Update: January Modeling Workgroup Quarterly Reviews

Water Quality Goal Implementation Team

February 9, 2015

Mid Point Assessment Modeling Workgroup Priorities

Airshed Model

- Update Airshed Model to new CMAQ Bidirectional Ammonia Model

Watershed Model

- Revise Watershed Model system structure
- Revisit Watershed Model calibration methods, including regional factors

Water Quality and Sediment Transport Model

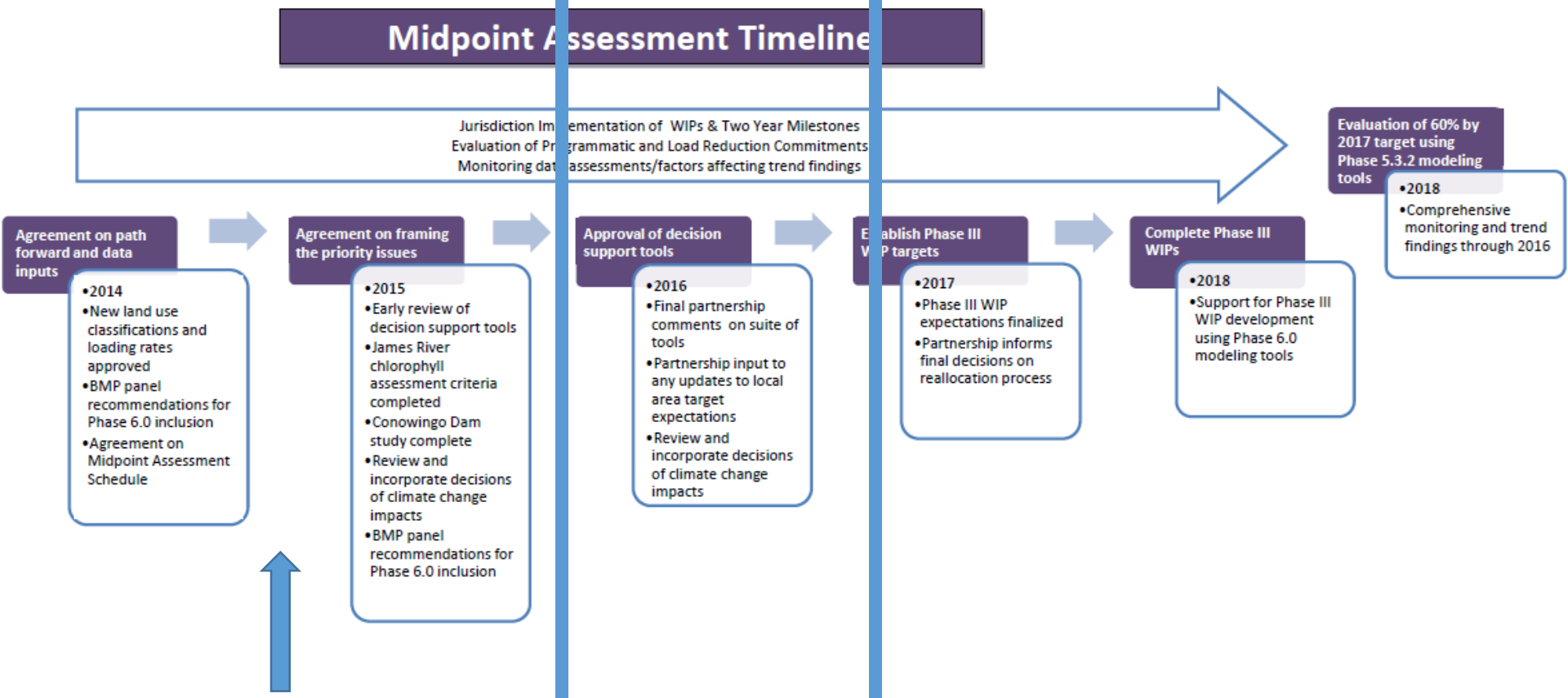
- Refine and update the Water Quality and Sediment Transport Model (WQSTM)
- Refinement of shallow water simulation for improved assessment of open water DO and SAV/clarity standards

TMDL Charges

- Effects of Conowingo infill on Chesapeake Bay WQS
- Examine the influence of climate change (CC) on Chesapeake WQ standards and the 2010 Bay TMDL
- Review James River chlorophyll criteria and James River TMDL allocations
- Influence of oyster filter feeders on water quality, with increased aquaculture and sanctuary development

STAR Requests

- Support needs of water quality goal team and TMDL Mid-point assessment support
- Assess and Explain Water Quality Trends



