MIDPOINT ASSESSMENT PRIORITY WORK PLAN:
ASSESS AND EXPLAIN WATER-QUALITY CHANGES
LEAD: SCIENTIFIC, TECHNICAL ANALYSIS, AND REPORT (STAR) TEAM

Full Title of Priority: Enhanced Analysis and Explanation of Water-Quality Data for the TMDL Mid-Point Assessment

Short Description of Priority: The Chesapeake Bay Program (CBP) will enhance the assessment and explanation of monitoring information as part of the Mid-Point Assessment for the *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment* (Bay TMDL). The CBP partners have endorsed (PSC, May 2012) an integrated approach that includes three primary pieces of information to assess progress toward water-quality standards:

- Reporting of water-quality practices.
- Trends of nitrogen, phosphorus and sediment in the watershed.
- Attainment of dissolved oxygen, chlorophyll-a, and water clarity/SAV standards.

This project will provide an integrated assessment and explanation of changes in watershed and estuary water-quality monitoring information to support the Mid-Point Assessment of the Bay TMDL. The results from the project will be used to enhance CBP models and by CBP partners to consider adaptations needed to meet the TMDL and associated water-quality standards in the Bay.

Supporting Partners: The effort will be coordinated by through STAR with leadership from USGS (Scott Phillips, Joel Blomquist, Doug Moyer), CBPO Office (Rich Batiuk, Gary Shenk, Peter Tango), and UMCES (Walter Boyton and Liza Hernandez). The project will require coordination among the STAR Nontidal Workgroup (NTWG), which includes all Bay States and DC, USGS, SRBC, and ICPRB; STAR Tidal Monitoring and Assessment Workgroup (TMAW), which includes MD DNR, VA DEQ, and academic partners; Water-Quality Goal Implementation Team (WQGIT) Watershed technical WG and BMP verification WG; the CBP Office modeling and monitoring teams; and the CBP Communications Team (see below for individuals listed). The USGS and the CBPO are also pursuing a new shared position to help coordinate and conduct analysis for the effort.

Study Approach, Necessary Datasets, Analyses, or Decisions: The integrated approach to assess and explain water-quality trends in the Bay and its watershed relies on monitoring information, enhanced BMP implementation data , and use of several models (CBP WSM and estuary models, USGS SPARROW model, and GW models). The following activities will be coordinated through the CBP STAR team and interaction with the WQGIT:

- *Analysis of trends of nitrogen, phosphorus and sediment in the watershed.* The USGS will work with the NTWG to provide an annual update of concentration trends in nitrogen, phosphorus and sediment concentrations for two time periods: 1985 to present, and the most

recent 10 year period. The USGS has also developed an additional technique (WRTDS) to assess change in nutrient and sediment loads and is working with the CBP Office and STAR NTWG on how to best compare these loads with watershed model results and Bay TMDL allocations/targets loads. The initial emphasis will be focused on the nine river-input monitoring (RIM) stations. Leads: USGS (Joel Blomquist, Doug Moyer, Mike Langland and Ken Hyer), CBP modeling team (Gary Shenk), STAR indictors team (Nita Sylvester) STAR NT WG (States, DC, USGS, SRBC, ICPSB, Chair, Scott Phillips). Expected products include: (1) USGS report on flow-normalized trends in nutrient and sediment loads (Jan, 2013), (2) annual updates of water-quality trends in watershed, (3) new indicator(s) for change in load over time (developed during 2013).

- *Enhance approaches to use tidal monitoring data to assess attainment of water-quality standards*. The CBPO monitoring team (EPA and UMCES) is working with the partners to develop a combined indicator of progress toward attainment of DO, clarity/SAV and chlorophyll-standards in the tidally-influenced segments of the Bay and tributaries. Work is underway through the Criteria Assessment Protocol Workgroup (CAPWG) to develop assessment procedures addressing the full suite of DO criteria. TMAW will also interact with USGS and academic partners to consider new trend approaches that adjust for changes in flow conditions. Leads: CAP WG (Peter Tango) and TMAW (Walter Boyton and Lisa Hernandez, UMCES). Expected products include: (1) annual updates of DO, Clarity and chlorophyll conditions in the Bay, and (2) new trend approaches and associated indicators.

