

# Assessing Conowingo's Super BMP Power



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## Can the Bay region dredge its way out of Conowingo Dam problem?

Karl Blankenship Jan 18, 2021 Updated Feb 5, 2021 1

**Presenters:**

- Andy Miller (UMBC): Key Background Review**
- Kathy Boomer (FFAR): Conowingo's Potential as an AdM Case Study**
- Larry Sanford (UMES): Monitoring Recommendations Discussion**



**Conowingo summary: what have we  
discussed in the last two meetings and  
what are our goals?**

**Andy Miller  
STAC Quarterly Meeting  
December 7, 2021**

## **Summary of previous investigations and STAC involvement**

- Lower Susquehanna River Watershed Assessment (2014 Draft, 2016 Final Report)
- STAC Review of LSRWA (2014)
- USGS long-term analyses of sediment and nutrient flux
- STAC Workshop on Conowingo Reservoir Infill (2016)
- UMCES Reports on Biogeochemistry, Geology and Physics of Conowingo Reservoir and Upper Chesapeake Bay (2017)
- 2019 USGS analysis of orthophosphorus flux trends
- 2020 STAC comment and recommendation to FERC on Exelon Agreement
- September 2021 conversations about pilot dredging programs and about recent research on Conowingo sediment and biogeochemistry

## Why have we engaged with this topic now?

- Continuing discussions about the influence of Conowingo infill and of sediment remobilized during storms on upper Bay water quality
- Creation of new Conowingo WIP
- Completion of pilot dredging programs by Northgate Environmental for MDE (not including any research on biogeochemistry)
- Recent research findings about biogeochemistry associated with remobilization of bottom sediment in the reservoirs → need for new research to understand dynamics
  - Including need to understand how dredging might affect biogeochemical cycling in the reservoir (see recommendations from Joel Blomquist, USGS)

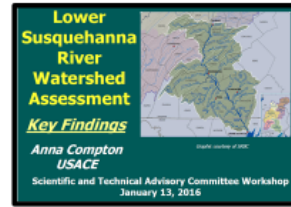
## Questions to be addressed

- Have we learned anything new over the last seven years that would suggest previous scientific conclusions need to be updated?
- What science questions need to be addressed now in order to support future policy decisions affecting Conowingo?
- What recommendations (if any) does STAC want to make regarding science needs for monitoring and data collection or for new process studies?

## Conowingo as a Model for Advancing CBP Adaptive Management:

- Observable science-to-policy implementation
- Tractable science-management challenge and research opportunity
  - Multi-model framework
- Communications challenge

