Development of Conowingo Infill Scenarios

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WHY?

- A recent study by Hirsch (2012) and previous studies suggest the ability of the three dams on the lower Susquehanna river to trap sediment is declining and that scouring of sediment is increasing over time.

- According to Hirsch (2012) Storm Lee contributed about 5% of the nitrogen, 22% of the phosphorus, and 39% of the suspended sediment from the Susquehanna to the Bay the last decade.

- Summary of Langland and Hainly (1997) predictions and Hirsch (2012) findings

Constituent	Change in average flux between conditions in the mid-1990's and when the reservoirs are at their sediment storage capacity (as predicted by Langland and Hainly, 1997)	the observed change in flow-normalized flux from 1996-2011 presented in this report
Total Nitrogen	+2%	-3.3%
Total Phosphorus	+70%	+55%
Suspended Sediment	+250%	+97%

Objective

- Assess the effect of Conowingo reservoir infill on Chesapeake Bay water quality using the Watershed Model Phase 5.3.2

Infill Scenarios

- Two types of Watershed Model (WSM) Phase 5.3.2 and Water Quality and Sediment Transport Model (WQSTM) scenarios were developed to assess the effect of Conowingo reservoir infill on Chesapeake Bay water quality.

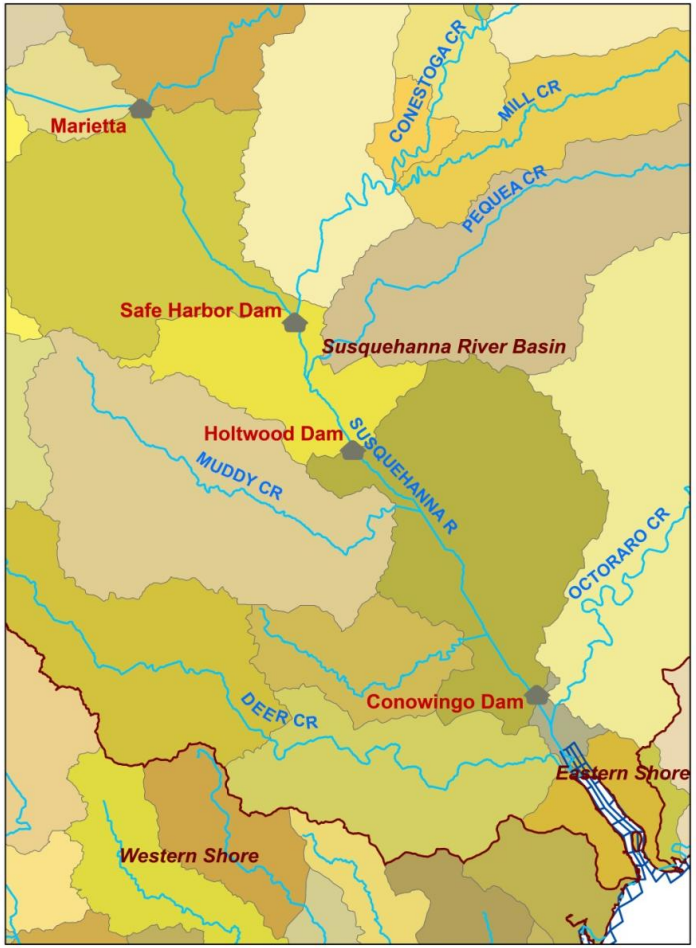
- WQSTM inputs were created for the 2010 Progress and the TMDL Scenario

- Run for a 10-year hydrology simulation period from 1991 to 2000

- The first type was an initial scoping scenario and was completed by modifying the linkage between the WSM and the WQSTM.

- The second type of scenario was a representation of the loads estimated by Hirsch (2012) and it was calculated by modifying parameters involved in the sediment and phosphorus calculations.

