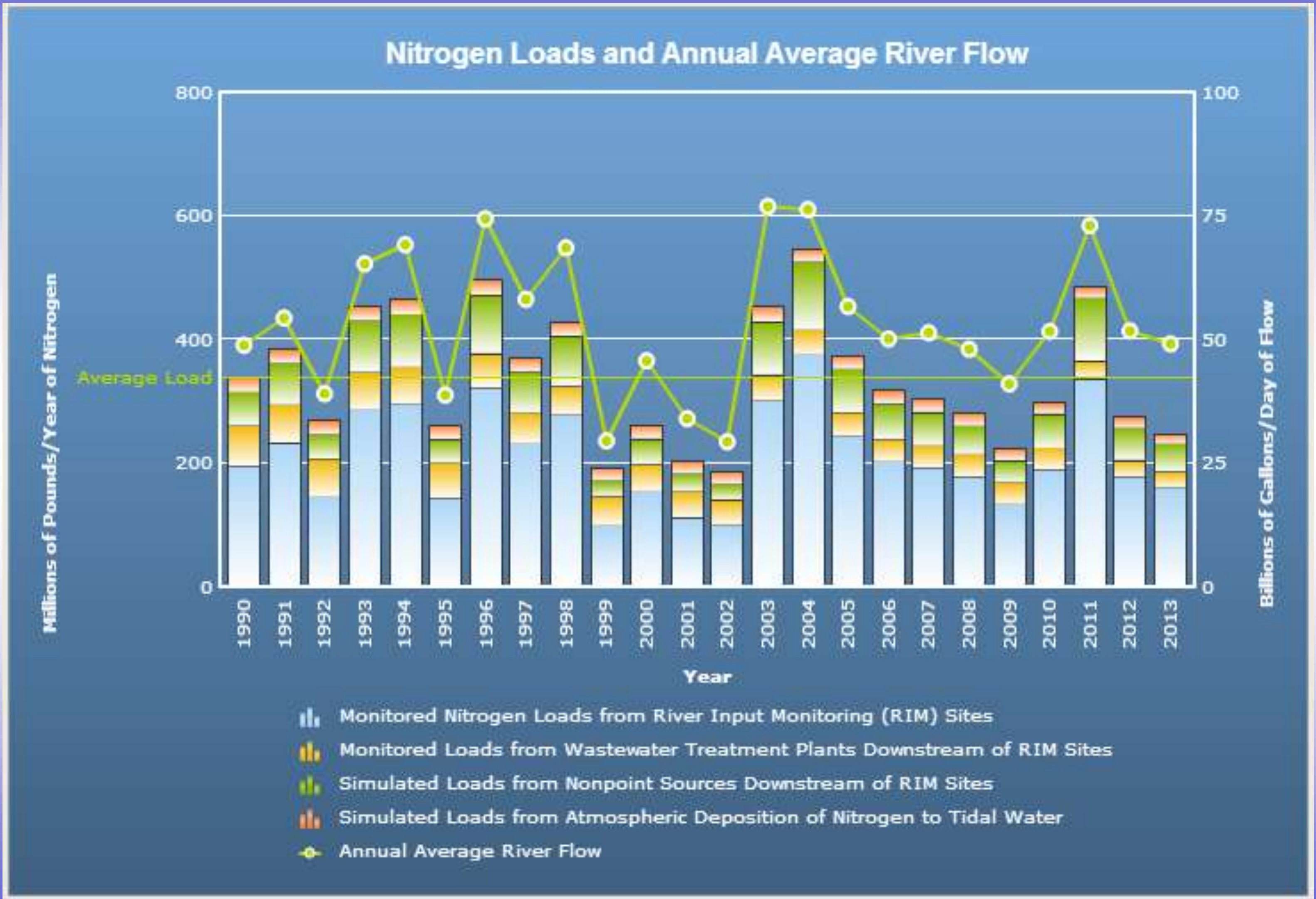
Long-Term Trend in Flow-Adjusted Total Nitrogen Concentration, 1985-2012



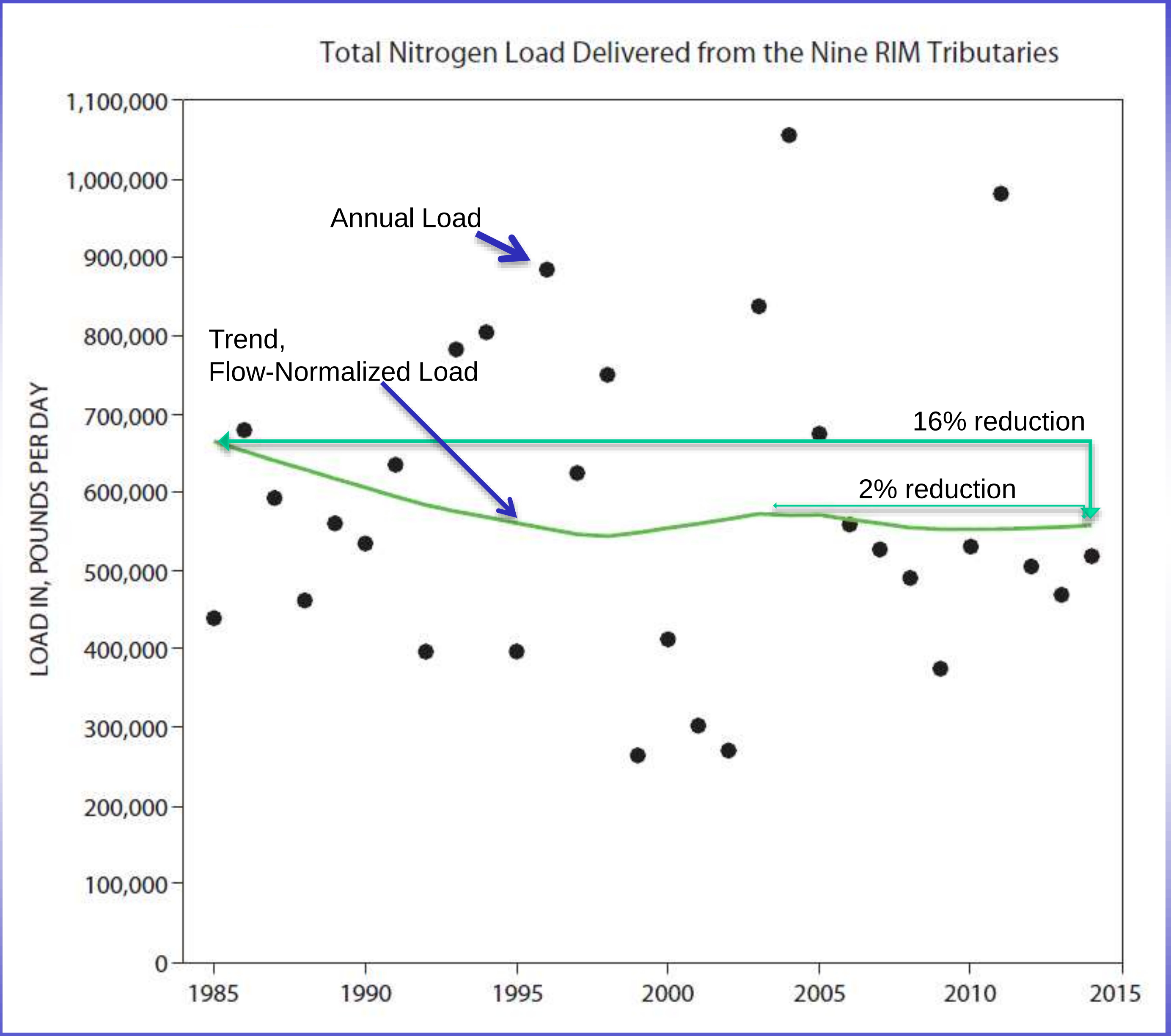
Long-Term Trend in Flow-Adjusted Total Phosphorus Concentration, 1985-2012



Total Nitrogen Delivered to the Bay



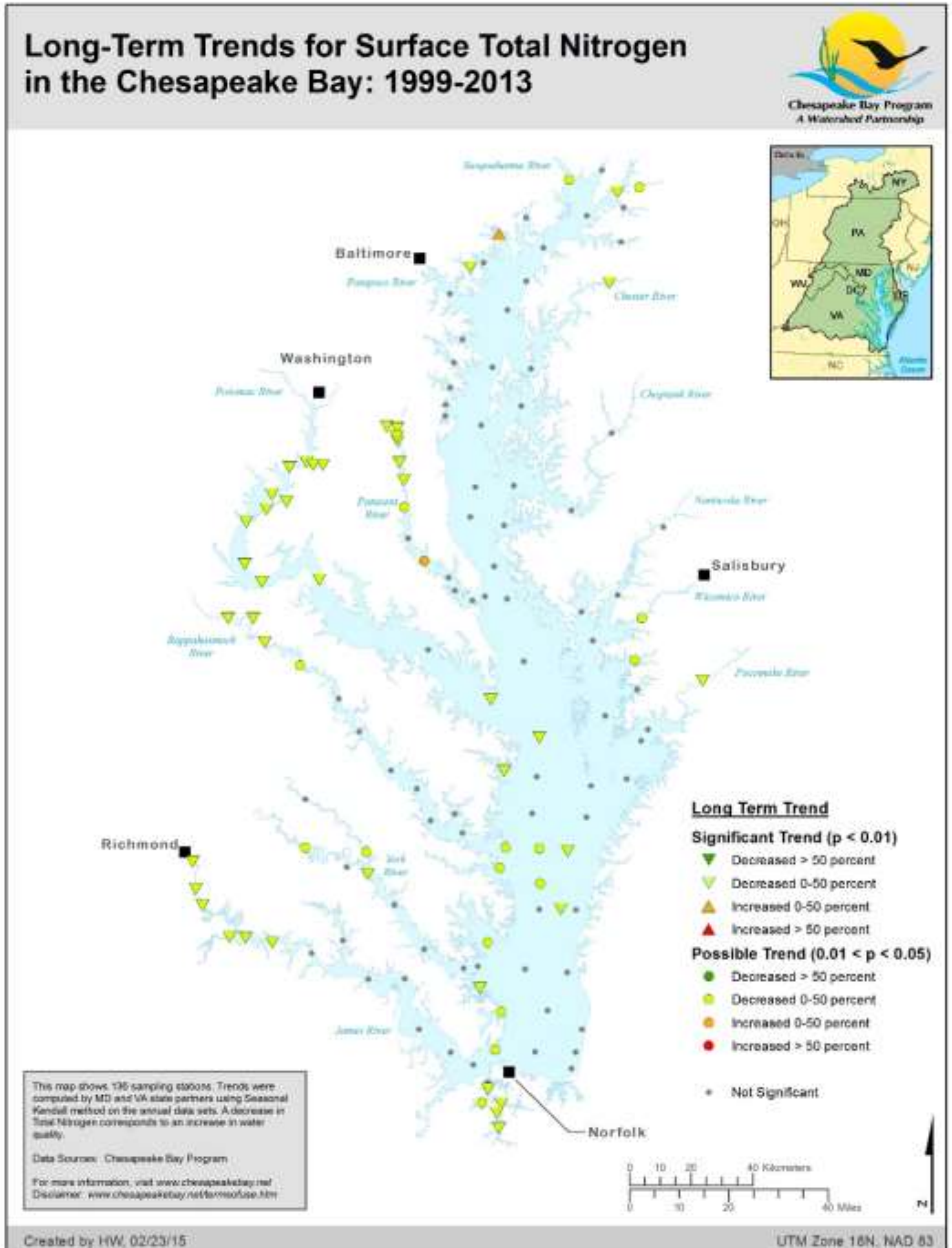
Changes in Total Nitrogen Delivered to the Bay Estuary from the 9 RIM Stations



Total reduction in RIM total nitrogen:

1985 to 2014 = 16%

2005 to 2014 = 2%

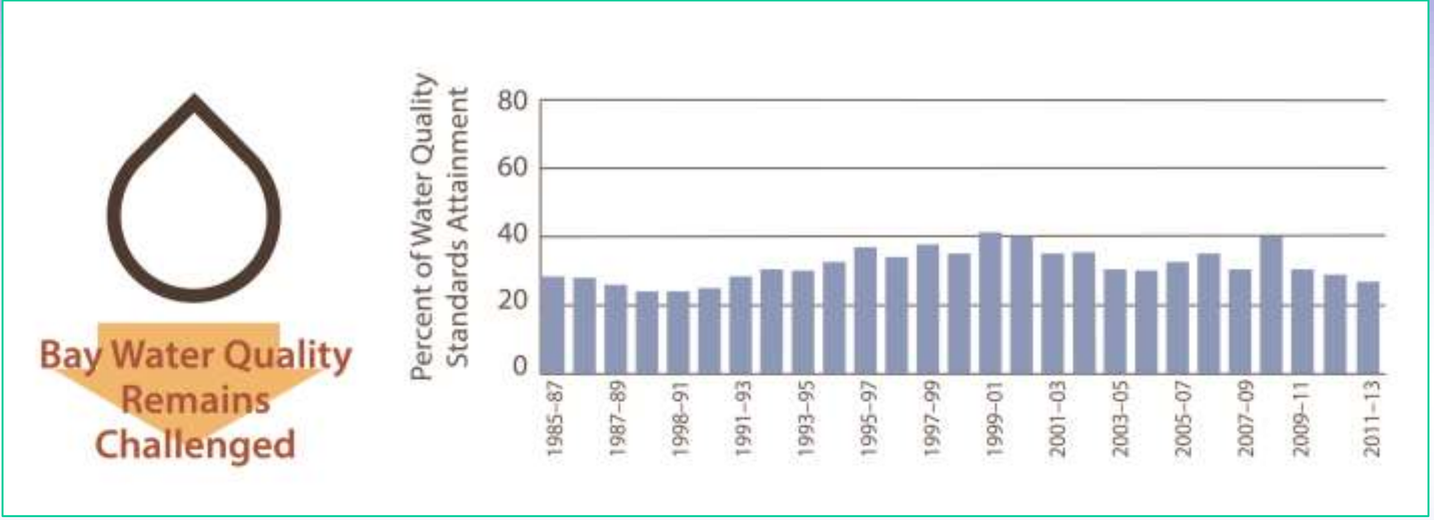


Long-Term Trends for Surface Total Nitrogen in the Chesapeake Bay: 1999-2013
Chesapeake Bay Program
A Watershed Partnership
Baltimore
Washington
Salisbury
Richmond
Norfolk
Long Term Trend
Significant Trend (p < 0.01)
Decreased > 50 percent
Decreased 0-50 percent
Increased 0-50 percent
Increased > 50 percent
Possible Trend (0.01 < p < 0.05)
Decreased > 50 percent
Decreased 0-50 percent
Increased 0-50 percent
Increased > 50 percent
Not Significant
This map shows 136 sampling stations. Trends were computed by MD and VA state partners using Seasonal Kendall method on the annual data sets. A decrease in Total Nitrogen corresponds to an increase in water quality.
Data Sources: Chesapeake Bay Program
For more information, visit www.chesapeakebay.net
Disclaimer: www.chesapeakebay.net/termsofuse.htm
Created by HW, 02/23/15
UTM Zone 18N, NAD 83

Bay (tidal) Water Quality

29% for 2011-13 period

(down slightly from 31% in 2010-12)



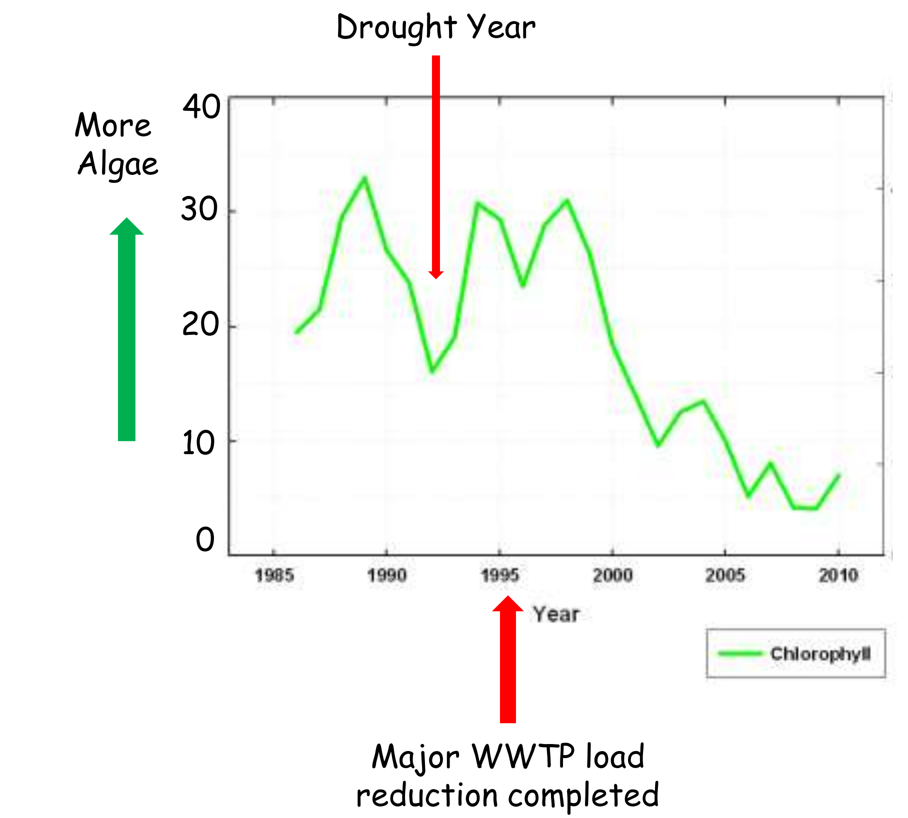
- 92 segments of tidal Bay evaluated using:
- 3 pieces of monitoring data for each:
  - Dissolved oxygen
  - Chlorophyll *a* (algae)\
  - Water clarity as measured by underwater grass abundance

Restoration of Mattawoman Creek: Potomac River estuary tributary

- strongly impacted by nutrients from 1970 – mid-1990s
  - large and persistent algal blooms, sea grasses rare
    - WWTP load reductions stimulated restoration

Photo from Elena Gilroy

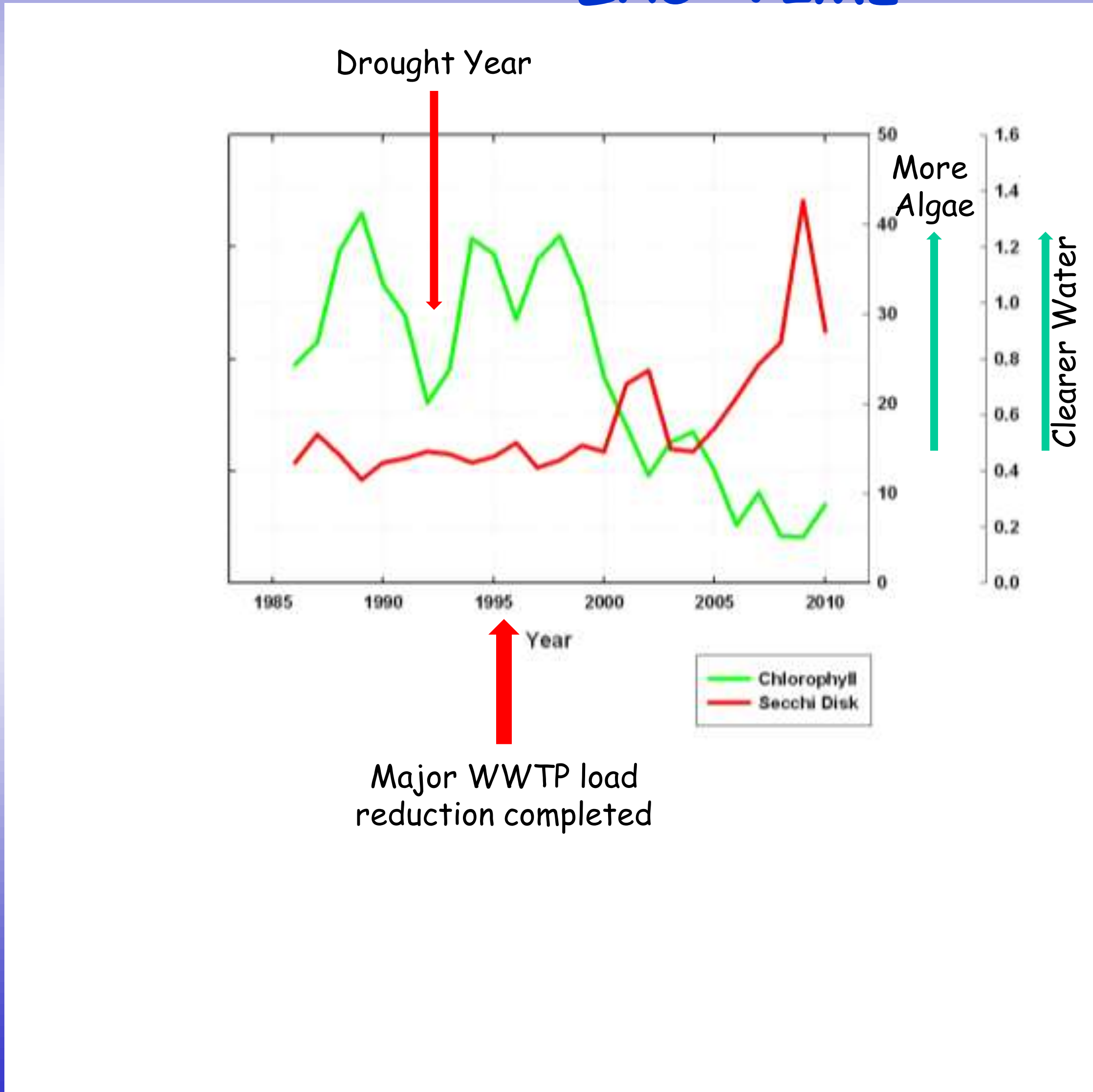
Algal Biomass Decreased…with Substantial Lag Time



- No clear response for about 4 years followed by sharp decline in algae

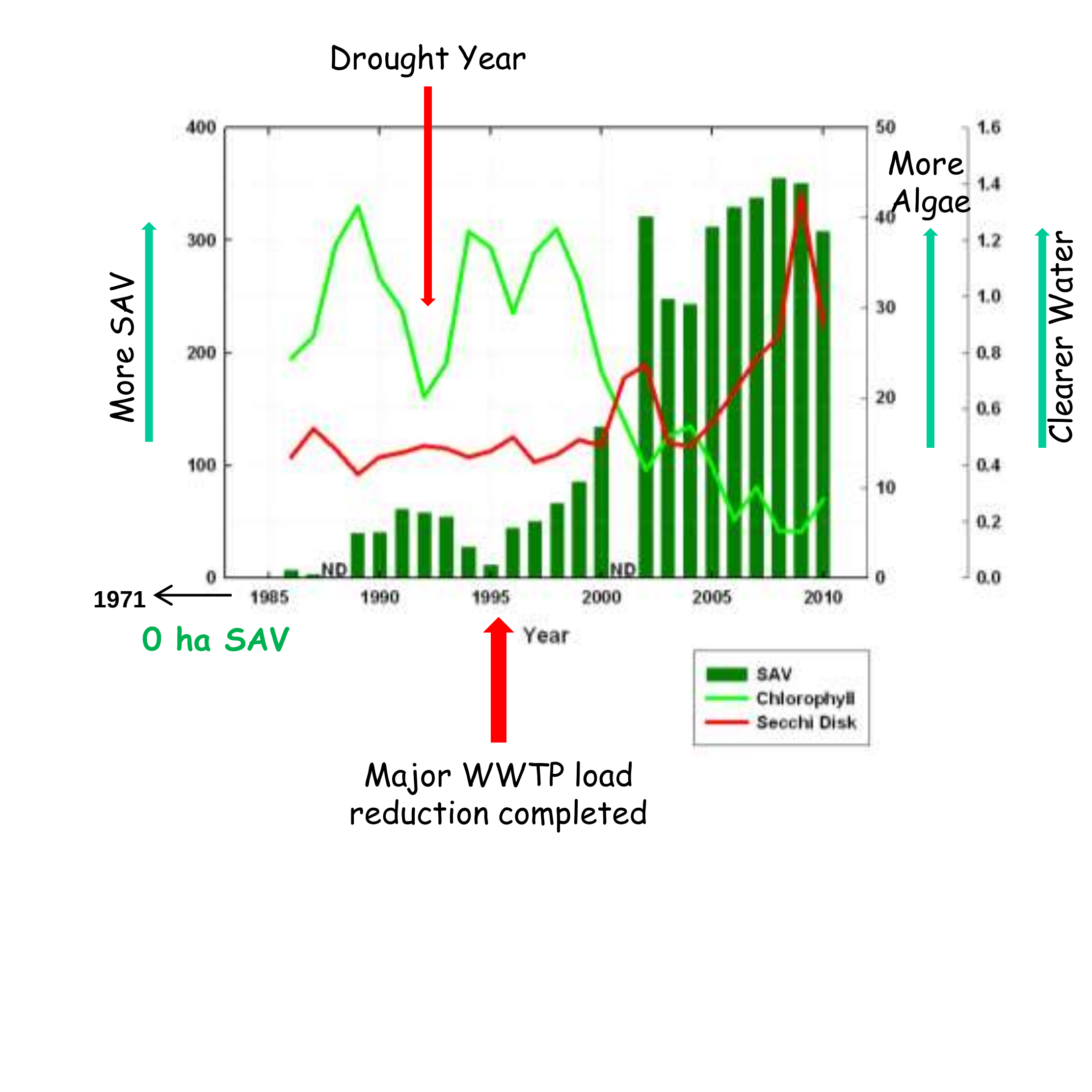
- After 2005 low levels of algae became normal

