Factoring in the Influence of the Conowingo Reservoir on State Allocations

Presented to the Chesapeake Bay Commission
on behalf of the Modeling Workgroup

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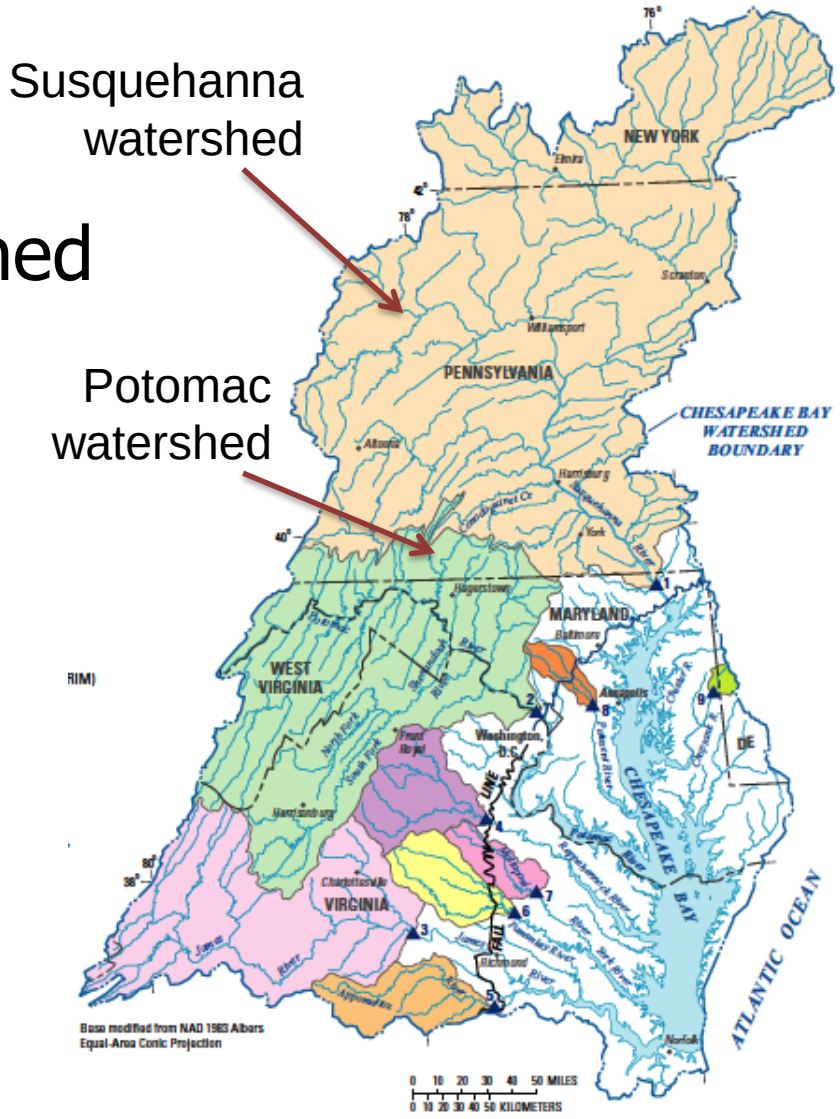
Goals for Today

- 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
- A timeline for determining the impact to jurisdiction allocations in the Phase III WIP

WHAT IS SCIENCE TELLING US ABOUT THE RESERVOIR SYSTEM?

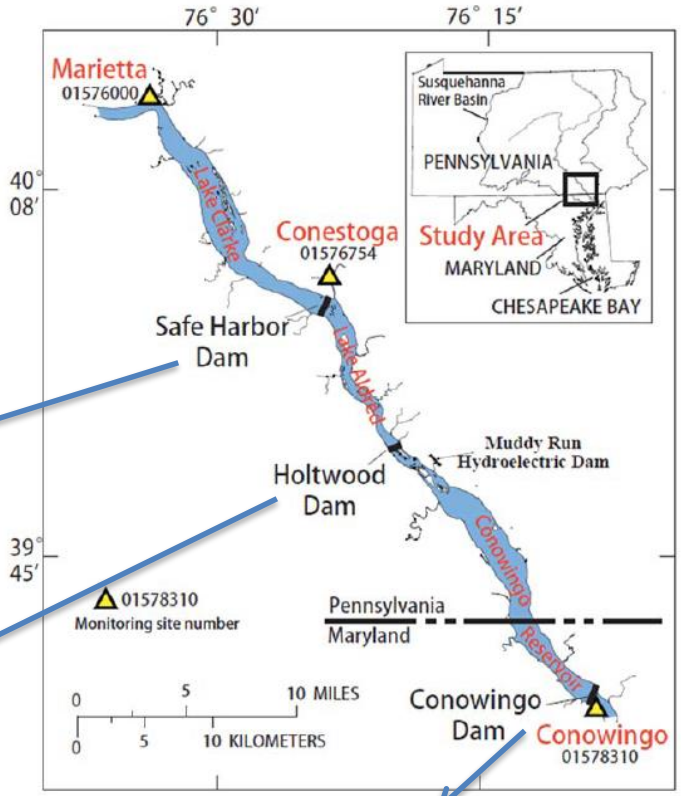
Susquehanna River Has Major Influence on Chesapeake Bay Water Quality

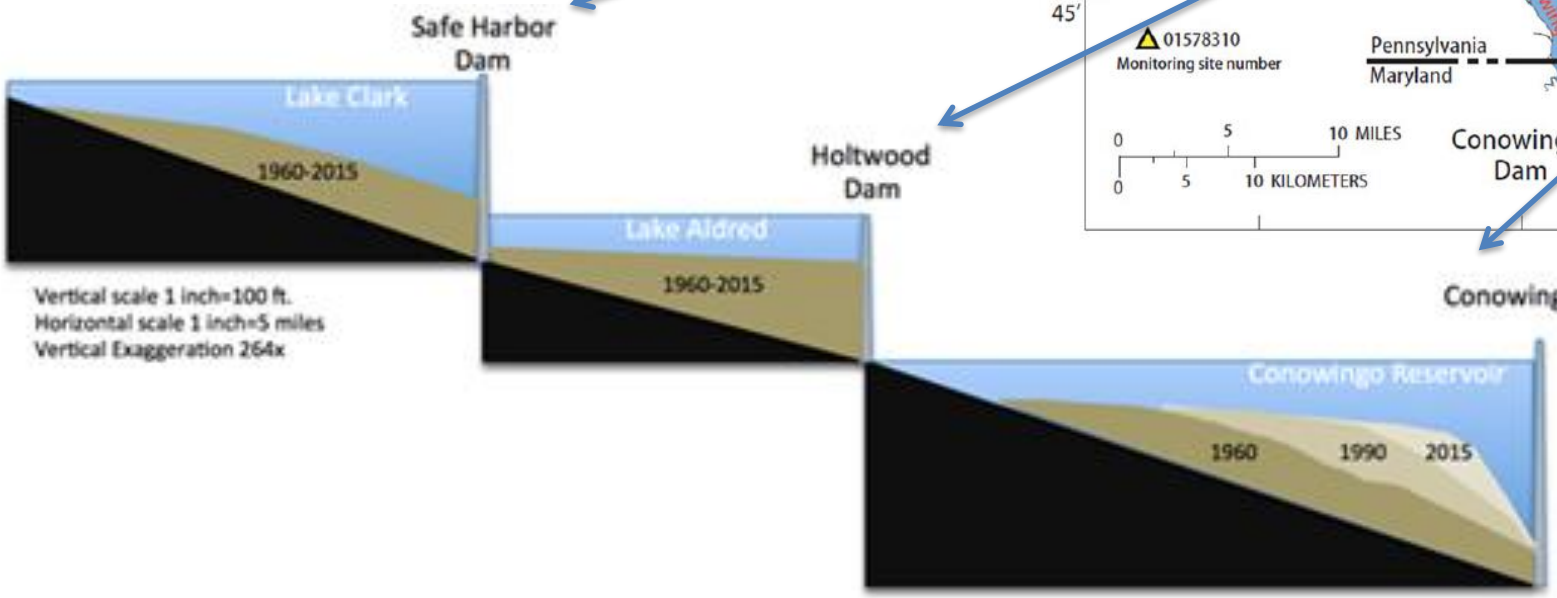
- 43% of the Bay watershed
- 47% of fresh water
- 41% of nitrogen
- 25% of phosphorus
- 27% of sediment