Scenarios Representing Estimated Nutrient and Sediment loads of Hirsch (2012)



- Scenarios were created that adjusted the river simulation only at the Conowingo river segment by modifying parameters that would increase sediment and phosphorus loads
- To increase scour and sediment loads the critical bed shear stress for scour parameter was decreased and erodibility parameter was augmented
- To increase phosphorus loads the model constant bed concentrations of ortho-phosphorus-P adsorbed to sand, silt, and clay parameters were augmented

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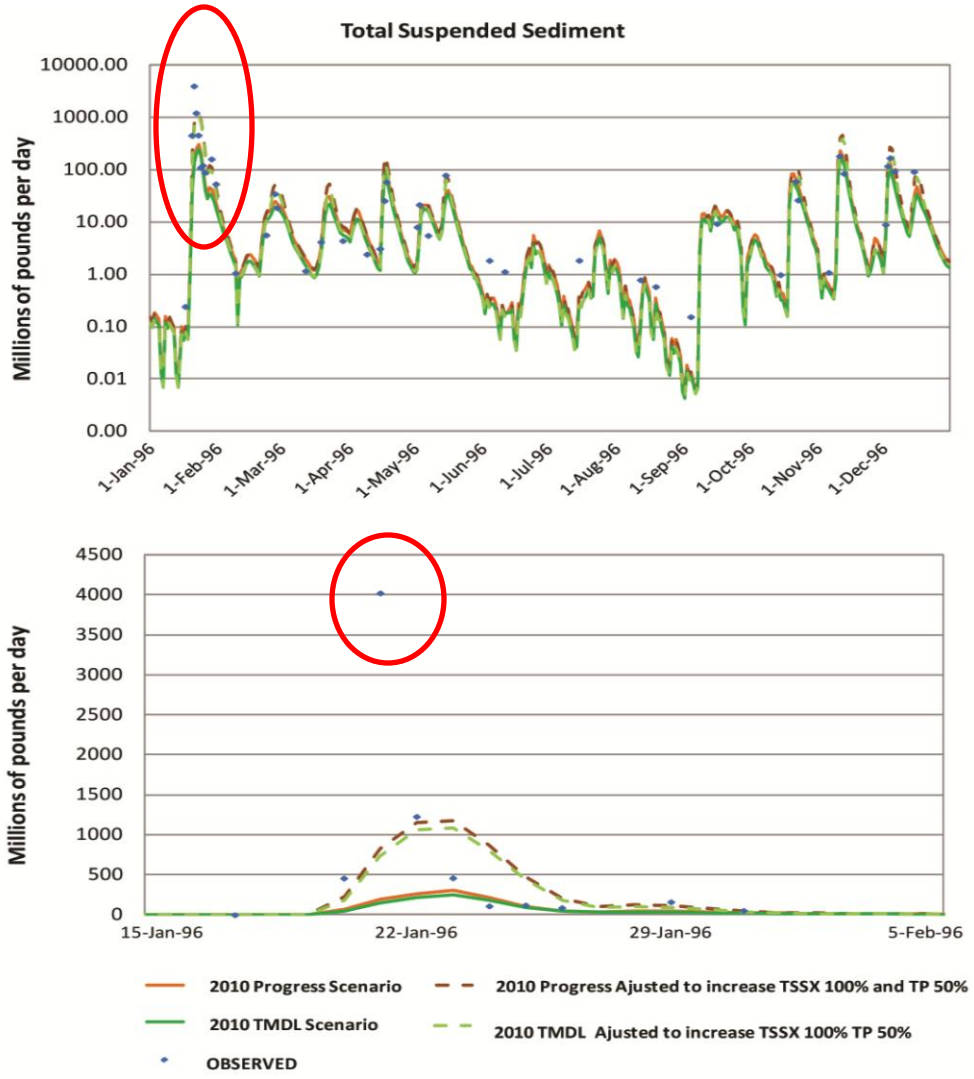

