Factoring in the Influence of the Conowingo Reservoir on State Allocations

Presented to the Water Quality GIT

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Goals for Today

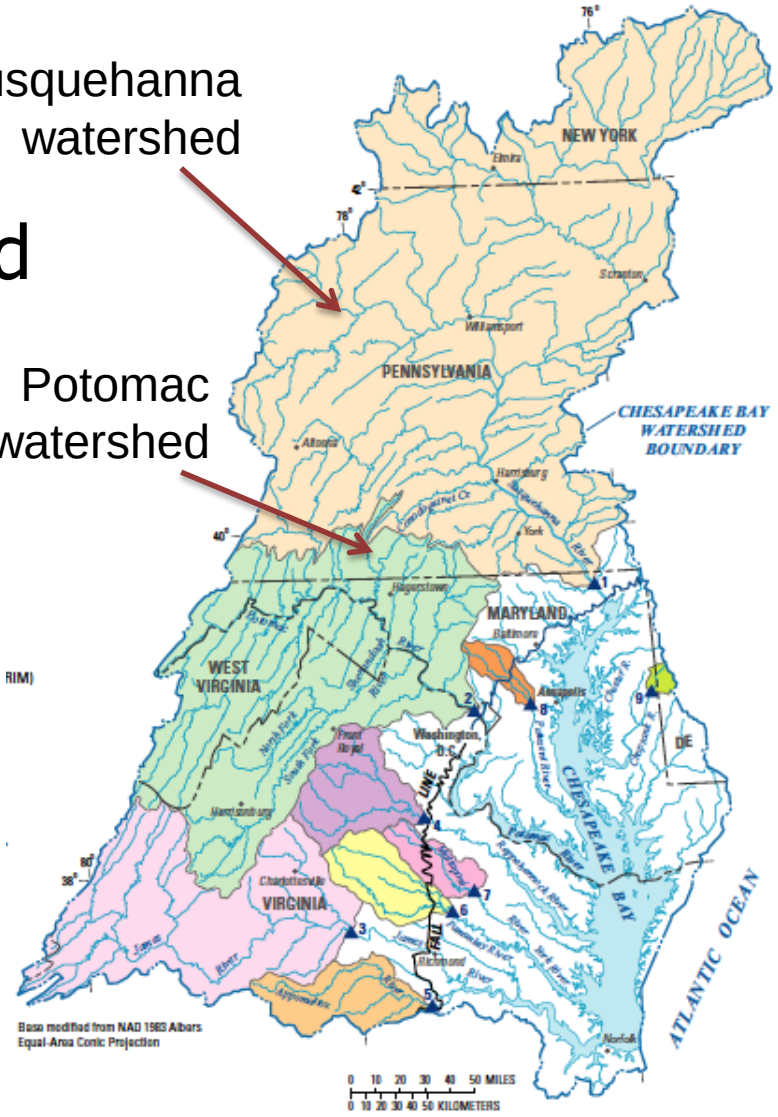
- A synthesis of what current research is telling us about changes in the reservoir system

- Insight on how these findings could impact state allocations, including key policy questions to be considered

WHAT IS SCIENCE TELLING US ABOUT THE RESERVOIR SYSTEM?

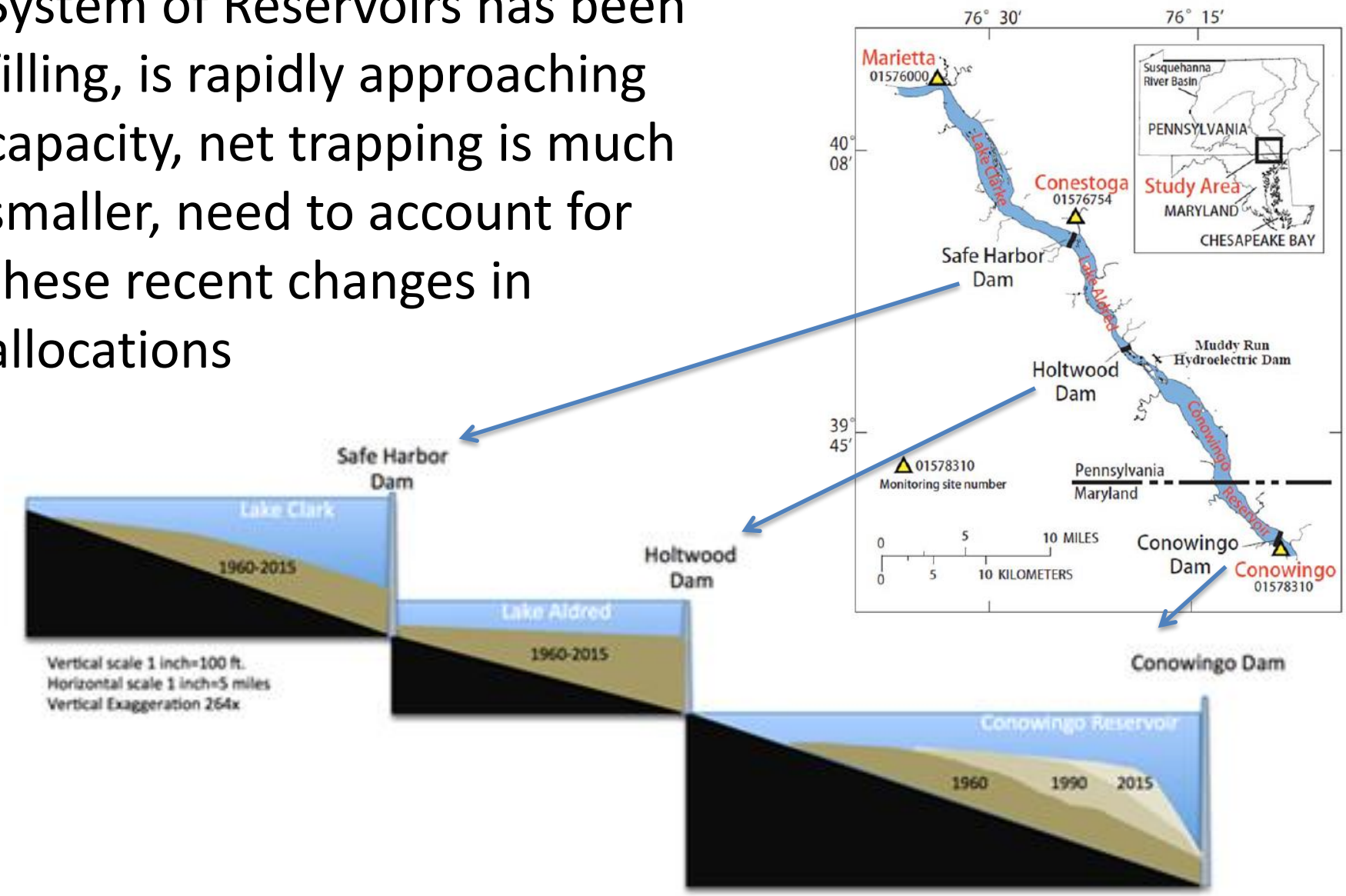
Susquehanna River Has Major Influence on Chesapeake Bay Water Quality