Water Clarity Increased…also with a Lag Time



- No clear increase for about 8 years followed by sharp increase in clarity
- Water clarity and algae highly correlated shallow Chesapeake Bay systems

SAV Increased...Shorter Lag with Threshold Response



- Very low levels of SAV were present prior to nutrient load reductions
- Major expansion of SAV in 2002, a severe drought year

Rich Batiuk

Associate Director for Science

U.S. EPA Chesapeake Bay Program Office

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www.chesapeakebay.net

www.epa.gov/chesapeakebaytmdl

Florida's Numeric Nutrient Criteria

Background and Implementation

- Doug Durbin, Ph.D. September 2015

Background

Florida NNC – Online Resources

- Background and links to rules, documents, maps, etc:
- *http://www.dep.state.fl.us/water/wqssp/nutrients/*

- Implementation guidance:
- http://www.dep.state.fl.us/water/wqssp/nutrients/docs/NNC_Implementation.pdf

- Development of Type III SSACs for nutrients:
- http://www.dep.state.fl.us/water/wqssp/docs/swqdocs/type_III_ssac.pdf

Florida NNC – General Timeline

- 2001 - FDEP began technical process
  - Data compilation and review
  - New data collection
  - NNC Technical Advisory Committee
  - Public input and meetings
- 2008 - Law suit filed by Earth Justice to compel EPA to establish NNC for Florida
- Jan 2009 – EPA issued a Determination Letter stating that NNC were required in FL to implement the CWA
- Aug 2009 - EPA and Earth Justice signed a consent decree
  - Established specific milestones dates

Florida NNC – General Timeline

- Nov 2010 – EPA finalized NNC for streams, lakes and springs
  - Used data and work from FDEP
  - Included specific "downstream protection values"
  - Provided for nutrient SSACs
- Many parties filed suit against EPA NNC
  - Judge upheld NNC for lakes and springs, but overturned other parts of the EPA rule
- Dec 2011 – FDEP adopted NNC for lakes, streams and springs
  - Challenges were filed, but NNC were upheld by FL judge
- Nov 2012 – EPA approved the FDEP NNC
  - Agreed that FL could continue to use narrative approach for certain waters
- March 2013 - EPA withdrew its NNC for FL
  - FL to continue NNC establishment for estuaries
- June 2013 – FDEP estuarine criteria approved by EPA
  - **Statewide NNC fully in place**

Florida NNC – The Regulations

- "*For many decades Florida has had a narrative nutrient water quality criterion in place to protect Florida's waters against nutrient over-enrichment. In 2009, the Department initiated rulemaking and, by 2011, adopted what would be the first set of statewide numeric nutrient standards for Florida's waters. By 2015, almost all of the remaining waters in Florida have numeric nutrient standards.*"

- There are actually four distinct sets of rules:

- Lakes, Streams and Springs (62-302.531)
- Estuaries and Coastal Areas (62-302.532)
- Everglades (62-302.540)
- Identification of Impaired Waters (62-303)

Florida NNC – What Did They Get?

- What did Florida get?:
- Statewide NNC
- Flexibility
  - (in some cases)
- Biological Confirmation
  - (when it's feasible)
- The very same numeric values EPA proposed for lakes, streams and springs
  - But, generally at the “back” of the rule, not the “front”
  - Over-protective?, under-protective?, ambiguous?

Florida NNC – The "Numeric" Parts

Summary of Fresh Water NNC – Lakes & Springs

Waterbody Type	Class	TN (mg/L)	TP (mg/L)	Chl-a (ug/L)
Lakes	Colored	1.27 [or up to 2.23]	0.05 [or up to 0.16]*	20
	Clear, Alkaline	1.05 [or up to 1.91]	0.03 [or up to 0.09]	20
	Clear, Acid	0.51 [or up to 0.93]	0.01 [or up to 0.03]	6
Springs	All	0.35**	N/A	N/A

TN and TP criteria can change based on observed Chl a levels

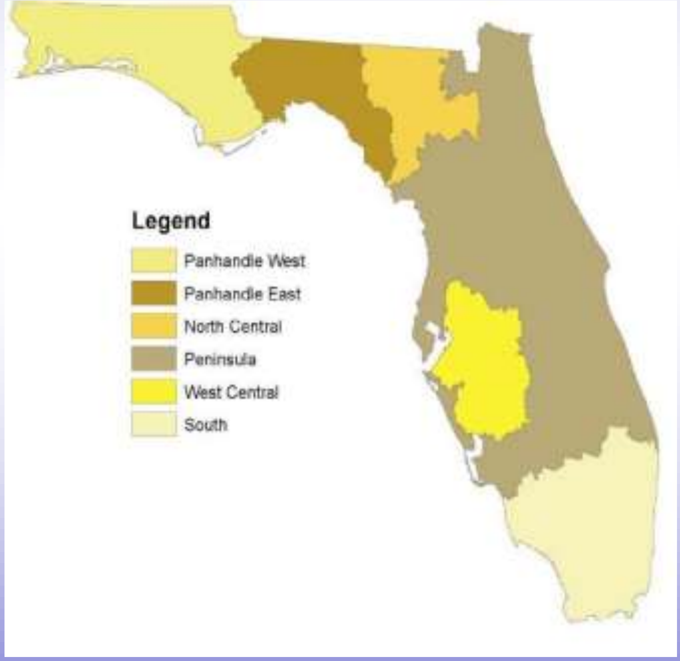
* For lakes in the West Central region, the maximum TP limit is 0.49 mg/L

**Criterion applies to nitrate+nitrite concentrations only

Florida NNC – The "Numeric" Parts

Summary of Fresh Water NNC – Streams

Nutrient Watershed Region	TN (mg/L)	TP (mg/L)
Panhandle West	0.67	0.06
Panhandle East	1.03	0.18
North Central	1.87	0.30
West Central	1.65	0.49
Peninsula	1.54	0.12



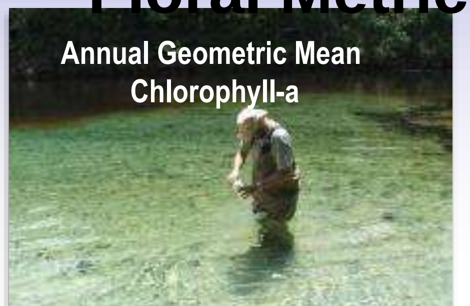
Florida NNC – The "Numeric" Parts

Estuarine NNC

- Numerous water-body-specific numeric criteria
- Some as loadings (tons/million cubic m)
- Others as concentrations (ug/L, mg/L)
- Some as annual mean
- Others as annual geometric mean
- Many are "hold the line" protective criteria
- Many are based on local estuary program data collection and management efforts
  - Estuaries are not all alike.

Florida NNC – Biological Aspects of NNC - Streams

Floral Metrics



Faunal Metrics

Nutrient Thresho

Nutrient Watershed Region	TN (mg/L)	TP (mg/L)
Panhandle West	0.67	0.06
Panhandle East	1.03	0.18
North Central	1.87	0.30
West Central	1.65	0.49
Peninsula	1.54	0.12

Florida NNC – Biological Factors

Fresh Water NNC – Streams

Floral Metrics		**Floral Metrics**
+	**OR**	+
Nutrient Thresholds		**Stream Condition Index**
↓		↓
Attains Nutrient Standard		**Attains Nutrient Standard**

Florida NNC – Biological Factors

Fresh Water NNC – Streams

Water Body Must Achieve All To Attain Numeric Interpretation of Narrative Nutrient Standard:

- Exotic aquatic vegetation not greater than 25%
- Mean Coefficient of Conservatism score greater than 2.5
- Benthic algae coverage of 6 mm or greater not more than 25%
- Benthic algae species is not nuisance or undesirable (if more than 20 % coverage observed)
- Average SCI score greater than 40
- Neither of the two most recent SCI scores less than 35
- Annual geometric mean chlorophyll-a less than 20 ug/L
  - Between 3.2 and 20 ug/L – site specific conditions must indicate nutrients not an issue
  - No increasing trend observed

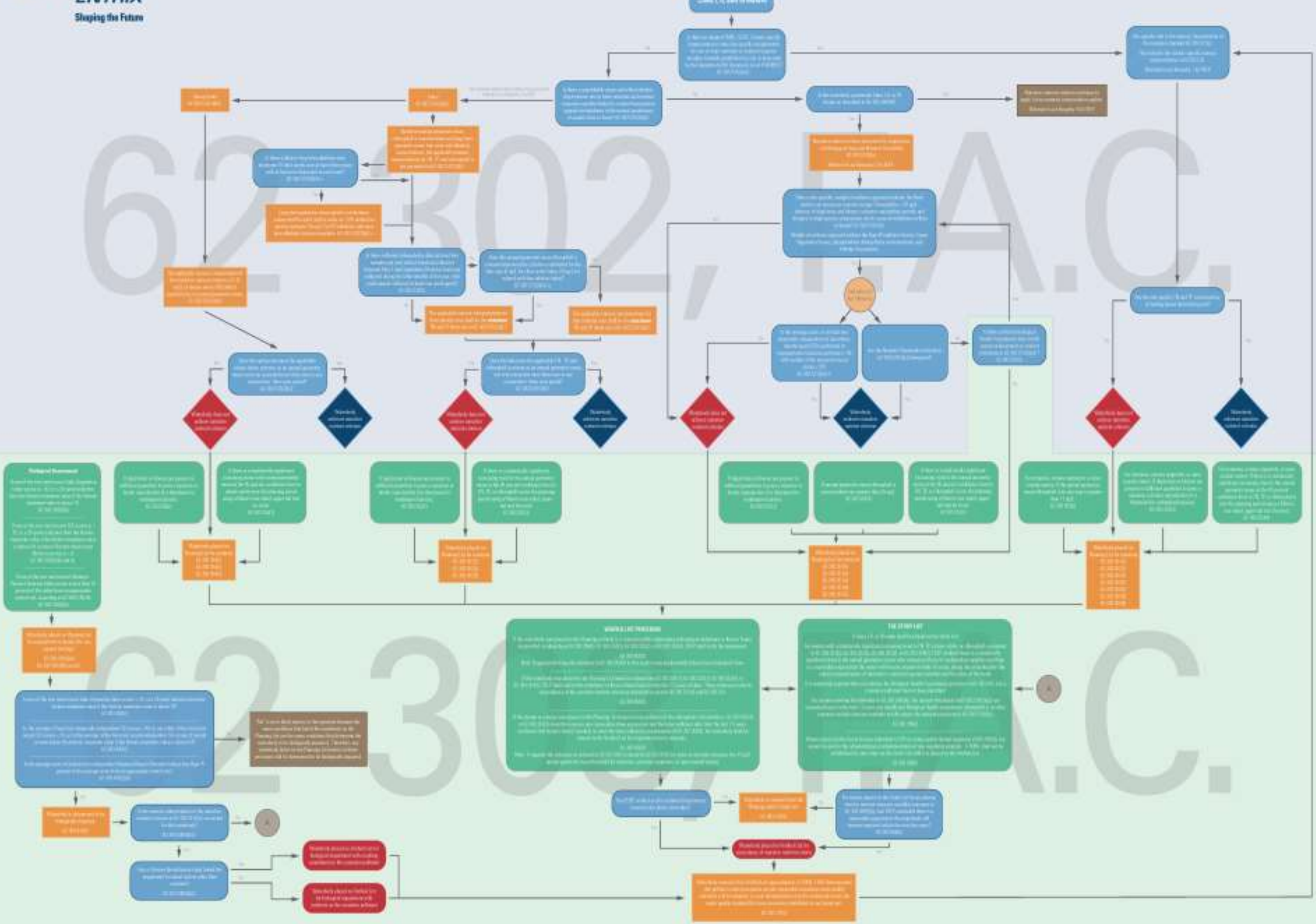
Florida's Underlying NNC Concept

If the biology of the system is ok, the nutrients must not be causing a problem.

