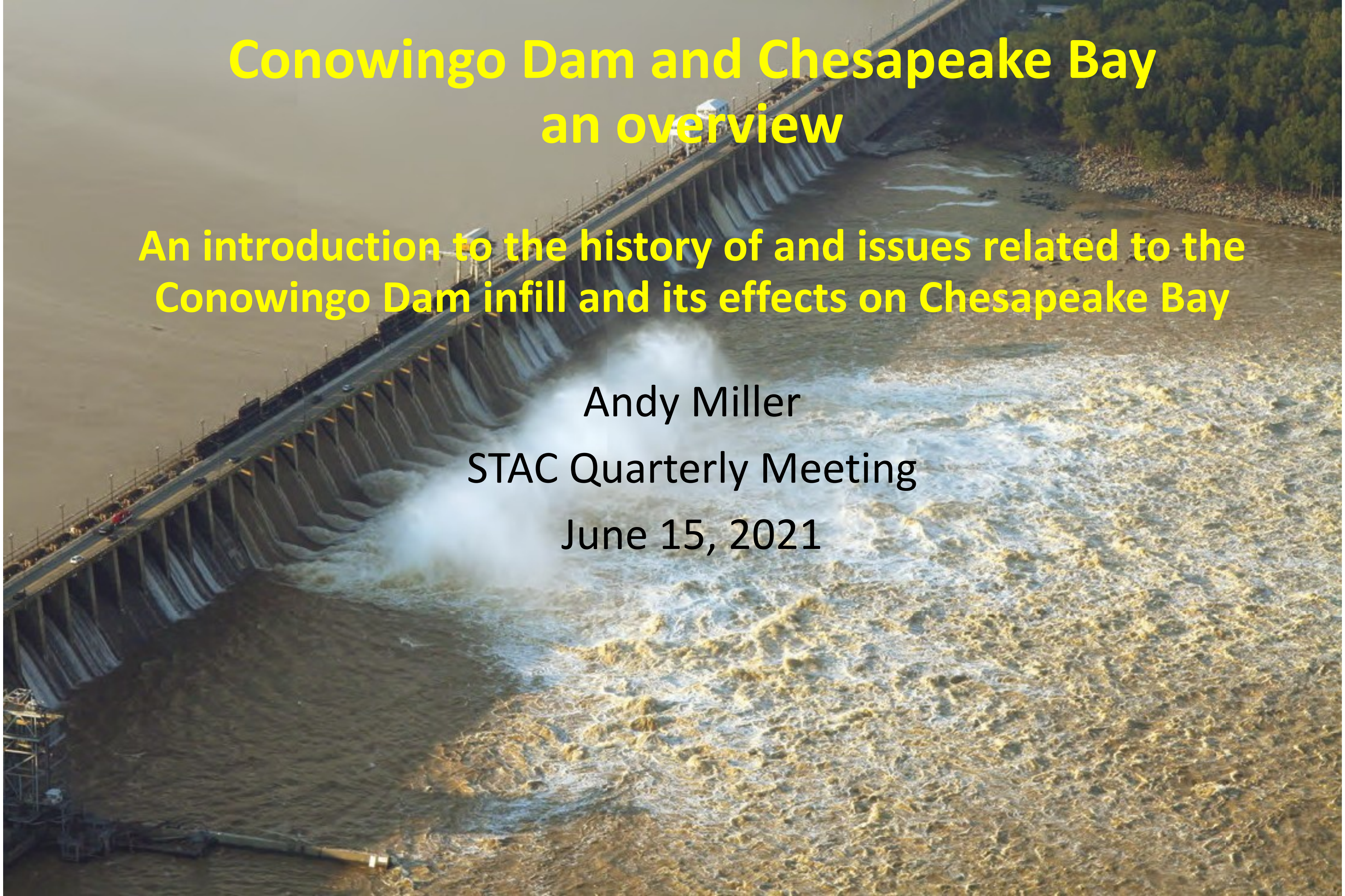
Conowingo Dam and Chesapeake Bay
an overview

An introduction to the history of and issues related to the Conowingo Dam infill and its effects on Chesapeake Bay

Andy Miller

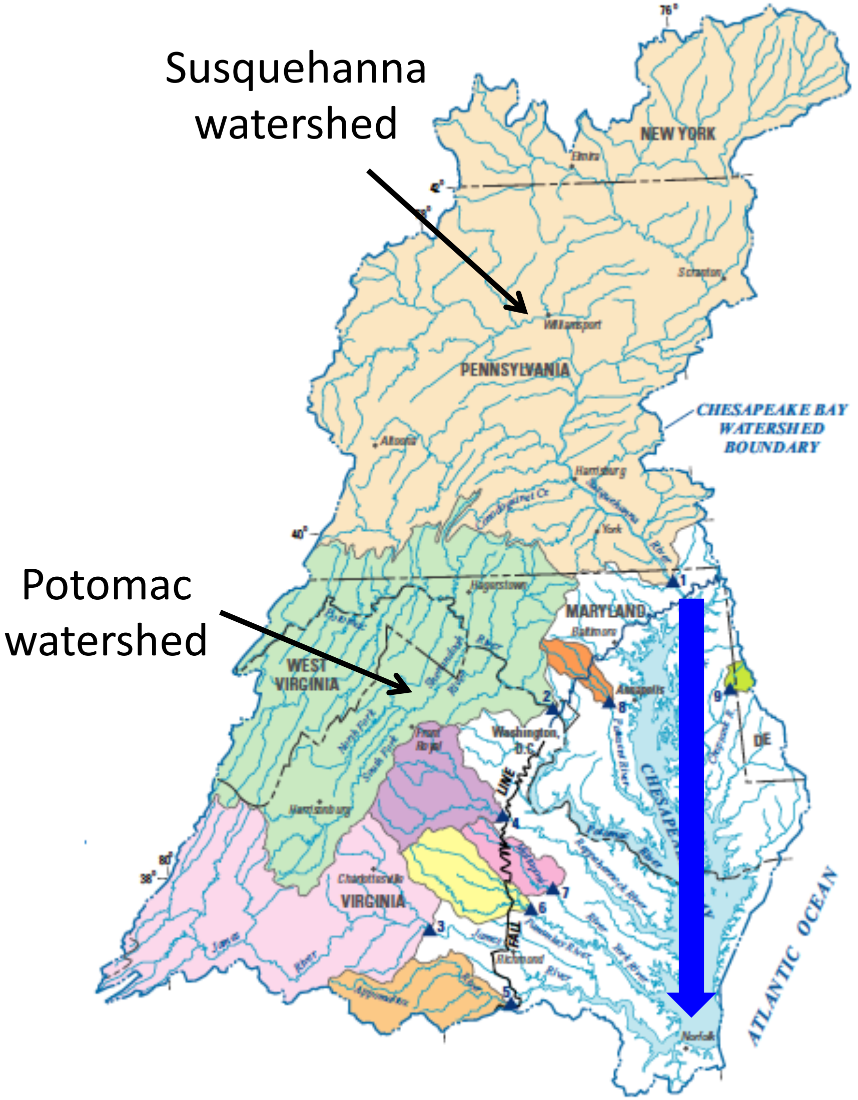
STAC Quarterly Meeting

June 15, 2021

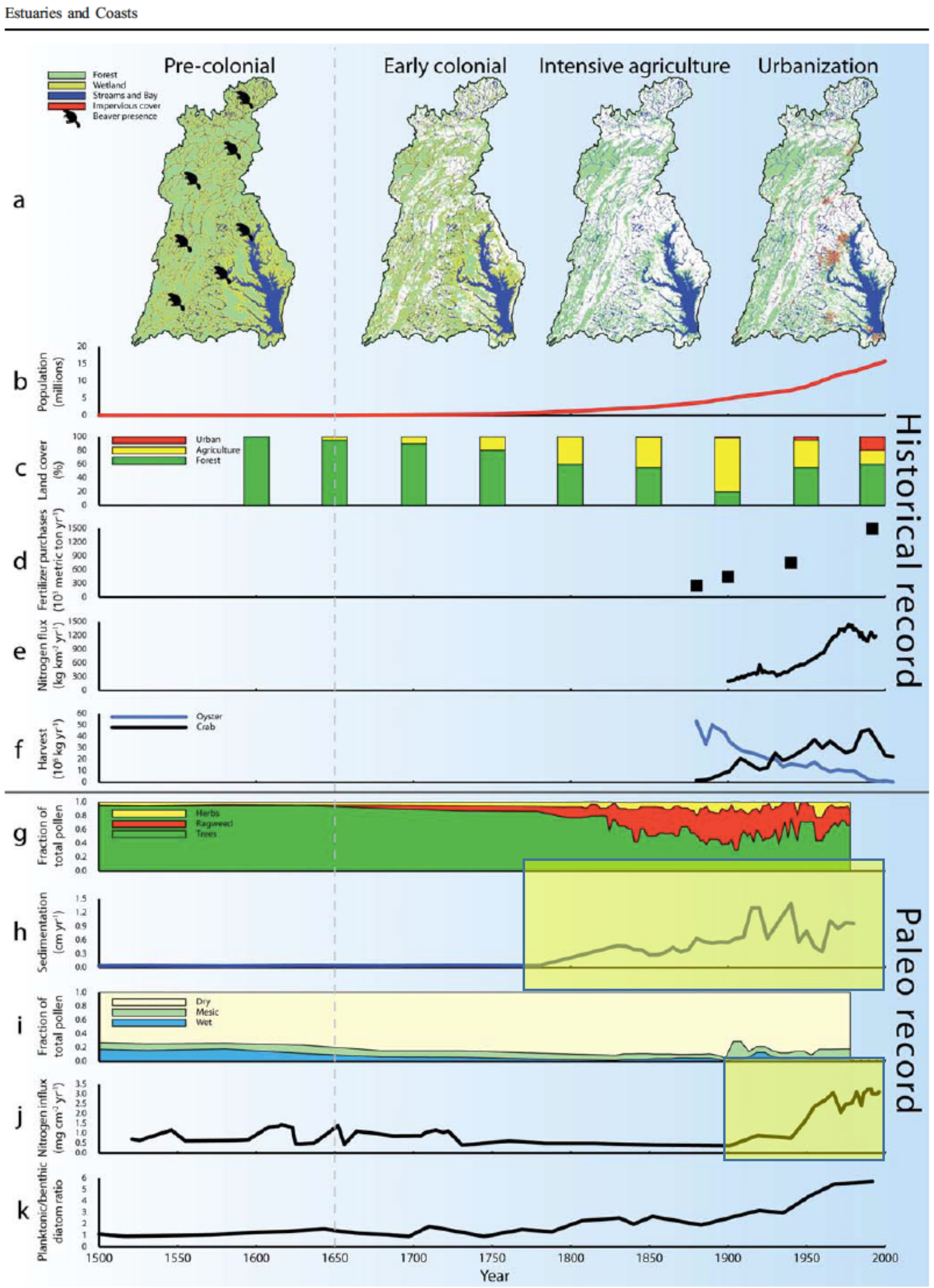


Susquehanna River Has a Major Influence on Chesapeake Bay Water Quality

- 43% of Chesapeake Bay watershed
- 47% of freshwater flow into the Bay
- 41% of nitrogen loads to the Bay
- 25% of phosphorus loads to the Bay
- 27% of sediment loads to the Bay
- Influences Bay water quality well into Virginia's portion of the Bay



Slide from Lee Currey,MDE; Source: Linker (2014)



Population

Land cover

Fertilizer purchases

Nitrogen flux

Shellfish harvest

Fraction of total pollen

Sedimentation rate

Fraction of total pollen

Nitrogen influx

Planktonic/benthic

Brush, 2007

Historical land use, nitrogen, and coastal eutrophication: a paleoecological perspective

Time scale extends from 1500-2000

Rapid increase in sedimentation goes back to European settlement, rapid increase in nutrient flux is dramatic after WW II