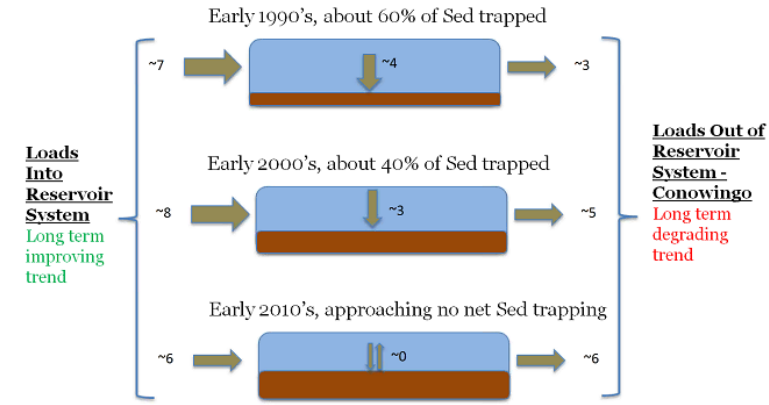
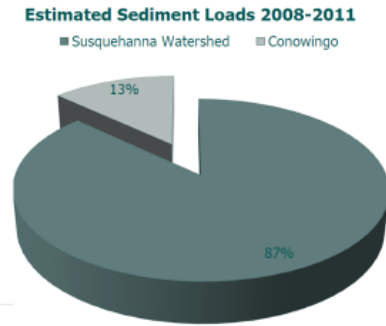
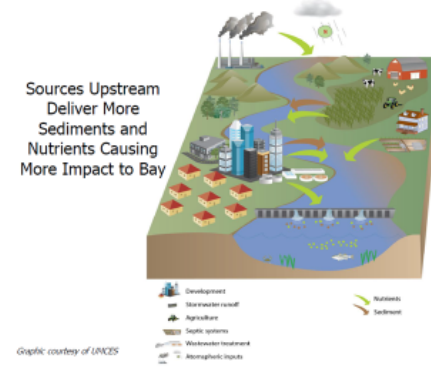
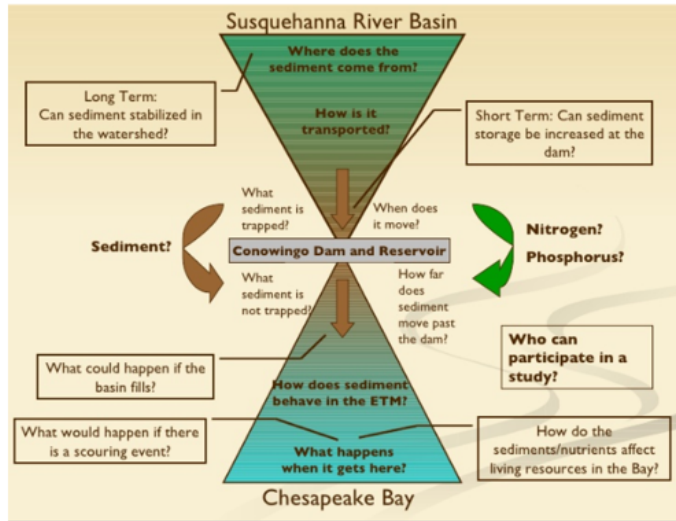
# Conowingo Reservoir - Science to Policy History



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

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

## 2016 LSRB Management Assessment



Source: Data from USGS (2016), [http://cbrim.er.usgs.gov/loads\\_query.html](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

### 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

- Dredging = Minimum, Short Lived Water Quality Benefits
- 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

## 2017 Conclusions

### Maryland Environmental Service Announces Start of Pilot Dredging Project at Conowingo Dam

**1,000 Cubic Yards to be Removed for Testing, Potential Reuse**

October 13, 2021

**\$3M/1000 yd<sup>3</sup>-yr**

FOR IMMEDIATE RELEASE:

MILLERSVILLE, MD – In an important step toward understanding the role that dredging can play in mitigating the effects of upstream discharges and the lost trapping capacity of the Conowingo Dam, the Maryland Environmental Service (MES), in coordination with the Maryland Department of the Environment (MDE), today announced that the dredging portion of the Conowingo Dredging and Innovative and Beneficial Reuse Pilot Project is scheduled to begin.

The contractor will dredge approximately 1,000 cubic yards of sediment, equivalent to 100 dump truck loads, from the Conowingo Reservoir, providing dredged material for various innovative reuse testing programs, including concrete and asphalt manufacturing, cement clinker, soil blending for sport horticulture, engineered highway soil, and/or supplemental cementitious materials.

The Conowingo Hydroelectric Dam, constructed in 1928, and owned and operated by Exelon Generation Company, LLC, has in the past trapped sediment and nutrients that enter the Susquehanna River upstream of the dam. Scientific reports confirm that the Conowingo Dam has reached full capacity and can no longer trap sediment and nutrients, meaning that upstream pollution is now entering the Chesapeake Bay.