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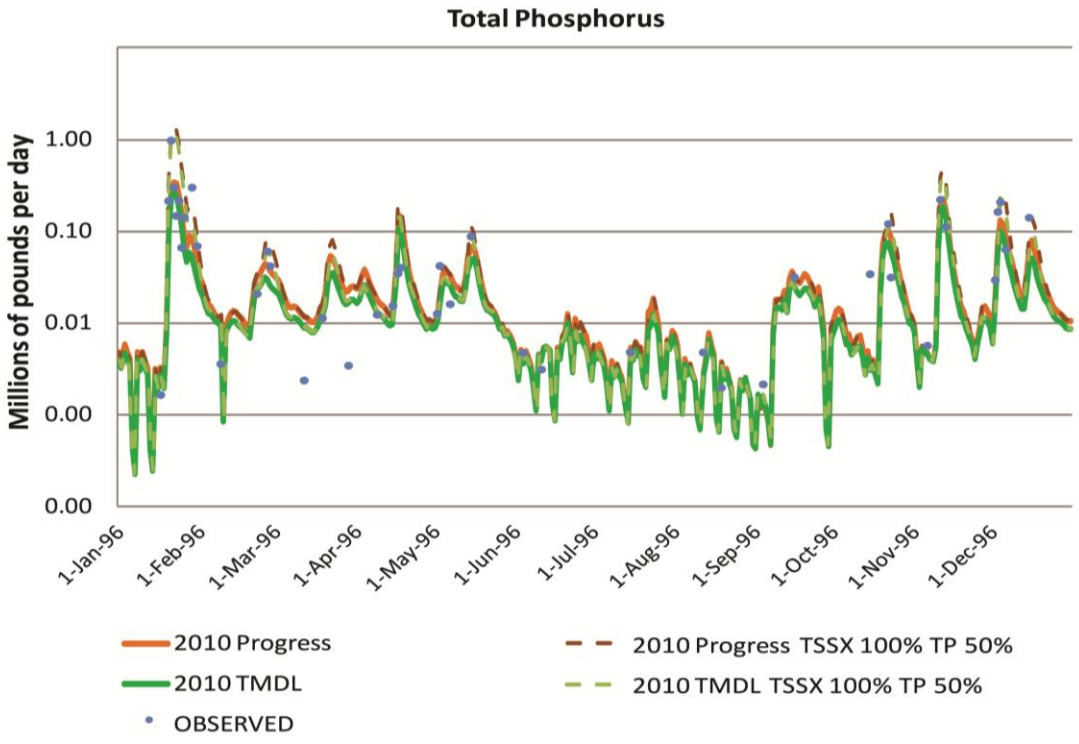
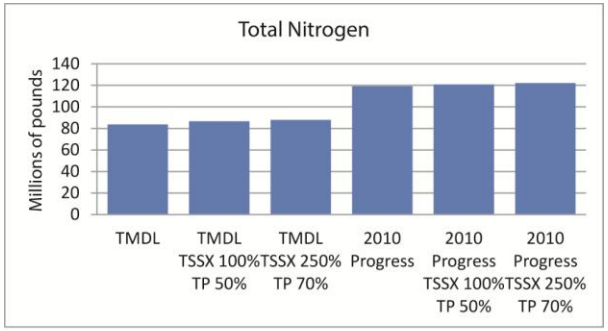
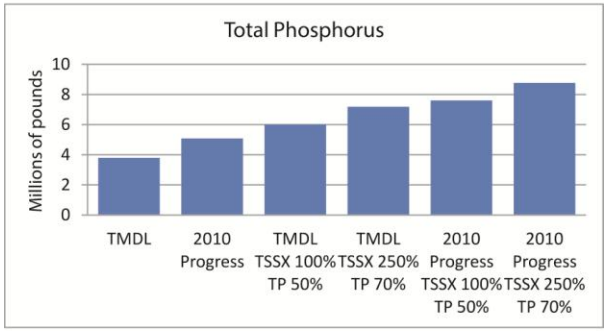


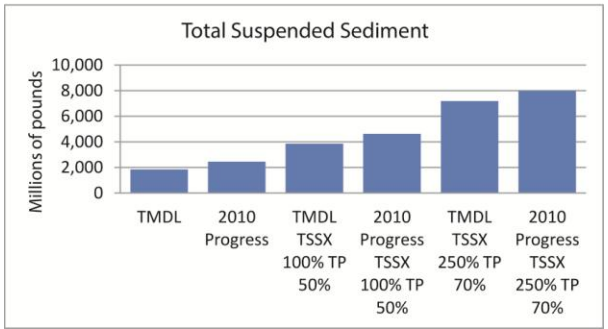
Scenarios Representing Estimated Nutrient and Sediment loads of Hirsch (2012)

Table 1. Scenario description.