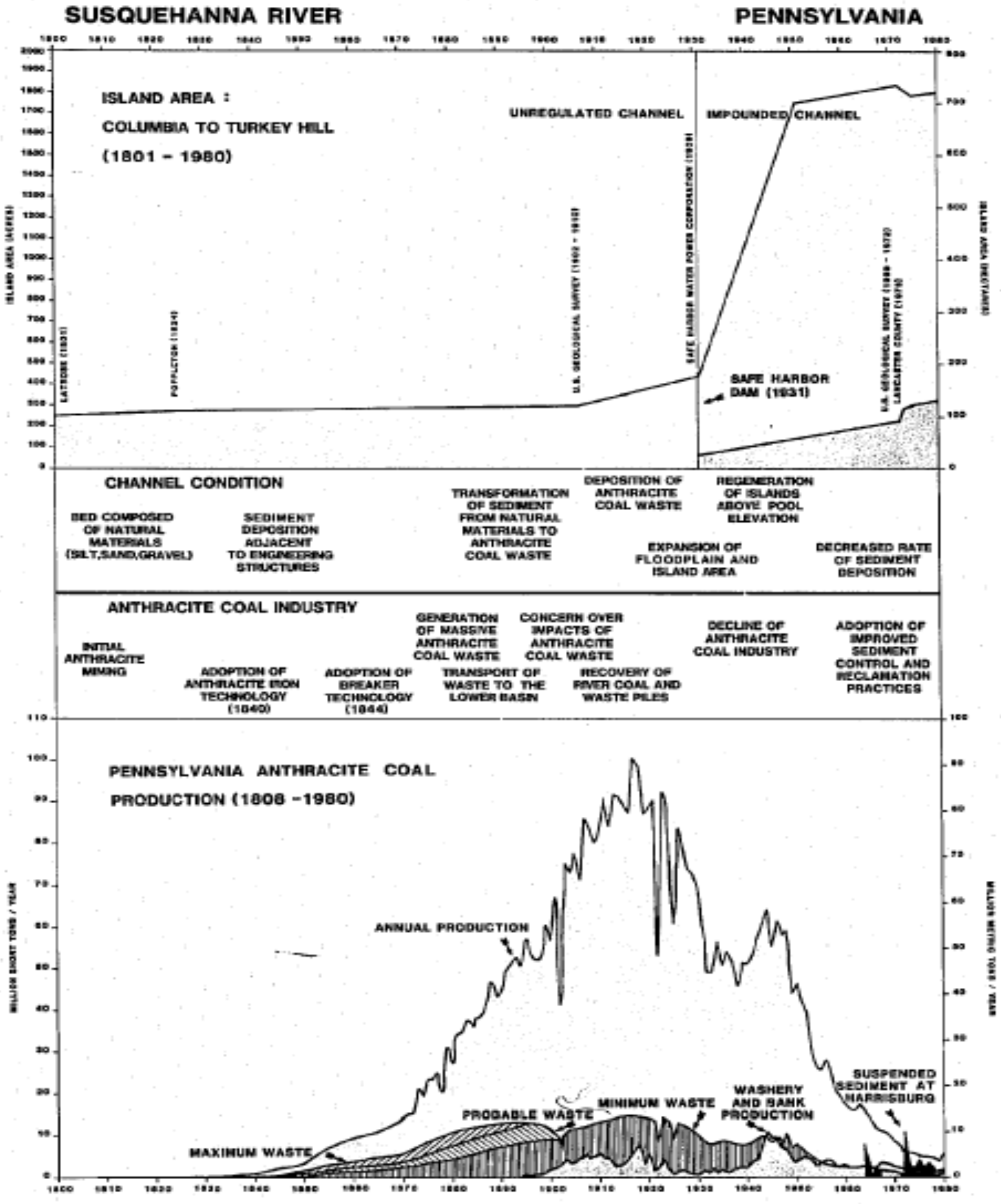


Figure 50.

Lintner, S.F., 1983. The Historical Physical Behavior of the Lower Susquehanna River, Pennsylvania, 1801-1976.

- The Susquehanna River basin had a history of hydraulic mining for coal beginning in 1840
- It took 30-40 years for large volumes of mining-related sediment to begin accumulating in the lower Susquehanna
- Net accretion of islands and aggradation on floodplains occurred up through 1929; rates of island growth accelerated after closure of Safe Harbor Dam
- Marietta floodplain aggraded 3-7 feet

1. Some historical context

From Gottschalk, 1945

EFFECTS OF SOIL EROSION ON NAVIGATION IN UPPER CHESAPEAKE BAY

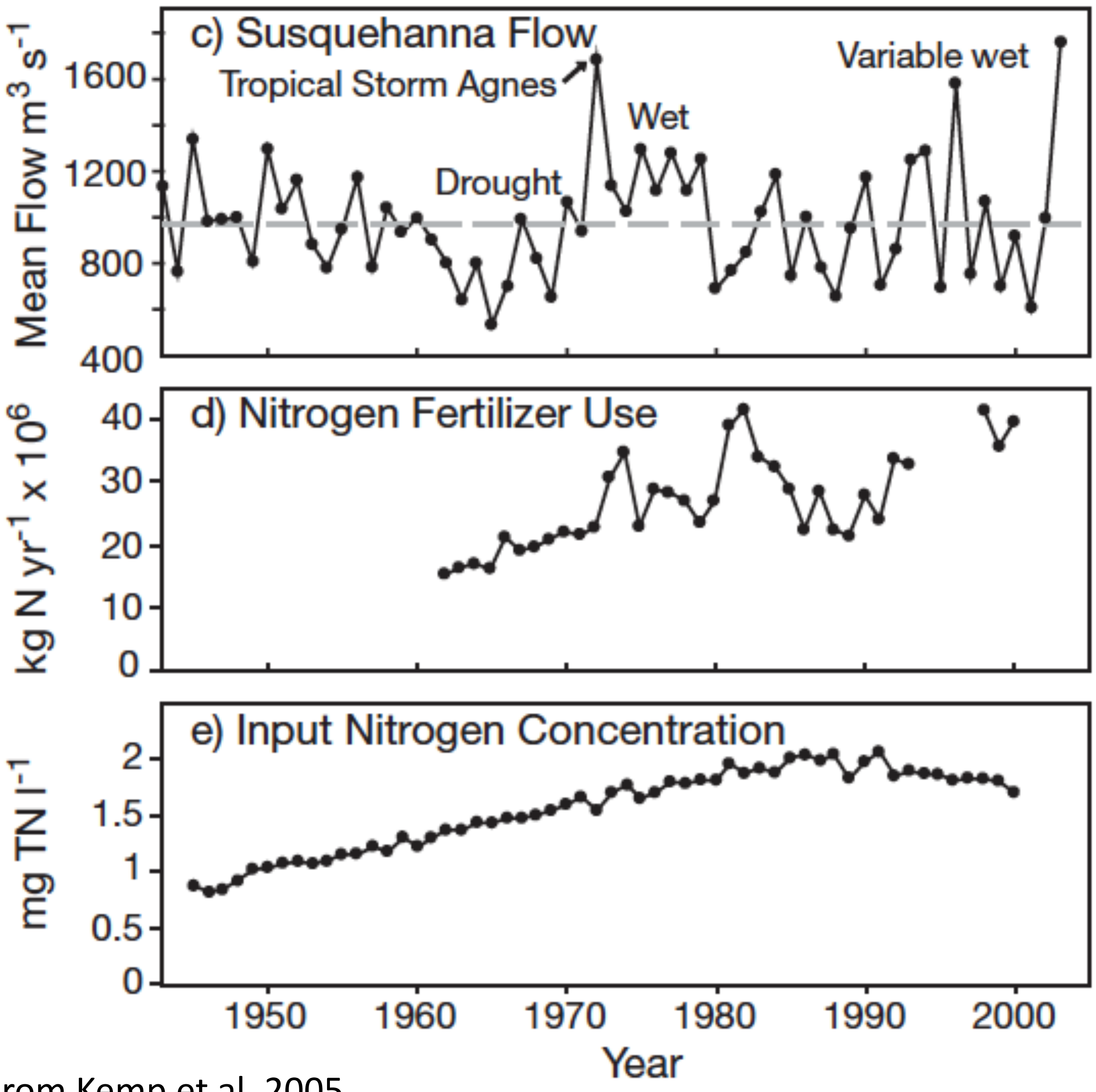
L. C. GOTTSCHALK

UR of the Chaldees, original home of Abraham, was a thriving seaport at the head of the Persian Gulf about 3000 B.C. Today its partly unearthed ruins lie in the desert 150 miles from the present shores of the Gulf. Century after century, the sediment brought down by the Tigris and Euphrates Rivers from the overgrazed highlands of Turkey, Syria, Iran, and 'Iraq has pushed back the head of tidewater. Currently the sediment load of the twin rivers is about 4 million cubic yards annually,[1] causing the delta to advance at the rate of about 1 mile in 30 years.

At the head of the Chesapeake Bay 85 million cubic yards of sediment[2] was deposited between 1846 and 1938. The average depth of water over an area of 32 square miles was reduced by 2½ feet (see Fig. 2). New land comprising 787 acres was added to the state of Maryland. The Susquehanna River is repeating the history of the Tigris and Euphrates.

Langland, USGS, 2015 – Open File Report 2014-1235

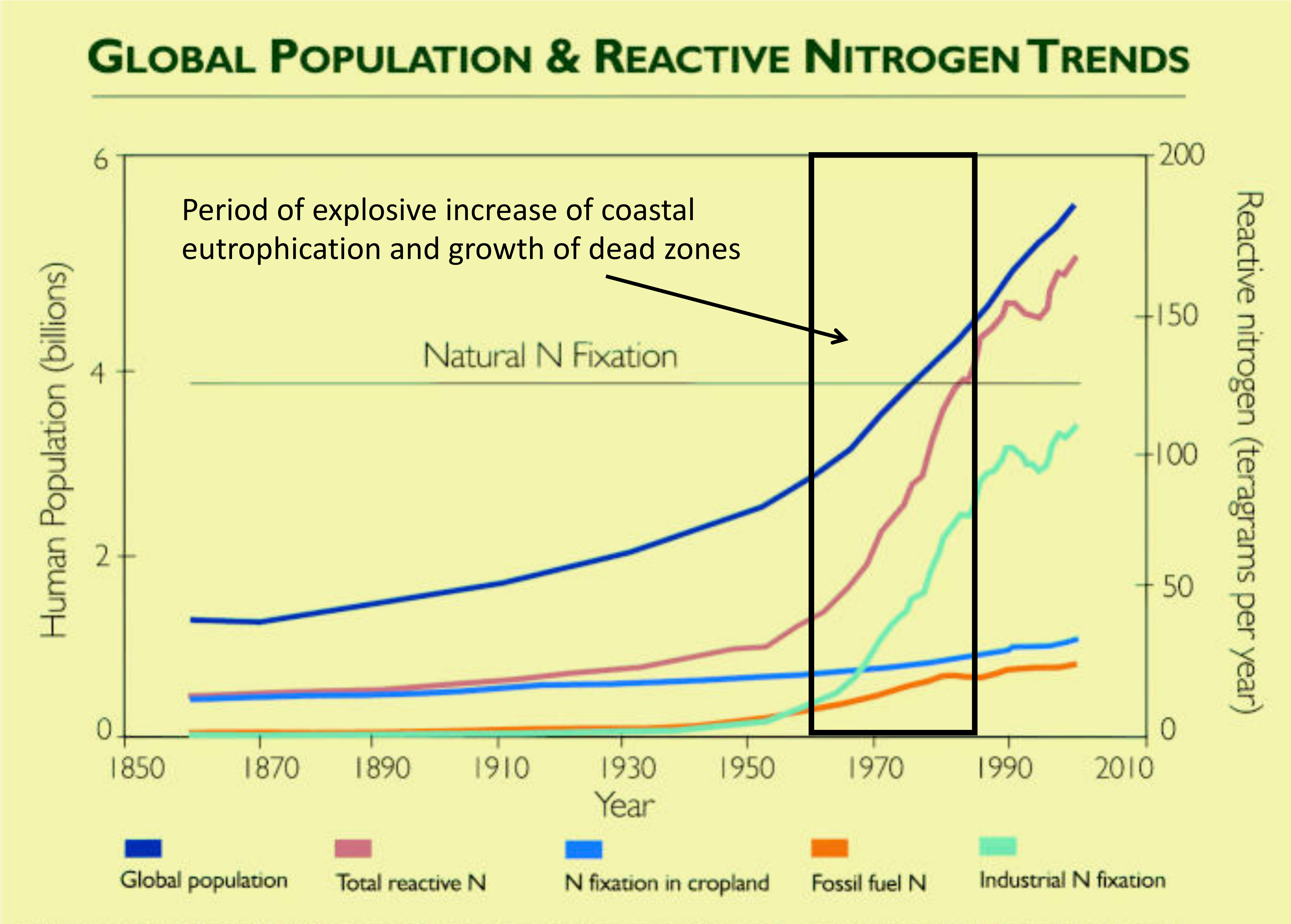
- Sediment loads were greater in the early to mid-1900s, averaging approximately 87 million tons per decade (8.7 million tons per year)
- In the 1950s, agricultural conservation measures were enacted (Wedin, 2002; Westra, 2003), helping to reduce sediment loads from 87 million tons in previous decades to approximately 60 million tons.
- Sediment loads have generally decreased from the 1960s through the 1980s as a result of more land reverting to forest from farm abandonment, a decrease in land disturbance from coal production, and new best-management actions to control sediment.
- Loads continued to decline to an average of 3.5 million tons per year over the period 1991–2012