Source: Linker (2014)

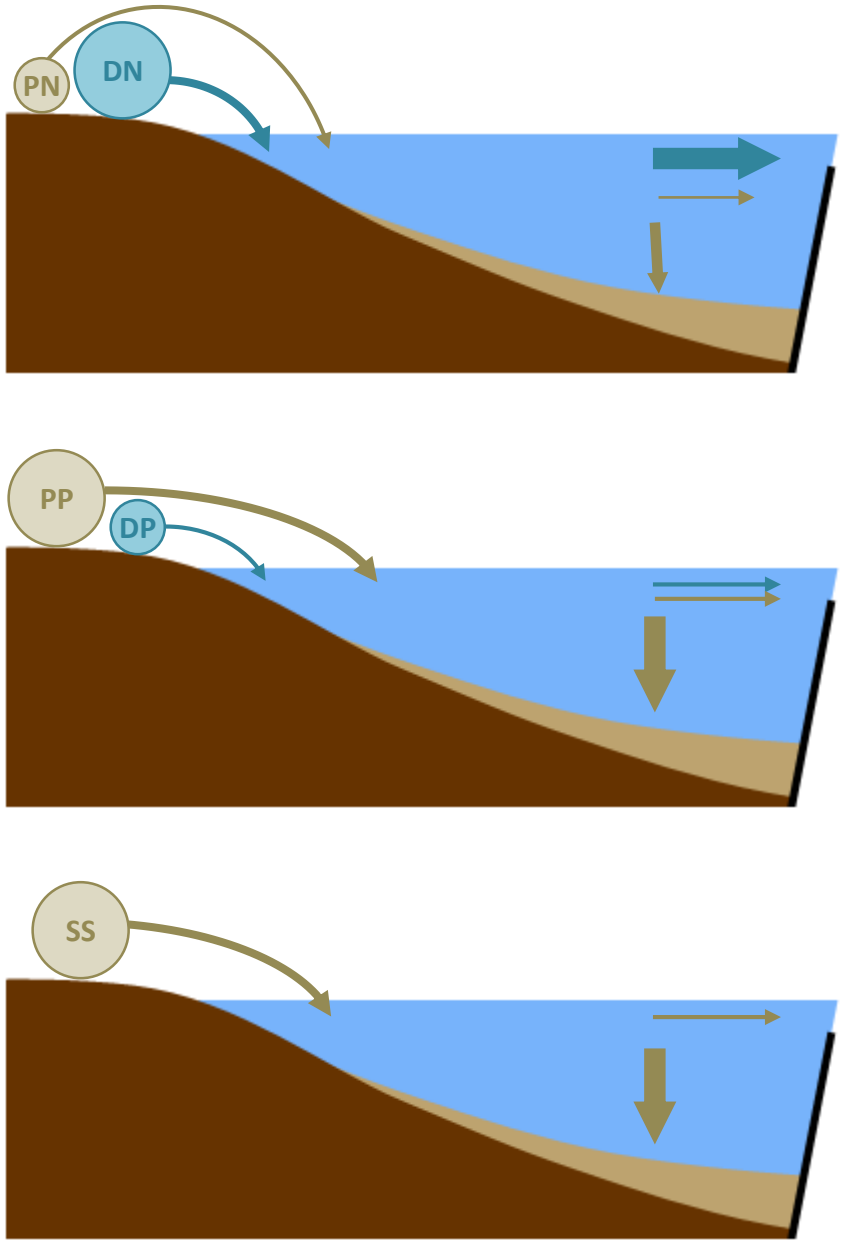
System of Reservoirs has been filling, is rapidly approaching capacity, net trapping is much smaller, need to account for these recent changes in allocations





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

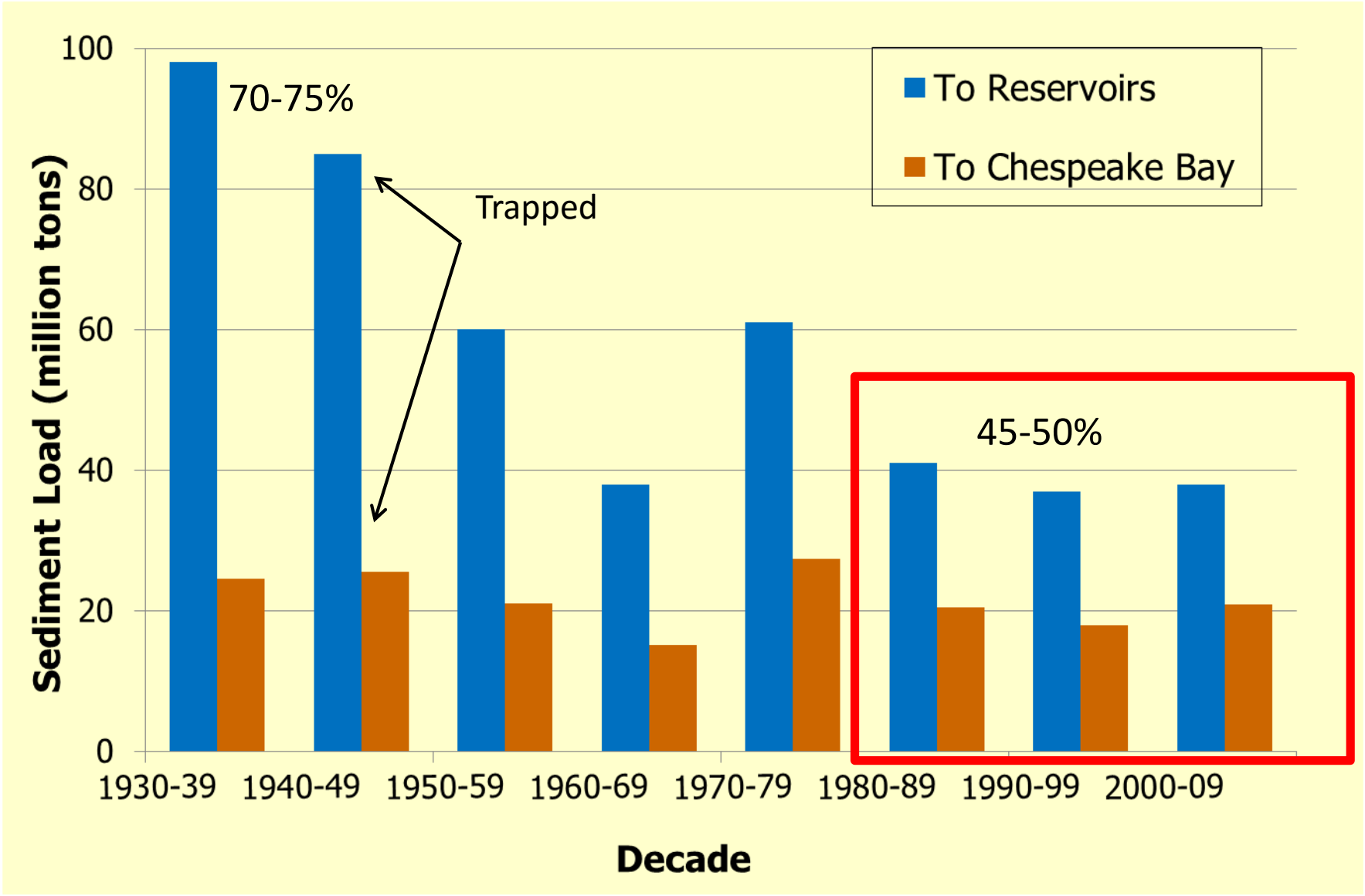
- Reservoir system has long been a trap for particulate nutrients and sediment but is at a condition of dynamic equilibrium
- Sediment, and particulate nutrient load, due to infill is considerably different now than the first 80 – 90 yrs.
- To quantify the influence, the following must be considered:
  - 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

