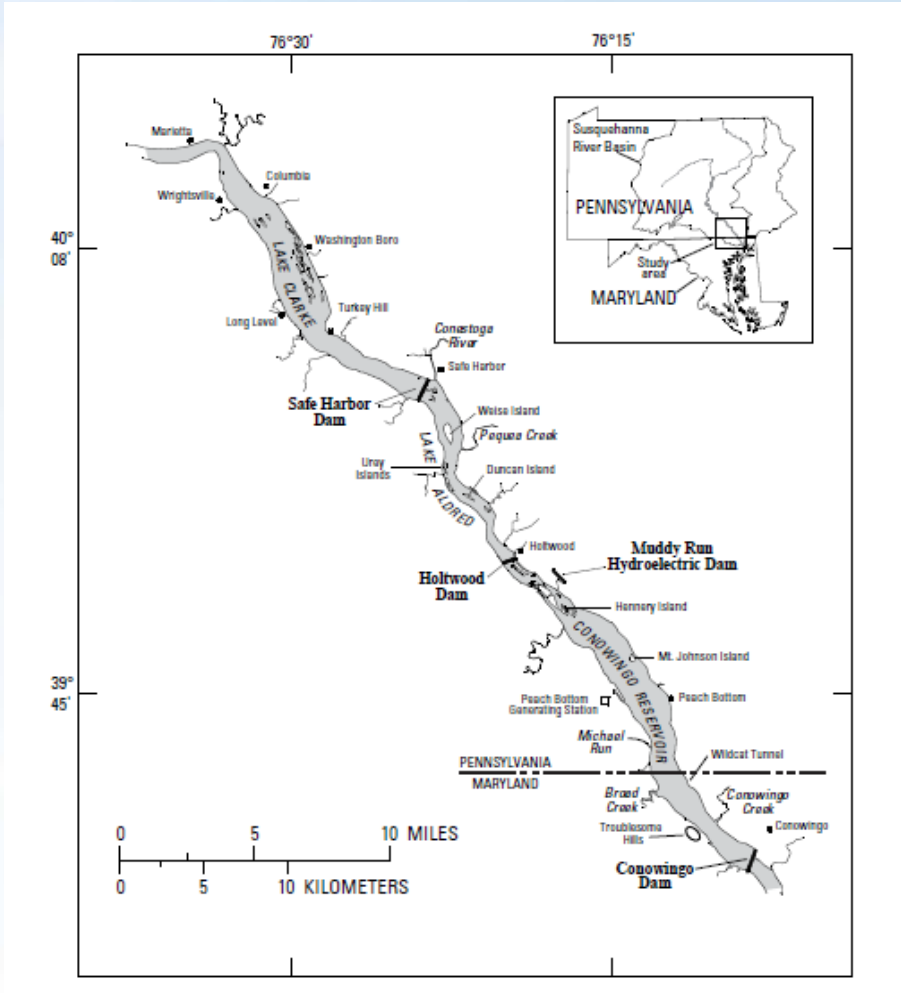
Assessment of Susquehanna River Reservoir Trapping Capacity and Potential Impacts on the Bay