Base Scenario	*Scenario name*	*Atmospheric deposition*	*Description*
2010 Progress	2010 Progress 100% TSSX 50%TP	2010 atmospheric deposition	Parameters are adjusted to increase sediment by 100% and phosphorus by 50% compared with the 2010 Progress base scenario at Conowingo
2010 Progress	2010 Progress 250% TSSX 70%TP	2010 atmospheric deposition	Parameters were adjusted to increase sediment by 250% and phosphorus by 70% compared with the 2010 Progress base scenario at Conowingo
2010 TMDL	2010 TMDL 100% TSSX 50%TP	2020 CAIR atmospheric deposition	Parameters were adjusted to increase the same amount of scour and phosphorus compared with its 2010 progress (100% TSSX 50%TP) scenario counterpart at Conowingo
2010 TMDL	2010 TMDL 250% TSSX 70%TP	2020 CAIR atmospheric deposition	Parameters were adjusted to increase the same amount of scour and phosphorus compared with its 2010 progress (250% TSSX 70%TP) scenario counterpart at Conowingo

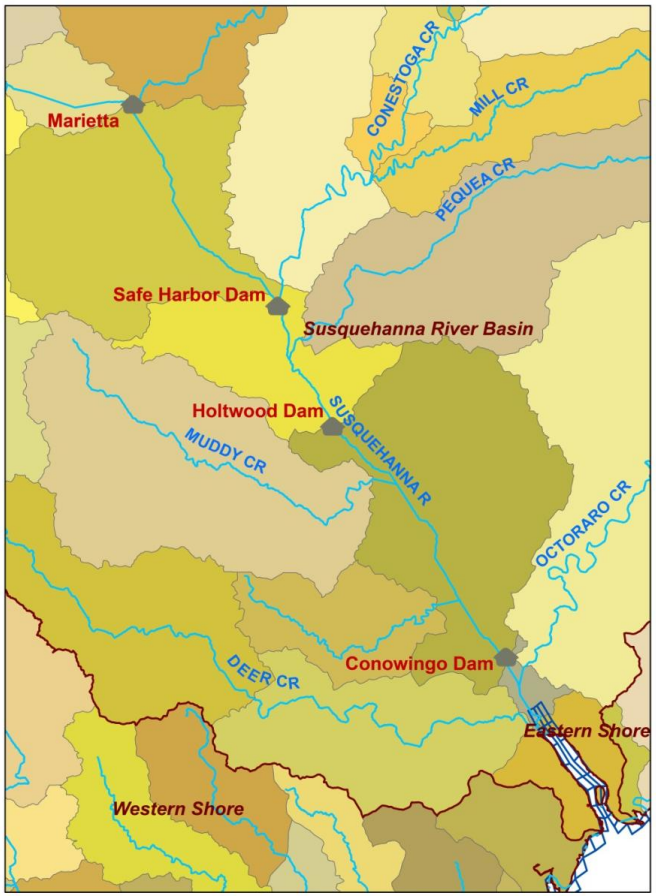


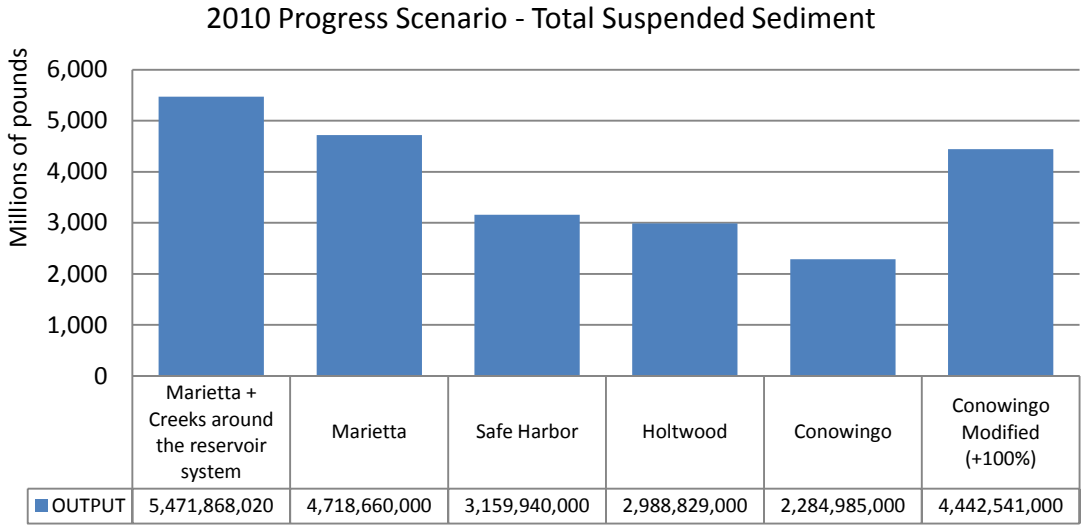


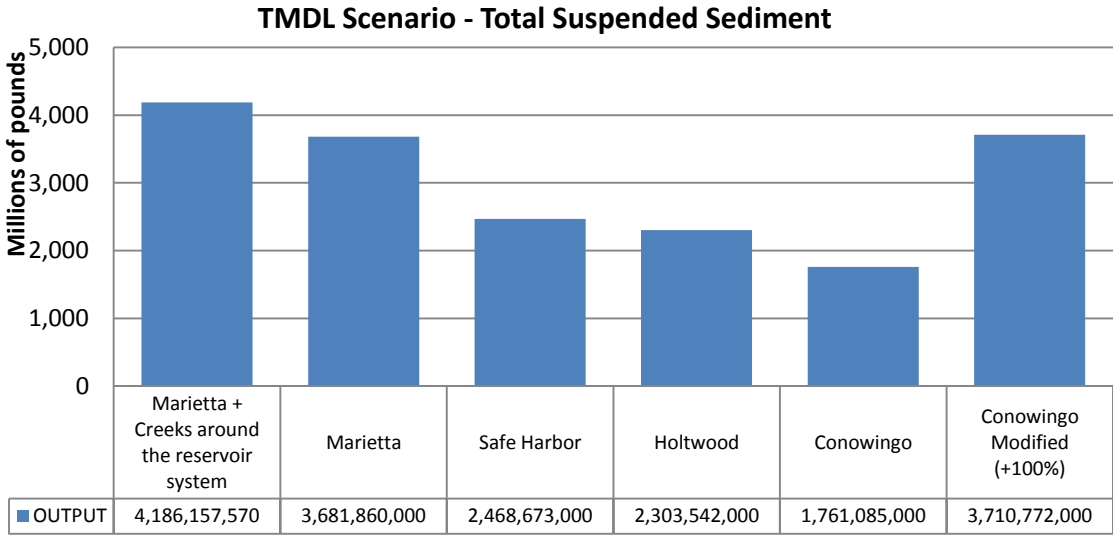


Input and Output Analysis

P532 scenario results suggest that there is enough total suspended sediment coming in to the reservoirs system to support Hirsch findings.