- *Explain water-quality trends in Bay and its watershed.* The STAR team (NT and TMAW workgroups, CBPO modeling and monitoring teams, USGS, and academic partners) will collaborate on an integrated approach to explain water-quality trends in the Bay and its watershed. The effort will include both geographically-specific and watershed-wide approaches to explain trends in the nontidal and estuarine areas. In addition to the watershed-wide analysis, the geographic areas that have tentatively been selected include: (1) Eastern shore, (2) Potomac River, (3) Lower VA rivers (Rappahannock, York, James), and (4) Susquehanna and upper Bay. The team will work to integrate findings to explain the relation between the watershed and estuarine areas. The team will investigate explaining trends in relation to both anthropogenic factors (including implementation of water-quality management practices and land-use changes) and natural factors (such as residence times of nutrients and sediment). Overall coordination will be led by USGS (Scott Phillips, Joel Blomquist, and Doug Moyer), CBPO (Gary Shenk and Peter Tango), the proposed new EPA-USGS shared position, and TMAW leadership (Walter Boyton and Liza Hernandez). Specific approaches for the watershed, estuary and modeling include:
  - *Explaining watershed trends:* Trends in nutrients and sediment will be explained for the major basins listed above and down to the most localized level possible within those basins. The team will examine water-quality changes at selected CBP monitoring stations (with an emphasis on the River-Input Monitoring (RIM) sites) using the new WRDTS approach. The factors to be examined at each site include: (1)

inputs of nutrient (such as fertilizer, manure, air deposition) and sediment sources, (2) land-use change, (3) implementation of practices to reduce nutrients and sediment, and (4) influence of watershed properties. Several models (CBP WSM, USGS SPARROW model, and ground-water models) will be used to help examine regional processes affecting trends. Results from small watershed studies being conducted by USGS and academic institutions will also be used to help understand processes affecting water-quality change. The USGS regional water-quality team (leads are Joel Blomquist, Doug Moyer, Scott Ator, new USGS-CBP position), CBPO modeling team (leads: Gary Shenk, Jeff Sweeney, and Matt Johnson), monitoring team (lead: Peter Tango), land-use team (lead: Peter Claggett), and NT WG (jurisdictions, EPA, USGS) will work together to explain trends in major watersheds listed above and for the entire watershed. The team will interface with academic partners to focus on different topics.

- o *Explaining estuary trends:* The effort will focus on explaining trends in DO, clarity/SAV and chlorophyll in the tidal waters of the Bay and the connections with watershed. In addition to the regional effort, there will be an emphasis on the geographic areas being analyzed by the watershed team: (1) Eastern shore, (2) Potomac River, (3) Lower VA rivers (Rappahannock, York, James), and (4) Susquehanna and upper Bay. The factors to be examined include: (1) inputs of nutrient and sediment loads from the watershed, (2) implementation of practices to reduce nutrients and sediment, and (3) influence of estuarine properties. . Leads: TMAW leadership (Walter Boyton, chair, Liza Hernandez, UMCES coordinating with, VA, MD, and UMCES, VIMS, and ODU) and Peter Tango (CBP monitoring team leader) and the new USGS-CBP position. The team will interface with additional academic partners to focus on different topics. Loads from the RIM stations will be provided by USGS and results from the USGS SPARROW model and Eastern Shore ground-water model will also be utilized to look at inputs to estuary waters. Information on loads from areas below the RIM stations will be generated by the CBPO modeling team and land use teams and include changes in nutrient/sediment sources, information on BMP implementation, and changes in land use. CBP modeling team leads are Gary Shenk, Lew Linker, Jeff Sweeney, and Matt Johnson) and the land use team leader is Peter Claggett.

- *Enhance CBP Models*. The CBP modeling team will enhance the WSM and estuary models with the new understanding gained through explaining trends in the watershed and tidal waters. The planned enhancements are explained in additional work plans that were prepared for the Mid-point Assessment of the TMDL. The CBPO will use results from the trends study to improve the suite of Chesapeake Bay Program Partnership modeling tools (e.g., watershed model, Scenario Builder, CAST). The modeling team will also be working with the USGS SPARROW modeling team to test the significance of selected variables to consider for WSM enhancements. The USGS SPARROW team will also be enhancing their models to provide

partners with a finer resolution of geographic information that can be used by partners to help focus implementation of practices for the TMDL. Leads are the Gary Shenk and Lewis Linker (EPA) and John Brakebill and Scott Ator (USGS).