April 6, 2010

Dams and Reservoirs on the Lower Susquehanna River

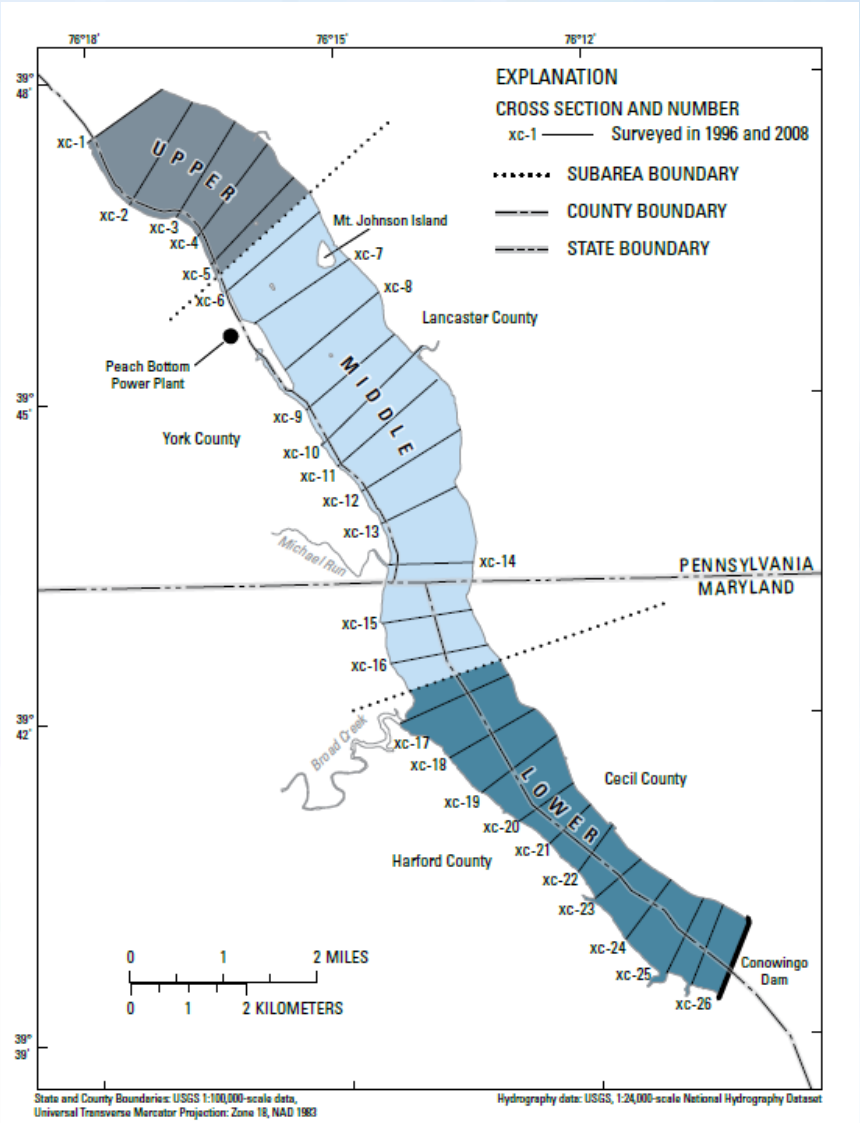


From Langland 2009, USGS

Sediment Trapping Capacity

Dam (year built)	Reservoir	Location	Reservoir Depth	Sediment Stored Behind Dam	Remaining Storage Capacity	Time until Capacity
Safe Harbor (1931)	Lake Clarke	32 miles upstream of Bay	10-15 feet in upper portions; 30-50 feet near the dam	92,400,000 tons	0	Reached long-term equilibrium in 1964
Holtwood (1910)	Lake Aldred	25 miles upstream of Bay	10-30 feet in the upper portions; 80-130 feet in “deeps” in middle and lower portion	13,600,000 tons	0	Reached long-term equilibrium in 1961
Conowingo (1928)	Conowingo Reservoir	10 miles upstream of Bay	15 feet in upper portions; 50-60 feet near the dam	174,000,000 tons	20,000 acre-feet (30,000,000 tons)	15-20 years 25-30 years with predicted future changes

Conowingo Reservoir



From Langland 2009, USGS

- Divided into Upper, Middle and Lower Parts
- Upper Part reached sediment storage capacity
- Middle Part has largely reached sediment storage capacity, except for minimal changes (5% from small scour events)

Lower Part of Conowingo Reservoir

- Only portion of the reservoir system with remaining sediment storage capacity
- Remaining storage capacity is 20,000 acre-feet (30,000,000 tons)
- Average reservoir sediment deposition rate from 1959-2008 is 2,000,000 tons/year (Langland 2009)
- Long-term trapping efficiency is about 55%

Time Remaining Until Sediment Storage Capacity is Reached

- At a deposition rate of 2,000,000/yr, time remaining is 15-20 years, assuming:
  - No major scouring events
  - Sediment input does not change
- Remaining time is increased to 25-30 years, if:
  - Sediment transport decreases by about 20%
  - Statistically expected scouring events occur
  - Trapping efficiency remains at an average rate of 55%
- Trapping efficiency is highly variable, depending on rainfall.
  - Drought conditions – as high as 80% trapping efficiency
  - Wet periods – as low as 40% trapping efficiency
- Scour events increase storage, they also increase pulse loads to the upper Chesapeake Bay

Consequences once Sediment Storage Capacity is Reached

- Annual suspended sediment loads will increase by 150% (Langland and Cronin 2003)
- Annual total phosphorus loads will increase by 40%
  - TP is frequently attached to sediment
- Annual total nitrogen loads will increase by 2%
  - The reservoir has a low TN trapping efficiency because TN is not highly sediment attached.
- Increased loads once sediment storage capacity is reached will also be exacerbated by increased loads from scour events (Langland and Cronin 2003).