- 43% of the Bay watershed
- 47% of fresh water
- 41% of nitrogen
- 25% of phosphorus
- 27% of sediment



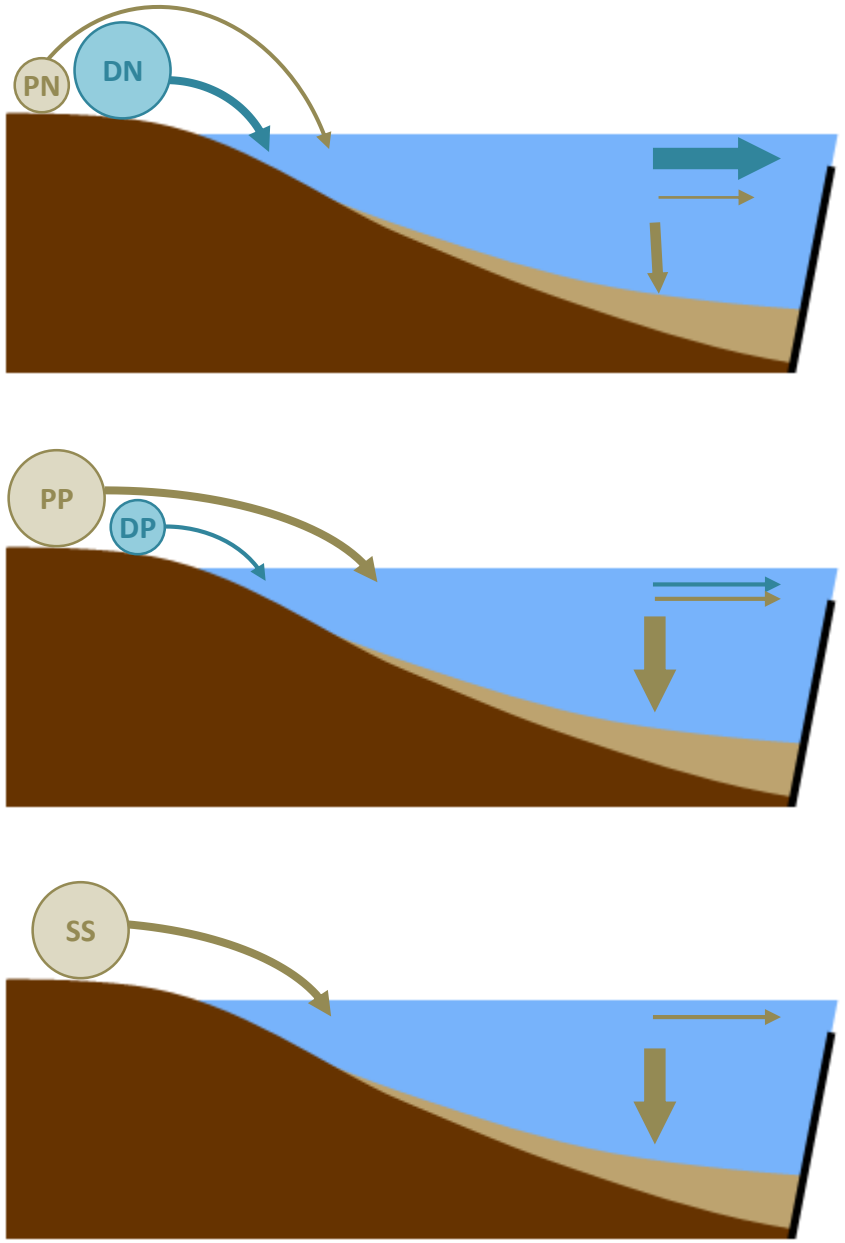
Source: Linker (2014)

System of Reservoirs has been filling, is rapidly approaching capacity, net trapping is much smaller, need to account for these recent changes in allocations



In a reservoir with capacity, most of the nitrogen is moving through while most of the phosphorus settles out and is “trapped”

