Chesapeake Bay Program
Science. Restoration. Partnership.

August 3, 2015

Dr. Kirk Havens, Chair
Scientific and Technical Advisory Committee
Chesapeake Bay Program
645 Contees Warf Road
P.O. Box 28
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Dear Dr. Havens:

Thank you for the opportunity to respond to the Scientific and Technical Advisory Committee's (STAC) report entitled "Estimating Land Management Effects on Water Quality Status and Trends". The subject of this report is timely in that Chesapeake Bay Program (CBP) partnership has committed to a greater role for monitoring data analysis for the assessment of progress in the 2017 mid-point assessment. As indicated in the responses below, the CBP partnership has reorganized workgroups under the Scientific and Technical Analysis and Reporting (STAR) team and has increased staff availability and support to address the recommendations in this report. We are addressing the specific recommendations as follows.

Prioritize work that adds the ability to estimate uncertainty to the Weighted Regressions on Time, Discharge, and Season (WRTDS) method.

Motivated in part by this workshop, STAC member Bob Hirsch and others have developed an uncertainty estimation method for WRTDS and have submitted a journal article describing the method and recommending management applications. In anticipation, the CBP has begun to discuss the application of this capability. Additionally, the CBP Office (CBPO) has made computing resources available to the U.S. Geological Survey (USGS) to facilitate the extensive calculations involved in uncertainty estimation.

Continue to develop and apply General Additive Models (GAMs) to the appropriate response variables in tidal waters, and develop a process of "artificial intelligence" that enables automated application of GAMs.

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Over the past year, the CBPO has devoted significant resources to further the development of GAMs for analysis of water quality trends in tidal waters of Chesapeake Bay. Rebecca Murphy, University of Maryland Center for Environmental Science (UMCES) at the CBPO, and Jeni Keisman (USGS) continue to lead this effort, with analytical and logistical support from CBPO staff and in consultation with colleagues at the Maryland Department of Natural Resources (MDNR) and the Virginia Department of Environmental Quality (VADEQ). In 2015, the CBPO is providing additional statistical consulting and statistical programming resources to enable the implementation of GAMs by MDNR and VADEQ staff for their standard annual trends analyses. As recommended, the GAMs development scope of work includes functionality to enable automated application of GAMs.

The CBP partners should continue efforts to improve reporting and tracking of Best Management Practices (BMPs). Bay Program leadership and staff should ensure that any partnership-derived assumptions and decision rules applied are transparent in the processing of reported BMP data.

The CBP partnership understands that this issue is priority for both the management and scientific community. STAC has appropriately raised this issue on several occasions and this continued involvement has been helpful in motivating activity in this area. A full response to this question was provided in the Management Board's response to STAC's workshop report on lag times and is restated below.

> "An accurate inventory of BMPs is at the heart of the accountability framework for the Chesapeake Bay TMDL and the CBP is addressing this issue in multiple ways. Verification protocols for all BMPs have been developed through the Basinwide BMP Verification Framework development process, adopted by the partnership in September 2014. The expected result is a system that will require verification to receive full credit for BMPs and evidence of maintenance to extend the effective life. The CBP is also working to improve the accuracy of historic BMP implementation, which will clearly be of use in calibrating a watershed model that includes lags, a specific commitment within the Basinwide BMP Verification Framework. Additionally, the partnership has agreed that a re-examination of historic BMP implementation is a necessary part of the Chesapeake Bay TMDL 2017 Midpoint Assessment. The USGS and USDA are working together to provide agricultural conservation practice data to the six watershed states that were formerly unavailable to the CBP jurisdictions based on privacy concerns, another specific commitment within the Basinwide BMP Verification Framework. The partnership is also moving to collect more specific performance-related data on several BMPs. Urban stream restoration and stormwater control BMP expert panel reports specify that these practices should be reported with site-specific characteristics related to expected effectiveness. Even with these extensive efforts, considerable difficulties remain in collecting accurate, specific, and comprehensive information on BMP implementation. The CBP will continue to work with the help of STAC and the partnership's Citizen and Local Government advisory committees to further adapt and improve the partnership's accountability system."

The Bay Program has recently devoted substantial resources to instituting a basin-wide BMP verification framework program across all source sectors and jurisdictions to, for example, reduce multiple counting of BMPs in reporting; clean historical BMP databases used in CBP modeling tools; better account for the useful life of BMPs; track and report more specific information for each

restoration project; assess degrees of meeting design standards; and evaluate and update Quality Assurance Project Plans for each agency submitting environmental data to EPA.

A wealth of information regarding this effort to verify both the existence and functionality of BMPs on the ground and reported for model purposes can be found under "Projects and Resources" under the CBP BMP Verification Committee site:

http://www.chesapeakebay.net/groups/group/best_management_practices_bmp_verification_committee.pdf

The CBP should prioritize more comprehensive and improved monitoring of BMP effectiveness. This includes assessing BMP effectiveness over time, both with and without proper operation as well as required periodic maintenance.

