Using Local Monitoring Results to Inform the Chesapeake Bay Program's Watershed Model

STAC Programmatic Workshop Proposal
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Submitted by:

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- Modeling Workgroup

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Workshop Objectives and Targeted Management Outcome

The Chesapeake Bay Program's Watershed Model (CBWM) has been used successfully to establish and track Best Management Practice (BMP) implementation and as a accounting tool for the Chesapeake Bay Total Maximum Daily Load (TMDL). Significant investments have been made by local governments and other local stakeholders who are interested in validating loads and progress in the TMDL through local monitoring data collected over the past 5-10 years. However, the data and the CBWM are not directly comparable due to differences in temporal and spatial scales and sometimes the water quality parameters being estimated or measured. *Therefore,* a STAC workshop is needed to bring together CBP modelers, local government stakeholders, and scientists who are monitoring and analyzing local water quality data to recommend ways in which local monitoring data can be used to inform the CBWM, identify gaps between modeled and monitored data, and be used to validate model predictions at the local scale.

Management Relevance

The current Phase 6 version of the CBWM was created by CBP Partnership and is used to inform management decisions by trading off various scenarios or factors that affect the delivery of nutrients and sediment to the tidal Chesapeake. In a typical year, hundreds of scenarios are run on the CBWM at different spatial scales and levels of management. These runs are used to develop watershed implementation plans, to develop 2-year implementation goals known as Milestones, to assess progress toward these goals, and for many other research and assessment efforts.

The CBWM is not a scientific model whose main purpose is to understand the complex dynamics of sediment and nutrient loading in the Bay watershed. Rather, it uses understanding generated by the large volume of available research and research-oriented models to create a system that can most effectively evaluate management trade-offs. The CBWM uses a simplified structure with parameters that are well-supported by multiple lines of evidence to avoid problems with over-parameterization and over-calibration.[i]

Confidence in the output of the CBWM is critical because of its role as the accounting mechanism for measuring progress toward the Bay TMDL's nutrient and sediment reduction goals. Those who are being asked or required to pay for these reductions, from state and local government managers to farmers and other individuals, must

believe in the CBWM's loading estimates or trust in the restoration effort will dissipate. Towards that end, several local entities have invested in extensive monitoring programs to characterize nutrient and sediment loading (among other water quality parameters) at a relatively fine scale (from a few acres to 5 square miles). These include partnerships with USGS scientists in Fairfax County, Va., the Hampton Roads Sanitation District (HRSD) and localities within Hampton Roads, Va., and York and Chester counties in Pa. The Steering Committee is aware of other local monitoring data, from the Baltimore Ecosytem Study - LTER and Occoquan Watershed Monitoring Program, for example, that also would be useful to this effort and will solicit participation from relevant local monitoring programs in the Bay watershed. The Fairfax County work provides a particularly apt example, the results of which were recently detailed in a 10-year data report, https://pubs.er.usgs.gov/publication/sir20205061, that include flow, concentration and load trend information for twenty watersheds that range in size from about 0.43 to 5.49 mi^2 across the County.[ii]

The proposed workshop would enable the local watershed managers and data scientists who have developed this data to share their insights with the Bay Program's modeling team. Presentations would include comparisons of the model prediction and monitoring estimates for selected watersheds and water quality parameters. It would provide the modelers with input data to assess and potentially improve the accuracy of the model at these smaller scales. It would provide the local monitoring managers with information about how well their data collection efforts are characterizing the inputs that can be used to inform the model.

In addition, a comparison of monitoring and modeling data at the local watershed scale may augment current CBP Modeling Workgroup efforts to reconcile load prediction estimates from the CBWM and those of the empirically based SPARROW model. (See "Factors driving nutrient trends in streams of the Chesapeake Bay watershed," https://doi.org/10.1002/jeq2.20101)

The interest of many parties to use the CBWM in prioritizing or targeting BMPs, a recommendation from a 2019 STAC workshop on targeting (Increasing Effectiveness and Reducing the Cost of Non-Point Source Best Management Practice (BMP) Implementation: Is Targeting the Answer? – STAC (chesapeake.org), also depends on improving the spatial resolution of model data inputs and verifying that model processes can accurately simulate loads at smaller scales.

Why a STAC Workshop and the Urgency

Although this workshop has some aspects of assessing the science of nutrient and sediment dynamics, its primary purpose is to provide programmatic recommendations for how to improve the accuracy of the CBWM at smaller scales and how to design or adjust local monitoring programs to better estimate nutrient and sediment fate and transport. The implications for model improvement are particularly timely since the Bay Program is in the process of creating a workplan for the Phase 7 version of the CBWM, which is to be finalized by 2027, with new processes and input parameters to be developed by 2025. A STAC workshop held in 2022 or early 2023 would allow for its findings to be used in this development process.

Workshop Preparation and Planning

The steering committee will meet periodically to finalize speakers, an agenda, and a format for the workshop. The preference is to conduct a two-day in-person meeting in which the morning of the first day will be devoted to presentations on the CBWM and local monitoring results and remainder of the time will be devoted to discussion of how to use these data in the CBWM. However, these plans may need to be adjusted to a virtual format depending on the public health measures in place in the future.