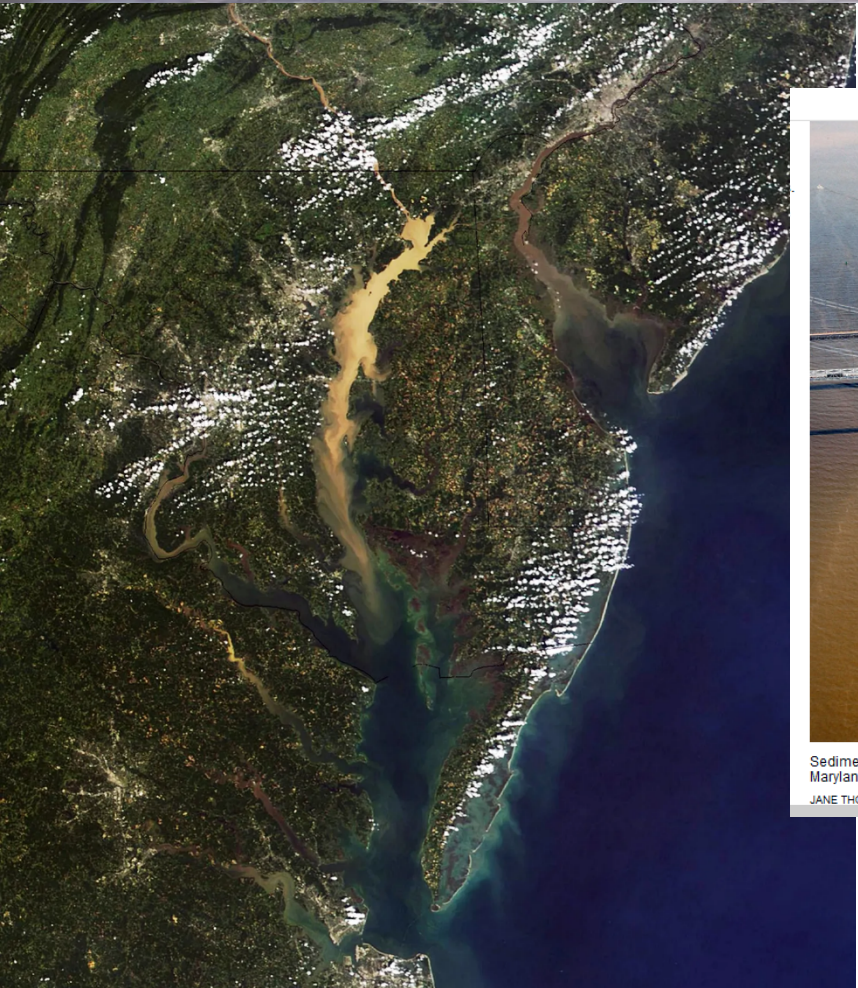
The Conowingo Dredging and Innovative and Beneficial Reuse Pilot Project is part of a multi-pronged approach to improve the health of the Chesapeake Bay. The state's holistic strategy includes conditions relating to the relicensing of the dam and an agreement between MDE and Exelon that requires the company to invest more than \$200 million in ecological and environmental projects and services, and operational enhancements to improve water quality in the Susquehanna River and Chesapeake Bay. It also includes an unprecedented, multi-state Conowingo Watershed Implementation Plan specifically designed to address the additional pollution that is moving into the Chesapeake Bay as a result of the lost trapping capacity of the Conowingo Dam.

## 2021 Actions



**KILLING THE CHESAPEAKE**

# Dammed if you dredge, dammed if you don't: Conowingo's toxic muck a vexing problem for bay



Sediment-laden plumes converge around the Chesapeake Bay Bridge in Maryland following huge rainstorms in 2006.  
JANE THOMAS, UNIVERSITY OF MARYLAND

The Conowingo Dam's reservoir is filled with decades' worth of sediment and pollution. **With each passing storm, more gets pushed into the Chesapeake Bay.**

Julia Rentsch, Salisbury Daily Times  
Published 3:54 PM EST Feb. 2, 2021

Local Opinions: **Maryland Gov. Hogan could save the Chesapeake**, By Andrew Manale

Continued purposeful neglect of the problem of the **sediment-filled reservoir behind the dam will mean disaster for the health of the Chesapeake Bay**, for the recreation that fulfills the life of the residents of our area, for the commercial activity that sustains bay communities, and for the wildlife that all of us value and wish to protect.