Loss of trapping will have more impact on P and Sed, than N



reservoir with trapping capacity

2016 STAC Workshop

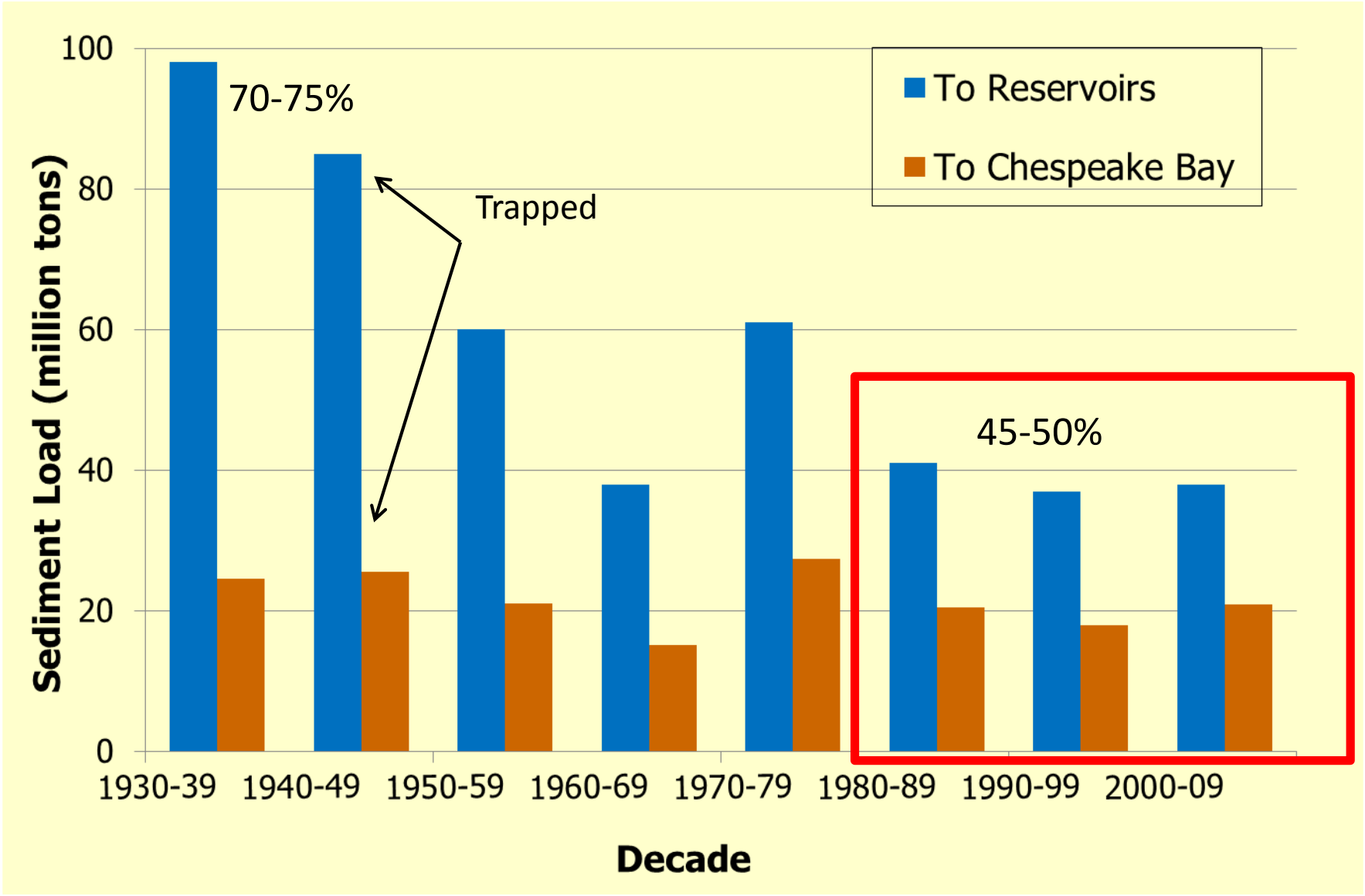
- Reservoir system has long been a trap for particulate nutrients and sediment but is at a condition of dynamic equilibrium
- Sediment, and particulate nutrient load, due to infill is considerably different now than the first 80 – 90 yrs.
- To quantify the influence, the following must be considered:
  - Loss of trapping during low to moderate flow
  - Change in scour threshold during higher flows
  - Relatively rare extreme events
  - Fate of particulate material to the Bay

Source: STAC (2016)

Monitoring, data analysis, and research related to this issue have accelerated substantially since 2011 and is guiding current modeling refinements

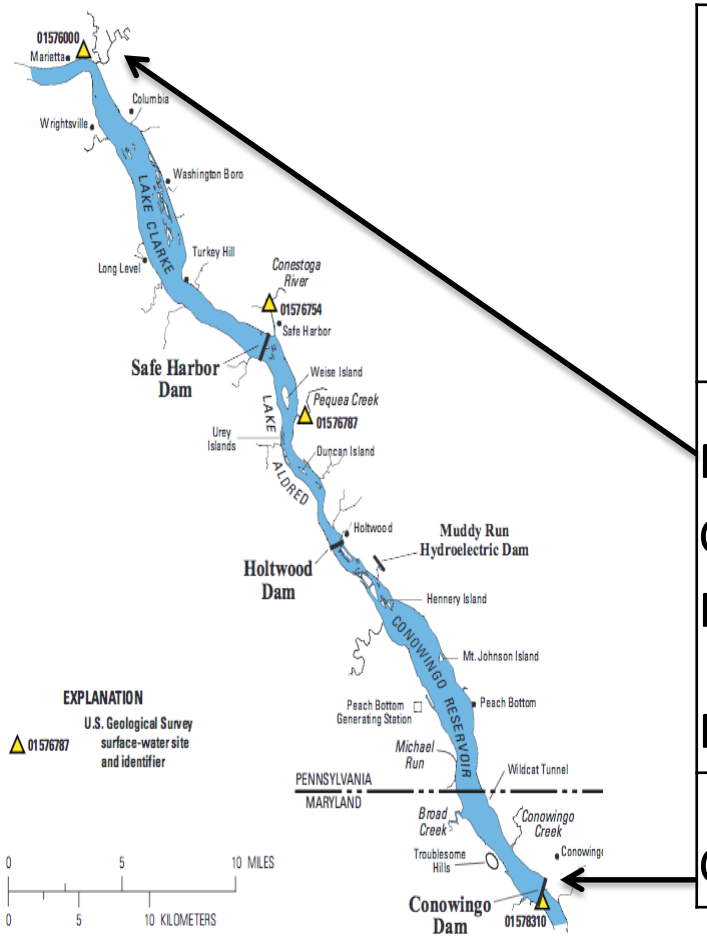
- US Geological Survey (2012, 2014, 2015)
- US Army Corps of Engineers (2015)
- Johns Hopkins University (2013, 2015, 2016)
- EPA CBP Scientific and Technical Advisory Committee (2014, 2016)
- Enhanced Monitoring and Modeling (Exelon, University of Maryland, USGS)

Trapping has significantly decreased over last century and now considered to be in dynamic equilibrium



Source: Langland 2016

Nutrient and sediment loading trends into and out of the reservoir system (1985 to 2015)