Easy and Straightforward So Far, Right?

Cardno ENTRIX
Shaping the Future

Numeric Interpretations Of The Narrative Nutrient Standard



Implementation

Implementing NNC

Implementation of

Florida's Numeric Nutrient Standards

Document Submitted to EPA in Support of the Department of Environmental Protection's Adopted Nutrient Standards for Streams, Spring Vents, Lakes, and Selected Estuaries

April 2013

57 pages, plus appendix !

Implementing NNC – FDEP Guidance Document

PURPOSE OF DOCUMENT

This document describes how numeric nutrient standards in Chapters 62-302 (Water Quality Standards) and 62-303 (Identification of Impaired Surface Waters), Florida Administrative Code (F.A.C.), are implemented by the Department of Environmental Protection (Department). The major topics include the hierarchical approach used to interpret the narrative nutrient criterion (NNC) on a site-specific basis; a summary of the criteria for lakes, spring vents, streams and estuaries; floral measures and the weight of evidence approach in streams; example scenarios for how the criteria will be implemented in the 303(d) assessment process; and a description of how the Water Quality Based Effluent Limitation (WQBEL) process is used to implement the nutrient standards in wastewater permitting. Finally, because of the complexity associated with assessing nutrient enrichment effects in streams, a summary of the weight-of-evidence evaluation involving flora, fauna, and Nutrient Thresholds is provided.

Hierarchical Approach

Nutrient Total Maximum Daily Loads, Site Specific Alternative Criteria, Estuary-specific Criteria, and Water Quality Based Effluent Limitations

↓

Stressor-Response Relationships (lakes & springs)

↓

Reference stream-based thresholds combined with biological data (flora and fauna)

↓

Narrative (wetlands, intermittent streams, South Florida flowing waters)

Summary of the Criteria

Covered on Earlier Slides

Nutrient Watershed Region	TN (mg/L)	TP (mg/L)
Panhandle West	0.67	0.06
Panhandle East	1.03	0.18
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Springs	All	0.35**	N/A	N/A

TN and TP criteria can change based on observed Chl a levels

* For lakes in the West Central region, the maximum TP limit is 0.49 mg/L

**Criterion applies to nitrate+nitrite concentrations only

Application of NNC in 303(d) Process

- **Lots of data compilation and analysis for streams and lakes**

- **Lots of new data collection**
  - Especially biological information
  - Generally more than one sampling event needed
  - "*Floral measures alone can provide evidence that the nutrient standard is not achieved, leading to the waterbody being placed on the Florida Verified List and Clean Water Act 303(d) list.*"
    - <u>EVEN IF THE WATER BODY IS BELOW THE NUMERIC CRITERIA VALUES</u>

- **Water body can have one of three designations**
  - Not Impaired (no TMDL required)
  - Verified Impaired (TMDL is required)
  - Study List (more data needed)

Application of NNC in 303(d) Process

Establishing Nutrient Impairment in FL Streams

	Attains Nutrient Thresholds for Both TN and TP (3 Years of Data)			Nutrient Threshold Attainment Inconclusive for Either TN or TP (< 3 Years of Data)			At Least One Nutrient Threshold Not Attained (3 Years of Data)		
	SCI Attains (2 Samples)	SCI Inconclusive (<2 Samples)	SCI Not Attained (1 or 2 Samples)	SCI Attains	SCI Inconclusive	SCI Not Attained	SCI Attains	SCI Inconclusive	SCI Not Attained
Attains Floral Measures (2 Sampling Events)	Attains .531(2)(c) Cat. 2	Attains .531(2)(c) Cat. 2	Attains .531(2)(c) Cat. 2	Attains .531(2)(c) Cat. 2	Cannot Conclude .531(2)(c) Assessment Cat. 3b	Cannot Conclude .531(2)(c) Assessment Cat. 3b	Attains .531(2)(c) Cat. 2	Cannot Conclude .531(2)(c) Assessment Cat. 4d (Study & 303(d) List)	.531(2)(c) Not Attained Cat. 5 (Verified & 303(d) List)
Floral Measures Inconclusive (<2 Sampling Events)	Cannot Conclude .531(2)(c) Assessment Cat. 3b or 3c(Planning List)	Cannot Conclude .531(2)(c) Assessment Cat. 3b or 3c(Planning List)	Cannot Conclude .531(2)(c) Assessment Cat. 3b or 3c(Planning List)	Cannot Conclude .53 1(2)(c) Assessment Cat. 3b or 3c(Planning List)	Cannot Conclude .531(2)(c) Assessment Cat. 3b or 3c(Planning List)	Cannot Conclude .531(2)(c) Assessment Cat. 4d (Study & 303(d) List)	Cannot Conclude- .531(2)(c) Assessment Cat. 4d (Study & 303(d) List)	Cannot Conclude .531(2)(c) Assessment Cat. 4d (Study & 303(d) List)	.531(2)(c) Not Attained Cat. 5 (Verified & 303(d) List)
Any One Floral Measure Not Attained (2 Sampling Events)	.531(2)(c) Not Attained Cat. 5 (Verified & 303(d) List)	.531(2)(c) Not Attained Cat. 5 (Verified & 303(d) List)	.531(2)(c) Not Attained Cat 5 (Verified & 303(d) List)	.531(2)(c) Not Attained Cat. 5 (Verified & 303(d) List)	.531(2)(c) Not Attained Cat/ 5 (Verified & 303(d) List)	.531(2)(c) Not Attained Cat. 5 (Verified & 303(d) List)	.531(2)(c) Not Attained Cat. 5 (Verified & 303(d) List)	.531(2)(c) Not Attained Cat. 5 (Verified & 303(d) List)	.531(2)(c) Not Attained Cat. 5 (Verified & 303(d) List)

Application of NNC in 303(d) Process

Establishing Nutrient Impairment in FL Lakes

- If annual geometric mean of chl a exceeds criterion for the lake type more than one in three years – Verified Impaired and 303(d) list

- If annual geometric mean chl a does not exceed the value for the lake type, but annual mean of either TN or TP exceeds the upper limit for the lake type more than one in three years – Verified Impaired and 303(d) list

- Within any year, if annual geometric mean of chl a exceeds criterion for that lake type, the TN and TP criteria are set at the lower thresholds – and vice-versa.
  - This means the TN and TP criteria for a lake can change on a year to year basis based on chl a values

Application of NNC in 303(d) Process

Establishing Nutrient Impairment in FL Springs

- Is NO_2+NO_3 above 0.35 mg/L – Verified Impaired and 303(d) list
- No phosphorus considerations
- No chlorophyll or other biological considerations

Application of NNC in 303(d) Process

Establishing Nutrient Impairment in FL Estuaries

- Straightforward application of numeric values in the Rule
- Ongoing data collection by FDEP, resource agencies, and local estuary stakeholders in most cases
- Could be confusion over tidal creeks, coastal marshes, etc.
  - Not the same as open waters

WQBEL Process – Wastewater Permits

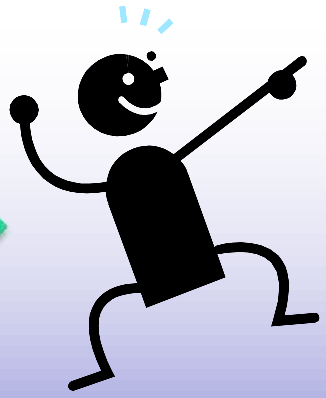
Renewal of Existing Permits

(nearly all NPDES discharges in FL are to streams)

- **Level I WQBEL**
  - Rely mostly on existing data
  - “Simple” analysis

- For Existing Discharges – Level I WQBEL

Evaluate Floral and Faunal Metrics in Receiving Water → If Achieved – nutrients in discharge must not be a problem → Permit Renewed with current permitted limits



WQBEL Process

New or Expanded Permits

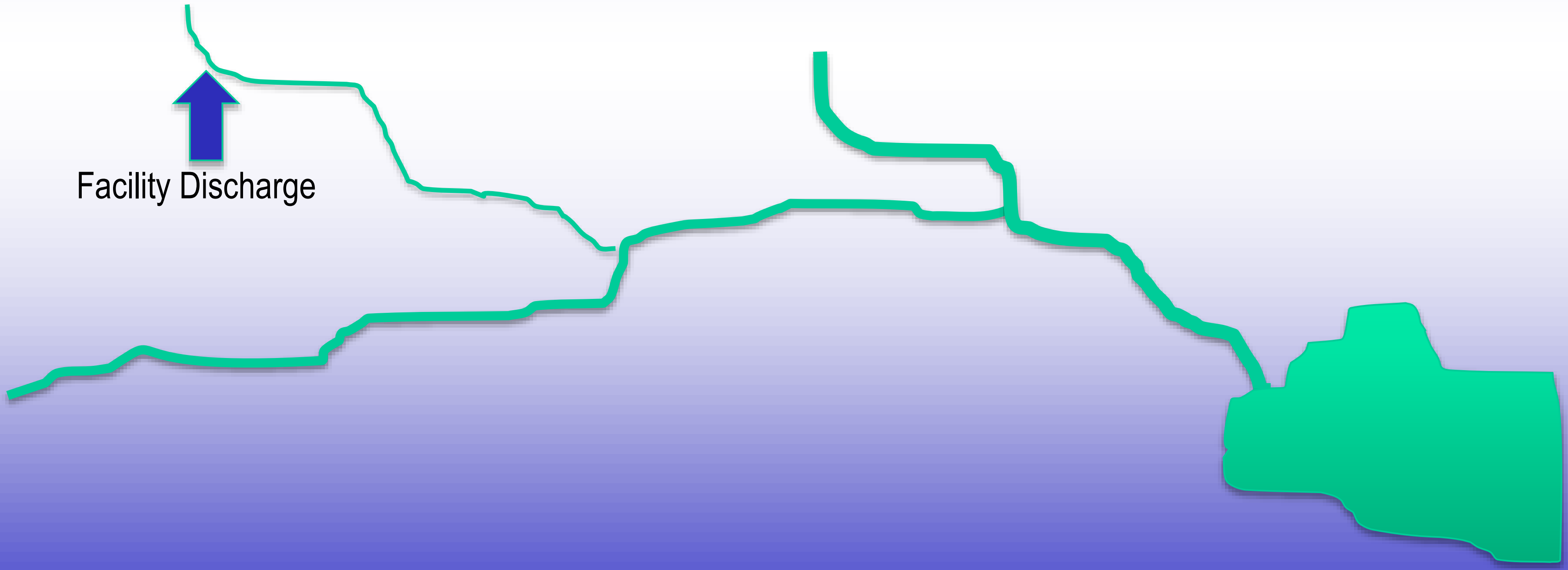
- **Level II WQBEL**
  - New data usually needed
  - More stringent analysis
  - More expensive
  - More time consuming
  - Likely to require water quality modelling