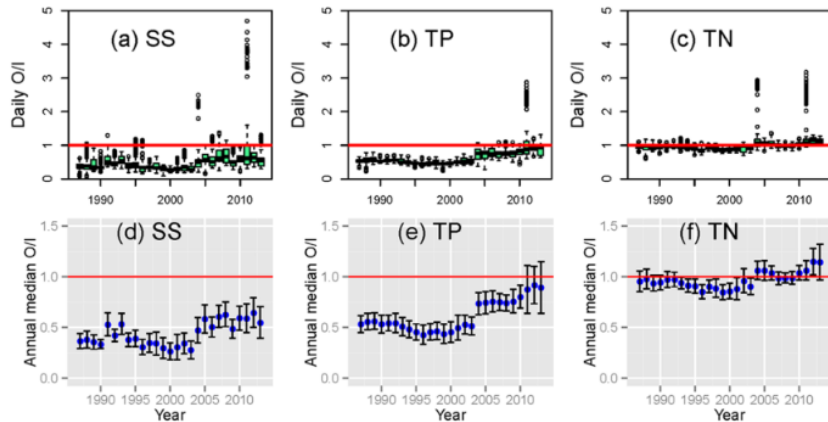
The Washington Post, August 20, 2021 at 10:00 a.m. EDT



# Evaluating Conowingo Reservoir's Super BMP Potential: What about the correlation between MDE infill model and declining water quality trends?

Long-Term Changes in Sediment and Nutrient Delivery from Conowingo Dam to Chesapeake Bay: Effects of Reservoir Sedimentation

Qian Zhang,<sup>\*,†</sup> Robert M. Hirsch,<sup>‡</sup> and William P. Ball<sup>†,§</sup>



## • Popular Explanation:

- Increased reservoir scour potential at lower storm flows, decreased reservoir deposition

## • Alternative/Additional Explanations:

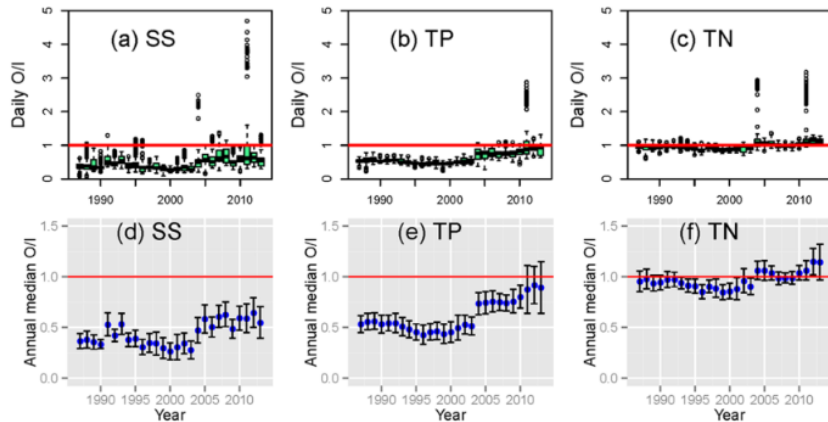
- Reservoir has limited influence on storm loads
  - Increased local catchment loads
  - Increased internal nutrient release under low flows
- (Historical) measurement error

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Environmental Science & Technology



## • Popular Explanation:

- Increased reservoir scour potential at lower storm flows, decreased reservoir deposition

→ (Strategic) dredging to “mine” sediment and nutrients and restore/manage trapping capacity

## • Alternative/Additional Explanations:

- Reservoir has limited influence on storm loads
  - Increased local catchment loads
  - Increased internal nutrient release under low flows