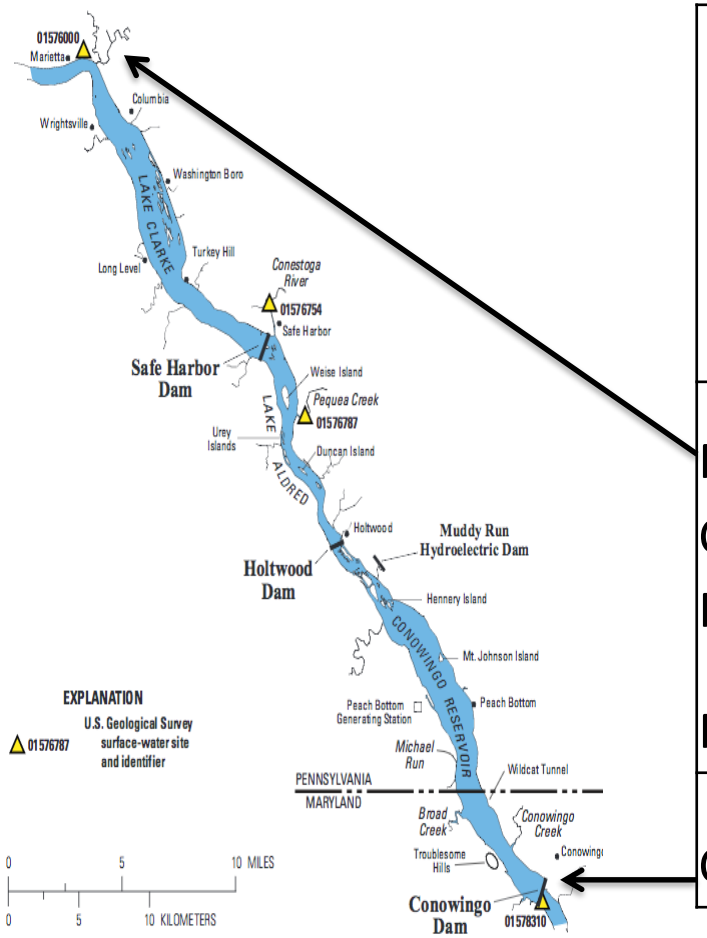
- US Geological Survey (2012, 2014, 2015)
- US Army Corps of Engineers (2015)
- Johns Hopkins University (2013, 2015, 2016)
- EPA CBP Scientific and Technical Advisory Committee (2014, 2016)
- Enhanced Monitoring and Modeling (Exelon, University of Maryland, USGS)