  - Must demonstrate discharge will not cause or contribute to violations of NNC
  - Must link nutrient concentrations in discharge to biology in receiving waters
    - Biological metrics

THESE ARE LARGELY UNCHARTED WATERS FOR NNC

Protection of Downstream Waters

"If downstream waters are anticipated to be potentially affected by the discharge of nutrients from an upstream facility, the potential impact must be assessed, regardless of distance." (FDEP 2013)



Site-Specific Alternative Criteria (SSAC)

Type III SSACs established specifically for NNC

Requires same data collection as biological health demonstration

- Must show attainment of all biological metrics
- Can be for segment or watershed

Sets numeric criteria for waterbody or segment

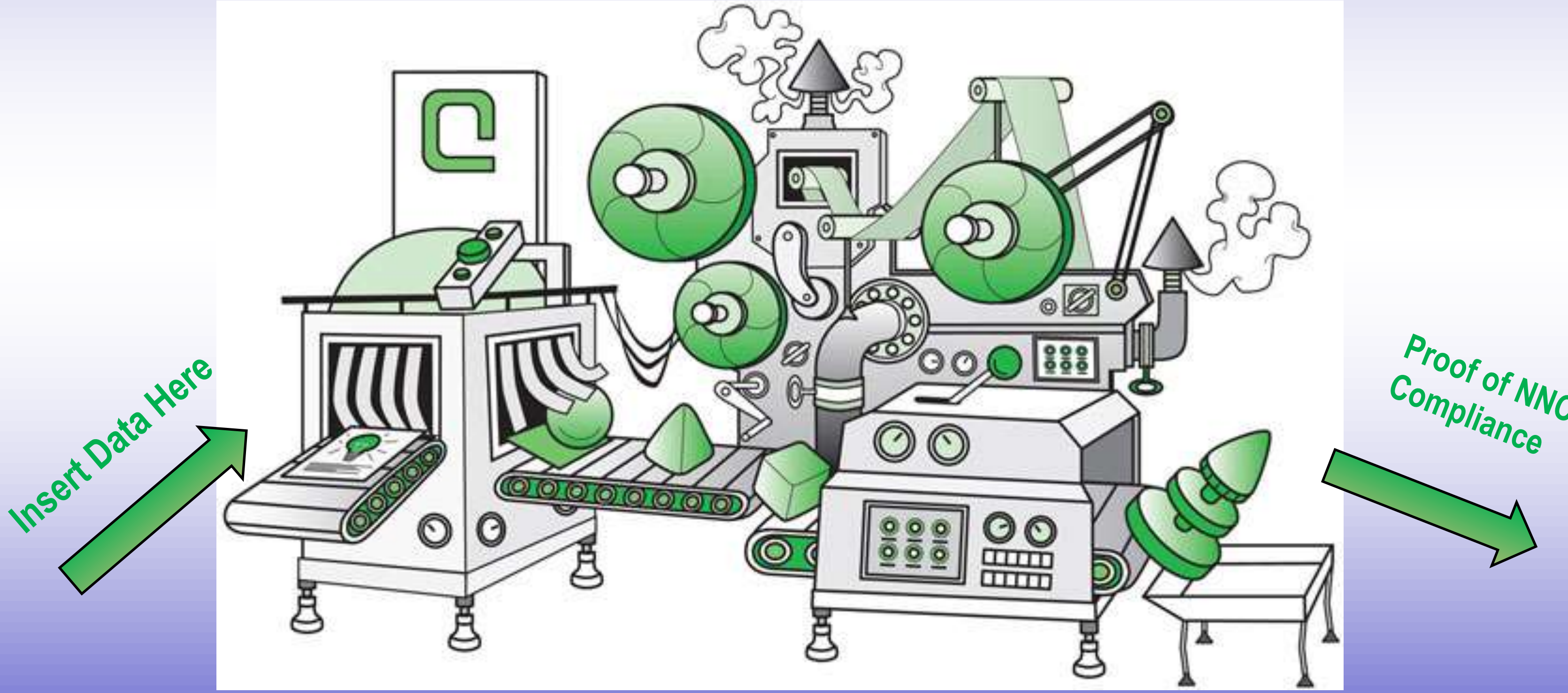
- Spatially defined by applicant
- Can provide regulatory certainty

Requires FDEP and EPA approval

- No defined timeline for approval

Must provide for downstream protection

NNC Implementation



Supplemental Information

Unexpected Consequences of Florida NNC

FL's NNC Are Intended to Play a Role in..

- FDEP
  - Managing the state 303(d) List
  - Identifying, regulating and restoring "impaired waters"
- NPDES Permit Applicants and Renewals
  - WQBEL Process
    - Domestic Waste
    - Industrial Waste

But Could They Have Influences Elsewhere . . . . ?

- **Federal Permitting**
  - USACE Dredge and Fill (404)
    - Same kinds of projects as State ERP
  - FERC (pipelines, power transmission
  - NEPA Process
    - Environmental Assessment
    - Environmental Impact Studies
  - EPA oversight of some…
    - Federal permitting
    - State permitting

Influences Elsewhere . . . . ?

- **Municipalities with MS4 Permits**
  - Form of NPDES permit
  - Many highly altered water bodies
    - Canals
    - Ditches
    - Impoundments
  - Complex
    - Multiple discharge points
    - Total dependence on storm water as their driver
  - Aging storm water ponds/systems with decades of sequestered nutrients

And Elsewhere . . . . ?

- **Construction Generic Permit**
  - Form of NPDES permit
  - Administered through FDEP
  - Requires a SWPPP
    - Evaluation of how and where pollutants may be mobilized
    - BMPs to control pollution
  - Historically focused on sediment/erosion
    - What if site abuts a stream or lake impaired for nutrients?
    - What if the impaired water is downstream but could be reached by runoff during construction?
  - Legacy nutrient issues could arise

And Elsewhere . . . . ?

- **Florida Environmental Resource Permitting**
  - Land development
    - Residential, commercial, industrial
  - Mining and Reclamation Activities
  - Transportation and other linear projects
  - Channel & marina dredging
  - State Water Quality (401) Certification via ERP
- **Beware of "Impaired Waters" on or near your development site**
  - WMD permitters have begun asking for stronger demonstration of net water quality improvement from development

And Elsewhere . . . . ?

- **Agriculture operations – especially conversions**
  - **Legacy nutrients**

- **Aquaculture facilities**

- **Brownfield management or redevelopment**

And Elsewhere . . . . ?

- **Local Government Regulation and Initiatives**
  - Local stormwater management policies
  - Fertilizer ordinances and other landscaping regulations
  - Setbacks and buffers from waters and wetlands
  - Septic tank & drainfield ordinances
  - Green Infrastructure Programs

And Still Elsewhere . . . . ?

- **Groundwater Regulation & Management**
  - Drinking water facilities
  - Springs protection and restoration
  - Land application (fertilizer, waste)
  - Septic tank & drainfield regulation or management
- * FDEP has funded a “seepage study” project to quantify nutrients in groundwater entering surface waters. Pilot project is on the Sebastian River associated with agricultural lands, with other projects to follow elsewhere in the state

Other Places NNC Could Be Felt

- Water Quality (Nutrient) Credit Trading
  - The recent Florida statute needs to be amended to open up more potential trades
  - DEP is in rulemaking on this (pay attention)
- Updated Waters of the US rule (WOTUS)
  - More jurisdictional wetlands - and particularly streams - may mean more places where NNC would apply
  - More likely to affect ERP permitting than NPDES
- "Stakeholders" in basins with nutrient TMDLs and BMAPs may face many challenges not associated with NPDES permits
- Types or frequency of legal actions brought by environmental NGOs may increase because NNC offer new entry points

Thank You

Nutrient Criteria Implementation in NC: Work In Progress

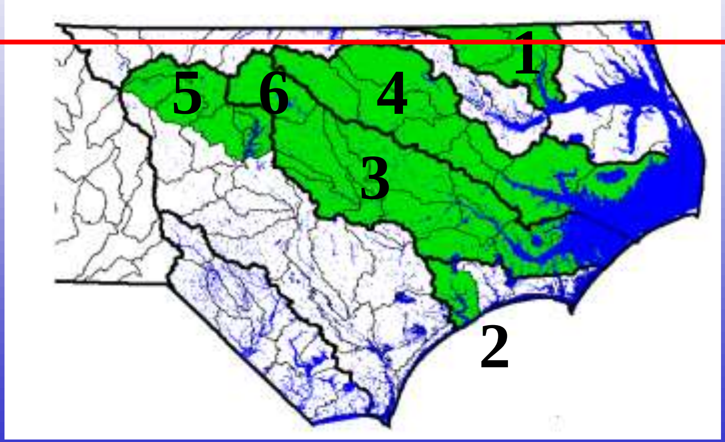
NC Nutrient Criteria Implementation Committee

Sept. 25, 2015

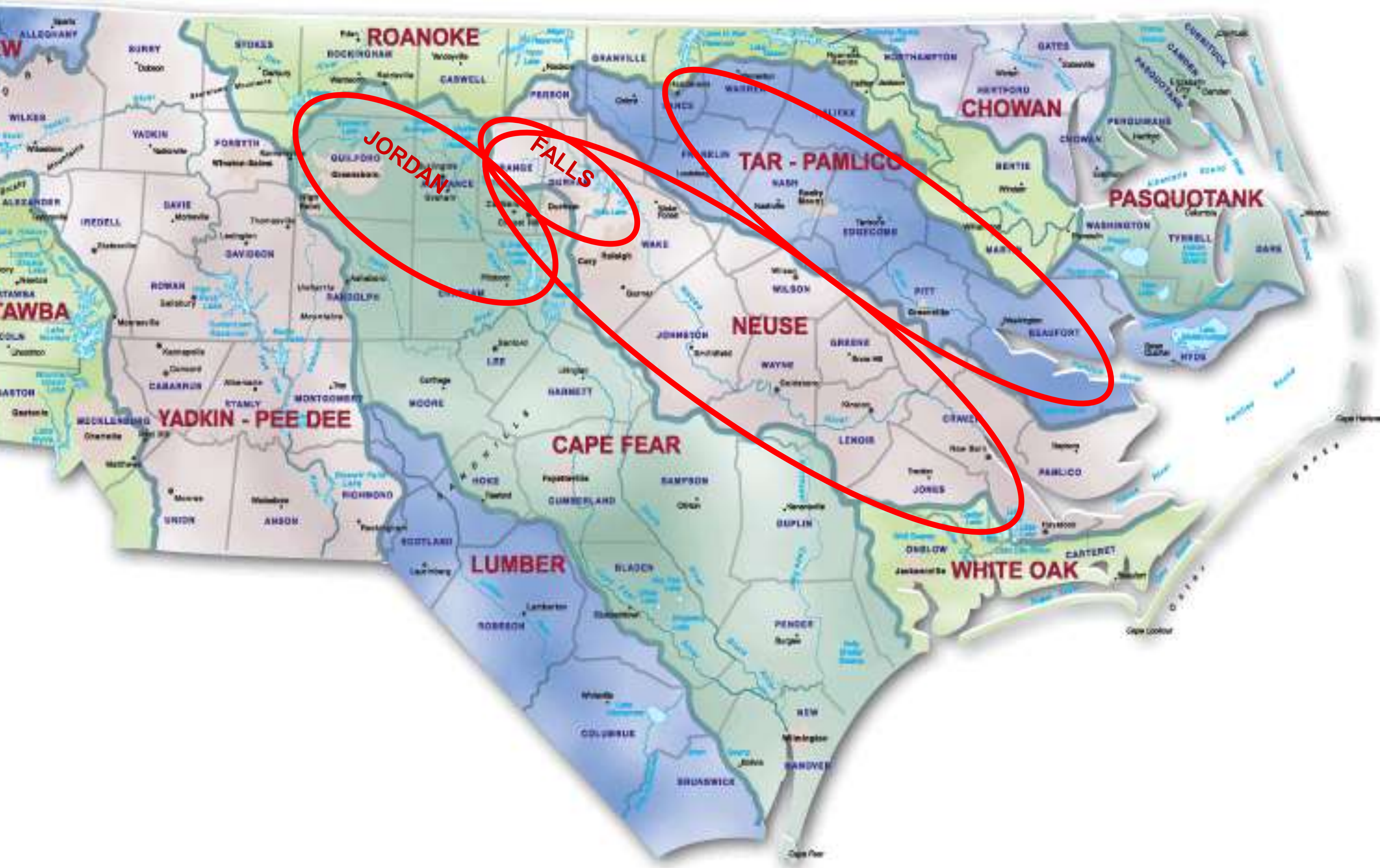
Rich Gannon
NC Division of Water Resources