→ Watershed BMP implementation

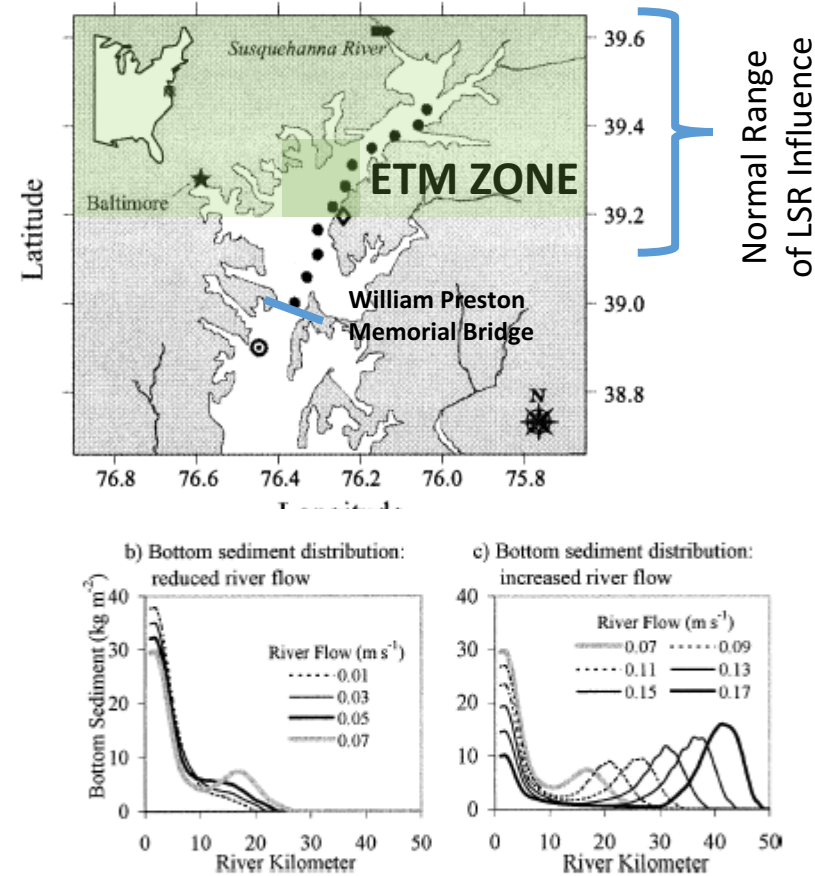
- (Historical) measurement error

→ Low flow management

Susquehanna River has limited influence on Chesapeake Bay shallow waters

# COROLLARY: Bay Restoration Depends on Watershed Management in All of Its Tributaries

North et al 2004:



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

Langland et al 2003

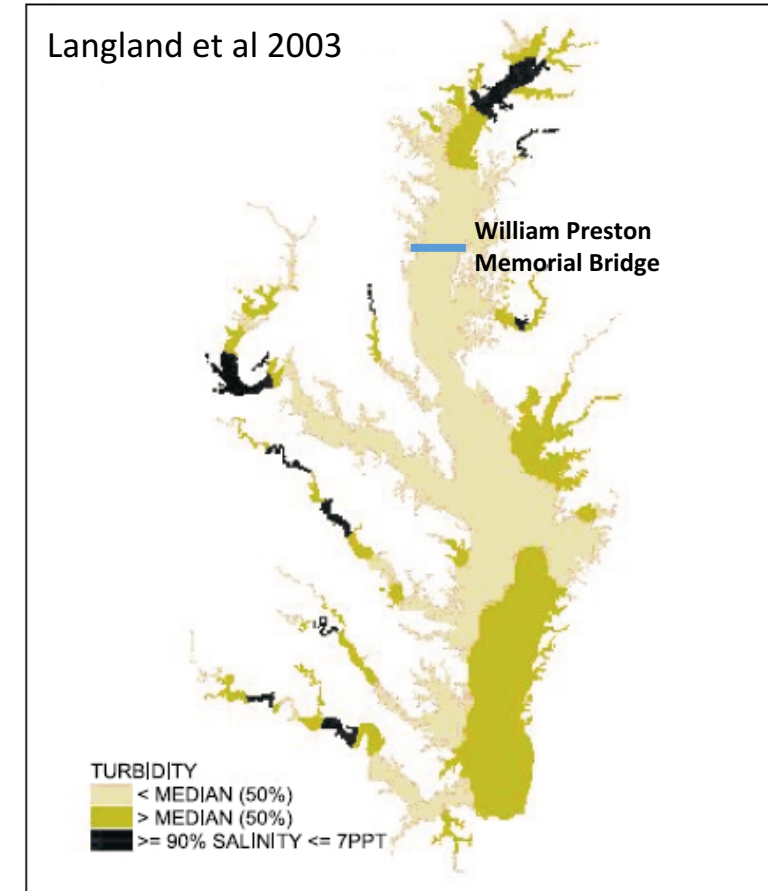


Figure 6.2. General location of turbidity maxima (dark areas) for the major tributaries and the bay (Marsha Olsen, U.S. Environmental Protection Agency, written commun., 2002).


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



  
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# Can the Bay region dredge its way out of Conowingo Dam problem?

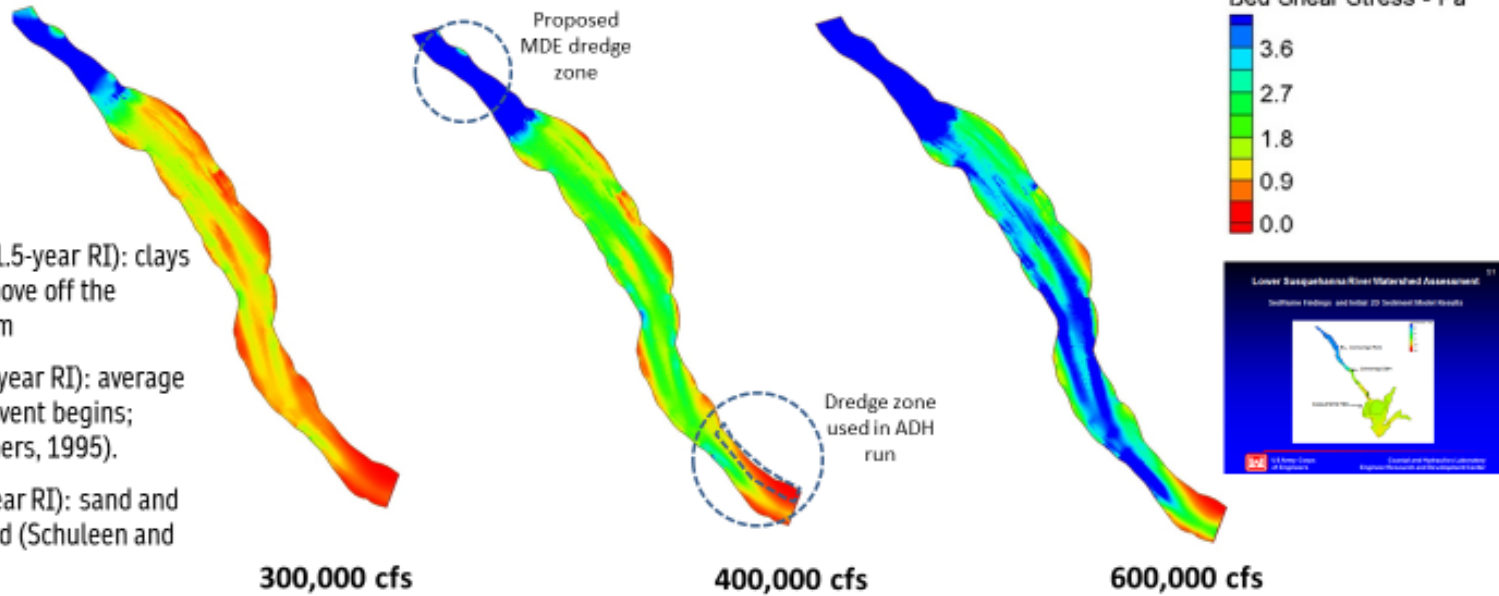
Karl Blankenship Jan 18, 2021 Updated Feb 5, 2021  1



**Selected Management Action Provides Research Opportunity:**  
How do we measure expected vs observed outcomes?  
How do we evaluate whether dredging provides favorable outcomes?  
What role can/should STAC play given relevance to CBP goals?