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	↓	↑	↑

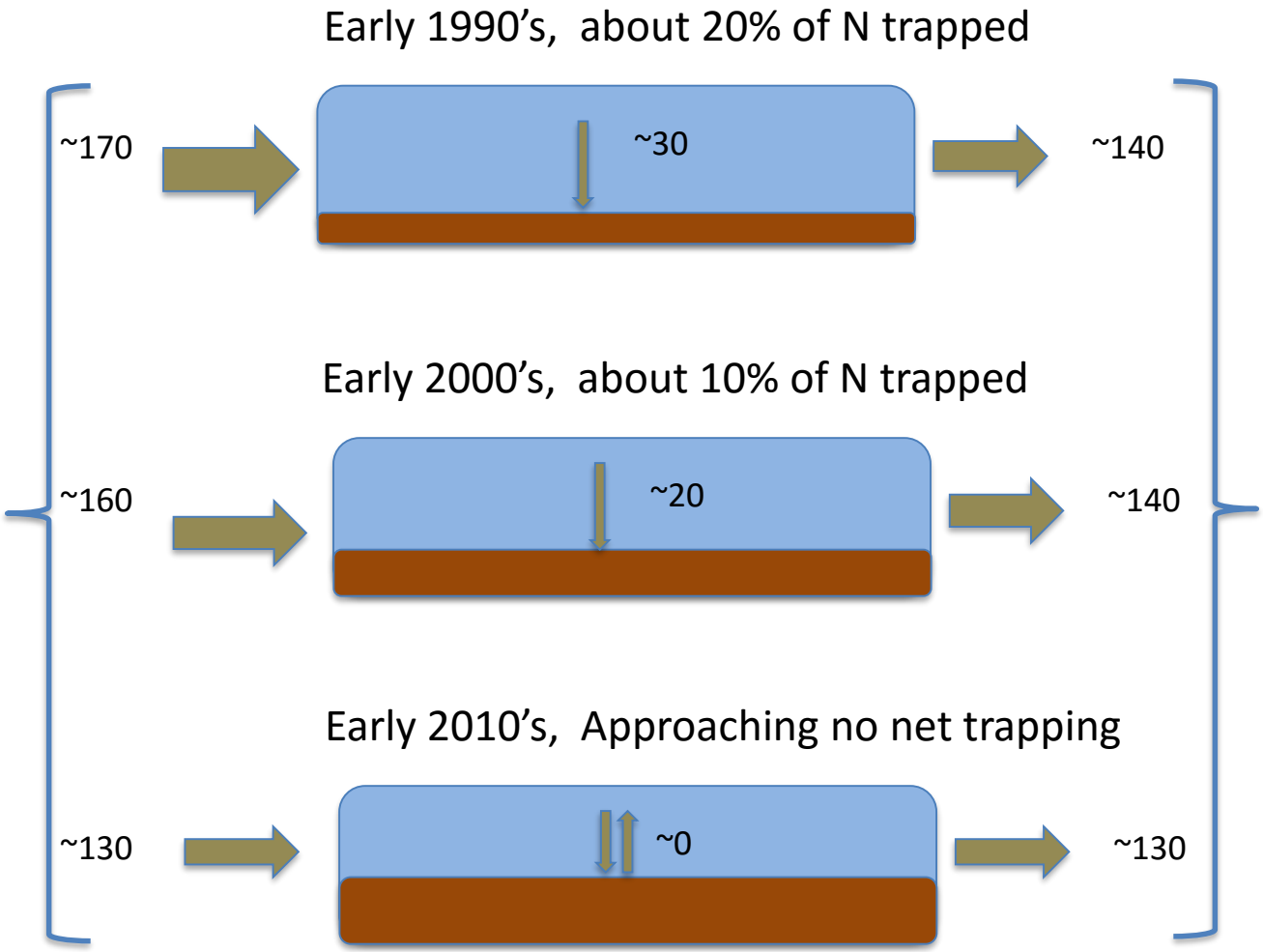
↓ - improving

↑ - 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

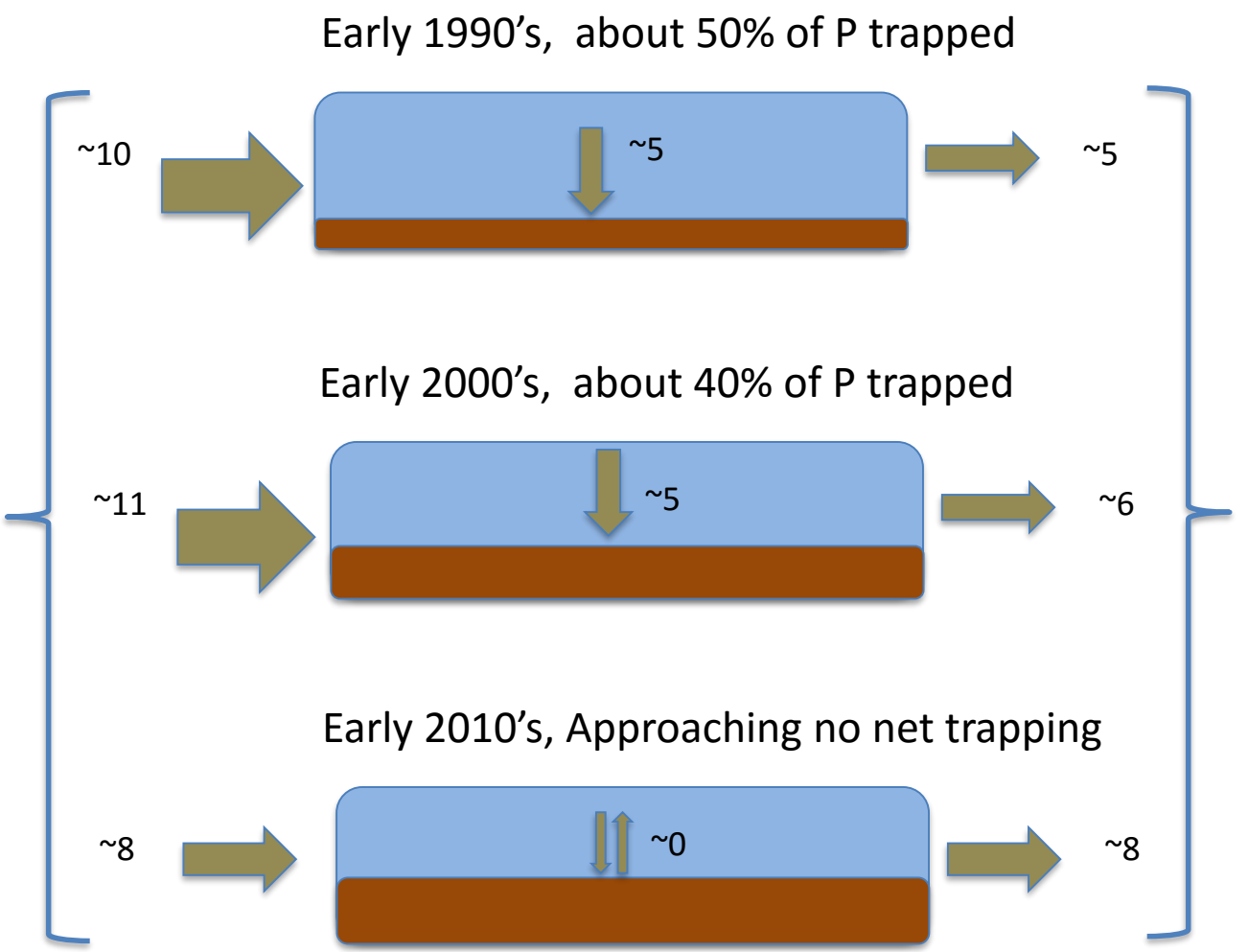
Loads Into Reservoir System
Long term improving trend