NC Nutrient Strategies Scorecard

Date	Watershed	Sources	Fully Implemented?	Success?
1981	Chowan (1)	Point	Yes ~1984	Yes!
1991	New (2)	Point	Yes ~1996	Yes!
1997	Neuse (3)	PS/NPS	Yes - 2003	Not so much
2000	Tar-Pamlico (4)	PS/NPS	Yes - 2006	"
2009	Jordan (5)	PS/NPS	No – 2029+	Too soon
2011	Falls (6)	PS/NPS	No - 2041	"



Big 4 'Comprehensive' Nutrient Strategies



Strategy Elements and Possible CIC Roles

Element Type	Possible Element	SAC Role?	CIC/Stakeholder Input?
What	[N], [P]	✓	
What	Response: [chl a] < 40? [Phyto types]?	✓ ✓	
When	Seasonal?	✓	
Where	Spatial?	✓	
How much	% N vs. P lb/yr ⇩		✓
Who	Which sources		✓
By When	Over what timespan		✓

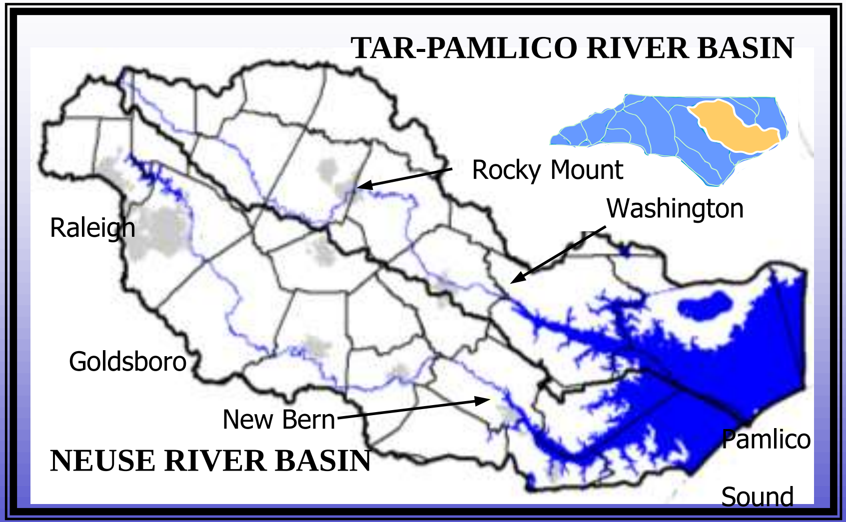
Nutrient Strategy Specifics – Who, What, How Much, Where, By When

See handout

Neuse and Tar-Pamlico – What Sources?

First ‘comprehensive’ nutrient regulations in NC

- Wastewater discharges
- Urban stormwater
- Agriculture
- Riparian areas protection
- Fertilizer management



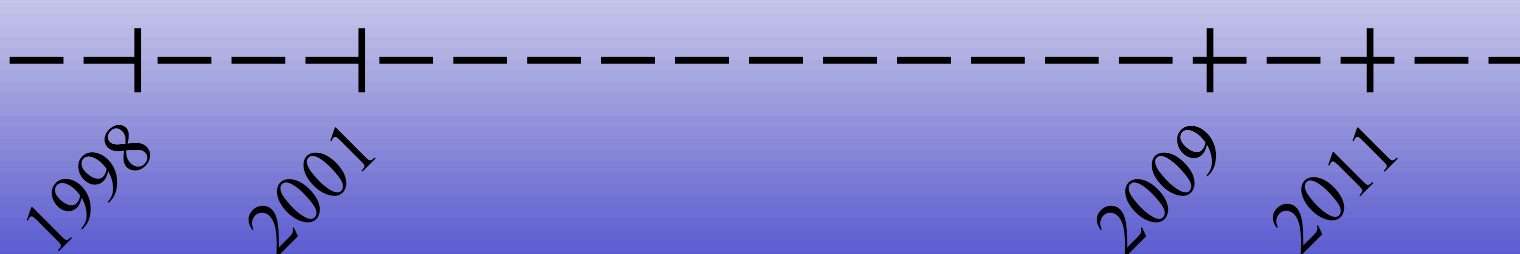
Sources Regulated under Big 4?

Neuse, Tar rules:

- Wastewater
- Agriculture
- New development stormwater (w/offsets)

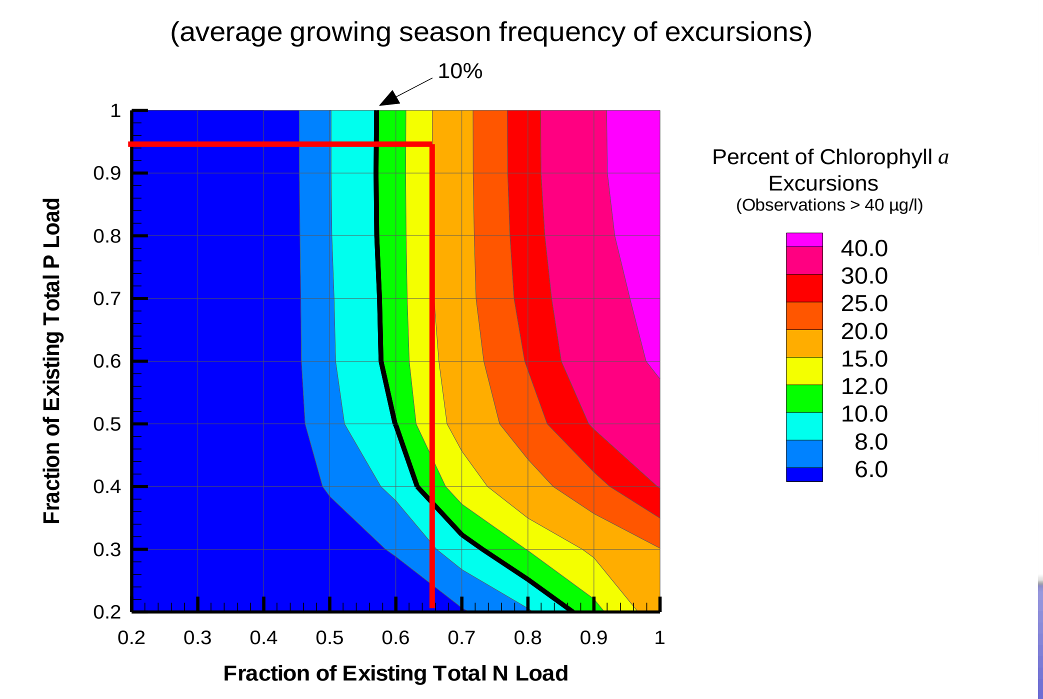
Jordan, Falls rules **add**:

- New D **all parties**
- Existing development stormwater
- Trading

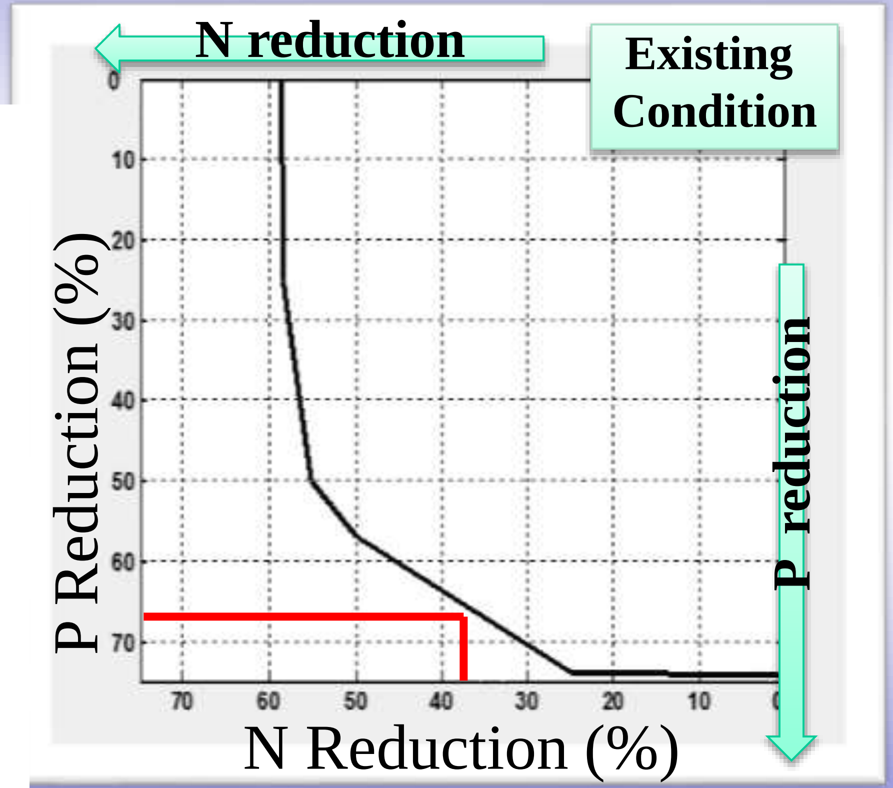


Jordan, Falls Target-Setting
Lake Model N/P Reduction Response Curves

Jordan Lake – Upper New Hope



Falls Lake



Common Features of Major Nutrient Strategies

- Collaborative development
- Waterbody-specific goals
- ‘All’ significant sources
  - Fair, reasonable, $\propto$ reductions
  - Load accounting
- Options, offsets, trading
- Increasingly complex, longer horizons

Challenges for Complex Strategies: NPS Accounting (science), Resources

- All NPS: Estimating **instream** loads & reductions
- New Development – hydrology
- Trading: useful structure
- Existing Development – bigger toolbox
- Agriculture
  - To-stream N accounting – loads, reductions
  - Quantitative phosphorus accounting
  - Pasture nutrient science
- Regulator resources – state, local
- Biology – Piedmont reservoirs …