From Kemp et al. 2005

As watershed sediment yield started to decline, nutrient flux was increasing…

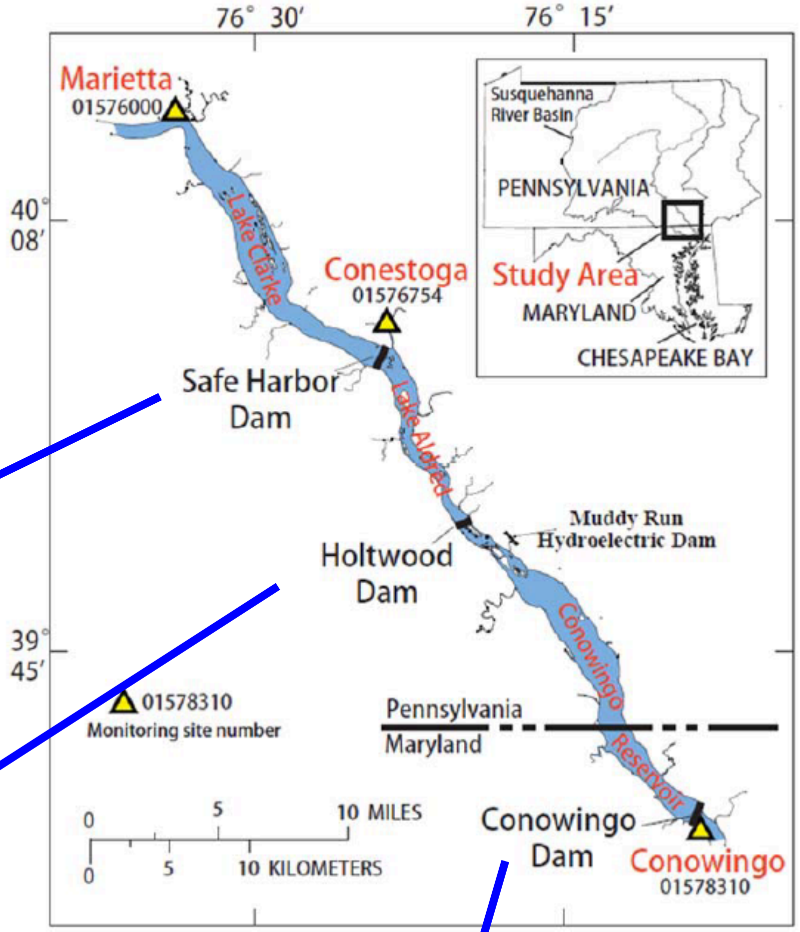
This was a global trend but it began to hit Chesapeake Bay particularly hard in the 1970’s and 1980’s

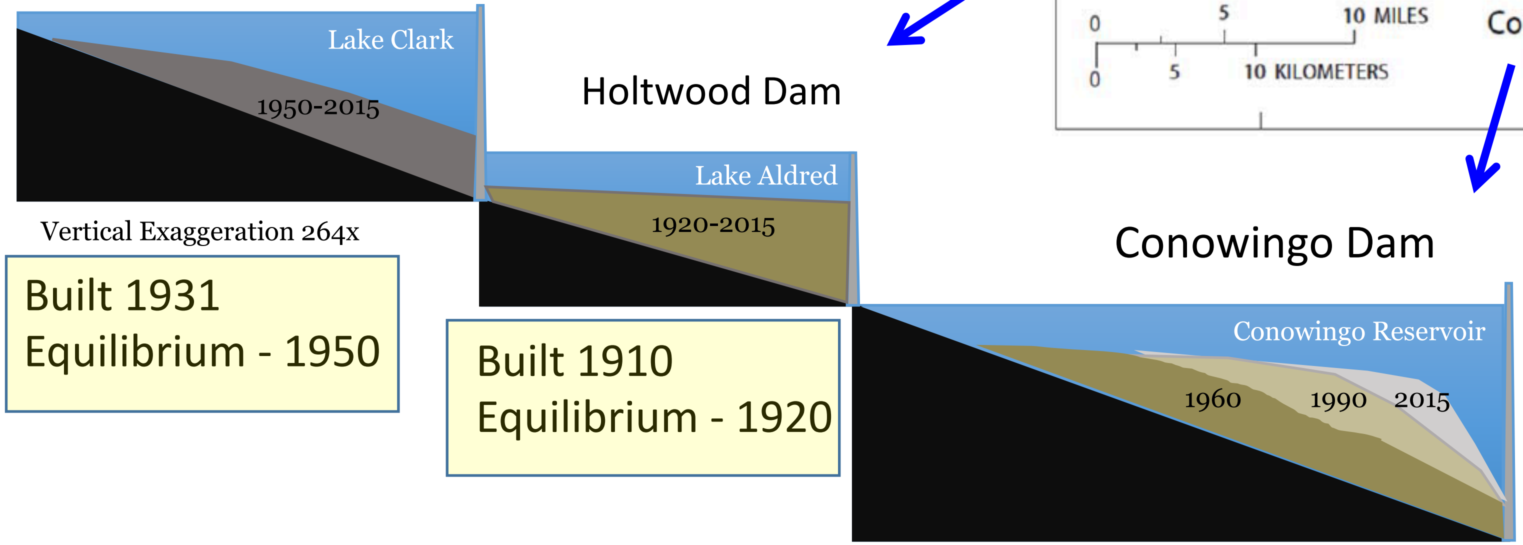


Source: Lambert KF, Driscoll C. 2003. Nitrogen Pollution: From the Sources to the Sea. Hanover, NH: Hubbard Brook Research Foundation; 4.

Three Reservoirs in the Lower Susquehanna

The System of Reservoirs has been filling over time.





Built 1931
Equilibrium - 1950

Built 1910
Equilibrium - 1920

Built 1928
Equilibrium – around 2010
(First evidence - late 1970s)

Source: Langland and Blomquist, USGS, personal communication

Timeline for Lower Susquehanna River Reservoirs: 1900-2020

1900	
	1910 – Holtwood Dam constructed
1920	1920 – Holtwood Dam reaches equilibrium
	1928 – Conowingo Dam constructed
	1931 – Safe Harbor Dam constructed
1940	
	1950 – Safe Harbor Dam reaches equilibrium
1960	1960s – Historical lowest flows in Susquehanna
	1972 – Tropical Storm Agnes
1980	1979 – Systematic water quality monitoring begins on the Susquehanna River at Conowingo Dam
	1996 – January "Big Melt" rain on snow flood event
2000	2001 – SRBC convenes "Susquehanna Sediment Task Force" Symposium; publishes report
	2010 – Chesapeake Bay TMDL established
	2012 – Hirsch 2012 - clear evidence for Conowingo Reservoir at or near dynamic equilibrium
2020	2017 – Bay TMDL Midpoint Assessment

Source: Langland, USGS, Personal Communication

Why regulate sediment?

- Degradation of habitat by siltation
- Limitation of light penetration in water
- Transport medium for nutrients and potentially for toxic contaminants
- Associated nutrients could contribute to algal blooms → hypoxia; or to Harmful Algal Blooms (HAB)
- It’s all the fault of Tropical Storm Agnes in 1972!

NEWS

Retrospective: The Damage Caused by Hurricane Agnes

People still talk about Hurricane Agnes, though it was no longer a hurricane by the time it devastated the region 40 years ago this month. Even so, the massive tropical storm flooded millions of acres, carried away cars, destroyed homes, took lives—and forever changed North America's greatest estuary, the Chesapeake Bay.

WRITTEN BY TOM HORTON | PUBLISHED ON JUNE 19, 2012

It has been known for more than 40 years that Conowingo was trapping large volumes of Susquehanna River sediment and associated contaminants, and could export a decade's worth or more of sediment in a single large flood

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Storm Agnes caused a historic flood to inundate the estuary with sediment and pollutants. (Oysters were already much reduced from a long period of mining of oyster reefs but remaining populations crashed mostly due to disease.)

Remobilization of sediment stored upstream of Conowingo Dam may be part of the story.

Calendar Year	burg, PA	Conowingo, MD
1966	1.5	0.7[b] (60%)*
1967	1.7	>0.3[c]**
1968	>1.7**	nd
1969	nd	0.32[d] (60%)
1970	>2.0**	>1.1**
1971	>1.4**	1.0 (51%)
1972	11.3	33[e]
Agnes, 24–30 June 1972	7.6	30[e]
1973	3.2	1.2[f] (54%)
1974	1.7	0.8[f] (53%)
1975	>3.8**	11
Eloise, 26–30 Sept. 1975	1.6	9.9
1976	nd	1.2

nd = no data.

From talking points prepared by Joel Blomquist of USGS to brief Senator Ben Cardin's staff, July 2020

1 **The Chesapeake Bay science and management community have been aware of the potential impacts of reservoir infill on bay restoration efforts since at least 1998.** At that time, the USGS (Langland, 1998) estimated 17-20 years to full sediment storage capacity.

17-20 years would put you at 2015-2020 – so it happened no more than 10 yrs early

2 **Reservoir infill was considered in development of the bay TMDL:** "EPA's intention is to assume the current trapping capacity will continue through the planning horizon for the TMDL (through 2025). The Conowingo Reservoir is anticipated to reach a steady state in 15 – 30 years, depending on future loading rates, scour events and trapping efficiency." (USEPA, 2010)

3 **The TMDL set a plan in place to handle reduced trapping capacity.** "If future monitoring shows the trapping capacity of the dam is reduced, then 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."

JANUARY 12, 2016, 8:13 PM

Commissioner Richard Rothschild, R-District 4, used his five-minute State of the County time slot to address issues in another part of the state, but ones he said are still affecting Carroll taxpayers.

Rothschild presented a slideshow to the audience depicting what he described as evidence that the federal government is lying to citizens about pollution of the Chesapeake Bay.

"When it comes to the bay, the Conowingo Dam is the 600-pound gorilla in the room," he said, noting the county's involvement with the Clean Chesapeake Coalition, an association of counties joined together to promote cost-effective ways to clean up the bay.

The coalition is comprised of six Eastern Shore counties and Carroll County, and has focused much of its energy advocating against state environmental programs it says are wasteful and ineffective. Although Frederick County left the coalition last year, the Carroll County Board of Commissioners voted 4-0 in May to stay involved. Commissioner Richard Weaver, R-District 2, abstained from the vote.

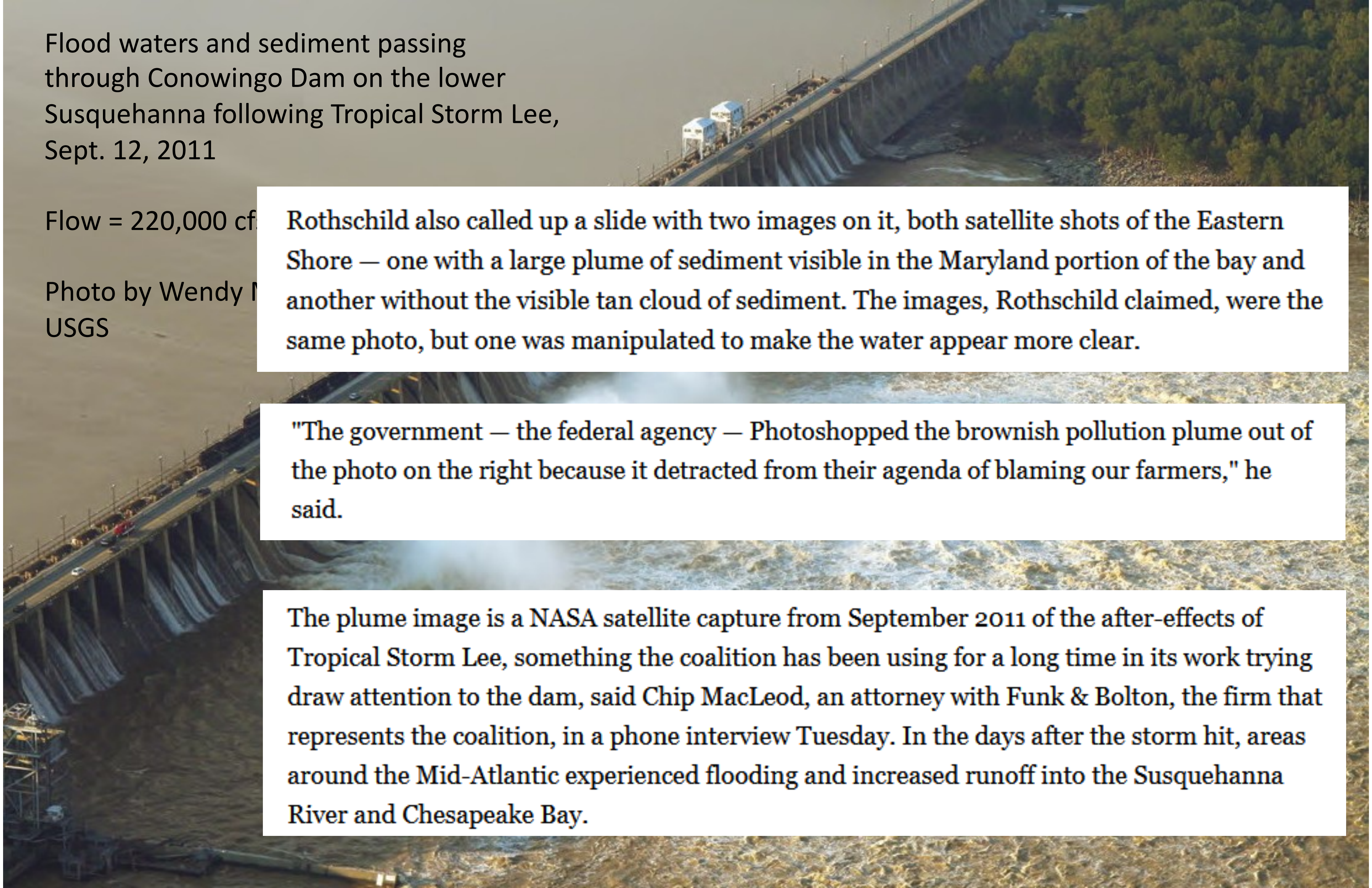
Since 2013, the county has paid $107,250 to participate in the coalition, according to County Administrator Roberta Windham.