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

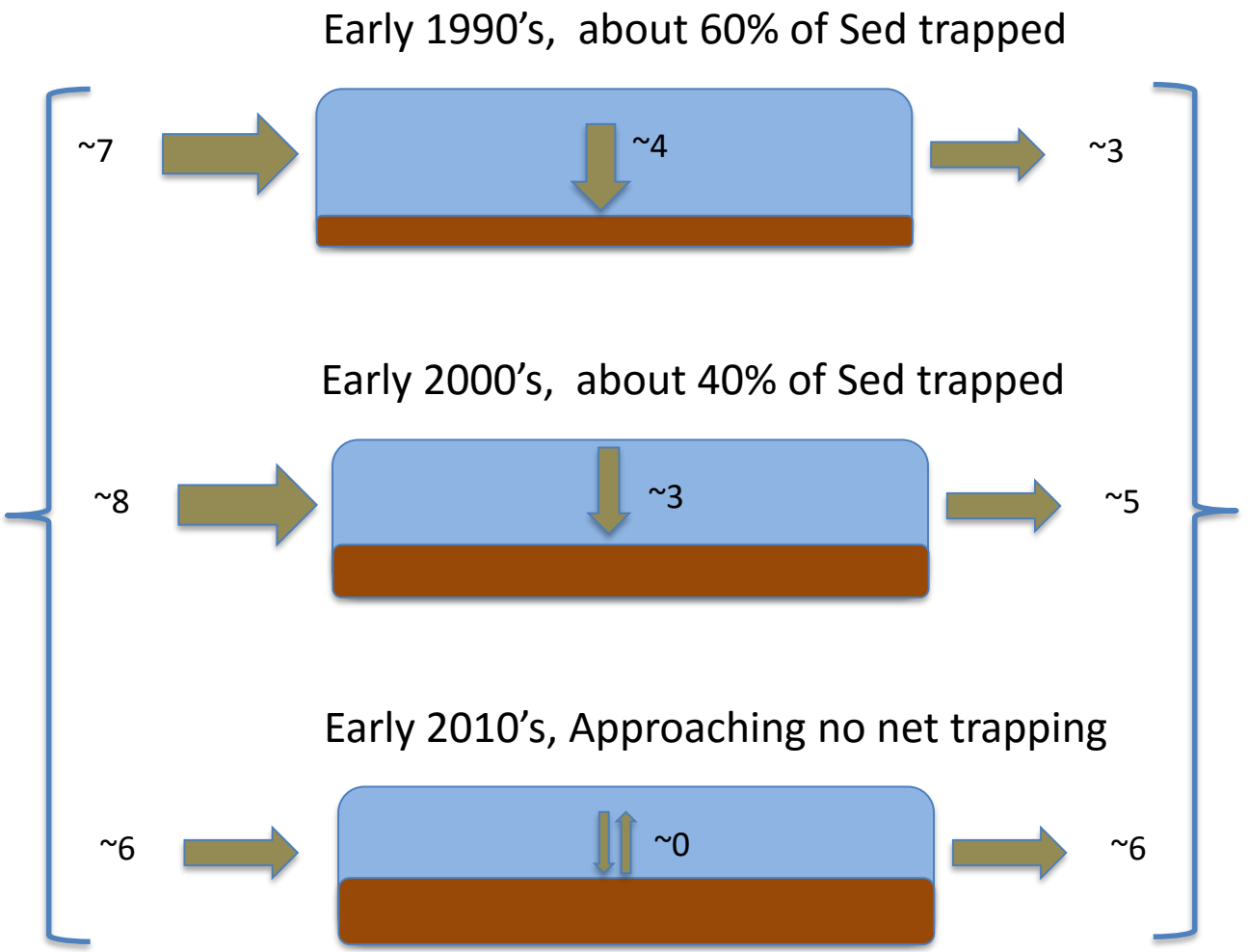


Loads Into Reservoir System
Long term improving trend

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

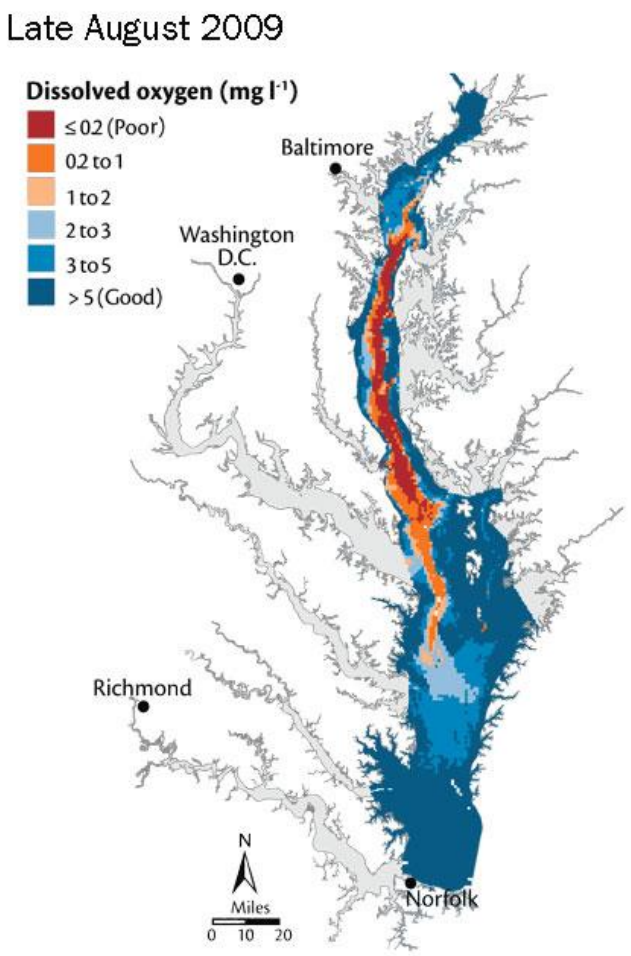


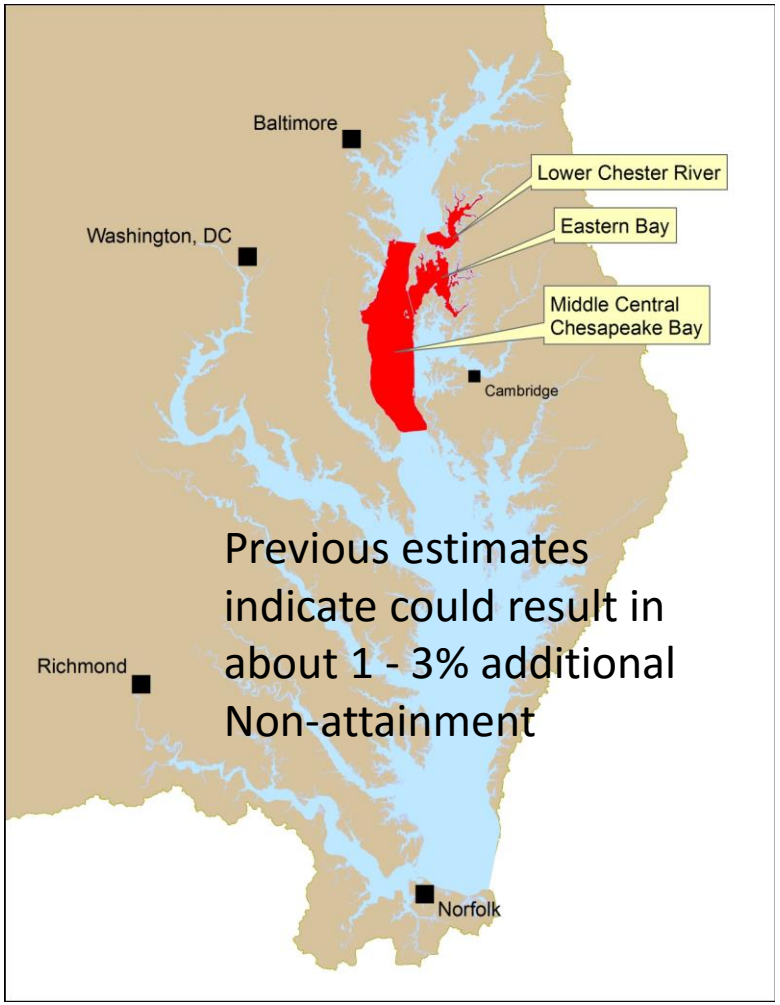
Loads Into Reservoir System
Long term improving trend

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

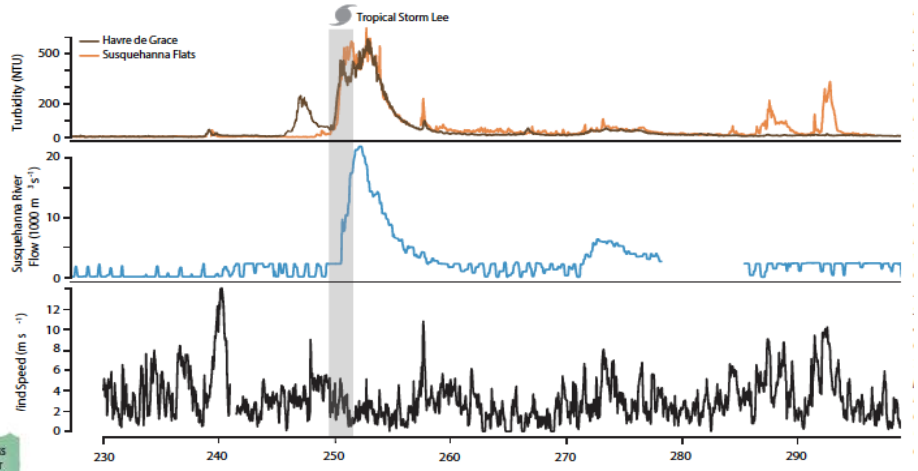
Increased particulate nutrients, as a result of less trapping, appear to have more influence on the ability to meet Bay TMDL water quality goals than increased sediments. Fate of material being factored in now.

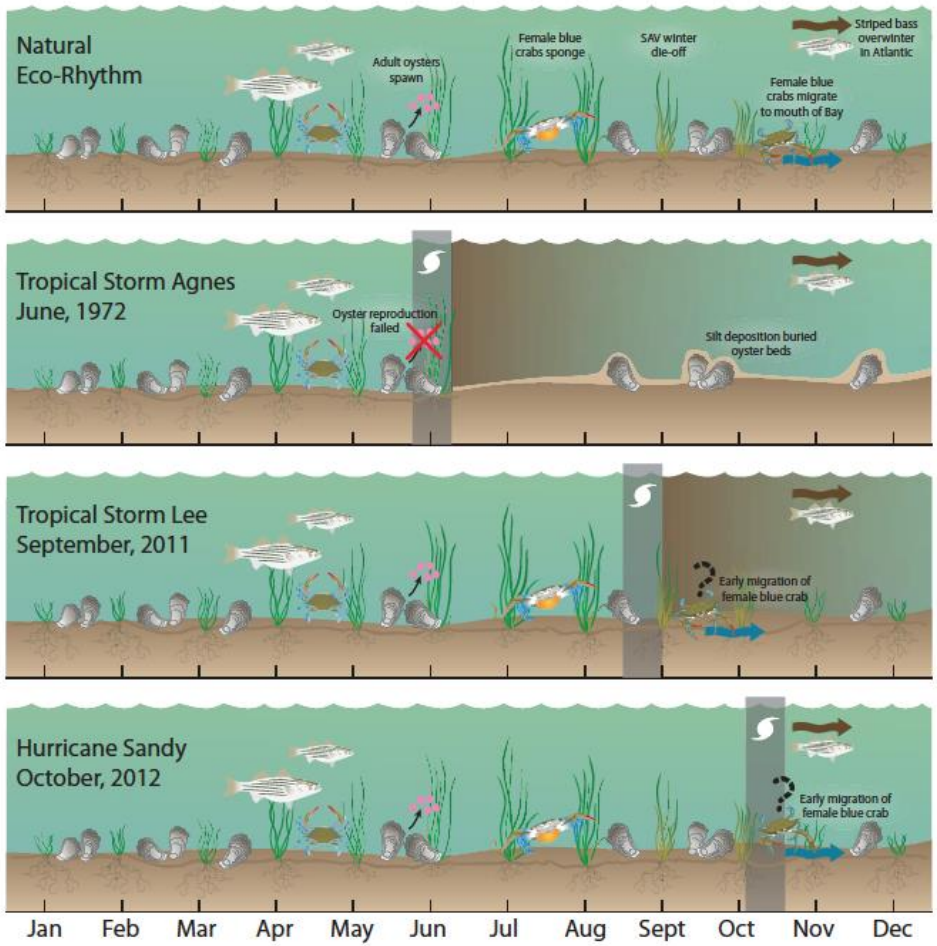




Source: LSRWA (2015), Personal communication Linker (2016)