Site Name	Total Nitrogen	Total Phosphorus	Sediment
	Long Term	Long Term	Long Term
Marietta River	↓	↓	↓
Conestoga River	↓	↓	↓
Pequea Creek	No data	No data	No data
Conowingo	↓	↑	↑

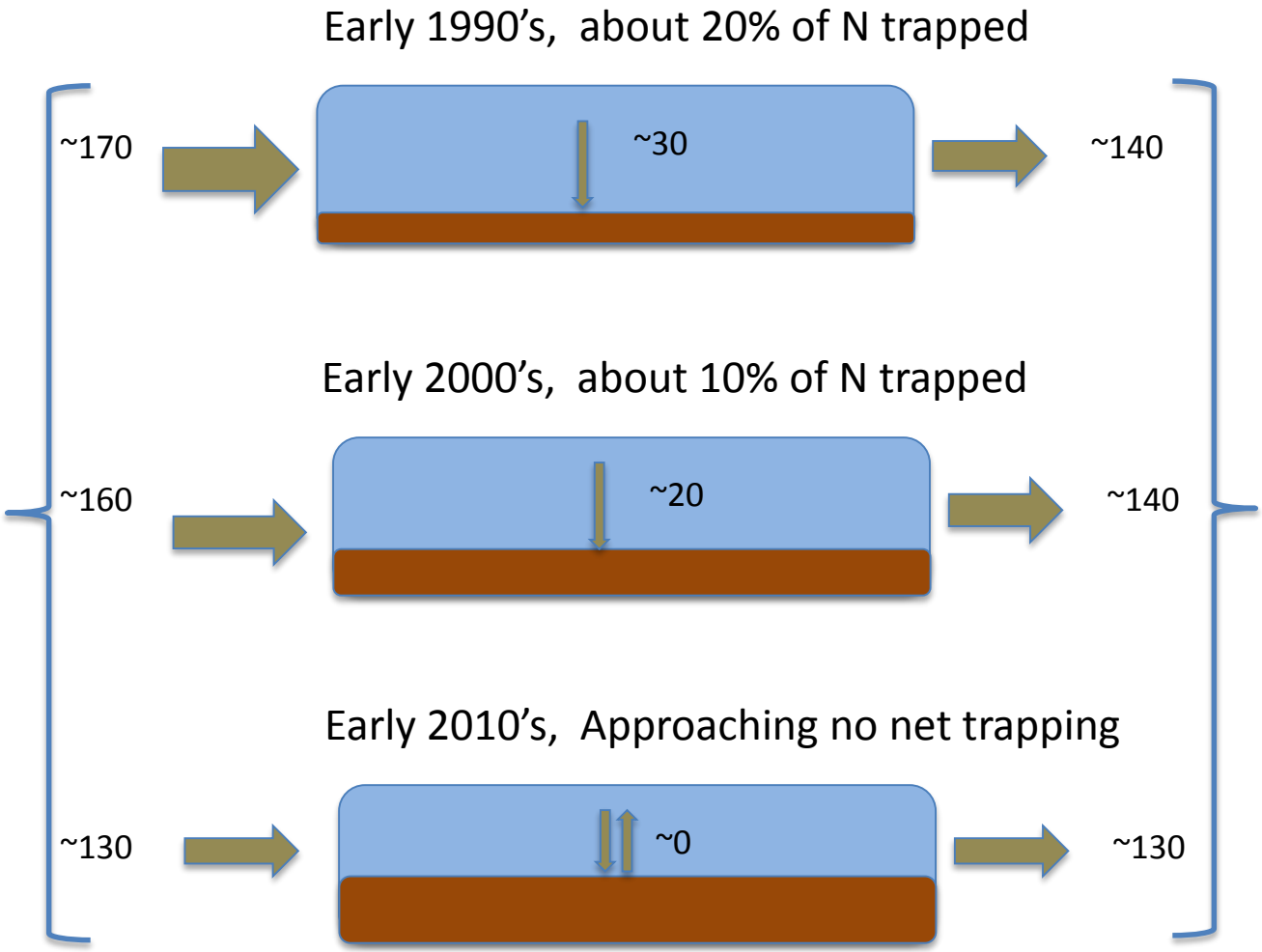
↓ - improving

↑ - degrading

Source: USGS Trend Results published to internet in 2016

Let's take a look at three time periods to better understand the system behavior; Nitrogen