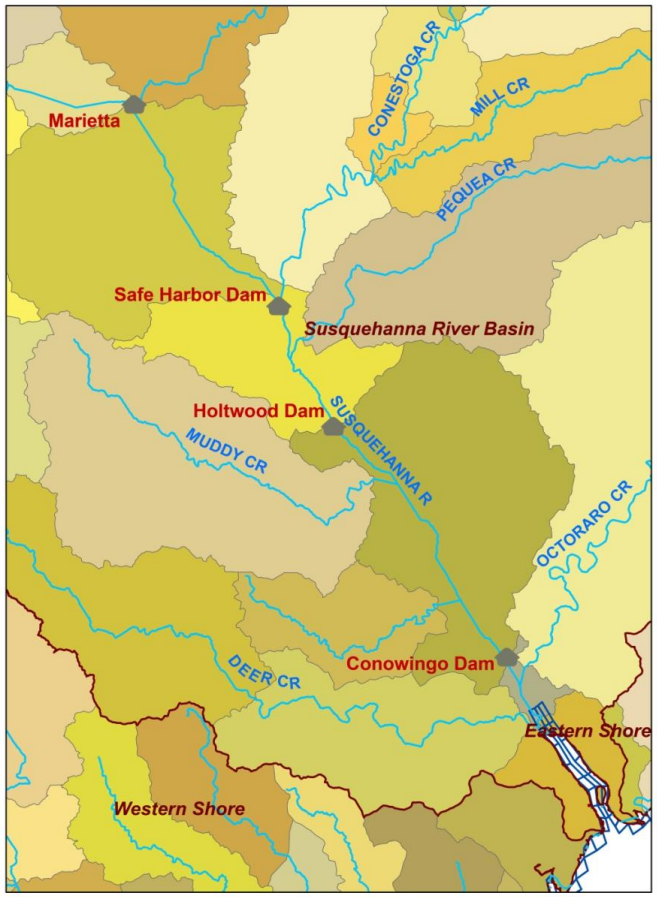


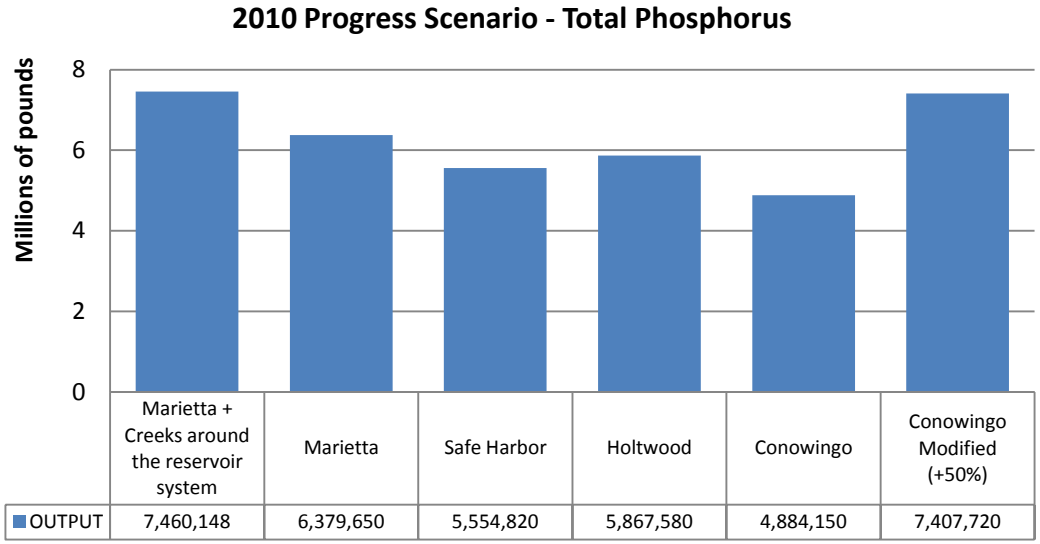


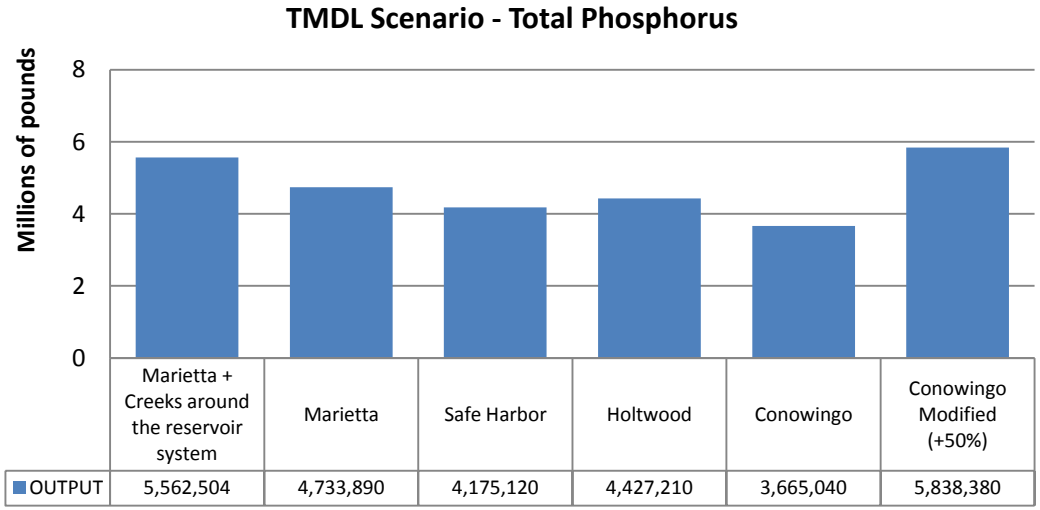


Input and Output Analysis

P532 scenario results suggest that there is slightly enough phosphorus coming in to the reservoirs system to support Hirsch findings.