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

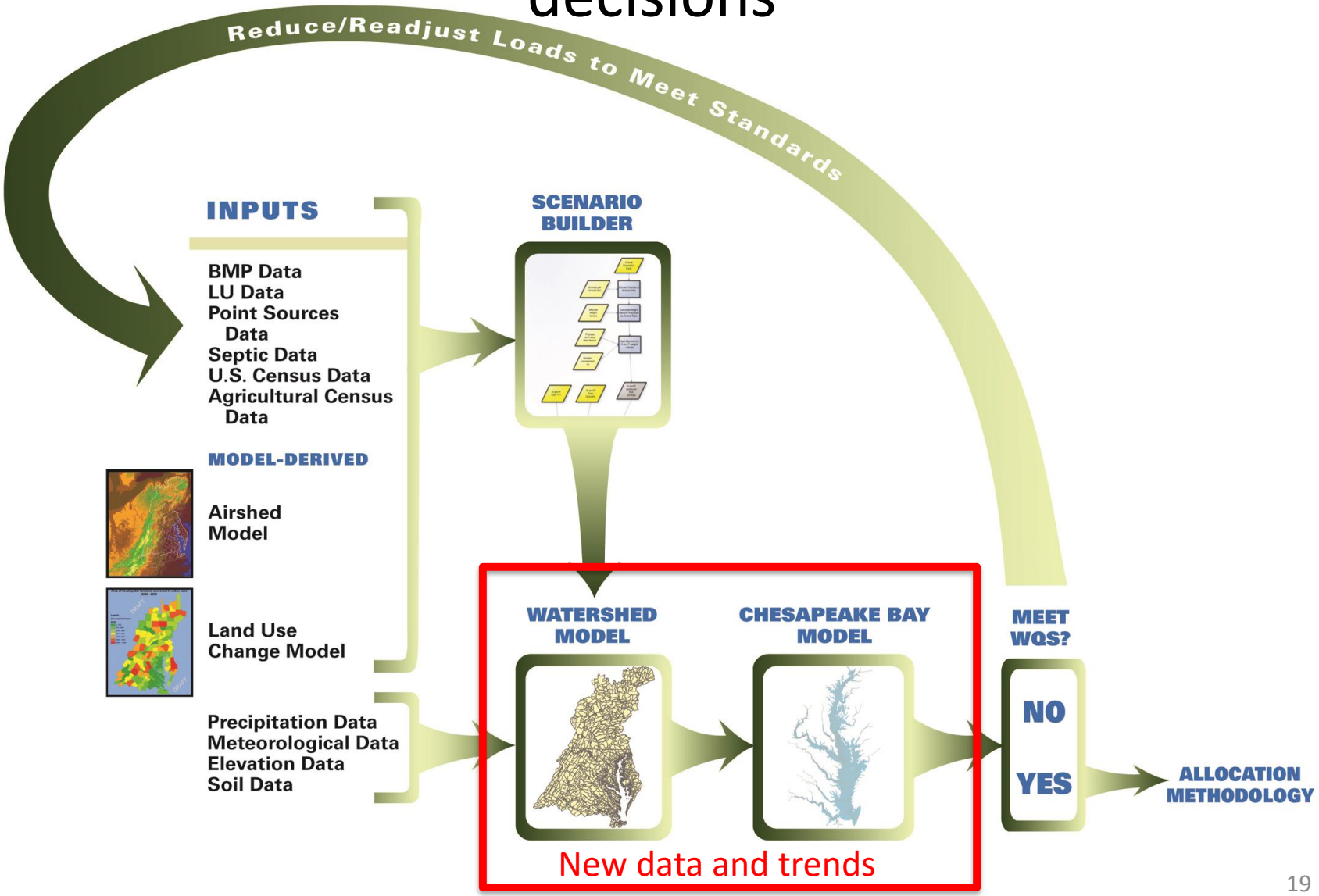
- The Susquehanna basin has a significant influence on Chesapeake Bay water quality
- The net reservoir trapping capacity is near zero
- Loss of trapping capacity will have more effect on the sediment and phosphorus than nitrogen
- New information available for factoring in the influence of particulate 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

The allocation principles applied in the Bay TMDL determined the cap and level of responsibility

- Attain WQ Standards
- Areas that contribute the most to the Bay water quality problems must do the most to resolve those problems (on a pound-per-pound basis).
- All tracked and reported reductions in nitrogen and phosphorus loads are credited toward achieving final assigned loads.
- Special considerations for upstream states

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



Water quality standards remain the same as in the Bay TMDL and are used to set the overall cap