Information

DWR Nutrient Strategies

http://portal.ncdenr.org/web/wq/ns

Nutrient Offset

http://portal.ncdenr.org/web/wq/ps/nps/nutrientoffsetintro

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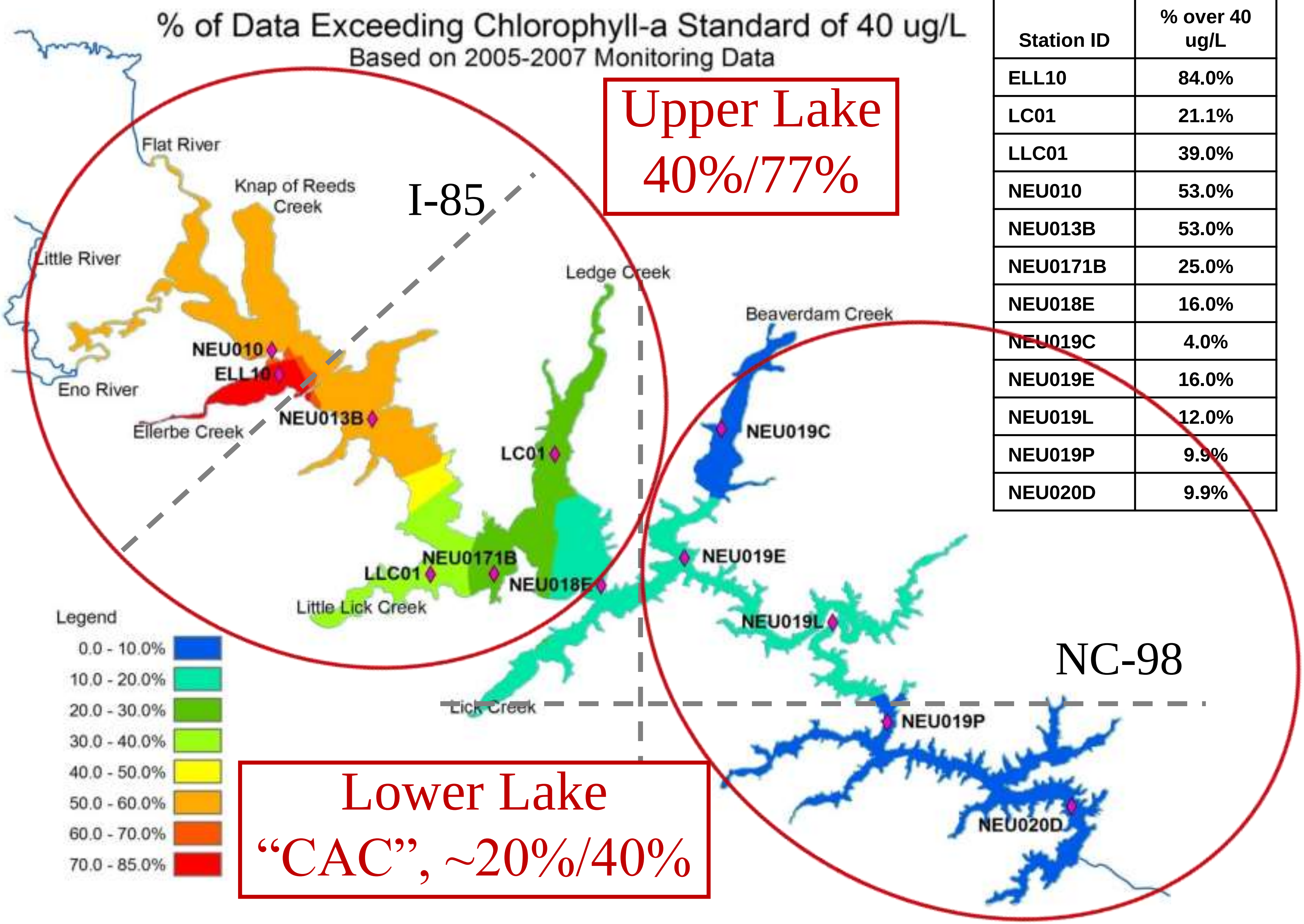
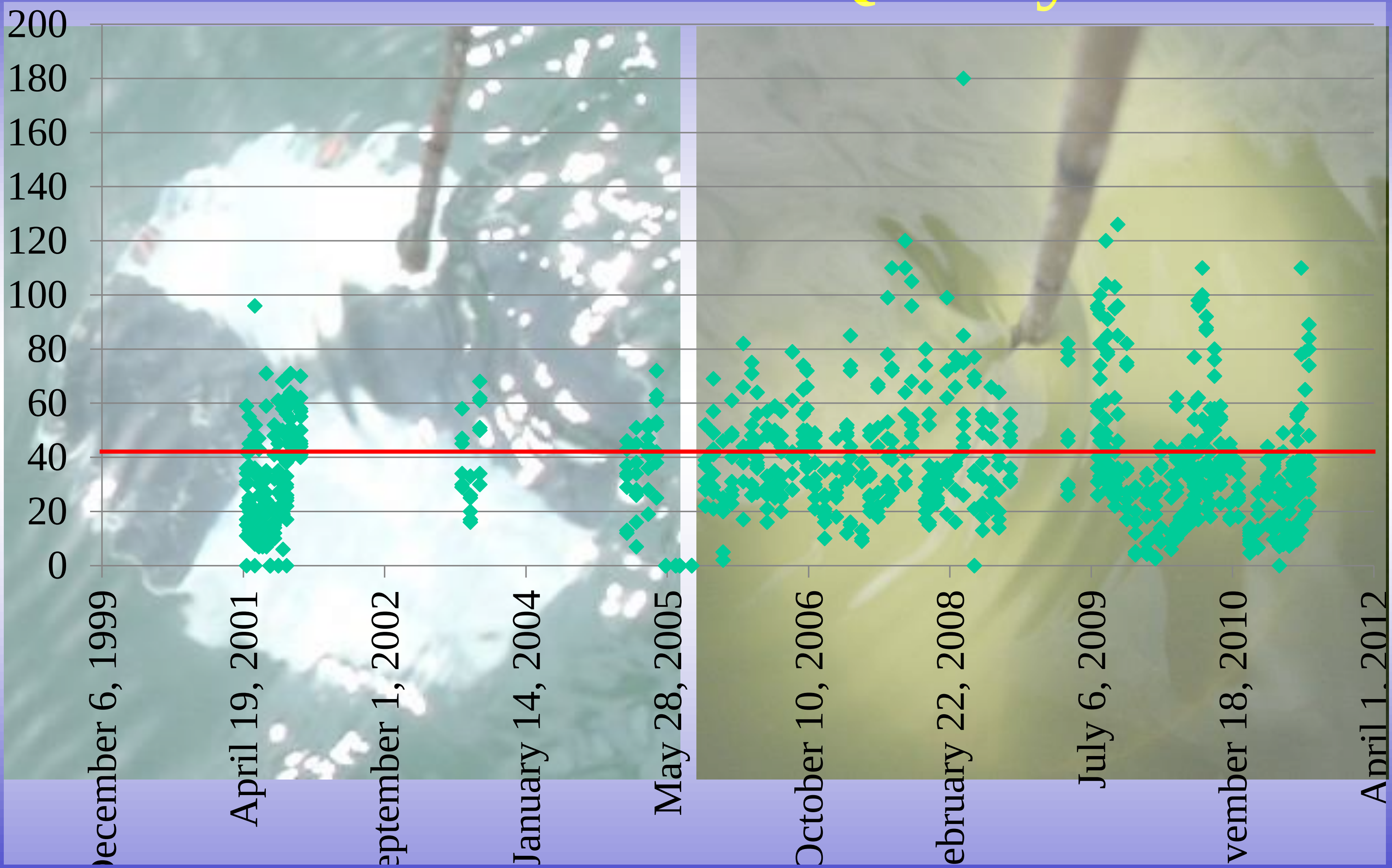
Falls Lake Impairment, Reduction Goals

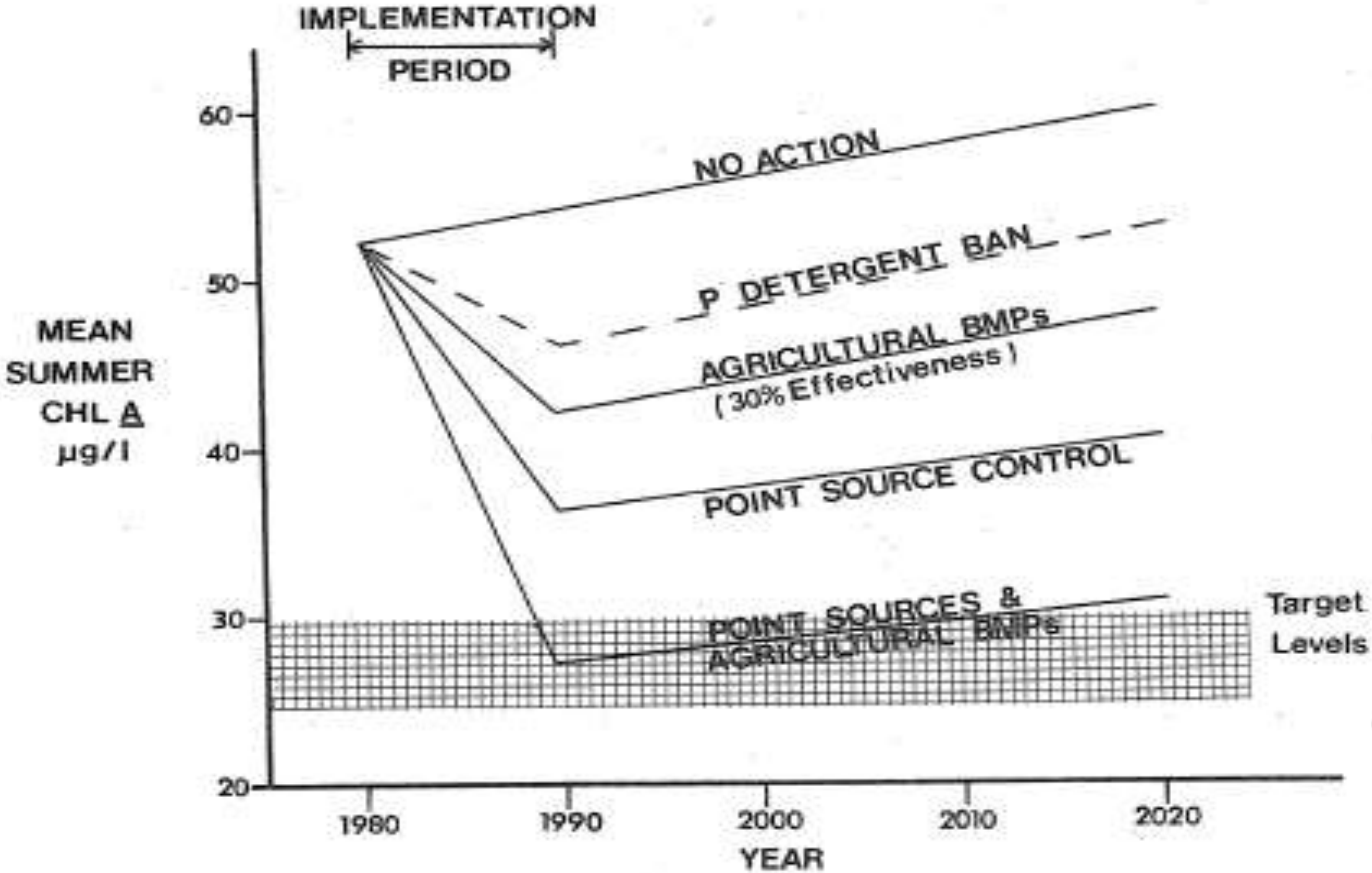


Station ID	% over 40 ug/L
ELL10	84.0%
LC01	21.1%
LLC01	39.0%
NEU010	53.0%
NEU013B	53.0%
NEU0171B	25.0%
NEU018E	16.0%
NEU019C	4.0%
NEU019E	16.0%
NEU019L	12.0%
NEU019P	9.9%
NEU020D	9.9%