While the state spends millions cleaning up the Chesapeake Bay, and farmers take a lot of the blame for the pollution, the dam between Harford and Cecil counties may be the real culprit, said Rothschild, Carroll's representative on the coalition.

Carroll County Times
January 12, 2016

Published during the STAC workshop, “Conowingo Reservoir Infill and Its Influence on Chesapeake Bay Water Quality”

"It's being used as an excuse to force environmental mandates upon us, including the phosphorus management tool, bad septics and the 'Rain Tax,' " he said of claims that farming runoff plays a major role in the pollution of the bay. "These unaffordable mandates hurt our businesses and our ability to fund critical services."



Flood waters and sediment passing through Conowingo Dam on the lower Susquehanna following Tropical Storm Lee, Sept. 12, 2011

Flow = 220,000 cf

Photo by Wendy M
USGS

Rothschild also called up a slide with two images on it, both satellite shots of the Eastern Shore — one with a large plume of sediment visible in the Maryland portion of the bay and another without the visible tan cloud of sediment. The images, Rothschild claimed, were the same photo, but one was manipulated to make the water appear more clear.

"The government — the federal agency — Photoshopped the brownish pollution plume out of the photo on the right because it detracted from their agenda of blaming our farmers," he said.

The plume image is a NASA satellite capture from September 2011 of the after-effects of Tropical Storm Lee, something the coalition has been using for a long time in its work trying draw attention to the dam, said Chip MacLeod, an attorney with Funk & Bolton, the firm that represents the coalition, in a phone interview Tuesday. In the days after the storm hit, areas around the Mid-Atlantic experienced flooding and increased runoff into the Susquehanna River and Chesapeake Bay.

Tropical Storm Lee sediment plume

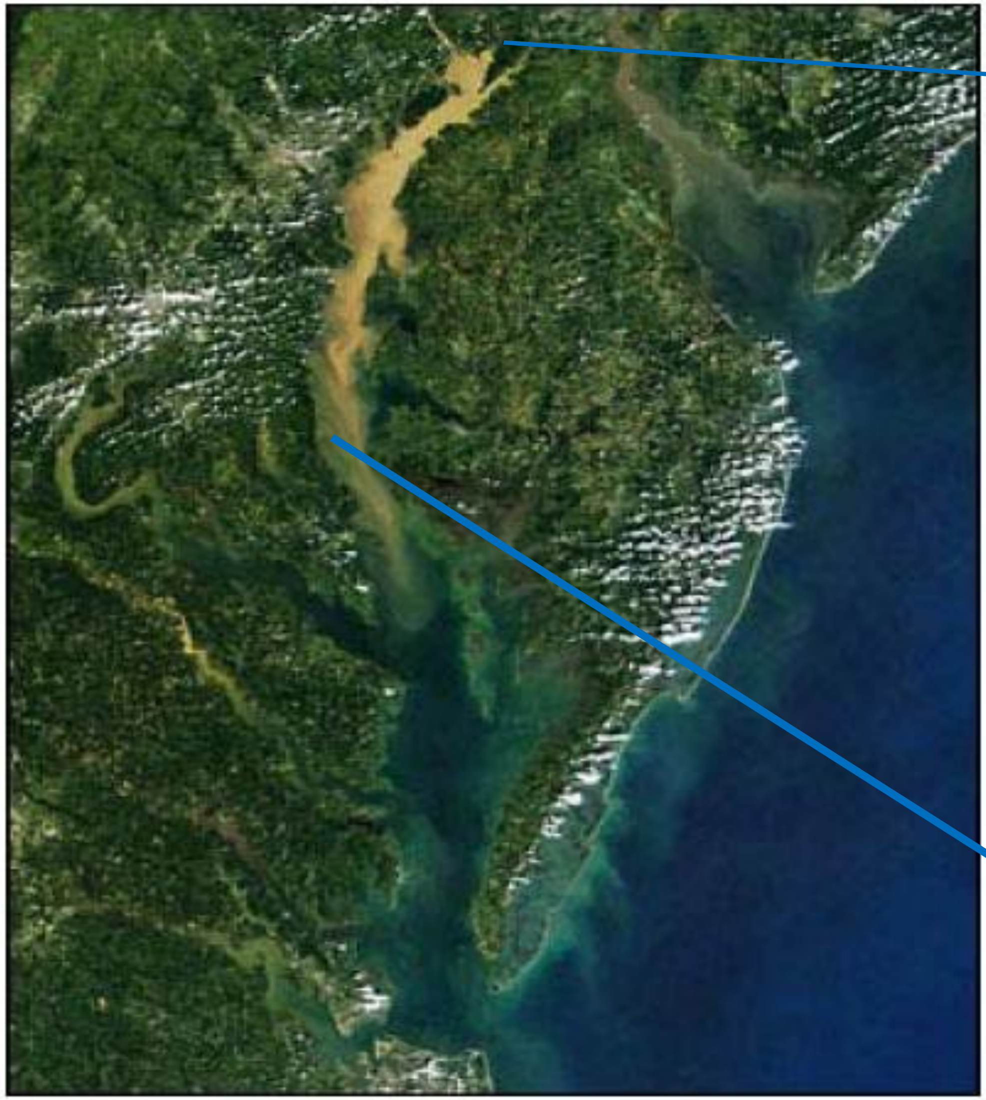
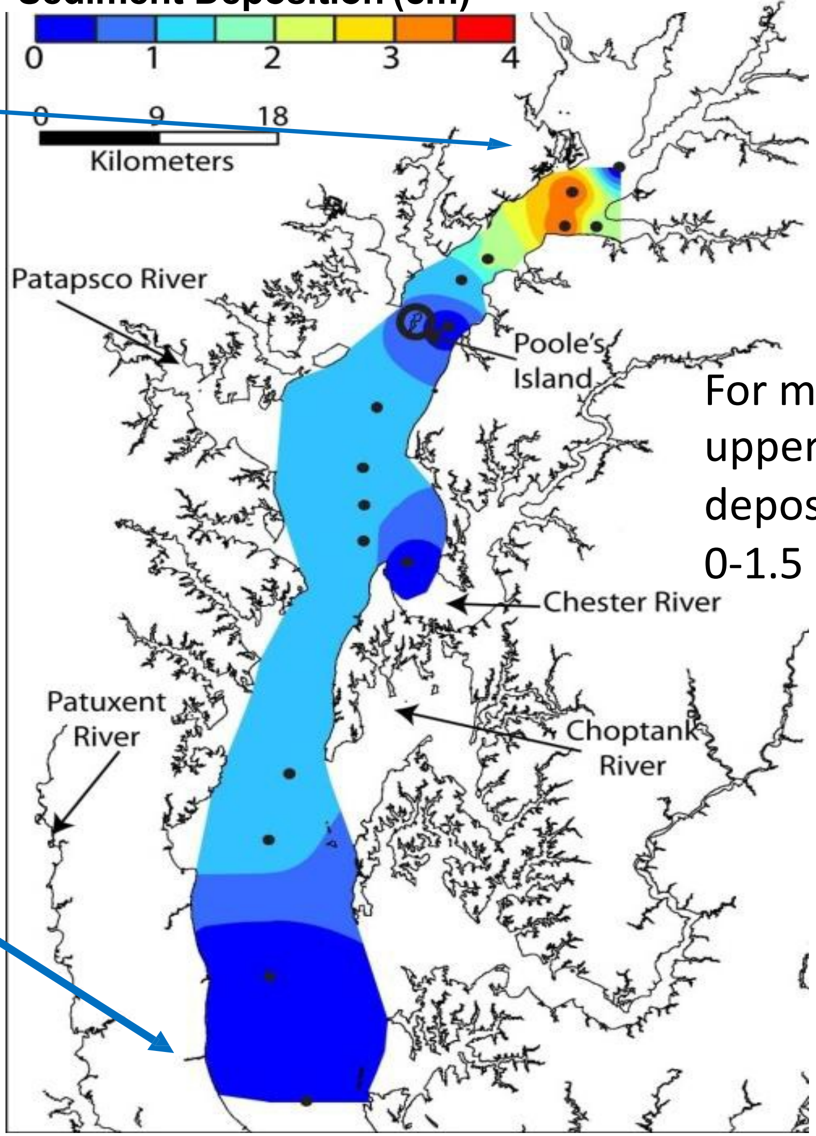


Photo Credit: NASA

What the Data Shows

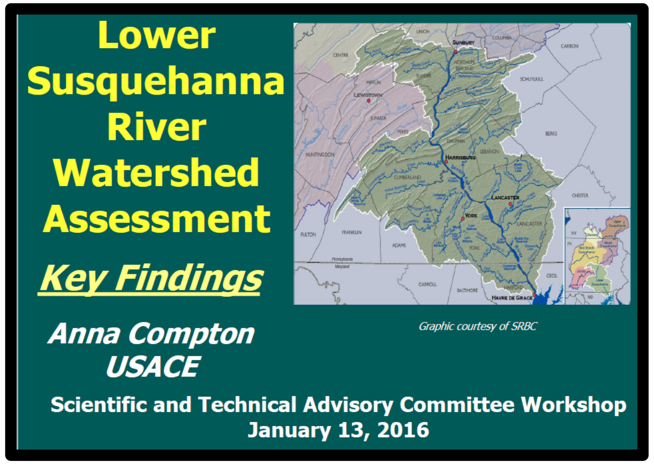


Palinkas et al., 2014

For most of the upper Bay, Lee deposits were 0-1.5 cm thick

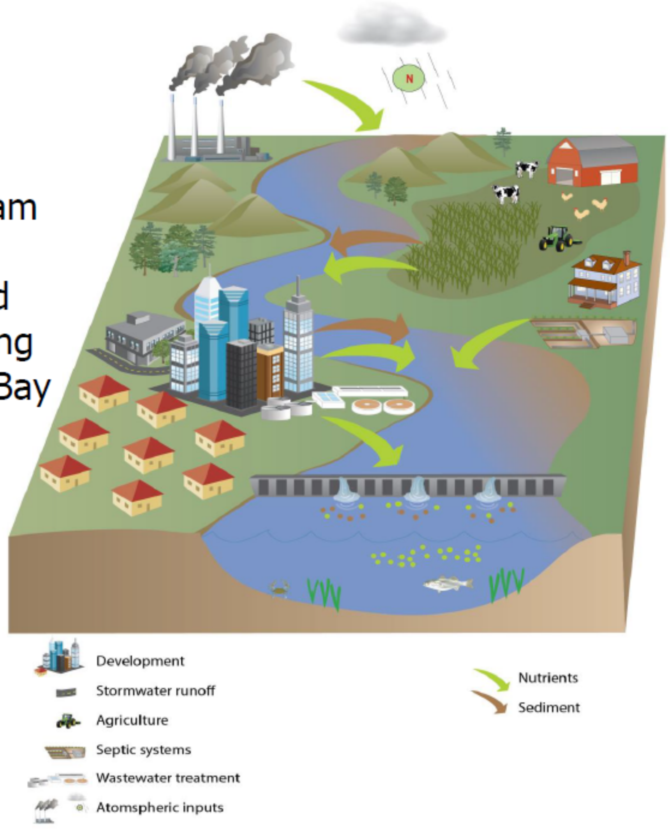
What is the truth about Conowingo Dam? Is it undermining Chesapeake Bay restoration efforts? Is dredging the answer?