Proposed Activities to Address Sediment Buildup Behind Conowingo

- 2009 – USACE received funds for a study of sediment management options
  - Preliminary idea is to develop a Sediment Management Plan
  - To date a cost-share partner had not been found
  - Exact project can change based on cost-share partner input

Proposed Activities to Address Sediment Buildup Behind Conowingo

- Conowingo Hydroelectric Project is undergoing Relicensing
  - FERC determination on the Revised Study Plan February 4, 2010
  - Revised Study Plan includes a study of "Sediment Introduction and Transport (Sediment and Nutrient Loading)"
    - Mostly a desktop review of storage capacity, accumulation rates, scouring events, etc.
    - Analysis of effects of project on habitat and substrate below the dam
    - Review of watershed-based management efforts and load reduction successes
    - Estimates dredging costs for annual sediment inflow at $48.4 million in 2009 dollars (based on SRBC estimate in 1995 at $28 million.)

Cost Comparison

- Cost Effective Strategies for the Bay (Chesapeake Bay Commission 2004)
  - Six most cost effective practices to reduce nutrient and sediment loading to the Bay
- Back of the Envelop Dredging Costs, using Exelon and SRBC figures

Practice	Annual Nitrogen reduction at maximum feasible level of implementation	Annual Phosphorus reduction at maximum feasible level of implementation	Annual Sediment reduction at maximum feasible level of implementation
Wastewater Treatment Plant Upgrades	35 million lbs @ $8.56/lb	3 million lbs @ $74.00/lb	Not applicable
Diet and Feed Adjustments	Under development	0.22 million lbs @ no additional cost (poultry only)	Not applicable
Traditional Nutrient Management	13.6 million lbs @ $1.66/lb	0.8 million lbs @ $28.26/lb	Not applicable
Enhanced Nutrient Management	23.7 million lbs @ $4.41/lb	0.8 million lbs @ $95.79/lb	Not applicable
Conservation Tillage	12.0 million lbs @ $1.57/lb	2.59 million lbs @ no additional cost	1.68 million tons @ no additional cost
Cover Crops	23.3 million lbs @ $3.13/lb	0.44 million lbs @ no additional cost	0.22 million tons @ no additional cost
“Back of the Envelope” Calculations of Dredging Costs	Annual Nitrogen Dredged Based on Removal equal to annual trapped amount	Annual Phosphorus Dredged Based on Removal equal to annual trapped amount	Annual Sediment Dredged Based on Removal equal to annual trapped amount
Dredge Conowingo Reservoir	3 million lbs @ $16.42/lb	3.48 million lbs @ $14.15/lb	4,420 million lbs @ $0.01/lb

Addressing the Sediment and Phosphorus Loads behind the Conowingo Dam in the TMDL

- The planning horizon for this TMDL is 2025, roughly coinciding with the earliest predicted time to lose sediment storage behind Conowingo
- Allocations are based on current trapping efficiency
- Does not account for the potential future loss of sediment trapping efficiency
- Included in TMDL as informational resource

Proposal for Addressing Conowingo

- Assume current trapping efficiency will continue
- If future monitoring show trapping efficiency reduced then PA/MD/NY 2-year milestone delivered loads will be adjusted accordingly
- Adjusted loads will be compared to the 2 year milestone commitments
- States should work together to develop an implementation strategy for the Conowingo dam

Conowingo Considerations

- Conowingo dam is one of the biggest BMPs in the watershed
- Storage capacity issue needs to be addressed to meet allocations
- There is already existing work and research to support development of a strategy
- Should work with FERC now while Exelon is still in the relicensing process.

Conowingo Dam