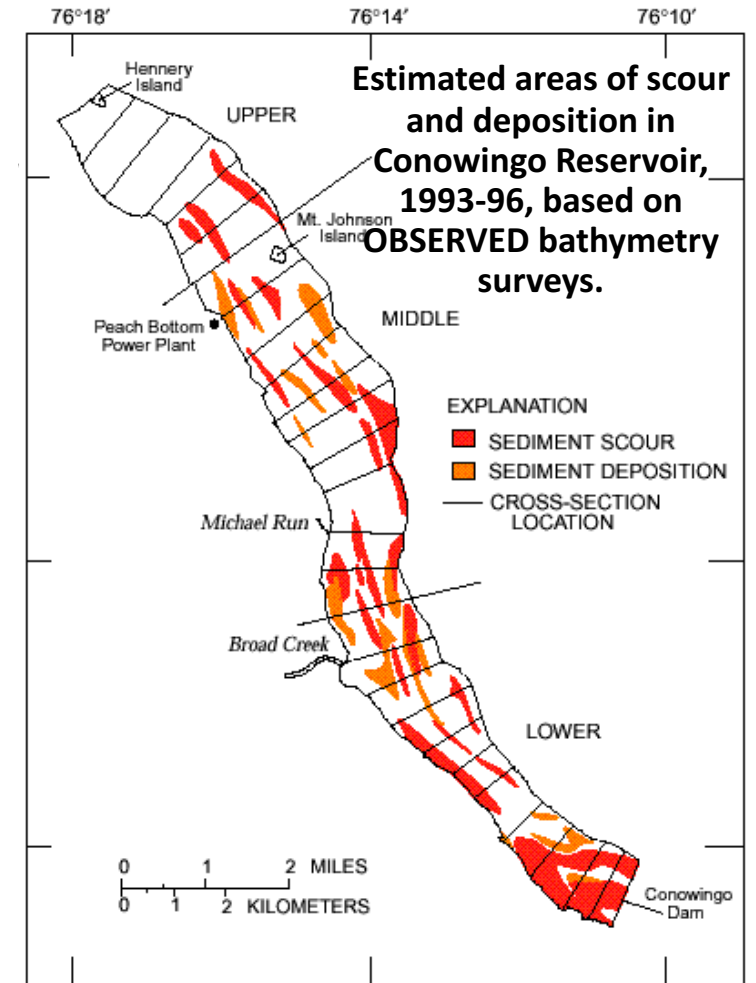
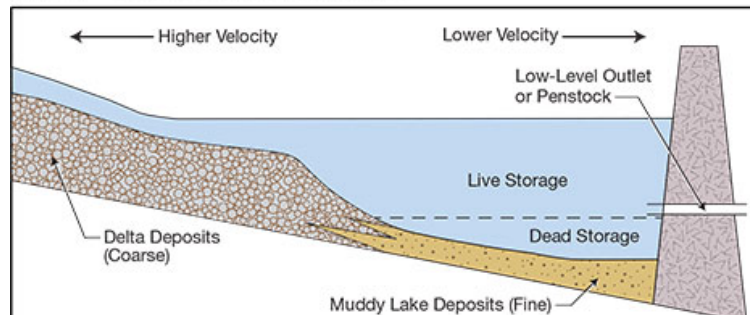
# Dredging Operation System Response: Monitoring/Research Opportunity

## Modeled Conowingo Reservoir Sediment Dynamics



- 200-250K cfs (1.5-year RI): clays and fine silts move off the reservoir bottom
- 400,000 cfs (5-year RI): average mass wasting event begins; (Hainly and others, 1995).
- 600K cfs (10-year RI): sand and gravel mobilized (Schuleen and Higgins, 1953).
- Since 1972, 11 storms with greater than 400K ft<sup>3</sup>/s flow.