- There has been rigorous scientific review of the dredging question. The Lower Susquehanna River Watershed Assessment (Army Corps of Engineers) was completed in 2014. A STAC review of the report was also published in 2014.
- There was a Chesapeake Bay Scientific and Technical Advisory Committee Workshop on the subject of Conowingo infill and its implications in January 2016.
- In summer 2017, research projects investigating the potential of Conowingo sediment to affect water quality in Chesapeake Bay were completed by UMCES scientists under contract to Exelon as part of its bid for relicensing of the Conowingo hydropower dam. A paper summarizing those findings was published in 2019.
- The 2017 TMDL Midpoint assessment included analysis of updated modeling results to determine the additional loads that would have to be accounted for as a result of Conowingo infill

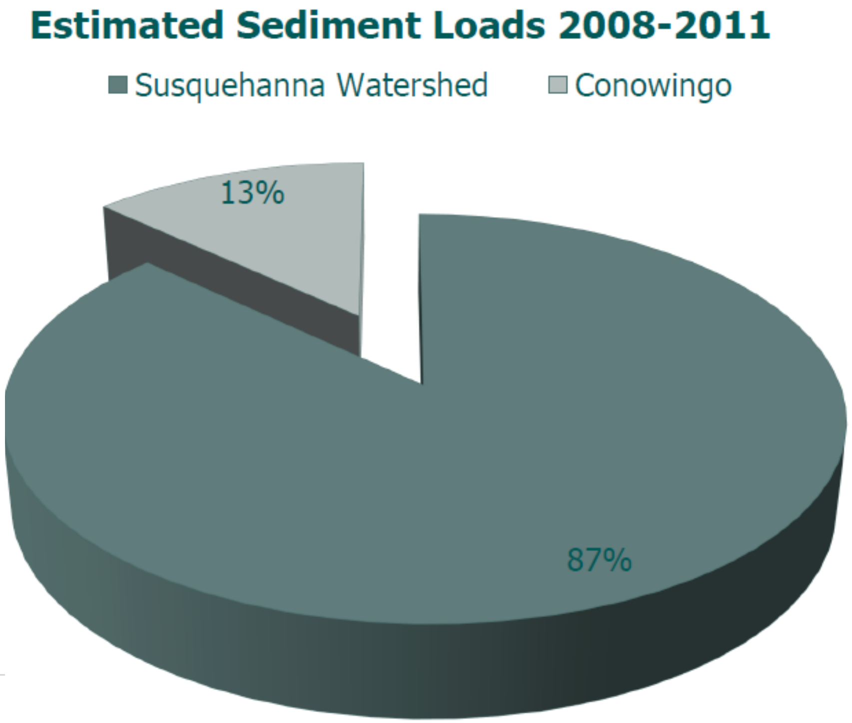


During Storm Events, Most of Conowingo Discharge is Delivered from the Watershed

Sources Upstream Deliver More Sediments and Nutrients Causing More Impact to Bay



Graphic courtesy of UMCES



Finding 3 Continued:

With or Without the Dams, Large Storms Will Continue To Contribute Sediment and Nutrients to the Bay

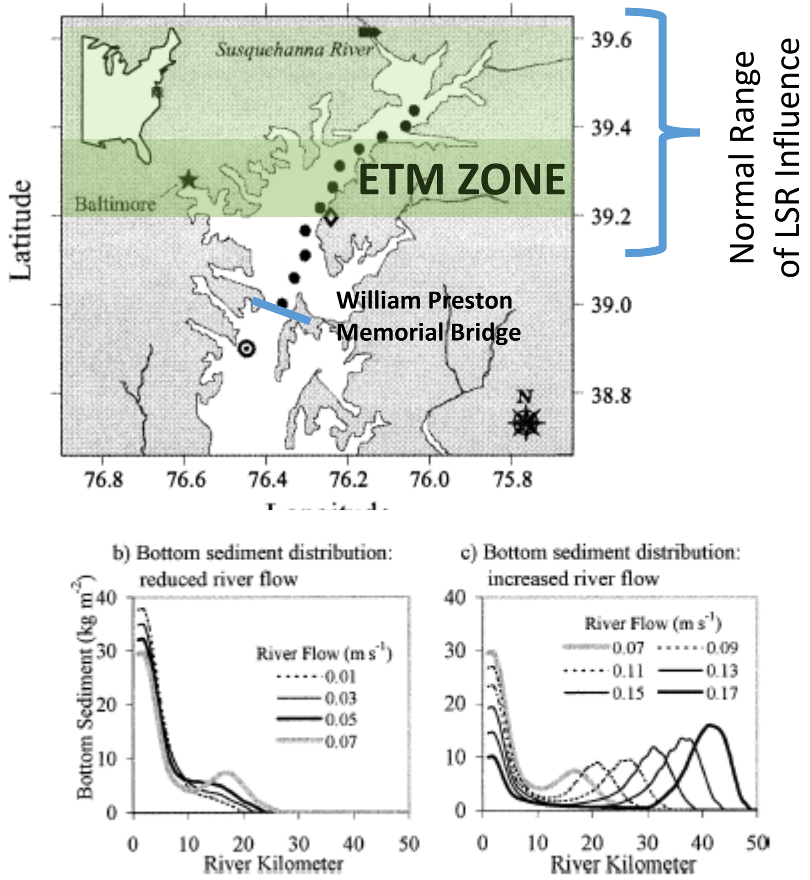
Finding 4: Dredging, Bypassing, and Dam Operational Changes, By Itself, Does Not Provide Sufficient Benefits to Offset Impacts From the Loss of Long-Term Trapping Capacity

- Cost: $15-270 Million Every Year
- Back to Mid-1990's = $496 million to $2.8 billion
- Only 'Keeping Up' With Inflowing Sediment
- Reducing Nutrients at Their Source More Effective

There are studies in progress to reevaluate whether an economically feasible dredging option can be developed. I have not seen any evidence regarding this option.

Bay Restoration Depends on Watershed Management in All of Its Tributaries

North et al 2004:



Under normal range of conditions, LSR influence extends, at most, to William Preston Memorial Bridge.

Langland et al 2003

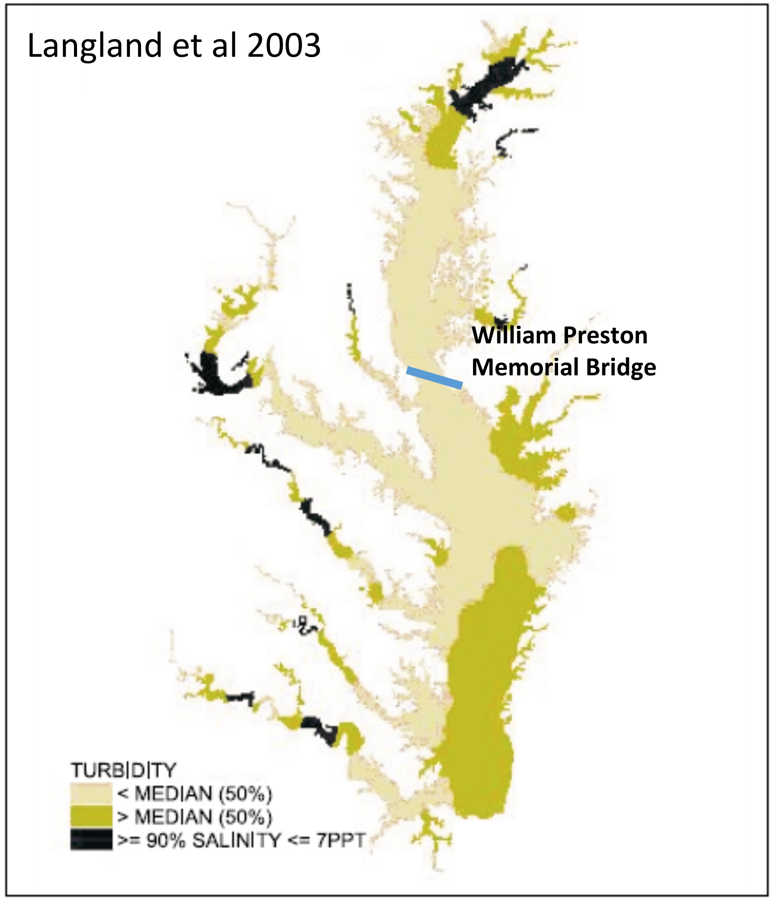


Figure 6.2. General location of turbidity maxima (dark areas) for the major tributaries and the bay (Marsha Olsen, U.S. Environmental Protection Agency, written commun., 2002).

Local tributaries primarily influence shallow Bay resources (SAV beds, crab habitat, oyster reefs, spawning habitat)

2014 STAC Review of LSRWA report:

- The Conowingo Reservoir is essentially at full capacity and is no longer a long-term sink helping to prevent sediment-associated nutrients (primarily particulate phosphorus) from entering the Chesapeake Bay.
- Increases in particulate phosphorus loads entering the Bay as a result of the full reservoir are likely causing significant impacts to the health of the Chesapeake Bay ecosystem.
- Sources of nutrients upstream of the Conowingo reservoir have far more impact on the Chesapeake Bay ecosystem than do the increases in nutrients caused by scour plus reduced deposition in the reservoir.
- Managing sediment via large-scale dredging, bypassing and/or operational changes are clearly not cost-effective ways to offset Chesapeake Bay water quality impacts from the loss of long-term trapping of sediment-associated nutrients.
- As soon as possible, follow-up studies should more fully quantify the impact on Chesapeake Bay water quality from increases in sediment-associated nutrients brought about by reservoir infilling.
- There is no compelling reason to reduce sediment loads *per se* from the Susquehanna watershed to compensate for increased sediment passing out of the Conowingo reservoir. Nutrients are the main problem, not sediments.
- Additional particulate phosphorus load reductions from the Susquehanna watershed (beyond present WIPs) should be considered to compensate for changes to the Conowingo.

From the STAC Workshop on Conowingo Infill

- Increases in phosphorus and sediment flux from the Conowingo Reservoir occurred despite observed reductions in the fluxes of sediment and phosphorus from the upriver Marietta, PA gauge as well as other upstream gauges and were therefore attributed to Conowingo infill.
- Infilling of the Conowingo Reservoir primarily influences particulate nutrient delivery, with negligible influence on fresh water discharge **or dissolved nutrient delivery** to the Chesapeake Bay system. Most nitrogen is transported in dissolved form.
- Under low to moderately high flow conditions, it is likely most of the sediment loading from the Susquehanna is trapped (and buried) by processes at or before the Estuarine Turbidity Maximum (ETM).
- There is significant bypassing of the ETM under very high flow conditions, but when and how much remains to be determined.

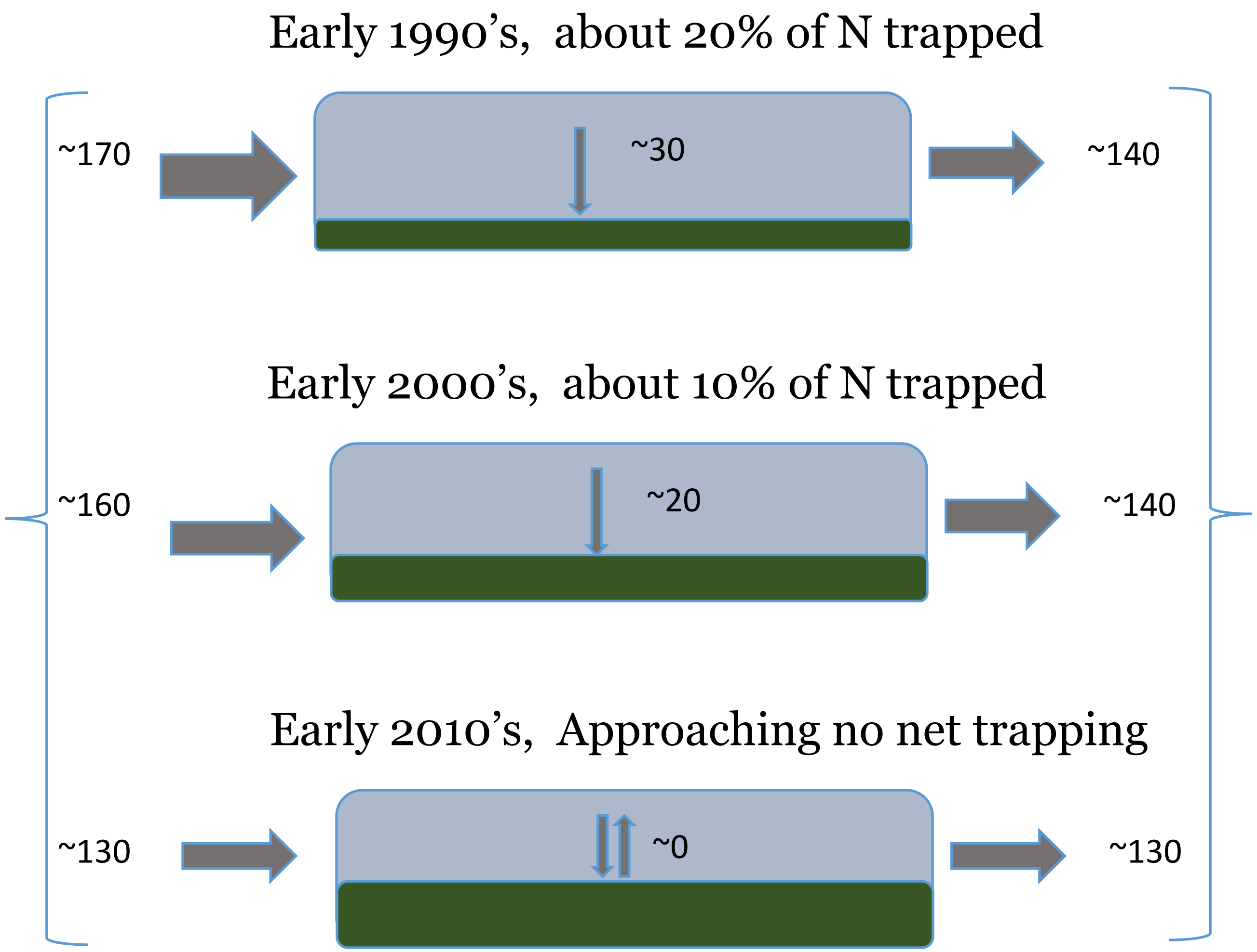
From the STAC Workshop on Conowingo Infill

- Suspended solids loads produced by a Conowingo scour event are relatively non-detrimental to Bay water clarity and SAV survival.
- The organic matter and nutrients associated with the solids are, however, detrimental.
- This material settles to the estuary bottom and is mineralized in bed sediments. Nutrients are recycled to the water column and stimulate algal production.
- As a result of a winter scour event, computed bottom-water DO in the subsequent summer declines up to 0.2 g m^{-3} although the decline is 0.1 g m^{-3} or less when averaged over the summer season.