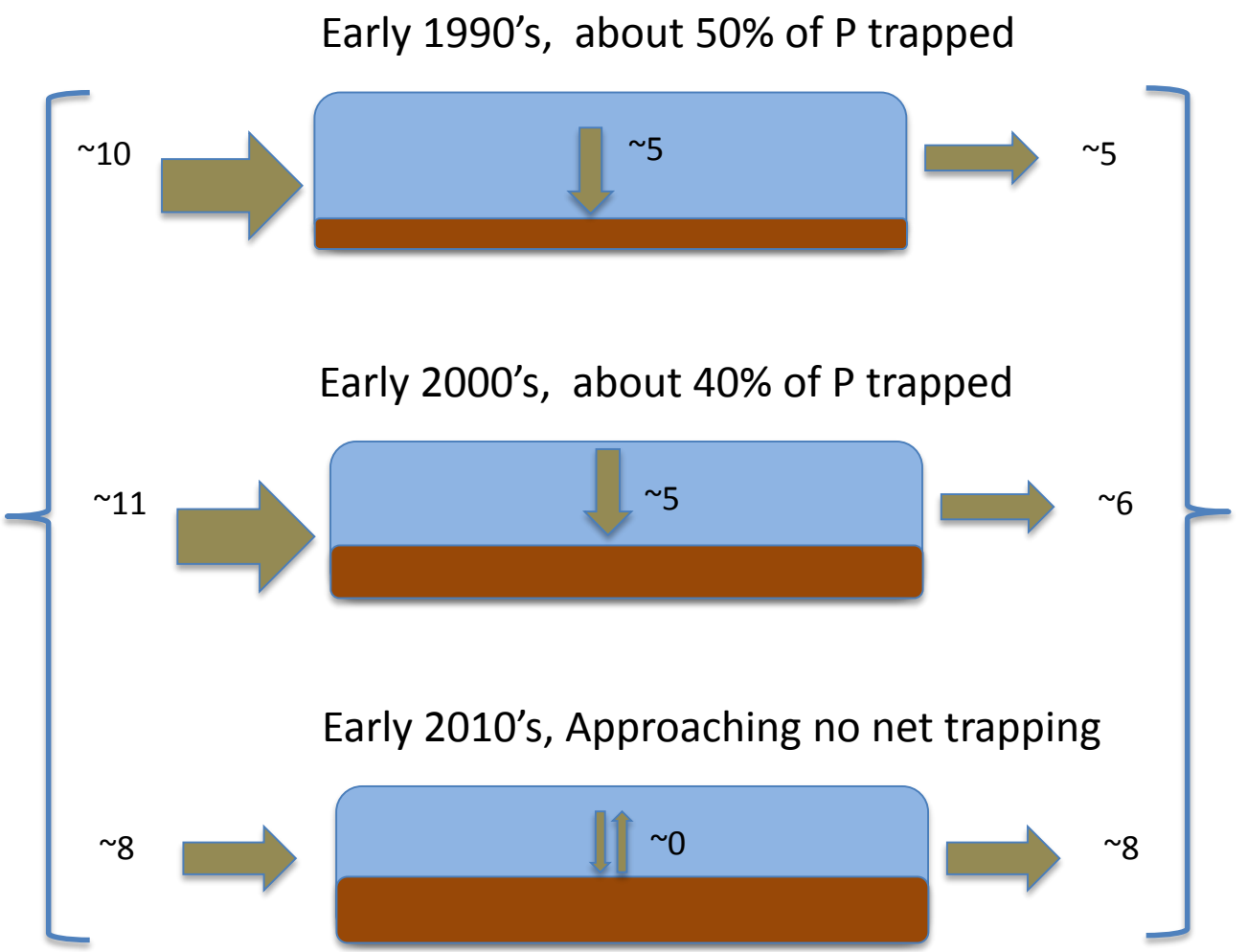
Loads Into Reservoir System
Long term improving trend



Loads Out of Reservoir System - Conowingo
long term improving trend

Source: Data from USGS (2016), http://cbrim.er.usgs.gov/loads_query.html
loads are approximate and in units of million lbs/year

Phosphorus

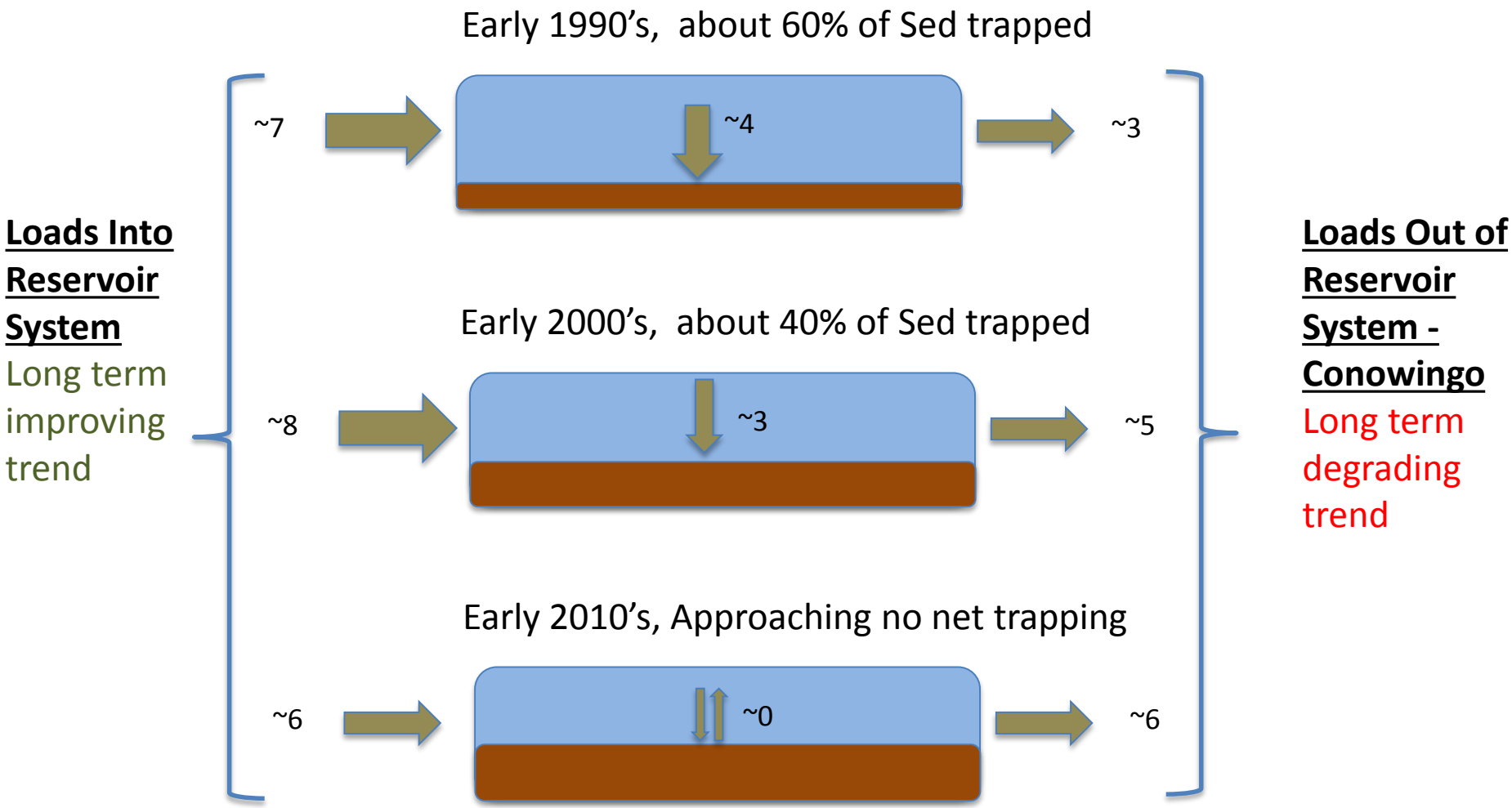


Loads Into Reservoir System
Long term improving trend

Loads Out of Reservoir System - Conowingo
Long term degrading trend

Source: Data from USGS (2016), http://cbrim.er.usgs.gov/loads_query.html
loads are approximate and in units of million lbs/year