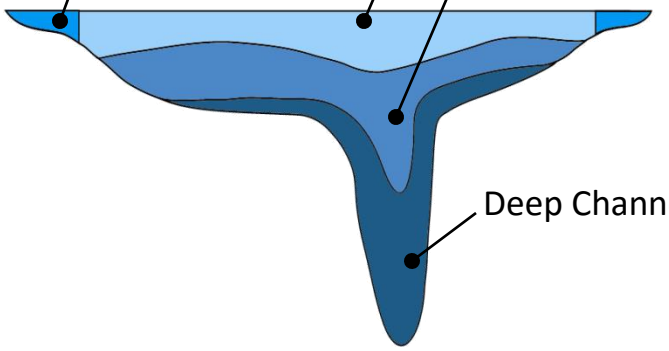
SAV

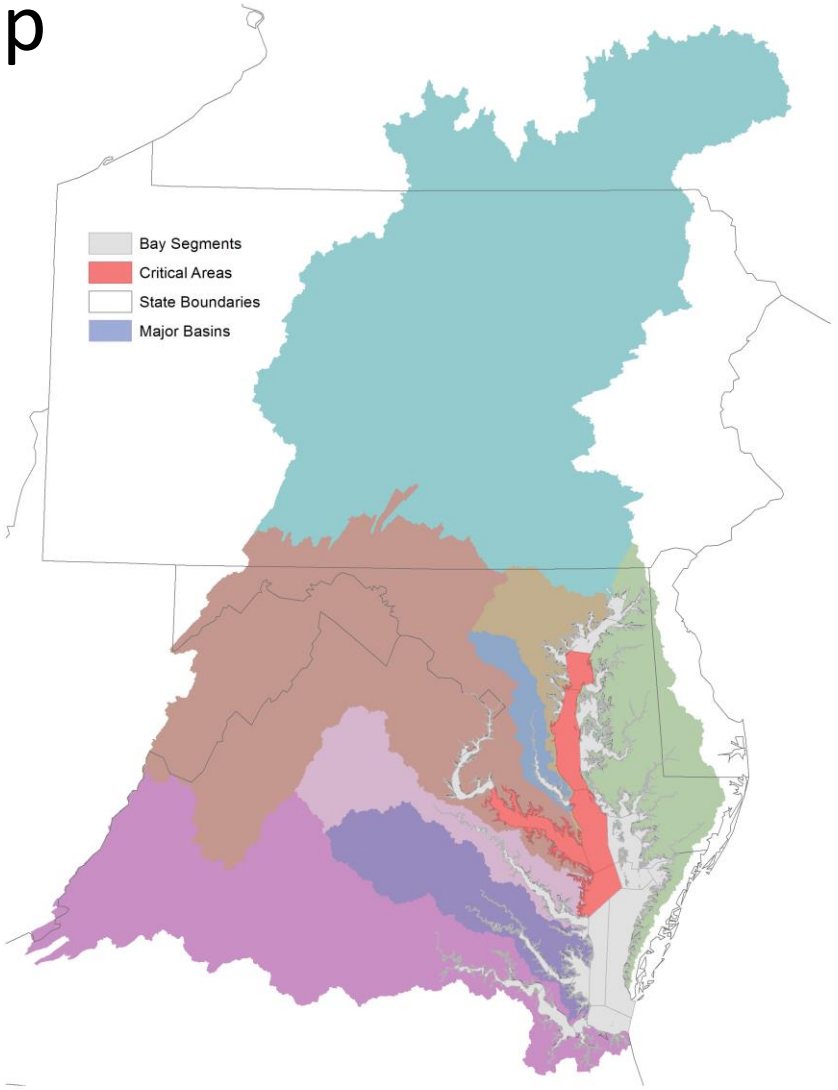
Migratory Fish Spawning & Nursery Areas

Shallow and Open Water Areas

Deep Water

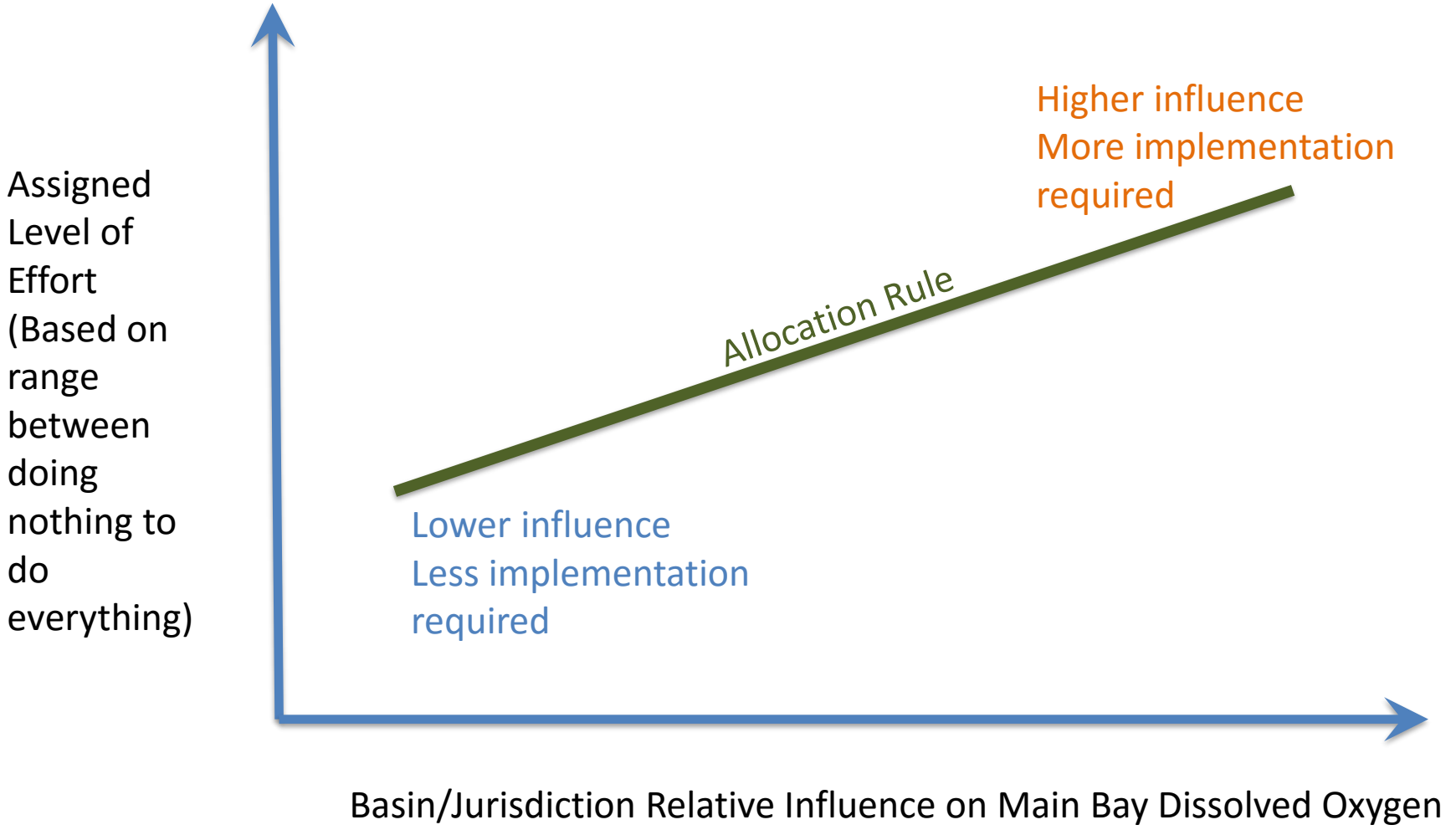
Deep Channel



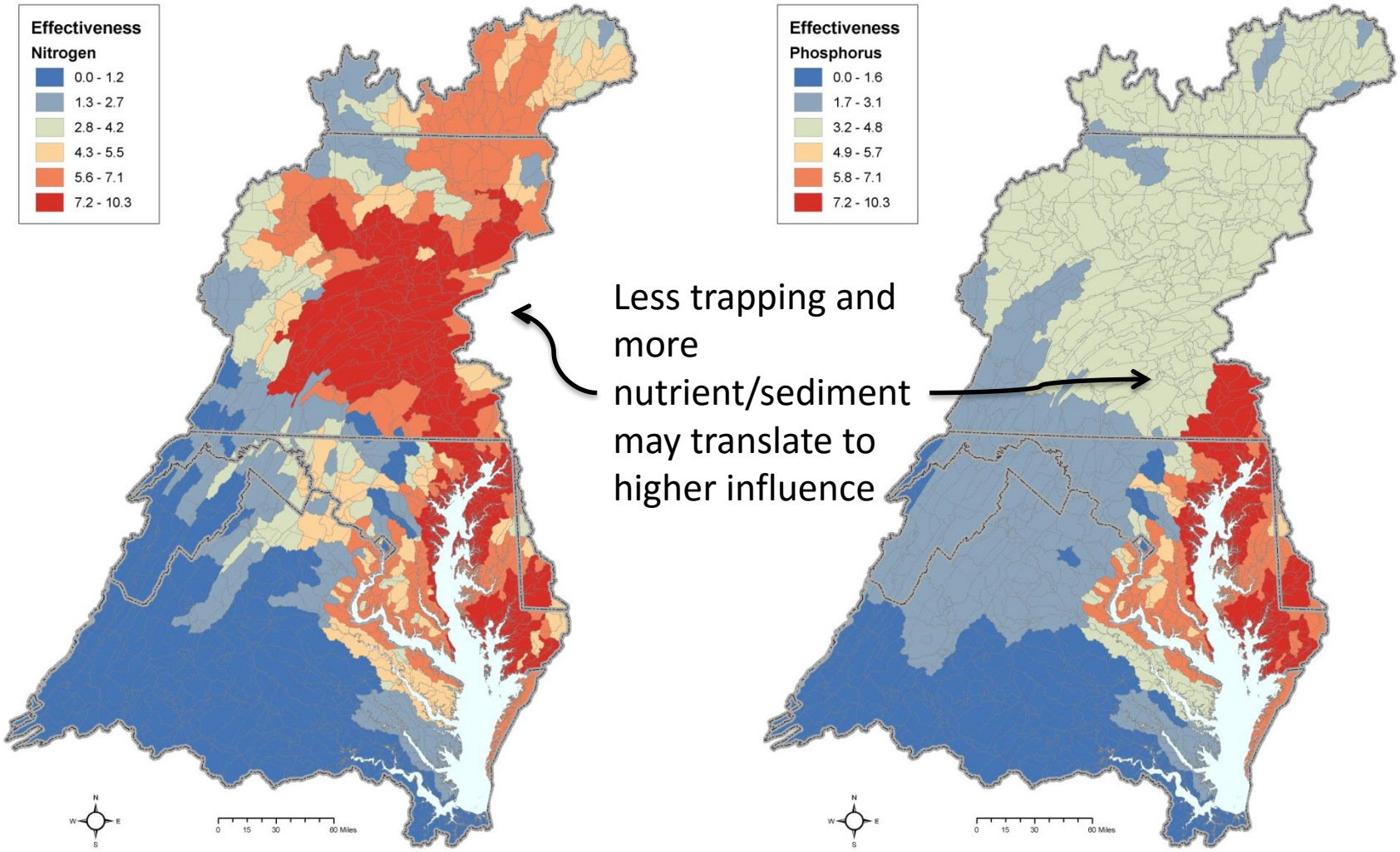


Allocation Responsibility Rules were used to divide the cap among the jurisdictions

(Informed by Models)



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



Source: EPA Chesapeake Bay TMDL, 2010

The Bay TMDL said*…

- The reservoirs were estimated to be filled in sometime between 2025 to 2040. But that has happened sooner than expected.
- As stated in Appendix T, increased loads would need to be offset, "if future monitoring shows the trapping capacity of the dam is reduced". In that case, "…EPA would consider adjusting the Pennsylvania, Maryland, and New York 2-year milestone loads based on the new delivered loads. The adjusted loads would be compared to the 2-year milestone commitments to determine if the states are meeting their target load obligations."

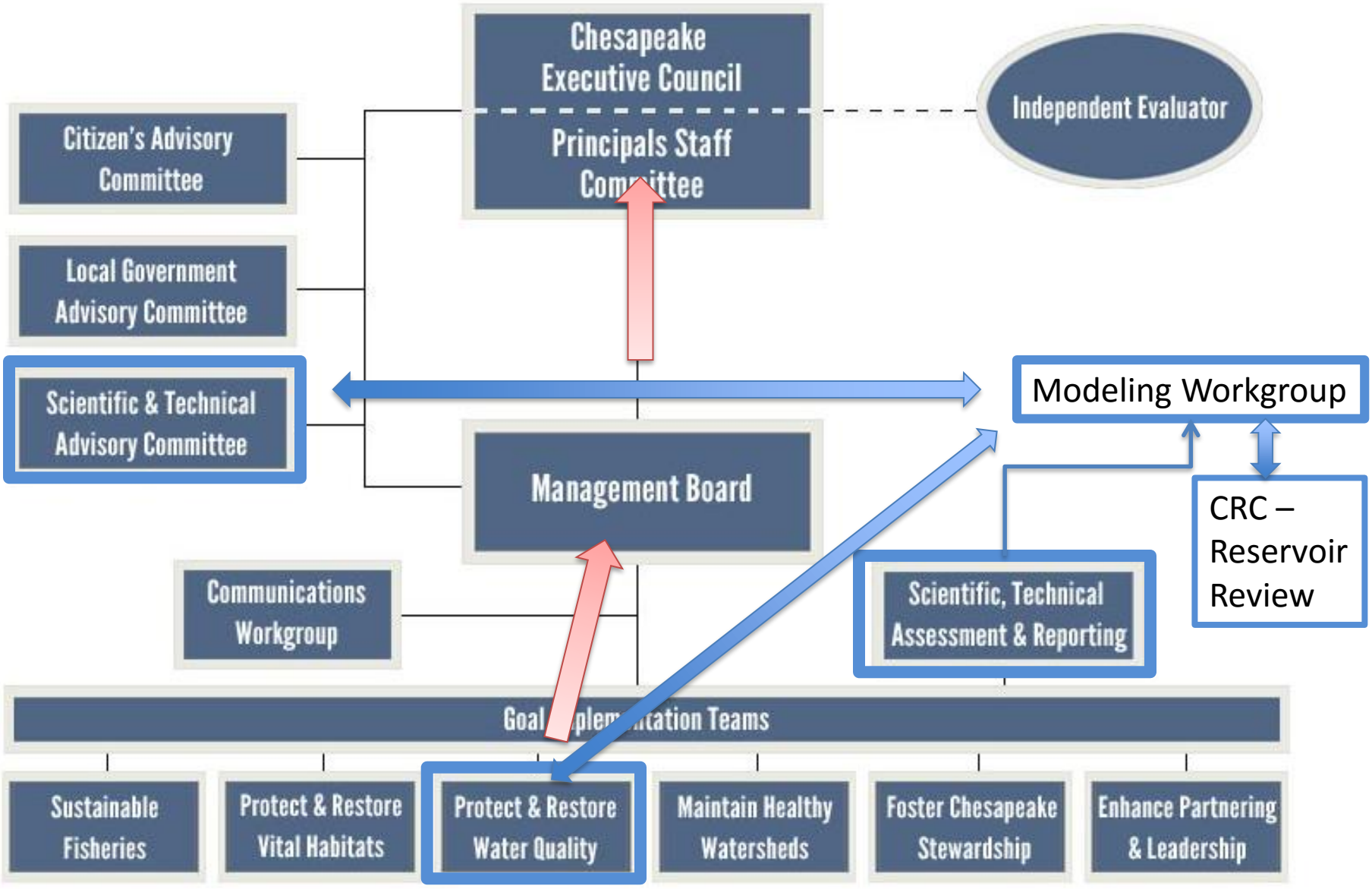
Appendix T. Sediments behind the Susquehanna Dams Technical Documentation: Assessment of the Susquehanna River Reservoir Trapping Capacity and the Potential Effect on the Chesapeake Bay (2010)
https://www.epa.gov/sites/production/files/2015-02/documents/appendix_t_susquehanna_dams_final.pdf

Possible allocation policy questions

- Will offsets be isolated to jurisdictions upstream of the reservoir system or spread across all jurisdictions?