Nitrogen Loads Into, Trapped Within and Exiting the Reservoir System: 1990s-2010s

From the 2016 Conowingo Infill Webinar

Loads Into Reservoir System
Long term improving trend

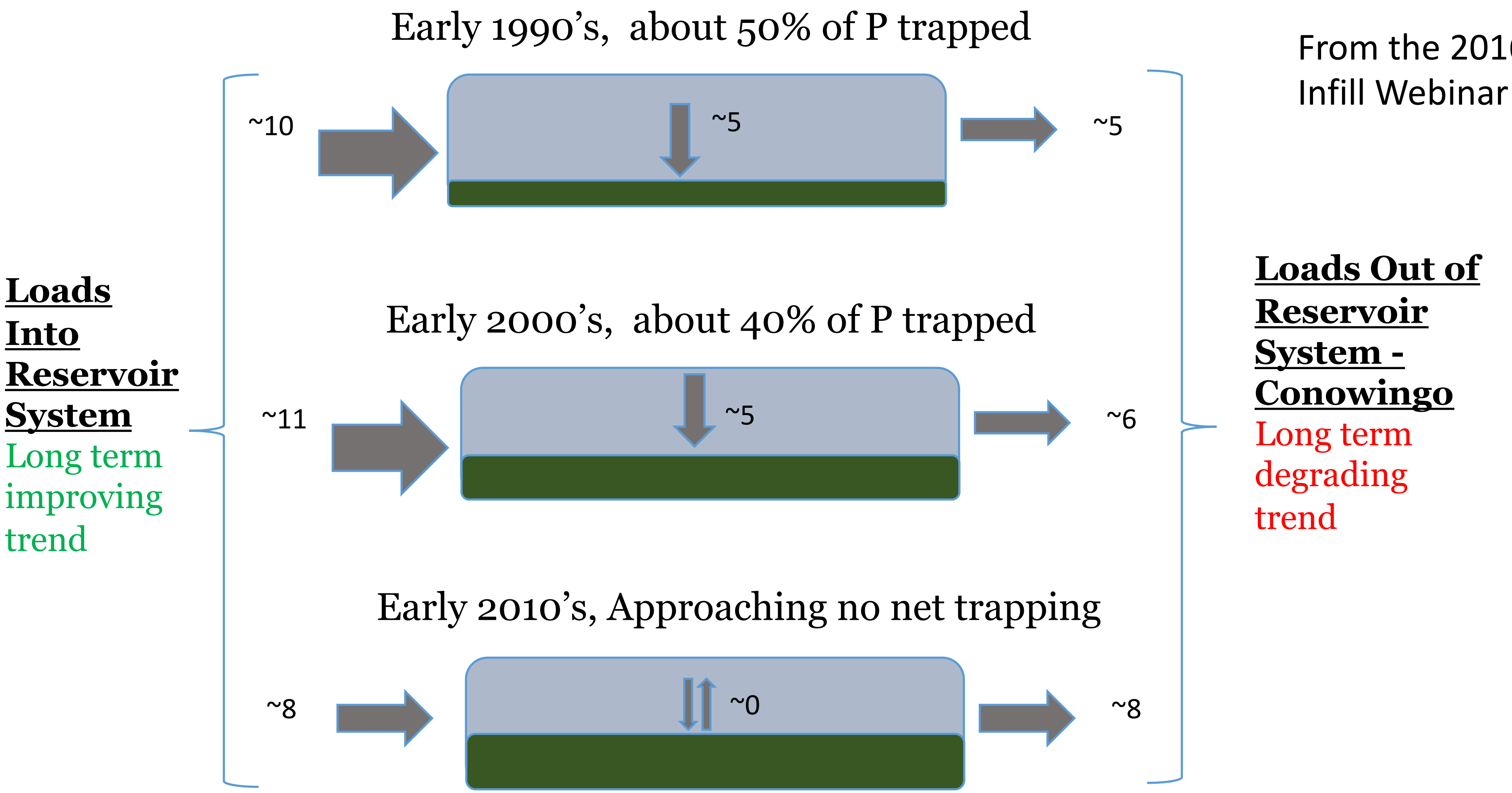


Loads Out of Reservoir System - Conowingo
long term improving trend

Source: Data from USGS (2016), http://cbrim.er.usgs.gov/loads_query.html
loads are approximate and in units of million lbs/year using estimates for 1992, 2002, and 2012

Phosphorus Loads Into, Trapped Within and Exiting the Reservoir System: 1990s-2010s

From the 2016 Conowingo Infill Webinar

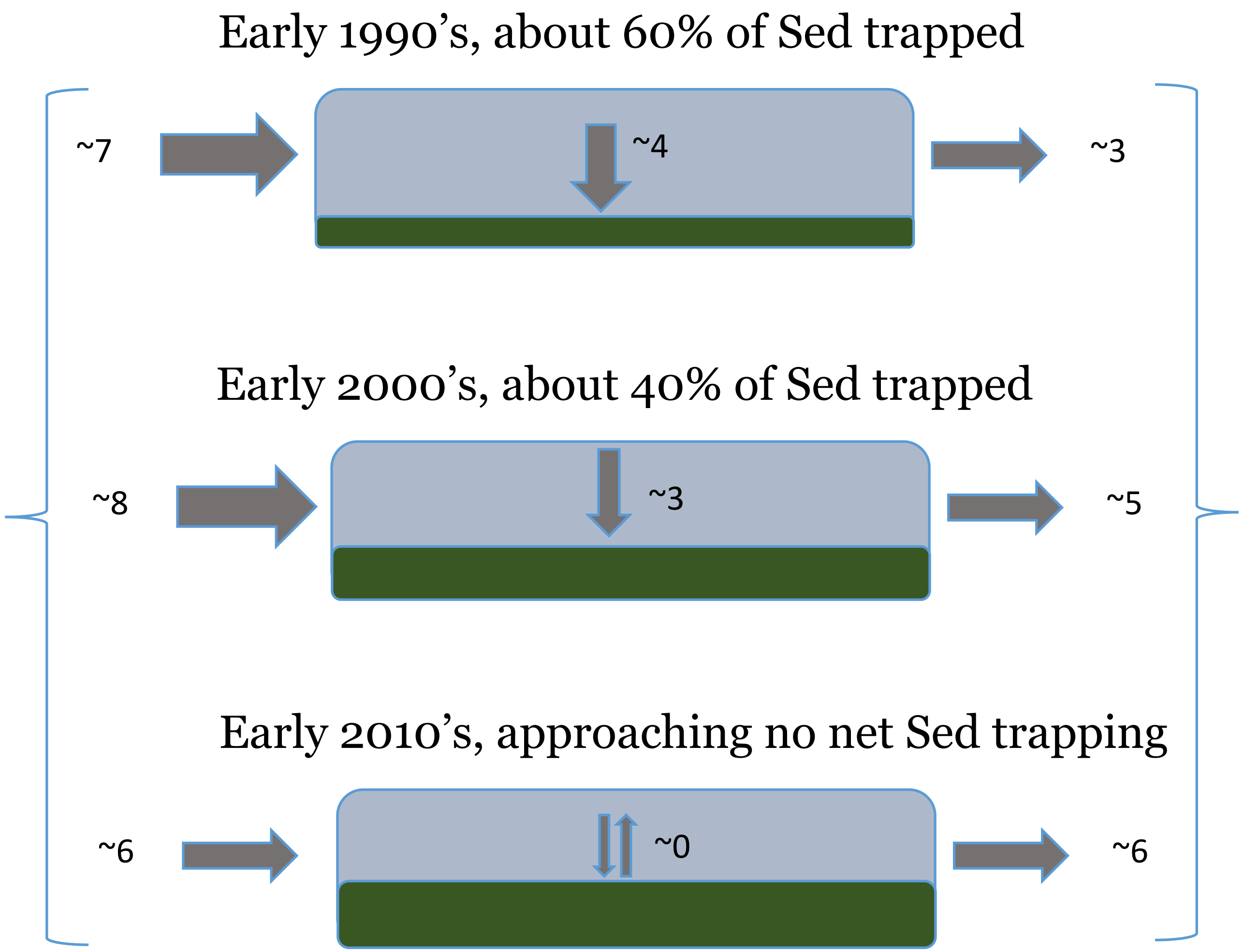


Source: Data from USGS (2016), http://cbrim.er.usgs.gov/loads_query.html
loads are approximate and in units of million lbs/year using estimates for 1992, 2002, and 2012

Sediment Loads Into, Trapped Within and Exiting the Reservoir System: 1990s-2010s

From the 2016 Conowingo Infill Webinar

Loads Into Reservoir System
Long term improving trend

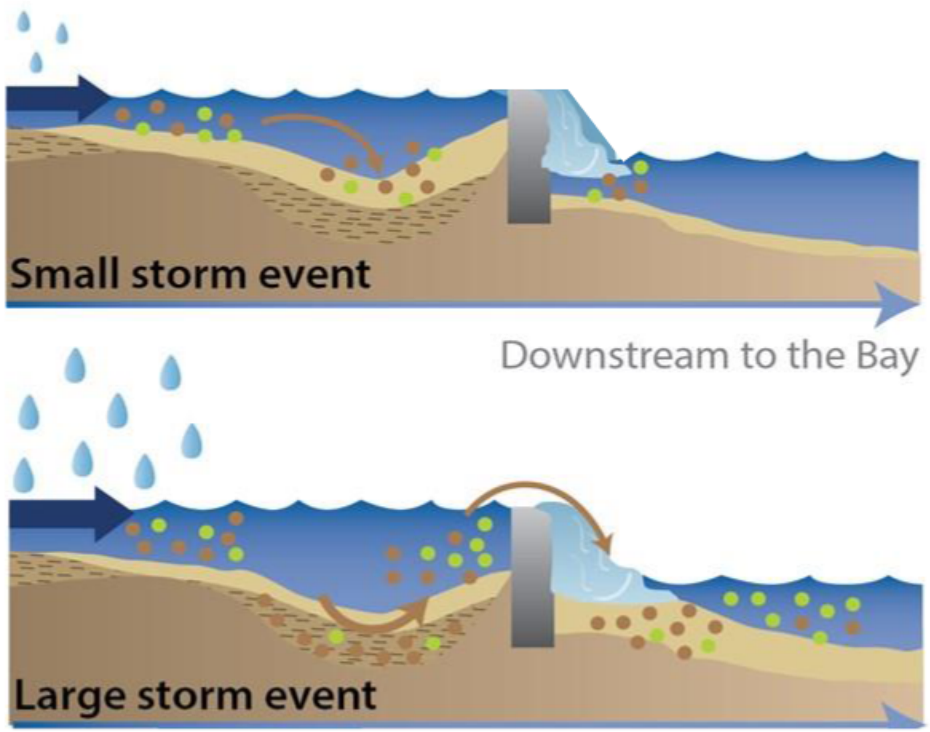


Loads Out of Reservoir System - Conowingo
Long term degrading trend

Source: Data from USGS (2016), http://cbrim.er.usgs.gov/loads_query.html
loads are approximate and in units of billion lbs/year using estimates for 1992, 2002, and 2012

Estimated Loads to the Bay with Conowingo Dam and Reservoir at Infill Conditions

Dec. 2017
WQGIT
Midpoint
assessment



- Almost all of the nutrients are from upstream sources
- Much of the nutrients are biologically available to algae when they enter tidal waters

- Some of the nutrients are scoured from the bottom sediments behind the dam
- Much of these scoured nutrients are <u>not</u> biologically available to algae when they enter tidal waters

Therefore, the determination of nutrient loads to be reduced to account for Conowingo infill must factor in the type of nutrients and the timing of delivery

Estimated Loads to the Bay with Conowingo Dam and Reservoir at Infill Conditions

Recommendations

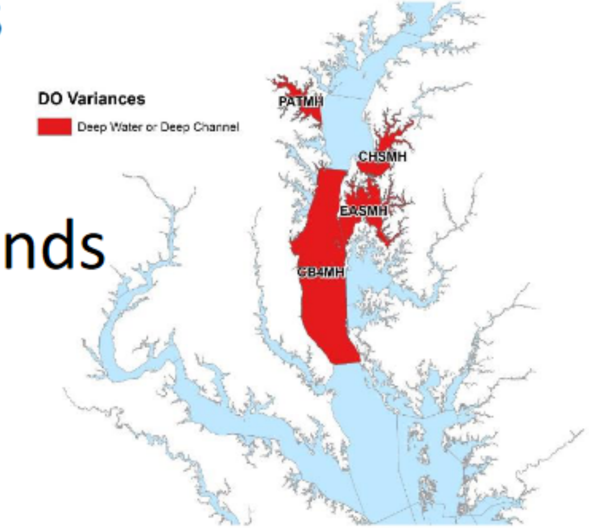
- Keep the focus on nutrients
- Assume necessary sediment load reductions will occur as the result of implementation of practices needed to achieve nutrient load reductions

Estimated Loads to the Bay with Conowingo Dam and Reservoir at Infill Conditions

Additional Nitrogen Load: 13 million pounds

+

Additional Phosphorus Load: 1.8 million pounds



HOWEVER: These are less bioavailable nutrients and its delivery to Bay is dependent on large storm events. Therefore, only a smaller than expected (2 percent increase) in non-attainment in Middle Central Chesapeake Bay Deep-Channel. Equivalent to 6 million pounds of Nitrogen and 0.26 million pounds of Phosphorus