The effectiveness of BMPs accounted for in the partnership's Watershed Model are established by expert panels and approved through relevant source workgroups and the Water Quality Goal Implementation Team. These panels follow the guidelines detailed in the "Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model," available at:

http://www.chesapeakebay.net/channel_files/22733/nutrient-sediment_control_review_protocol_v7.14.2014.pdf.

The BMP and source experts typically consider many types of data and studies across many scales and conditions, following a process that is consistent, transparent, and scientifically defensible.

In defining BMP effectiveness estimates, the protocol calls for giving the highest priority to peer-reviewed monitoring studies with data sources at operational scales – over small-scale, carefully controlled research scales. The composite results of the many studies and analyses add to a body of knowledge employed in previous versions on the modeling tools. The process and data sources are not always ideal or perfect, but there have been considerable improvements in developing BMP effectiveness estimates in response to similar criticism that imperfect operation and maintenance (O&M) of BMPs is not fully accounted for.

The issue of using monitoring data to verify or establish BMP performance in the field was most-recently addressed more directly in "New Insights: Science-based evidence of water quality improvements, challenges, and opportunities in the Chesapeake" available at:

http://www.chesapeakebay.net/channel_files/21409/new_insights_report.pdf

This report summarized results from more than 40 case studies in the Chesapeake Bay watershed across sectors where water quality monitoring was conducted to detect benefits from implementation of BMPs. The three themes that emerged from the data were:

1. Several groups of practices are proven effective;
2. Certain challenges can impede water quality improvements; and
3. Practices that target the impacts of intensified agriculture and rapid population growth are needed to enhance progress toward improving water quality.

The Phase 6 version of the Watershed Model that is currently in development will include life-spans for each of the BMPs. In other words, BMPs are retired and benefits no longer credited past the useful life of the BMP unless the practice is reported as inspected and maintained. This is a significant change from all earlier versions of model where BMPs remained in the database and were credited unless designated as annual practices and implementation levels refreshed by jurisdictions each year for model progress assessments.

The CBP partnership should implement continuous monitoring for locations, times, and constituents that maximize utility for improving assessment of effectiveness of management actions.

The CBP agrees that the use of continuous monitoring should be enhanced in the watershed and tidal waters. As part of the Building And Sustaining Integrated Networks (BASIN) Phase II initiative, the CBP and STAC are engaged in an ongoing effort to identify and implement optimal water-quality monitoring strategies for the Chesapeake Bay watershed and estuary. The "Building Environmental Intelligence" (BEI) report to be released in summer, 2015 discusses opportunities for innovation, including increased use of continuous monitoring the Chesapeake Bay watershed and estuary. Opportunities in the watershed include use in small watersheds to better document water-quality change to management practices and in larger rivers to improve nutrient and sediment load estimates. Continuous monitoring in tidal waters could benefit assessment of water-quality standards.

The CBP partners have implemented continuous monitoring in several small watersheds (NRCS showcase watersheds) and on the Susquehanna River to improve estimates of sediment from the Conowingo Reservoir. Additional sites will be considered through the STAR Integrated Monitoring WG but costs are a limitation for implementation.

Learn more about BASIN II here:
www.chesapeakebay.net/groups/group/building_and_sustaining_integrated_networks_basin

The CBP partnership should engage in a concerted effort to energize the academic and federal research communities to conduct collaborative studies using the most capable and feasible techniques from among those suggested in this report. A number of techniques hold promise for application at a range of scales, or even for integrated application across scales from small watersheds to the entire Chesapeake Bay drainage basin. Multiple tools and approaches were suggested both for small watershed studies and regional analysis. These approaches need to be evaluated to explain observed water quality changes.

The CBPO recognizes that developing an understanding of the effects of management actions on water quality will require exploitation of all available resources across the region's community of researchers and managers. To that end, a new CBP STAR team – the Integrated Trends Analysis Team (ITAT) – has been created to serve as a forum for researchers to discuss results of their ongoing and recent activities, as well as to exchange ideas and share their experiences with novel analytical techniques. Under the leadership of Jeremy Testa (UMCES) and Joel Blomquist (USGS), the ITAT held its first face-to-face meeting at the USGS MD-DE-DC Water Science Center in November 2014. The meeting was attended by 50 individuals from across about 20 academic, federal, state, and independent organizations. Additional meetings in March and June of 2015 were similarly well-attended.

To further support integration and synthesis of research to quantify the effects of management actions on trends in water quality, the CBPO will also provide support for a small number of focused synthesis efforts to be completed between now and March, 2017. Requests for funding of synthesis efforts will be open to ITAT participants and researchers who have demonstrated a commitment both to explaining trends in water quality in the Chesapeake Bay watershed and estuary, and to the application of their research to inform management strategies in the region. A formal description of expectations for synthesis efforts is forthcoming. Requests for synthesis support will be selected and projects initiated by December 2015.

On behalf of the Management Board, I want to thank you for your timely recommendations. Please extend our gratitude to STAC and the workshop steering committee for the time and effort involved in the production of this report. We greatly appreciate the ongoing role of STAC in serving as an independent review body directly towards continually improving our overall management of the Chesapeake Bay and watershed restoration efforts.

Most sincerely,

Nicholas A. DiPasquale, Chair
Management Board