- Will the Bay TMDL allocation policy rules be used to factor in the water quality impact resulting from reservoir infill?
- To what extent will restoring reservoir capacity be factored into the allocations?
- The reduced reservoir trapping has resulted in relatively more phosphorus increase than nitrogen. What are the opportunities to exchange nutrients to balance these impacts?
- How will these Bay TMDL/WIP decisions link with MD's 401 Water Quality Certification and FERC relicensing?

DECISION MAKING, TIMELINE, NEXT STEPS

Accountability and decision making



Timeline (2016)

- Reservoir system state of the science webinar/paper this fall
- Modeling tools to reflect trends by fall and fully developed, with new information, by early winter
- STAC and CRC review of modeling tools this fall and winter
- In Oct, WQGIT meeting to approve the Phase III WIP jurisdiction planning target method for presentation to Management Board
- Policy for factoring in the impact of infill to targets this winter

Timeline (2017)

- January – March: final calibration of Phase 6 modeling system by the modeling team (through Modeling WG)
- March –May: fatal-flaw review of Phase 6 modeling system by Bay Partnership
- June: Partnership release of final Phase 6 modeling system and EPA releases draft Phase III WIP planning targets that factor in the Conowingo infill

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
- Offset policy by end of calendar year
- Decision tools avail in winter and finalized by spring 2017
- Targets, with estimated current progress, by June 2017