- In December 2017 the idea of a separate Watershed Implementation Plan to address these additional loads was brought to the Principals Staff Committee
- Draft Conowingo Watershed Implementation Plan released in October 2020
- Public comment period ended January 2021, final draft CWIP brought to PSC in May, PSC members voting to approve by email to submit to EPA, approval of final CWIP anticipated September
- CWIP financing strategy still under development, draft plan to be submitted in December for implementation in 2022
- Also in 2017 a series of UMCES reports prepared to provide background prior to the Exelon relicensing agreement were released, followed by a 2019 paper

2019 paper summarizing the 2017 UMCES studies conducted to improve understanding in advance of the Exelon relicensing agreement

Estuaries and Coasts
https://doi.org/10.1007/s12237-019-00634-x

Influences of a River Dam on Delivery and Fate of Sediments and Particulate Nutrients to the Adjacent Estuary: Case Study of Conowingo Dam and Chesapeake Bay

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Received: 23 April 2019 / Revised: 2 August 2019 / Accepted: 11 September 2019

Estuaries and Coasts

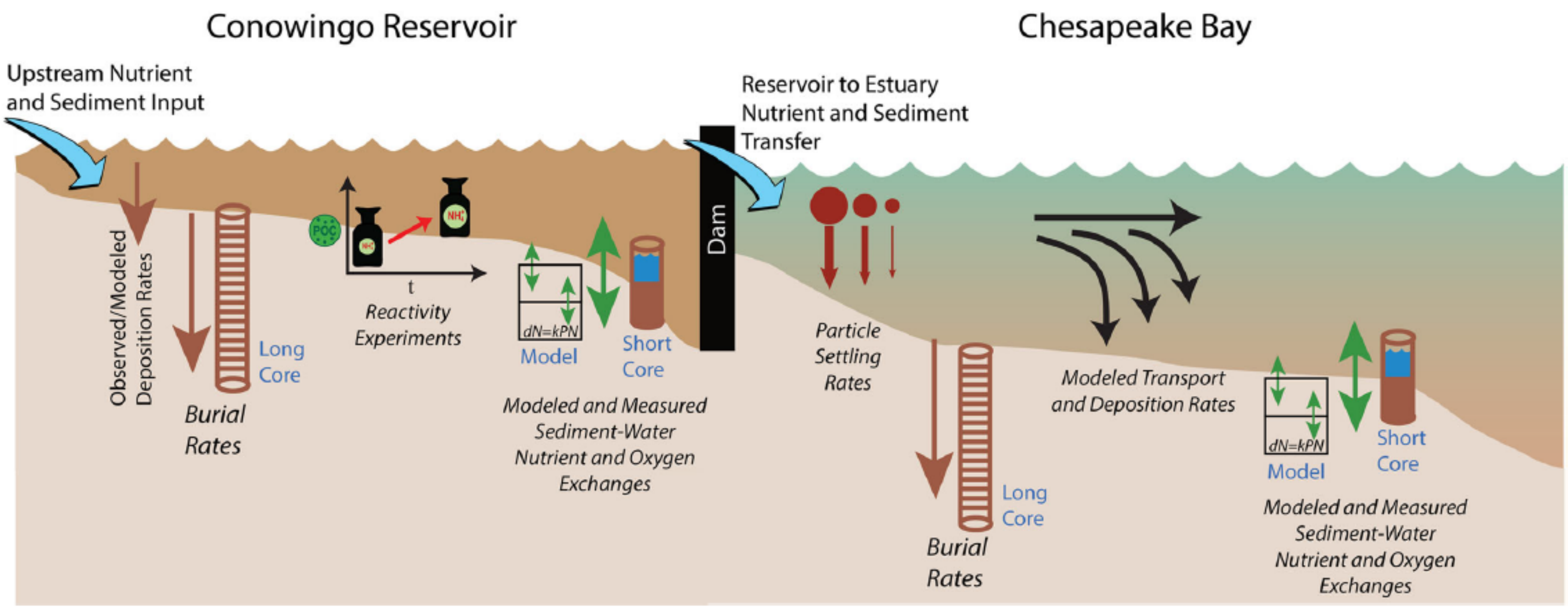


Fig. 1 Conceptual model of the various methods used in this study and their relationships to components of the Conowingo Reservoir-Chesapeake Bay continuum. See "Methods" for details of individual methods

From the UMCES July 2017 reports and Palinkas et al. 2019

- Model analyses of reservoir sediments suggest that a substantial scour event (top 5 cm of the entire reservoir) would contribute 20% of P loads in a TS Lee-like storm and only 6% of N loads.
- The scoured particulate N and P loads that do enter the Chesapeake Bay are also highly refractory (turnover time » 1 year).
- Particulate forms of N and P that enter Chesapeake Bay are efficiently retained in the upper Bay, especially near the Susquehanna River mouth, due to high sinking rates or trapping within the ETM (Sanford et al. 2001).
- The tidal fresh/oligohaline region where the majority of sediments deposit has typically low rates of sediment-water N and P fluxes, as a result of high rates of denitrification (Testa et al. 2013), effective phosphorus retention in iron-enriched, oxidized sediments (Hartzell et al. 2017), and low reactivity of the organic material.
- Any scoured material that is regenerated in the upper Bay enters a highly enriched water column that is rarely nutrient limited (Fisher et al. 1999).
- Model simulations of scour events within Conowingo Reservoir have only shown marginal impacts on dissolved oxygen (Cerco 2016).
- Slurrying of sediments for dredging and transport of dredge spoil could release high concentrations of ammonium to the water column. This should be studied further.

Key takeaways from the Palinkas et al. abstract:

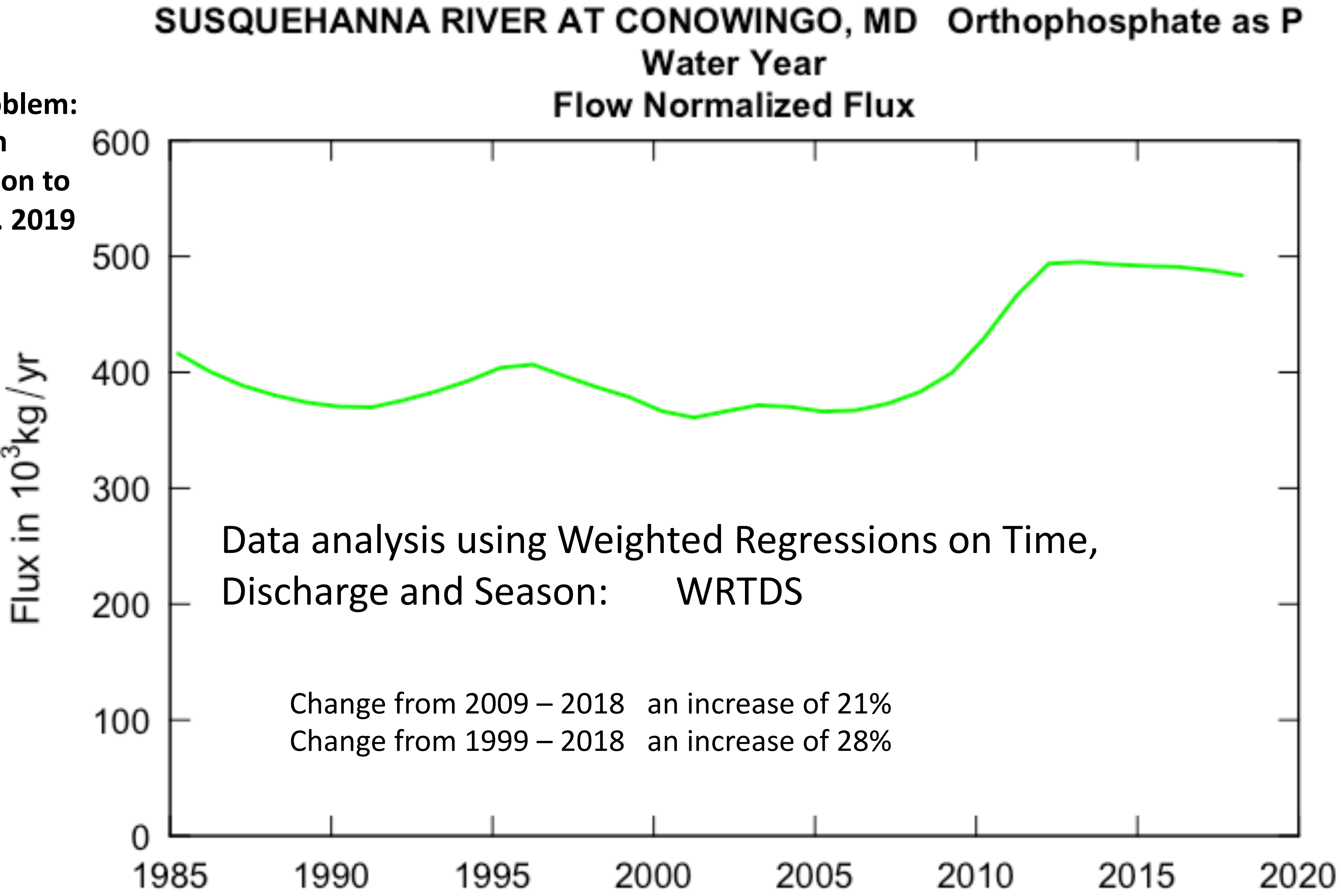
Loads entering the estuary are largely retained in the upper Bay – but can be transported farther downstream during large events

Reservoir sediments are highly refractory and inputs of reservoir-like organic matter DO NOT enhance modeled sediment-nutrient release in upper Bay sediments

These findings highlight the Bay's resilience to large sediment loads during events such as Tropical Storm Lee in 2011, likely aided by ongoing restoration efforts

While events can have major short-term impacts, the long-term impact to Bay biogeochemistry is less severe

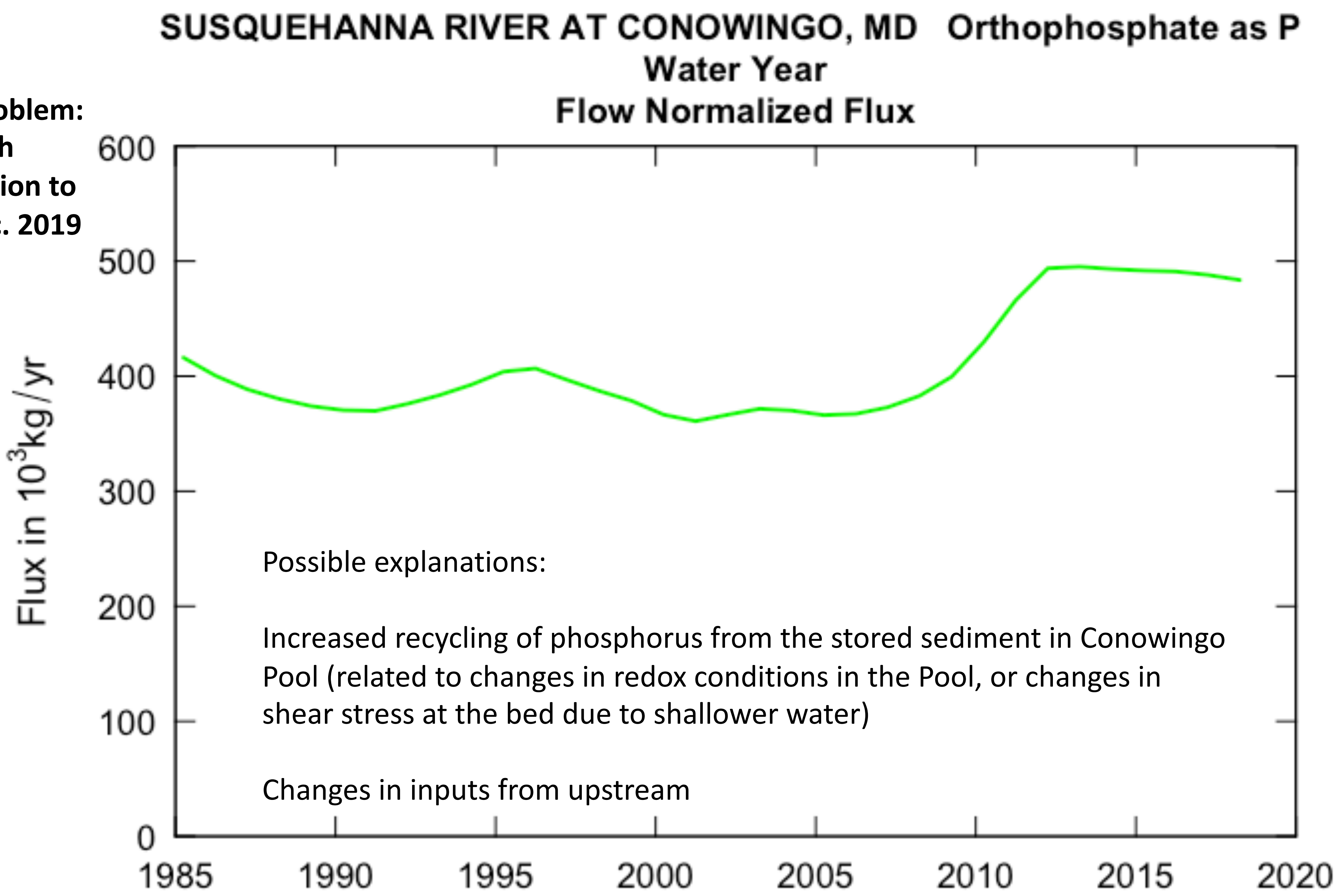
A new problem: Bob Hirsch presentation to STAC, Dec. 2019