- *Synthesize and Communicate Results and Implications for the TMDL.* Three primary audiences and associated products have been identified to use the results:
  - Science Audience/WQGIT workgroups: Technical Reports/Journal articles
  - Water-Quality Goal Team, Federal and state managers on Management Board: Science Fact Sheets/tailored PowerPoint presentations/briefings
  - Implementers: local governments/conservation districts/watershed organizations: more simplified and more geographic specific explanations and clear statements of implications for ongoing implementation programs and efforts.

The project team will provide key results to these groups using different communication products so they can better apply the CBP adaptive management framework to focus and potentially refine their efforts to achieve the TMDL and associated water-quality standards. Additionally, the information will be available for inclusion into decision-support tools (such as ChesapeakeStat) and other WWW applications. This effort will require interaction between STAR (Leads: Bill Dennison, UMCES and Scott Phillips, USGS), Rich Batiuk (EPA), and CBP Communications Office (Margaret Enloe) to communicate results. Supporting materials on the WWW will be coordinated with Nita Sylvester, and Mike Land. Some specific products include the CBP STAR team is summarizing information from case studies in the Bay watershed and other national efforts for a "lessons learned" report about the effect of BMP implementation on water-quality improvements (to be released by UMCES in spring, 2013).

- *Key Collaborating Activities include:*
  - *Using BMP information being reported for progress toward the Bay TMDL.* The CBP is working to enhanced tracking and verification of BMP implementation, which will increase the accuracy of annual progress reports that are used to track 2-year milestones (lead: Rich Batiuk). The accuracy of the historical BMP information will have to be assessed and improved to be more useful to explain trends (Lead: Matt Johnson and Jeff Sweeney (WQ watershed technical team).
  - *Maintaining monitoring, and enhancing data management, in the watershed.* The EPA has worked with the jurisdictions and USGS (through the STAR NTWG) to add 35 monitoring sites during 2011-2012 in suburban, urban, and agricultural areas. With the new sites, CBP nontidal water-quality network will have about 120 locations where monitoring data can be used to help assess status and trends of nitrogen, phosphorus and sediment loads and concentrations. This information will be used for enhanced analysis but data management efforts will need to be increased given the number of new stations. Lead: STAR NTWG (Mike Mallonee, Mary Ellen Ley and with additional help needed)

Start Date: October, 2012

Interim Deliverables, Including Leads and Deadlines: Some of the proposed products include:
- USGS report on flow-normalized trends in nutrient and sediment loads (Jan, 2013)
- Annual update of water-quality trends in watershed and Bay (Bay Barometer and supporting indicators (Jan, 2013)
- Lessons learned on BMPs implementation and water-quality improvements (CBPO monitoring team, NTWG, TMAW, Spring, 2013)
- Description of land cover and land-use changes in the Bay watershed (CBPO and USGS) (2014)
- Synthesis of factors affecting nutrient trends in nontidal waters on the Eastern Shore (USGS, Dec. 2013)
- Synthesis of factors affecting nutrient and sediment trends in nontidal watershed in the Potomac basin (USGS, CBPO modeling team, NTWG, 2016/17)
- Synthesis of factors affecting nutrient and sediment trends in nontidal watershed in VA Rivers (USGS, CBPO modeling team, NTWG, 2016/17)
- Response of tidal waters in selected estuaries (TMAW)
- Summary of factors affecting trends in the Bay and its watershed (2017)
- Other report and products are being planned.

Completion Date: October, 2017

Level of Effort for Lead and Supporting Partners, Including (as relevant) CBPO Modeling Team: High level of effort for CBP monitoring team, USGS, NTWG, TMAW, CAP, moderate effort for CBPO modeling team. USGS and the CBPO are pursuing a new shared position to help coordinate and conduct analysis for the effort.

Potential Conflicts with Other Priorities: CBP modeling team may not be able to provide effort needed to help explain trends given other commitments.

Issues Requiring Input from Full WQGIT: indicator development, verification protocols, review of key findings.

Issues Requiring Input from Management Board and/or Principals' Staff Committee? A Approach for assessing progress has already approved by MB and PSC.

Other Notes: