Chesapeake Bay Program
Science. Restoration. Partnership.

410 Severn Avenue Suite 112 | Annapolis, MD 21403 | 410-267-5700

March 16, 2015

Dr. Kirk Havens, Chair
CBP Scientific and Technical Advisory Committee
645 Contees Wharf Road
P.O. Box 28
Edgewater, Maryland 21037

Dear Dr. Havens:

Thank you for the opportunity to respond to STAC's report entitled, "Incorporating Lag-Times into the Chesapeake Bay Program." We appreciate work that went into producing this thorough summary of issues related to physical lag times in the watershed. The workshop included wide-ranging useful discussions of the issues and the resulting document lays out an extensive research agenda that will be useful not only to the Chesapeake Bay Program (CBP) partnership, but the broader academic and government communities as well. The recommendations directed at the management community for public communication of lag time issues and expectations are also welcome.

We are addressing the recommendations as follows:

Increasing the priority given to identifying Best Management Practice (BMP) maturation and effective operational periods in the CBP models.
As a result of this workshop and similar discussions, the CBP has become increasingly aware of this issue and it has been a topic for consideration in multiple venues. The current version of the BMP review protocol calls for panels to include in their report the "Temporal performance of the BMP including lag times between establishment and full functioning", and "Useful life: effectiveness of practice over time". The CBP's Basinwide BMP Verification Framework also highlights the BMP life cycle to include periods of lower performance both before and after a BMP's fully functional life span and commits the technical source sector and habitat workgroups to develop specific life spans for all CBP approved BMPs. The CBP commits to continue to place priority on identifying the maturation and effective operational periods of all new and revised BMPs coming forward through the partnership's BMP protocol process for CBP review and approval.

Revising water quality models to include BMP efficiencies as a function of precipitation amount and age of BMP, while also expanding consideration for different landscape types and geographic locations.
STAC's 2008 review of the CBP's Phase 5 Chesapeake Bay Watershed Model included a recommendation to consider hydrologic effects on BMP performance. The CBP implemented several algorithms to deal with hydrologic effects at that time which still remain in the watershed model. This

capability was exploited in a soon-to-be-released study headed by STAC member Susan Julius investigation the robustness of the Patuxent WIP with respect to climate and growth uncertainty.

Where data are available, the CBP assigns different overall efficiencies based on landscape and physiographic criteria. Both of these effects are challenging to parameterize within the modeling framework. The hydrologic effect has gotten little attention, but the CBP BMP panels have been able to expand the geographic specificity of BMP effectiveness estimates in many cases. In particular the recent cover crop BMP expert panel's report, approved by the CBP Water Quality Goal Implementation Team, has increased the specificity to include nearly 2000 variants of the cover crop BMP.

The CBP commits to amend the BMP protocol to include a charge to all future BMP panels with the responsibility for fully considering whether there is sufficient data and information available to support recommending BMP efficiencies as a function of precipitation amount and age of BMP as well as for different landscape types and geographic locations.

The CBP will consider how this information will be used in measuring the progress towards meeting the Chesapeake Bay TMDL goal having all practices in place by 2025 to meet water quality standards. The 2025 goal did not consider the effect of lag time. This information may be useful in optimizing a jurisdictions' Phase III Watershed Implementation Plans, as described below in the response which immediately follows.

Prioritizing the development of a comprehensive local inventory of all agricultural and urban BMPs, including performance characteristics and previously unaccounted measures, such as farm and recreational ponds and stream bank restoration.
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.

Developing and applying supplemental models to inform the Chesapeake Bay Watershed Model (CMWM) on processes not currently simulated, to facilitate insights into lag-time, and to provide site-specific targeting of BMP placement for more effective load reduction. Specific priorities should include models to improve the representation of lags in 1) sediment storage during transit in the basin

and 2) nitrogen loading from groundwater in all physiographic provinces of the watershed should be modeled in these complementary efforts, following collection of need data of transport times and flow paths.

Clearly, this recommendation is not one that can be carried out quickly or cheaply. The CBP Modeling Workgroup and the Chesapeake Bay Program Office's (CBPO) Modeling Team are partnering with regional academic researchers to move along several paths that should provide these results in the long term. STAC's convening of workshops and articulation of lag time and other modeling issues have been instrumental in bringing together managers and scientists. These efforts have been part of the driving force behind the establishment and funding of research grants focused in these areas. Two examples are the EPA-funded Center for Nutrient Solutions at Penn State and the NSF-funded Water Sustainability and Climate projects headed by Johns Hopkins and Virginia Tech. It is expected that the Johns Hopkins project will contribute directly to the CBP's Phase 6 Chesapeake Bay Watershed Model simulation of lag times.

Developing and applying a conceptual framework needs to be developed that encompasses the interactions between floodplains, stream channels, and sediment storages.

The CBP's Phase 5 watershed model used in the development of the 2010 Chesapeake Bay TMDL had nutrients simulated at the edge-of-stream, meaning at the watershed scale. The CBP's Phase 6 watershed model will have nutrients simulated at the edge-of-field with explicit, albeit simplistic, representation of floodplains and channels in low order streams. Development of these simulations of landscape features is a high priority of the CBP's Land Use Workgroup and the CBPO Land Data Team, supported by ongoing USGS research and a multi-year EPA CBPO cooperative agreement to the Center for Watershed Protection.

Developing guidance for new monitoring efforts to explicitly evaluate hypotheses needed to guide restoration, BMP implementation, and land planning in a holistic manner. An expanded dialogue is needed between the scientists who assess water quality and modelers, both to improve calibration of the models and to improve the understanding of the changes taking place in the watershed.

This expanded dialogue, known as Explaining Trends, is a major priority within the Chesapeake Bay Program partnership, with the Scientific, Technical Assessment and Report (STAR) Team taking the lead working directly with the Water Quality Goal Implementation Team (WQGIT). Trends evaluation and Explaining Trends is an explicit partnership approved component of the Midpoint Assessment. STAC hosted a March 2014 workshop on this topic entitled 'Management Effects on Water Quality Trends'. STAR has reorganized with a workgroup devoted to Explaining Trends and the USGS and EPA have partnered to hire a coordinator for this effort. The CBP looks forward to supporting this effort into the foreseeable future.

Developing and applying educational materials to explain the presence of lag-times in all natural systems and that they vary widely for different practices. Improved communication with the public is needed to distinguish between BMPs that may be expected to show relatively immediate water quality benefits and those whose impact may not be seen for some time. Additional ecosystem system benefits, beyond those anticipated in the Bay itself, need to be highlighted as well.

As noted by the STAC workshop report and acknowledged in this letter, the science allowing for full enumeration of expected lag-times is still being developed and it is difficult and risky to communicate specifics under these circumstances. However, an awareness of the importance of lag times has been communicated by the partnership on several occasions including an open letter from Nick DiPasquale in

2013 and the 2014 'New Insights' report authored by a team lead by the University of Maryland Center for Environmental Science.

Recognize that the failure to account for lag times in point/nonpoint trading programs, either through forward markets or trading eligibility rules, could lead to a degradation of water quality.
STAC has effectively raised the issue of lag times in point/nonpoint trading programs. It is now understood that the reductions occurring through nonpoint actions will be delivered at a later time than point reductions. State trading programs are still under development and this point is a useful consideration during this process. EPA is accounting for lag time in its series of Trading Technical Memoranda under development by EPA and review by the CBP's Trading and Offsets Workgroup.

Including the consideration for information about lag-times in all adaptive management process, to educate the public about setting realistic restoration expectations, to evaluate the effectiveness of point/nonpoint water quality trading, and to assist local managers in more appropriate selection of control measures that will produce the desired short-term and long-term effects necessary for Bay restoration.
This particular recommendation is a good summary of the eventual expected outcomes of the changes to programs and models brought about through the other recommendations in this letter. As STAC is well aware, the CBP is committed to implementing adaptive management at multiple levels. To the extent that lag time considerations can be integrated into trading, communications, models, data acquisition, and data analysis, the CBP will be able to consider lag time in its adaptive management processes.

Please extend my thanks to the workshop steering committee and external reviewers for the time and effort involved in the thoughtful production of this report. We appreciate the role of STAC in serving as an independent review body in improving our overall management of the Chesapeake Bay and watershed restoration effort.

Sincerely,

Nicholas A. DiPasquale, Chair
Management Board
Chesapeake Bay Program Partnership

ec: Management Board
Water Quality Goal Implementation Team