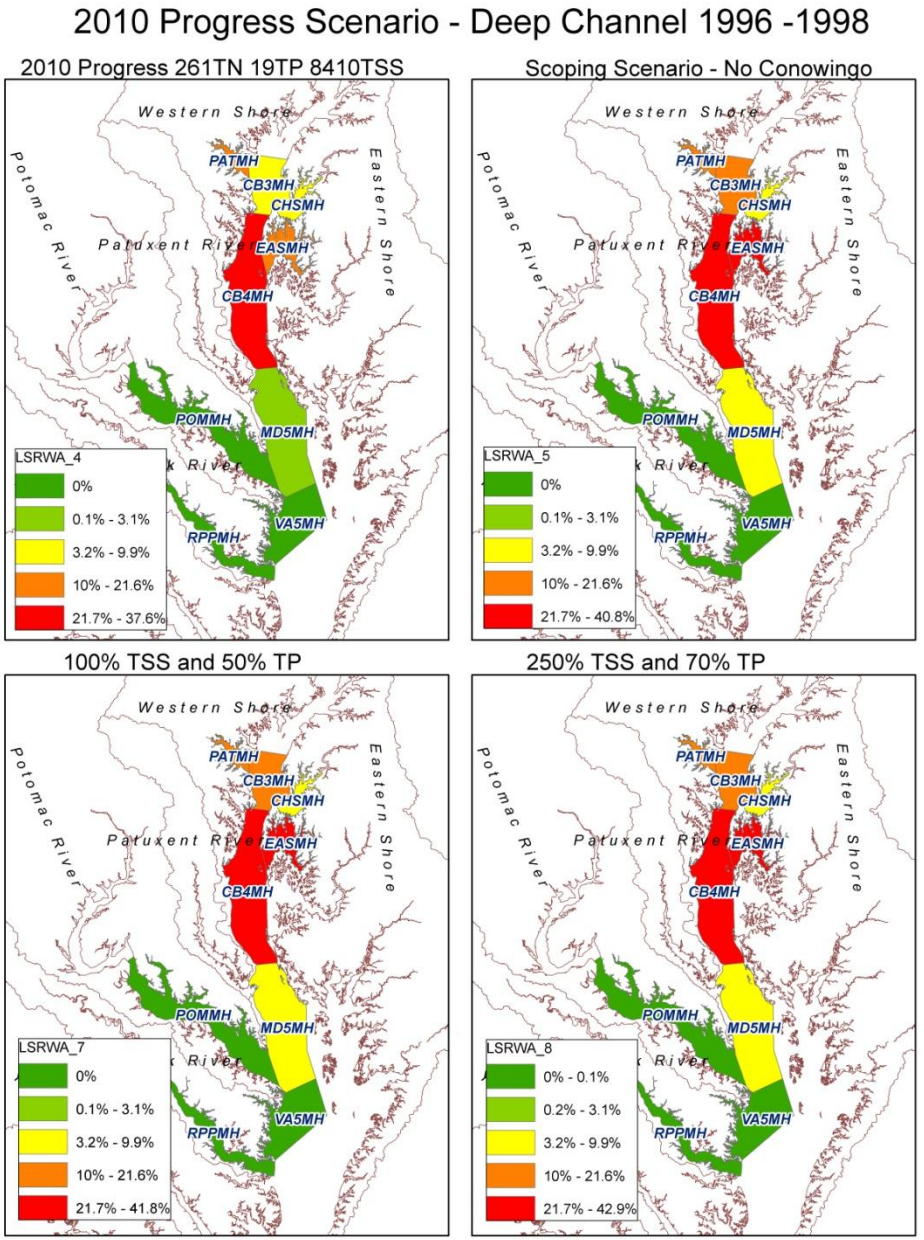




DO ASSESSMENT OF STANDARDS ATTAINMENT

- The degree of achievement of the Chesapeake Bay water quality standards was assessed through quantitative analyses of the WQSTM results for each scenario and for each CB TMDL segment to determine the percent of time and space that the modeled water quality results exceeded the allowable criteria concentration.

- The Conowingo infill scenario loads from the Susquehanna increased Deep channel DO and Deep water DO levels of nonattainment.