Data analysis using Weighted Regressions on Time, Discharge and Season: WRTDS

Change from 2009 – 2018 an increase of 21%
Change from 1999 – 2018 an increase of 28%

A new problem: Bob Hirsch presentation to STAC, Dec. 2019

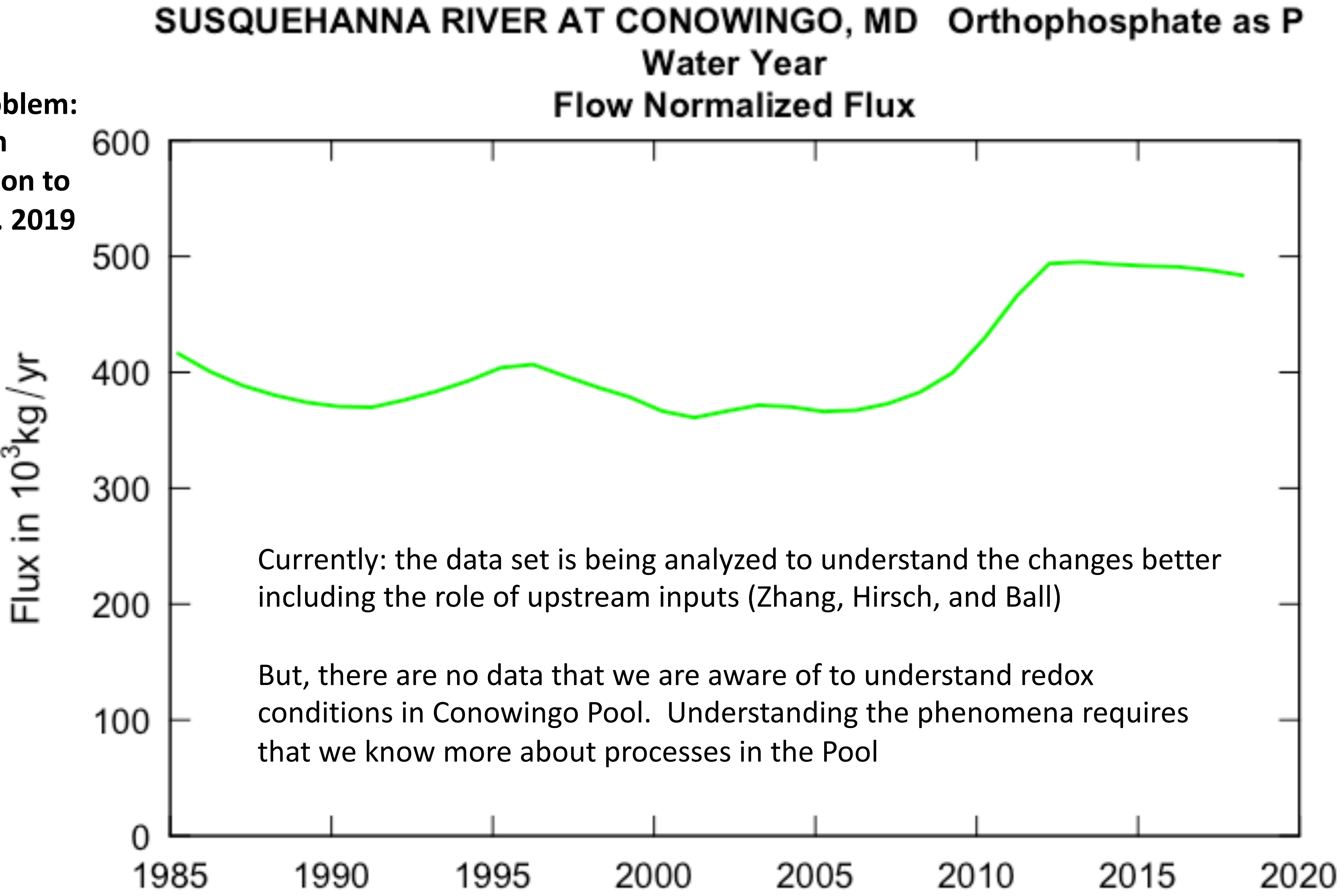


Possible explanations:

Increased recycling of phosphorus from the stored sediment in Conowingo Pool (related to changes in redox conditions in the Pool, or changes in shear stress at the bed due to shallower water)

Changes in inputs from upstream

A new problem: Bob Hirsch presentation to STAC, Dec. 2019



Currently: the data set is being analyzed to understand the changes better including the role of upstream inputs (Zhang, Hirsch, and Ball)

But, there are no data that we are aware of to understand redox conditions in Conowingo Pool. Understanding the phenomena requires that we know more about processes in the Pool

- Exelon and State of Maryland agreed on a relicensing plan in October 2019
- STAC submitted a comment in January 2020 recommending funds from the agreement should be committed to study of biogeochemical processes that might lead to release of dissolved orthophosphate from the reservoirs to the upper Bay

January 17, 2020
To: Federal Energy Regulatory Commission (FERC)
Docket #P-405-106

Statement on behalf of the Chesapeake Bay Program Scientific and Technical Advisory Committee

STAC recommends that MDE consider using some of the funds from the Exelon agreement to undertake new programs of monitoring within Conowingo Reservoir and its environs that will allow better understanding of trends affecting the flux of dissolved nutrients, and particularly dissolved phosphorus, to the upper Bay. This comment is not related to any specific concerns with the written agreement per se, but rather relates to what STAC perceives as an appropriate interpretation of how some of the proposed funding might best be used.

Recent trend analysis based on a set of 925 samples collected and processed by USGS between 1985 and 2018 indicates with a high degree of certainty that there has been an increase in flow-adjusted dissolved phosphorus flux from the Susquehanna River over that time period. At this time we do not have an explanation for the trend, but there is some concern, based on patterns that have been observed both in lakes and in tidal fresh estuarine waters, that increased dissolved phosphorus input might increase the potential for harmful algal blooms in the upper Bay.

This is not necessarily related to the filling of Conowingo reservoir with sediment or the role of large floods in excavating sediment from storage, which has more to do with particulate than with dissolved material flux. Dissolved phosphorus was not a primary topic of investigation in previous research projects. It is the consensus opinion of scientists who are familiar with the evidence from previous studies that we need a better understanding of the dynamics of nutrient exchange and mobilization within the reservoir system and the changes associated with increased export of phosphorus in dissolved form. Earlier reports, including the 2015 Lower Susquehanna River Watershed Assessment and the STAC review of that document, have also articulated the need for such understanding.

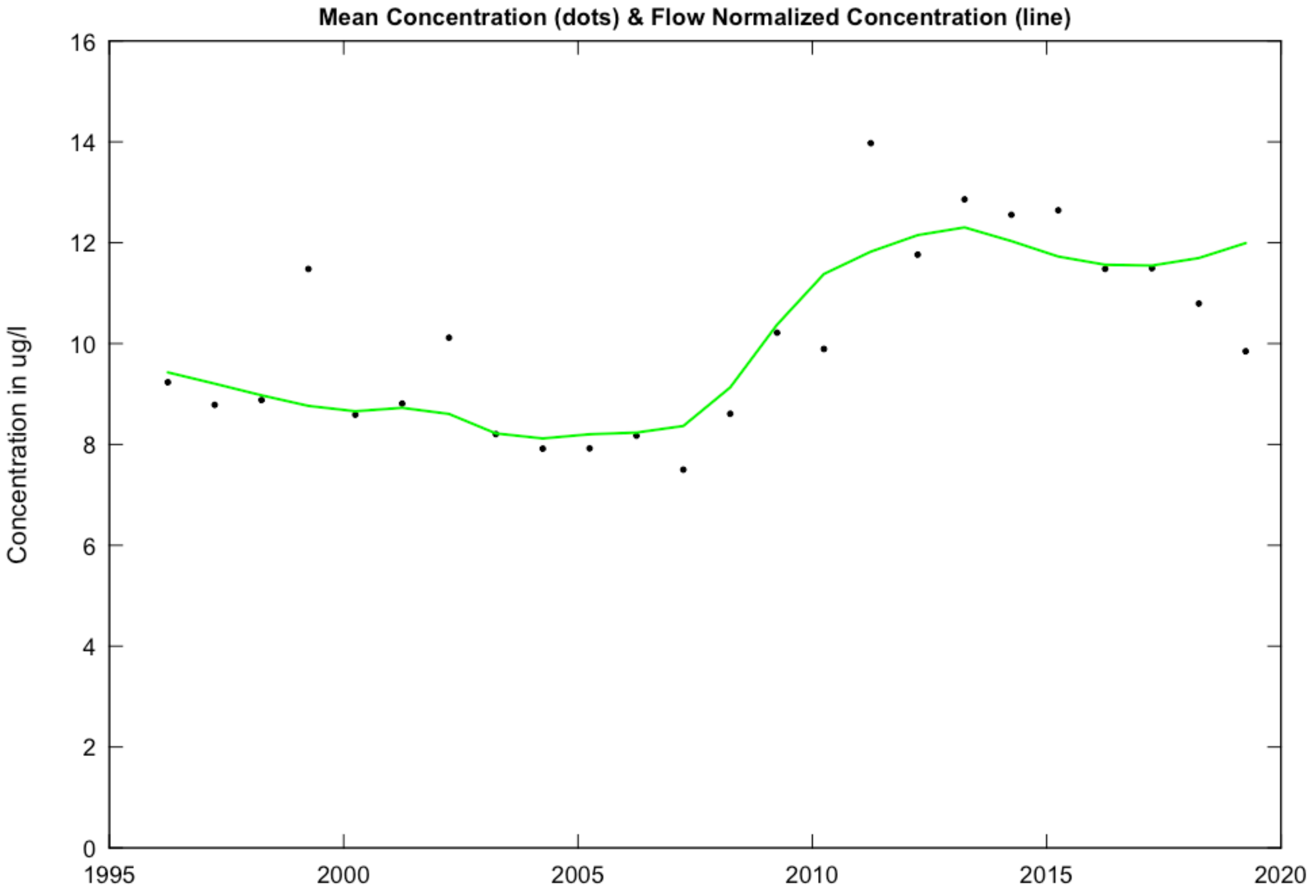
Recent obsevations - from Joel Blomqist, USGS

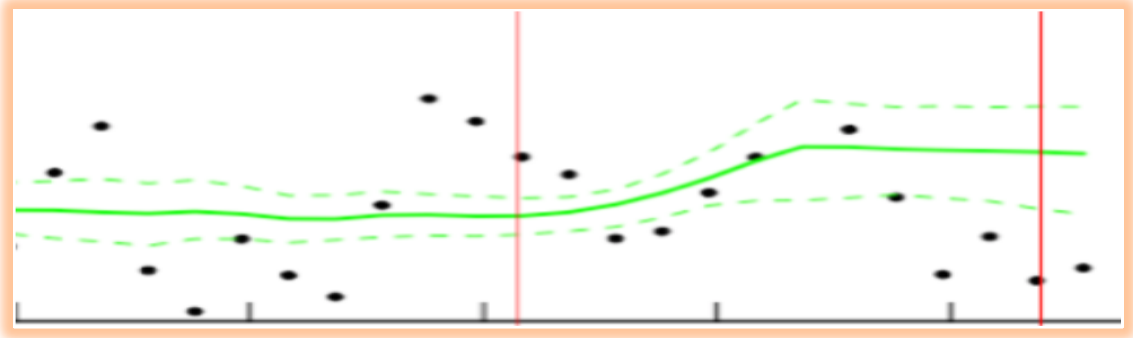
Susquehanna River at Conowingo, MD Chlorophyll-A

- Chlorophyll A concentration trends are commensurate with observed PO4 flux increased

- Trends are focused on changes on low to mid-range flows

- Given the observed ecological response in Conowingo Reservoir, one must expect a similar response occurred in the upper freshwater Chesapeake





Ecological Changes In Conowingo Reservoir

Emergence of SAV beds (early 2000's?)

Fall die off

Photos: J. Blomquist, Oct 9, 2013

Increase in Mayfly swarms
(Timeframe undocumented)

Photo: Wikipedia

Additional points from Joel Blomquist:

Nancy Rybicki (USGS) conducted some preliminary work to try to evaluate growth of submersed aquatic vegetation in the three reservoirs

Goal was to evaluate whether dissolved orthophosphate trends might be accounted for by the increased SAV growth, senescence, and released of solutes upon decay

According to Joel, this accounted for 10% or less of the observed increase

The jury is still out on what is happening and whether it poses a risk

Increases in orthophosphate load and consequences

The biggest unresolved scientific questions that are not being addressed by the watershed partners are:

- what is causing the increase in orthophosphate concentrations coming from the reservoirs?
- Do these have the potential to cause problems with Harmful Algal Blooms?
- What if anything can be done to mitigate this problem if it has the potential for serious consequences?

- STAC has already posted a comment on the Exelon agreement requesting some funding of studies
- USGS and partners have submitted grants to multiple funding sources and have been unable to get traction on this issue
- What else can/should STAC do to highlight this issue?