Other Midpoint Assessment Priorities of the Modeling Workgroup

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The 2010 TMDL documentation identified five areas to be addressed by the 2017 Midpoint Assessment. These include:

- The influence climate change will have on water quality standards and the Chesapeake TMDL.
- The affects of Conowingo infill on Chesapeake water quality standards.
- The influence of oyster filter feeders on water quality, particularly with increased aquaculture and sanctuary development.
- The refinement of the shallow water simulation for the improved assessment of open water DO and SAV/clarity standards.
- A refined assessment of James River chlorophyll.

Climate Change Influence on the Chesapeake TMDL

The 2010 TMDL documentation and the 2009 Executive Order call for an assessment of the impacts of a changing climate on the Chesapeake Bay water quality and living resources. The airshed, watershed, and Water Quality and Sediment Transport models will be used to examine the impact of climate change on projected water quality. Current efforts are to frame an initial future climate-change scenario based on estimated 2050 conditions. Conditions to be described include land use, rainfall, air temperature, water temperature, sea level rise, and wetland loss due to sea level rise. The Watershed Model will be employed to predict flows and loads from the watershed based on the projected conditions. New tidal Bay hydrodynamics will be required based on projected flows, sea level, and shoreline geometry. Multiple eutrophication model and living resource model runs will be made based on the projected conditions and management plans including the TMDL. Particular attention will be devoted to the effects of climate change on living resource regions including SAV beds and wetlands.

Active collaboration is ongoing with researchers from 1) EPA's Global Change Research Program 2) Penn State 3) University of Maryland, 4) USGS, and providing the CBP with additional high quality climate change analysis.

The Global Change Research Program of EPA's Office of Research and Development is applying a decision framework called RDM (Robust Decision Making) to an assessment of the Patuxent watershed under estimated 2050 climate change conditions. The RDM will provide quantitative estimates of uncertainty related to management decisions and climate change, in the management of storm water in the Patuxent under estimated 2050 conditions. The basic steps of the RDM analysis include 1) defining key objectives, uncertainties, strategies, and relationships, 2) modeling each of many sets of assumptions to explore performance of strategies, 3) identifying conditions under which goals are / are not met, and 4) analyzing tradeoffs among strategies and making potential modifications.

The Penn State analysis of climate change examines how to best simulate watershed hydrology under future climate conditions particularly with appropriate representations of evapotranspiration.

The University of Maryland's Center for Environmental Science study focuses on the Patuxent watershed and estuary with respect to the potential impacts of climate change on water quality and living resources, and how changes in climate can exacerbate or ameliorate the impacts of other stressors such as land use change. In particular, stream restoration strategies and intertidal marshlands performance under changing climatic conditions will be examined.

The USGS analysis involves the examination of Chesapeake watershed hydrology under future climate change conditions. The assessment uses 72 Watershed Model runs based on 6 climate change models (BBCR, INM, CSIRO, NCAR, CCSM, MIROC), 3 Intergovernmental Panel on Climate Change (IPCC) scenarios (SRES A1B, SRES A2, and SRES B1), and 4 future time periods covering 2025-2035, 2035-2045, 2055-2065, and 2085-2095.

A STAC workshop proposal will be put forward by the Modeling Workgroup to examine the current collaborative efforts of the four research teams as well as proposed additional efforts going forward in 2014 and 2015 to assess the influence climate change on the Chesapeake water quality.

Conowingo Infill Influence on the Chesapeake TMDL

The Modeling Workgroup will work with the US Army Corps of Engineers (USACE) Lower Susquehanna River Watershed Assessment (LSRWA) study, and the Scientific, Technical Assessment, and Reporting (STAR) workplan for the assessment of trapping capacity behind dams, especially the Conowingo, as well as greater representation of local impoundments and reservoirs throughout the Phase 6 Watershed Model domain.

The LSRWA is a 3-year partnership of USACE, USGS, Maryland Department of Natural Resources, Susquehanna River Basin Commission, and the Nature Conservancy to assess watershed impacts to the upper Bay. An analysis of the entire system/watershed will enable USACE to make recommendations that will address habitat restoration and water-quality goals under the EO strategy. USACE is looking at potential options such as dredging, bypassing, offsets/trading, and BMP implementation. The study options will play a critical role in guiding the future restoration strategies undertaken by the Chesapeake Bay Program. A series of Watershed Model and Water Quality and Sediment Transport Model scenarios have been completed for the LSRWA and have examined the influence that Conowingo infill has on Chesapeake water quality standards, as well as provide support for initial assessments of possible mitigation measures.

The collaborative work with USACE has a high priority for the Modeling Workgroup in 2013. A STAC workshop proposal to examine the state of the science in the assessment of Conowingo infill and its influence on the Chesapeake water quality will be put forward by the Modeling Workgroup.

In addition, work with STAR on greater representation of local impoundments and reservoirs throughout the Phase 6 Watershed Model domain is an ongoing activity of assessing reservoir decision rules and operations for reservoirs not currently simulated in the Phase 5.3.2 Model. The work on small impoundments involves land use characterization of small impoundments and their associated drainage area.

Filter Feeders

The roles of filter-feeding oysters and menhaden were previously examined as called for in the Chesapeake 2000 Agreement. Results to date indicate living resource restoration is a supplement, not a substitute for nutrient and sediment load reductions. Living resource restoration was not considered in the 2010 TMDL because low filter feeder biomass was insufficient to influence water quality, and because of future biomass uncertainty due to harvest, disease, and lack of habitat.

Since then significant oyster restoration has occurred and more is planned, as well as a recent resurgence of aquaculture in the Chesapeake. Aquaculture activities alter the historical distribution of oyster biomass and also different patterns of water-column filtration and of feces and pseudofeces deposition, compared to native oyster reefs. Nutrient removal due to oyster harvesting must also be taken into account. The oyster model will be revised as necessary to incorporate aquaculture operations and additional oyster biomass brought about by restoration activities including sanctuaries. Current and projected data on biomass distribution and abundance will be mapped onto the current computational grid and various combinations of restoration and load reductions will be examined. The oyster analysis is planned for the 2014 calendar year.

Refinement of the Shallow Water Simulation

Refinement of the open water and SAV/clarity water quality standards in shallow-water regions (depth < 2 to 3 m) adjacent to the Bay shoreline is an objective identified in the 2010 TMDL documentation. The refined shallow water simulation would take advantage of data in recent years from the shallow water monitoring program that were unavailable to previous versions of the WQSTM as well as advances in shallow water simulation.

The Scientific and Technical Advisory Committee (STAC) advocates the use of multiple management models for the Bay. The employment and rigorous comparison of different models applied to shallow-water systems by different teams is proposed as an initial step towards the development of multiple management models, which would contribute to the research and development of shallow-water modeling. The work will produce improved model representation of shallow-water regions in time for the 2017 Midpoint Assessment.

Refined Assessment of James River Chlorophyll

The Modeling Workgroup is working closely with the principal investigators of the James River Chlorophyll Model and is providing assistance as requested on an as needed basis. Assistance includes technical assistance as requested, including boundary condition support, model data needs support, and other ancillary technical support as requested.

The Modeling Workgroup receives regular quarterly updates on the status of the James Chlorophyll Model from Virginia's Department of Environmental Quality.