Sediment

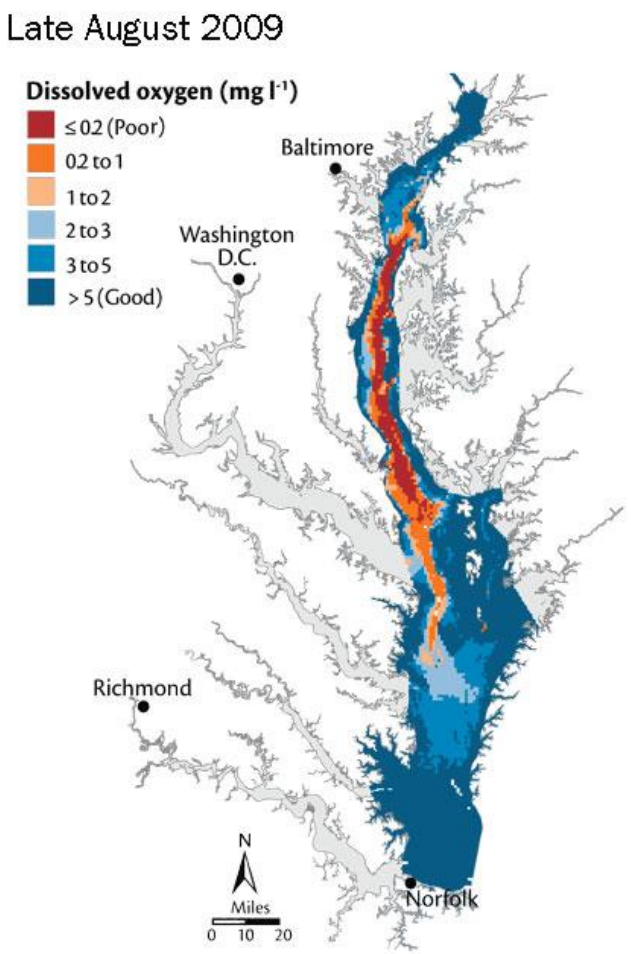


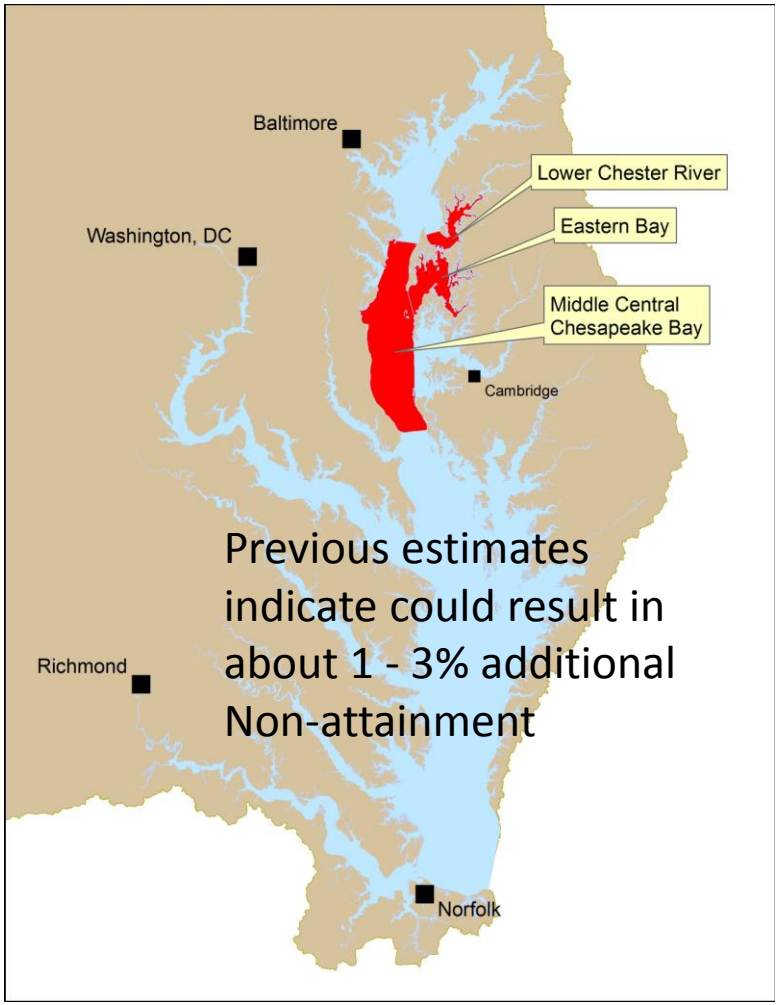
Loads Into Reservoir System
Long term improving trend

Loads Out of Reservoir System - Conowingo
Long term degrading trend

Source: Data from USGS (2016), http://cbrim.er.usgs.gov/loads_query.html
loads are approximate and in units of million lbs/year

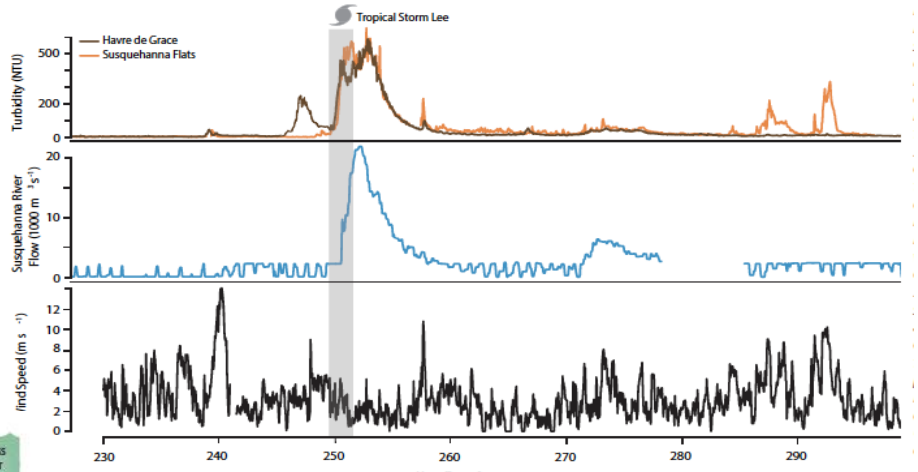
Increased particulate nutrients, as a result of less trapping, appear to have more influence on the ability to meet Bay TMDL water quality goals than increased sediments. Fate of material being factored in now.