SOURCE: Langland, OFP 2014-1235





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### Guardians of the Reservoir




Launched: July 14, 2020

Phase 1 Submissions Deadline: October 20, 2020, 5:00 pm EDT (CLOSED)

December 10, 2020 — Reclamation moves five ideas forward in prize competition to help improve sediment removal in reservoirs

[Read more about the winners on the Guardians of the Reservoir website](#)

The lifespan of reservoirs relies on our ability to effectively and continually manage sediment. Sediment enters reservoirs each year, particularly when rivers are experiencing floods or runoff conditions. Sediment accumulation reduces available water

Biographies 

- [Governor Larry Hogan](#)
- [Lt. Governor Boyd K. Rutherford](#)
- [First Lady Yumi Hogan](#)

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## Governor Hogan Announces Landmark Agreement with Exelon on Conowingo Dam

*Proposed settlement to provide more than \$200 million toward Chesapeake Bay restoration and environmental projects*

**ANNAPOLIS, MD**—Governor Larry Hogan today announced a comprehensive agreement between the Maryland Department of the Environment (MDE) and Exelon Generation Company, LLC, which requires Exelon to invest more than \$200 million in environmental projects and operational enhancements to improve water quality in the Lower Susquehanna River and the Chesapeake Bay.

The agreement settles Exelon's legal challenges to the water quality certification issued in 2018 by Maryland under Section 401 of the Clean Water Act, removing the prospect of years of costly litigation and delay and, instead, setting the stage for immediate and lasting water quality benefits.

"Our administration has committed an historic \$5 billion toward wide-ranging bay initiatives and taken bold and aggressive steps to address the challenges posed by pollution, sediment, and debris at the Conowingo Dam," said Governor Hogan. "This settlement is a significant and positive step in the right direction, and with the cooperation of Exelon and upstream states, we can continue making progress in our efforts to preserve and protect this great national treasure."

Under the agreement, Exelon will make a total investment of more than \$200 million, including nearly \$107 million in cash payments to support these environmental initiatives:

- \$52 million to implement new requirements for flow control that will create more natural conditions in the Lower Susquehanna River, resulting in enhancements to aquatic life and the downstream ecosystem, and better upstream migratory fish passage.
- \$47 million for climate resiliency projects, including submerged aquatic vegetation, clams, oysters, and restoration of living shorelines.
- \$41 million to significantly increase efforts to remove trash and debris flowing down the Susquehanna River.
- \$25 million for an unprecedented initiative to restore a healthy population of water-filtering mussels in the Susquehanna River, including contribution of land for the construction of a 40,000 square foot, state-of-the-art hatchery.
- \$19 million for other projects to improve water quality in the Chesapeake Bay, including agricultural projects such as cover crops and forest buffers.
- \$12 million to support MDE and the Department of Natural Resources in overseeing and implementing the agreement.
- \$11 million—over and above the commitments already made by Exelon in its 2016 settlement with the U.S. Fish and Wildlife Service—to make upgrades and operational changes to improve the passage of migrating fish and eels.
- \$5 million to conduct chlorophyll A monitoring and reporting.
- \$1 million for eel-related research and projects.
- \$500,000 to fund a study of dredged material management options.

Elements of the agreement will be submitted for approval to the Federal Energy Regulatory Commission (FERC) as part of the licensing renewal for the dam.

"This agreement charts a bold course for clean water and climate resiliency in the Susquehanna River and Chesapeake Bay," said Maryland Environment Secretary Ben Crumbles. "This comprehensive, enforceable commitment by Exelon is part of Maryland's holistic strategy to improve water quality and accelerate the restoration of the Chesapeake Bay."

The settlement builds on commitments Exelon has previously made to improve environmental and recreational conditions at and around the dam. In 2016, Exelon entered into a settlement agreement with the U.S. Fish and Wildlife Service to implement critical improvements to the fish passage facilities at the dam, which Exelon estimates will require investments exceeding \$300 million. Exelon also estimates that it will invest more than \$120

### Press Release Archives

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## Biographies

- Governor Larry Hogan
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## Press Release Archives

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