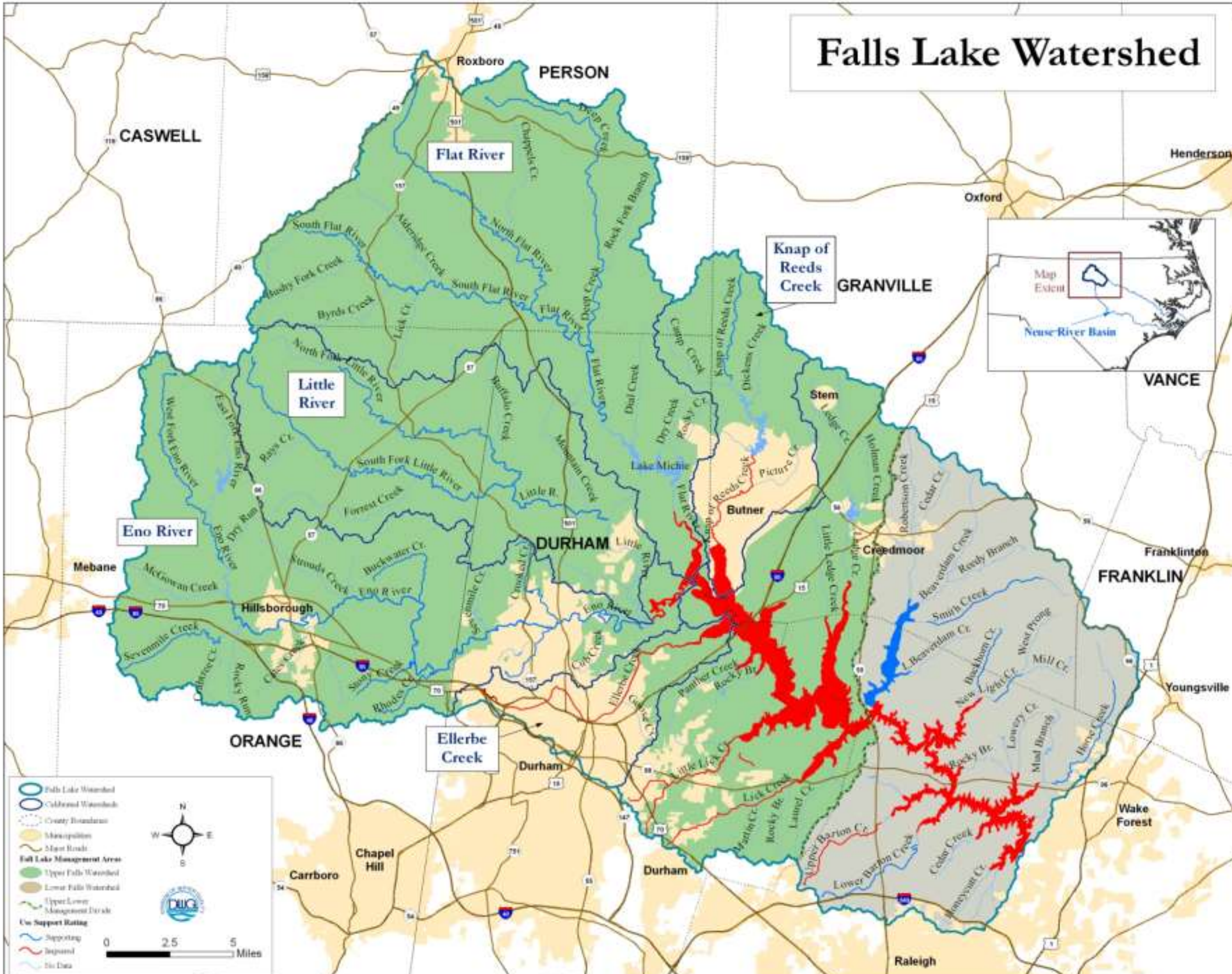
Jordan Water Quality



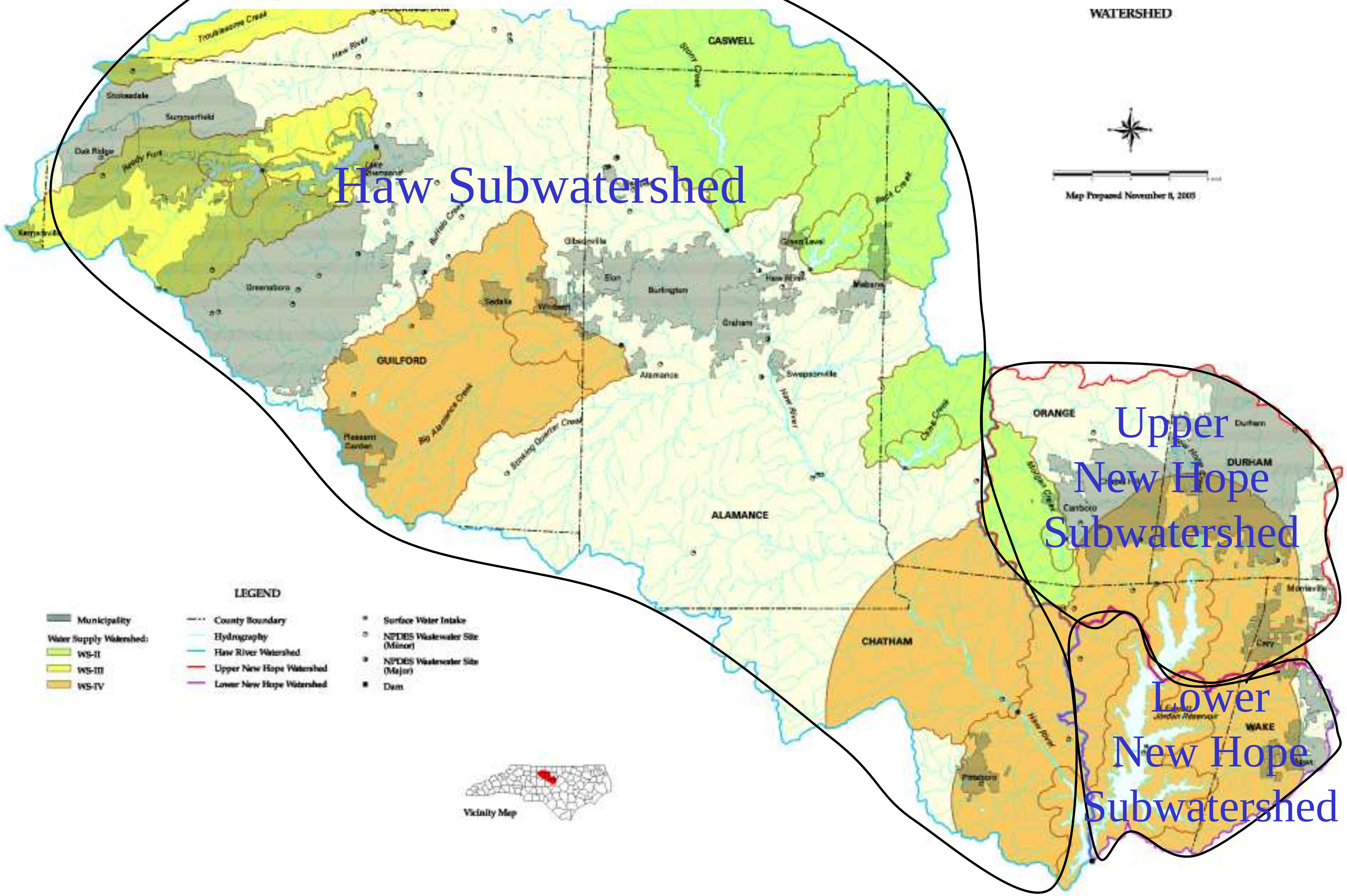
Chowan Watershed Management Options with Projected Population and Land Use Changes



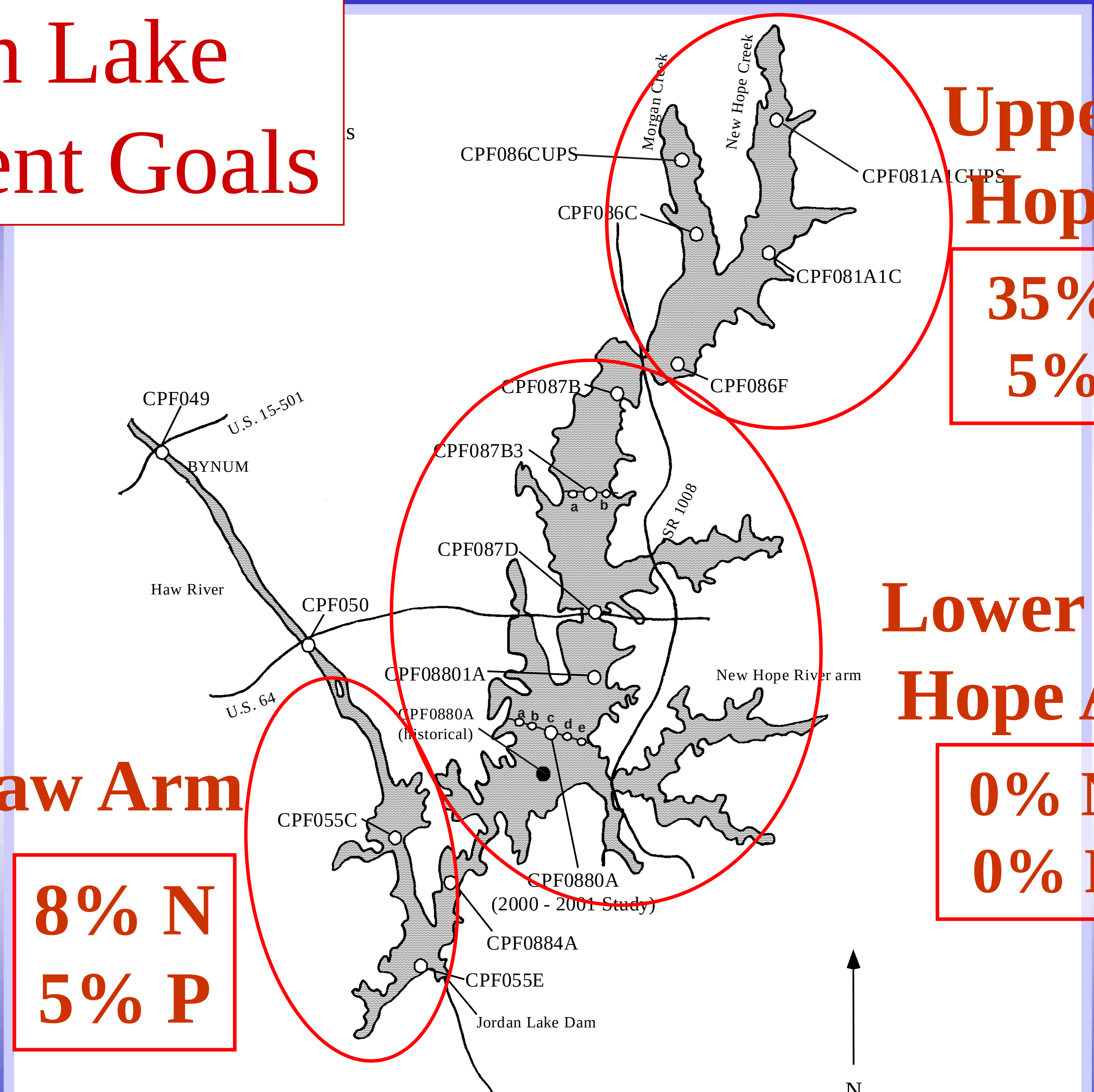
Falls Lake Watershed



Challenge: Up/Down Cost/Benefit Perceptions



Jordan Lake Nutrient Goals



Upper New Hope Arm

35% N
5% P

Lower New Hope Arm

0% N
0% P

Haw Arm

8% N
5% P

Goals are relative to a baseline period ending 2001

Progress on ED Measures

- Programmatic
  - Improved street sweep
  - Malfunctioning septic
  - Urban canopy increase
  - Fertilizer controls
- Wastewater/Pumped
  - Discharging sand filter
  - Algal turf scrubber
- Ecosystem
  - Stream restoration
  - Buffer credit revisions
- Stormwater
  - Pond retrofits
    - Floating wetlands
    - Littoral sand filter
    - Upflow filter
  - Regen. St'water Conveyance
  - Divert impervious
  - Soil amendment
  - Infiltration devices
- Agriculture
  - Cropland conversion
  - (Buffered) exclusion

Point Source Requirements

Waterbody	Estimated Nitrogen Concentrations	Estimated Phosphorus Concentrations	Facilities Affected
Tar Pamlico Estuary	Group Cap (2010) 6.85 mg/l	Group Cap (2010) 0.92 mg/l	15 WWTPs
Neuse River Estuary	Mass limits Equivalent to 3.75 to 5.5 mg/l	Equivalent to 2.0 mg/l	18 > 0.5mgd
Jordan Lake ▪Upper New Hope ▪Lower New Hope ▪Haw River	Equivalent to: ▪5.35 mg/l ▪3.0 mg/l ▪5.39 mg/l	Equivalent to: ▪0.23 mg/l ▪0.37 mg/l ▪0.66 mg/l	▪4 WWTPs > 0.1 mgd ▪1 WWTP > 0.1 mgd ▪10 WWTPs > 0.1 mgd
Falls Lake Watershed ▪Stage 1 ▪Stage 2	▪3.0 - 3.6 mg/l ▪1.13 mg/l	▪0.33 - 0.46 mg/l ▪0.06 mg/l	3 Major > 0.1 mgd

Chowan Sets Stage for Subsequent Strategies

SUCCESS!

- **1978 – adopted chlorophyll a standard**
- **1979 – NSW classification; Chowan 1st**
- **1980's – Chowan strategy**
  - **Point source: reduced to background**
  - **Launched NC Ag Cost Share Program**
- **1988 – phosphate detergent ban**

Coastal New River Strategy

- "Nutrient Sensitive" 1991
- Point source improvements
- By 2001:
  - Reduced frequency, duration of blooms
  - Mainstem "fully supporting"