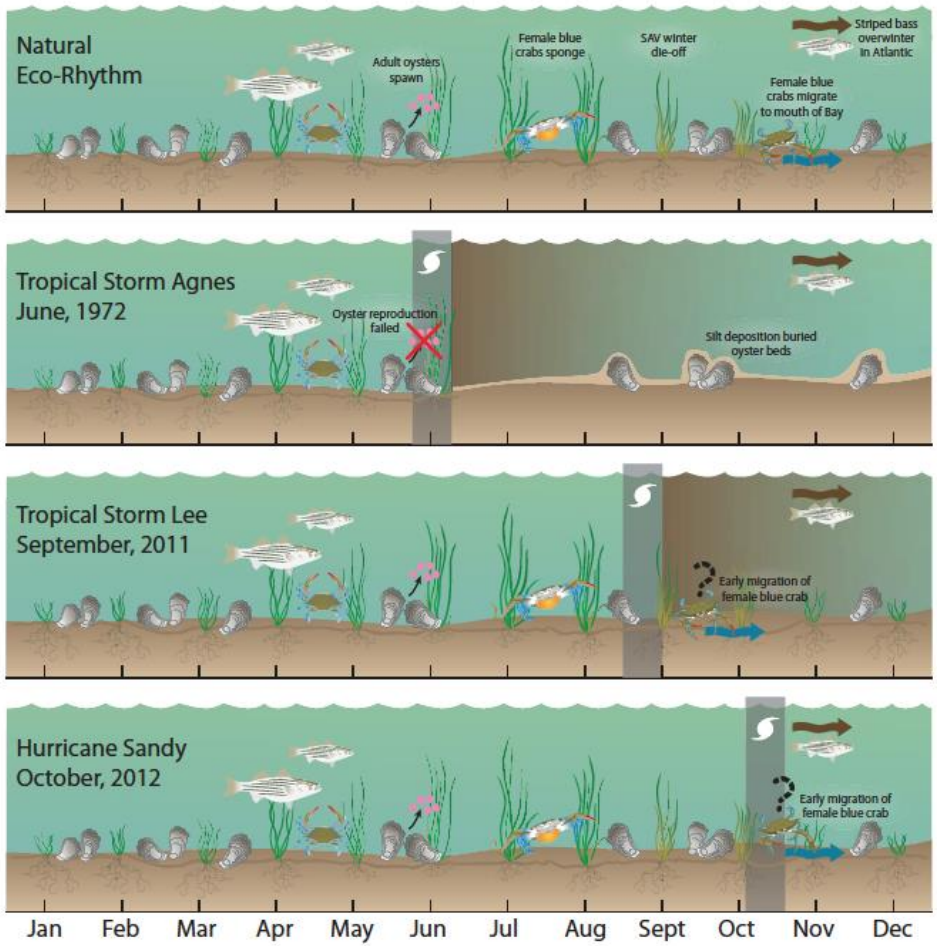




Source: LSRWA (2015), Personal communication Linker (2016)

Extreme events have impacts but are relatively rare, timing is important, clarity recovers relatively quickly, resiliency between events important for recovery