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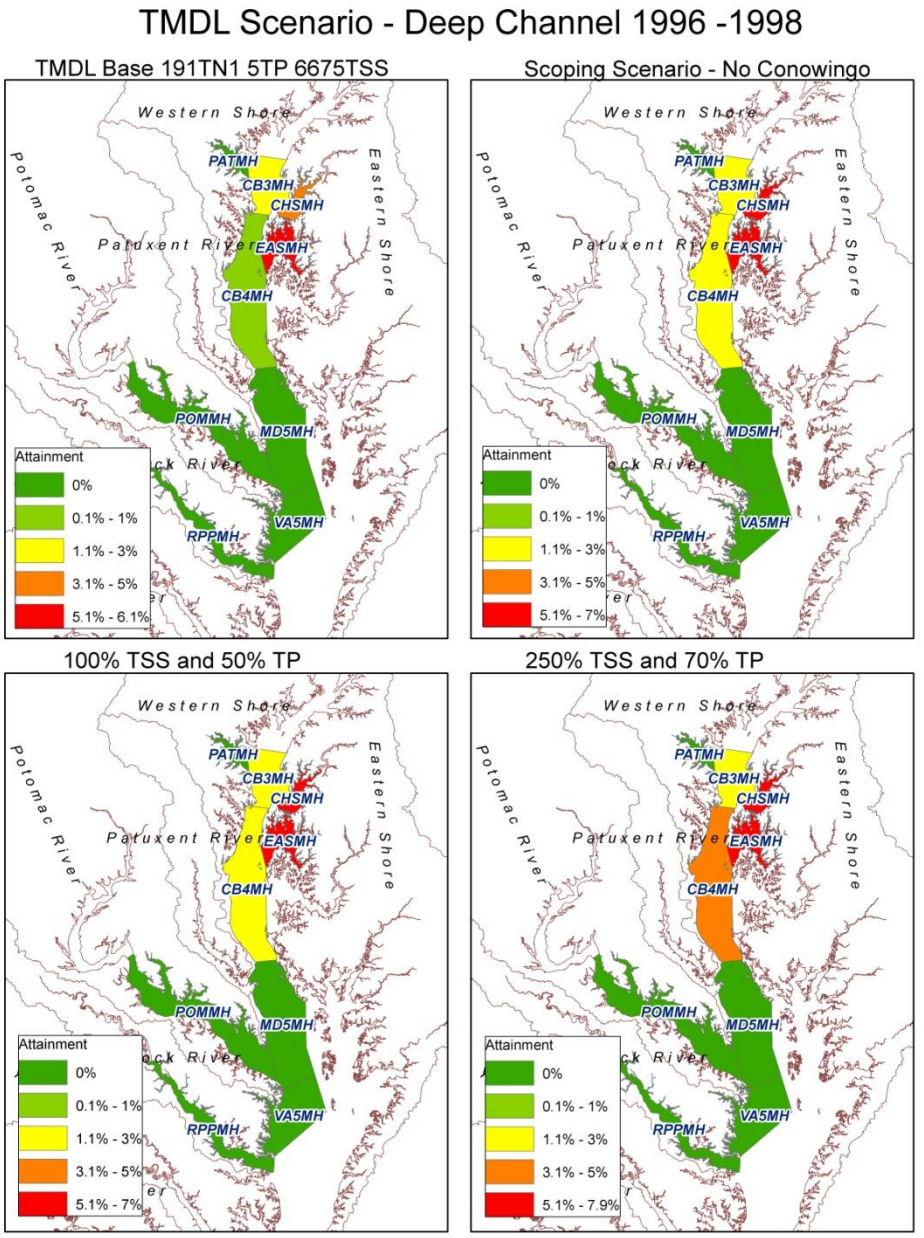

Conclusions

- The WSM Phase 5.3.2 infill scenarios results suggest that there is enough total suspended sediment coming in to the reservoir system to support Hirsch findings.

- The WSM Phase 5.3.2 infill scenarios results suggest that there is slightly enough total phosphorus coming in to the reservoir system to support Hirsch findings.

- The Conowingo infill scenario loads from the Susquehanna increased Deep channel DO and Deep water DO levels of nonattainment for both 2010 Progress and TMDL scenarios.