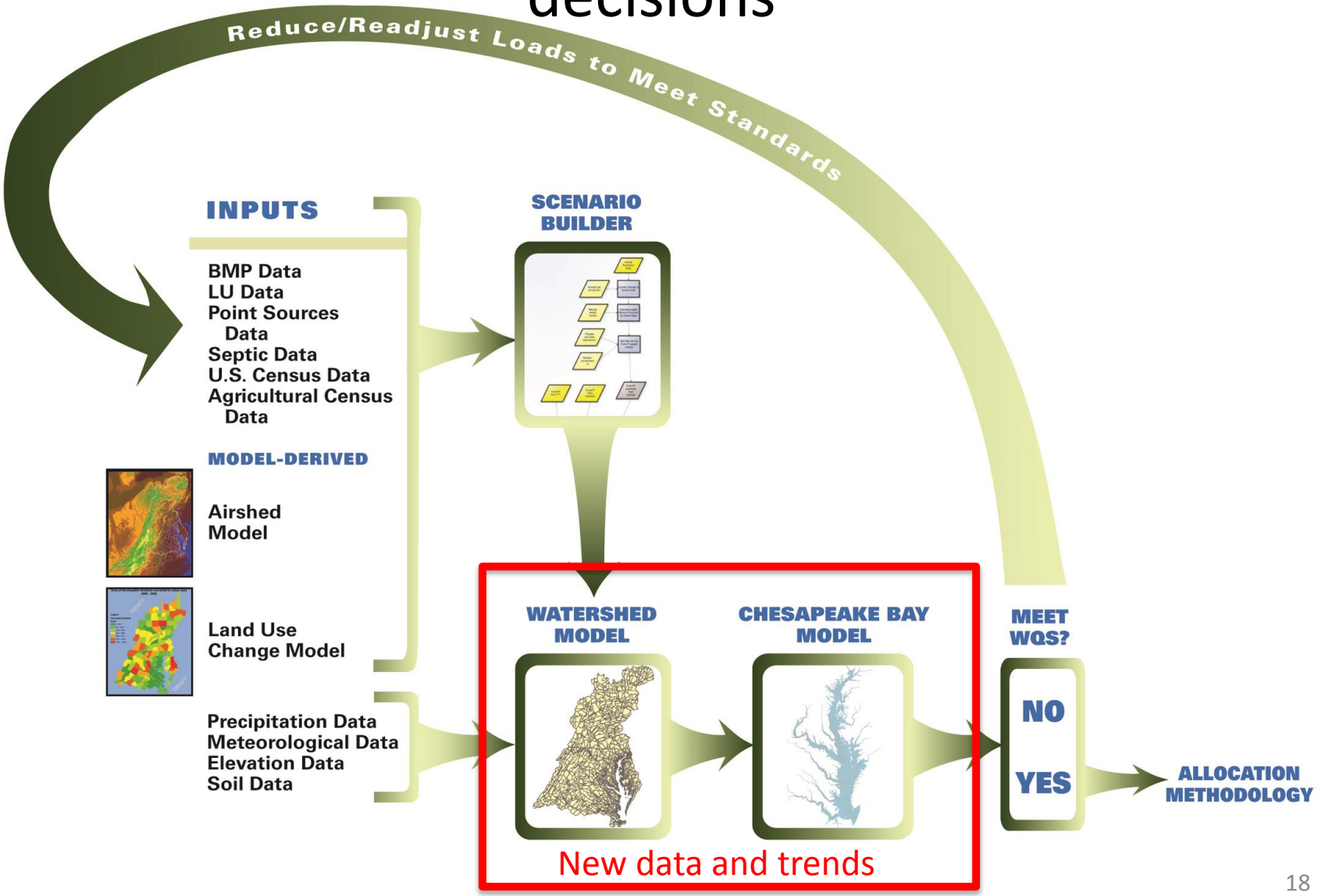
Source: Images UMCES

Take Away Messages

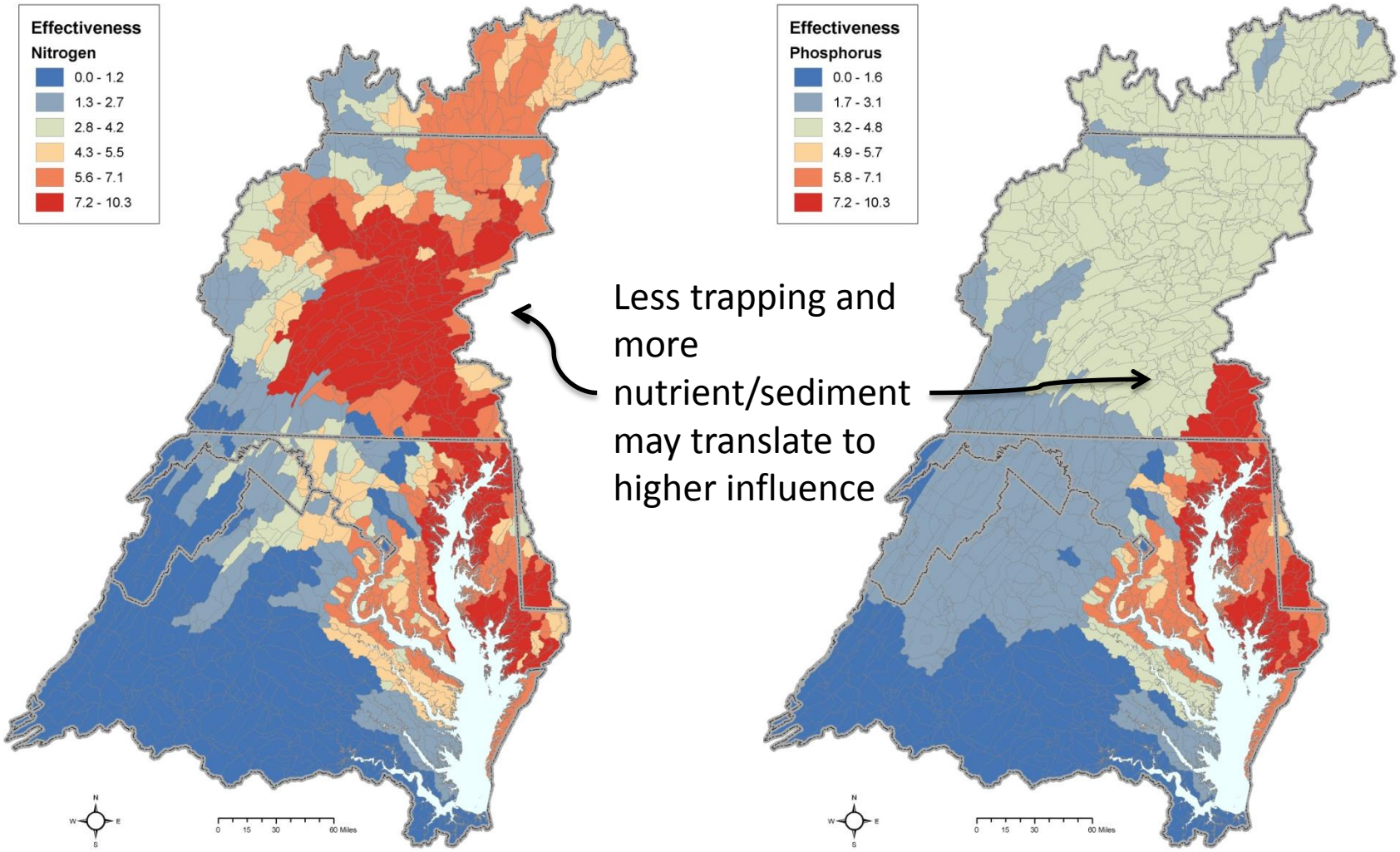
- The Susquehanna basin has a significant influence on Chesapeake Bay water quality
- The net reservoir trapping capacity is near zero
- Loss of trapping capacity will have more effect on the sediment and phosphorus than nitrogen
- New information available for factoring in the influence of particulate nutrients on Bay WQ
- Loss of reservoir trapping impacts the ability to achieve the Bay TMDL water quality goals under current strategies, but not yet fully quantified with new info
- The majority of nutrients are transported to the Bay during moderately high flow periods

HOW WILL THIS INFORMATION FACTOR INTO JURISDICTION BAY TMDL ALLOCATIONS

Models are central to allocations and are being updated to reflect new science and inform policy decisions



Relative Influence on Main Bay Dissolved Oxygen Changing as a result of Reservoir Infill



Source: EPA Chesapeake Bay TMDL, 2010

Take Away Points

- Observed loss of net trapping in reservoir system – “Dynamic Equilibrium”
- Affects nitrogen and phosphorus differently
- Previous analysis indicates offset required
- Refining estimates with new data and research