CREATE
The Models

REVIEW
The Models

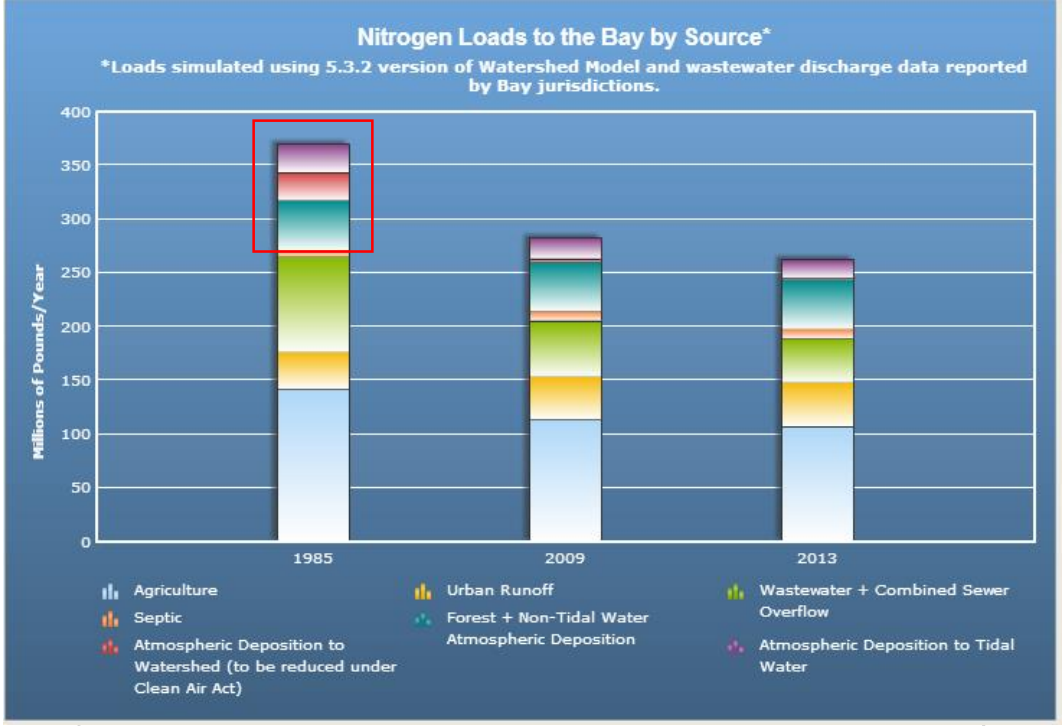
USE
The Models

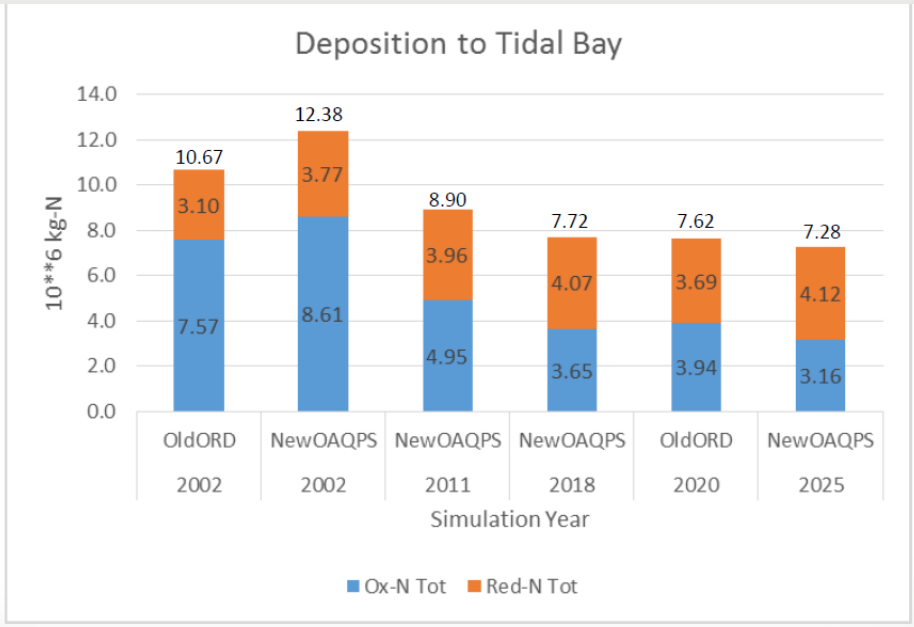
Calibration Timeline
Oct 2014 to Dec 2016

- **October 2014** – Rough Draft of major changes to nutrient processing in Scenario Builder will need to be complete. Continued sensitivity refinement
- **February 2015** - draft targets for draft land Uses
- **March 2015** – All major partnership decisions are made on changes to scenario builder processing and data. Scenario builder final modifications begin.
- **April 2015** - final targets approved by Modeling Workgroup for draft land uses
- **Early October 2015** – All inputs are final and delivered to the WSM by the scenario builder team for the final calibration run. Final targets are based on this information.
- **December 2015** - Phase 6 draft model is complete.
- **December 2015 – December 2016** - Evaluation followed by fine tuning during the next year. Key scenarios available
- **September 2016** – Final comments on the draft Phase 6 model
- **December 2016** - All models are final. The partnership decision-making process begins to discuss how these new models will be used in the WIP3 process

Airshed Model

- The 2002, 2011, 2018, and 2025 CMAQ Scenarios are developed with CMAQ 5.0.2 which is the latest release.
- Future reductions are likely but at a lower rate. We are getting the most reductions now.
- All future scenarios are projected from the 2011 NEI emission inventories





The time series shows the anticipated diminishing rate of future decline.

Watershed Model - Status Report

- Groundwater Lag
- Sensitivities to inputs
- Watershed Model Development
- Land Use Types and Acreage
- Fine-scale Processes
- Land Use Loading Rates
- Calibration Methodology
- Reservoirs
- Climate Change — Early January
- Scenario Builder Development — SEP
- Atmospheric Data

Watershed Model - Status

- Incorporates STAC Guidance
- Extension to 2013.
  - The 2011 model complete
  - More monitoring stations
- Hydrology calibration method complete and improved
- Land and river sediment improved calibration methods
- Provisional water quality running with
  - Sensitivities
  - Lag times
  - Land to stream factors
  - Stream to river factors
  - P5 land use types and acreages

Watershed Model - Update

- Working with Ciaran Harman, JHU and Ward Sanford, USGS to represent nitrogen lag times in Phase 6.
- Phase 6 sensitivity to nitrogen is being actively worked on and will result in nitrogen sensitivities (the amount of nitrogen that comes off the land from a unit change of nitrogen inputs like fertilizer) consistent with Phase 5.3.2, SPARROW, and APEX.
- Phosphorus sensitivity will be more complex and will be based in part on the APLE phosphorus model.

Watershed Model - Update

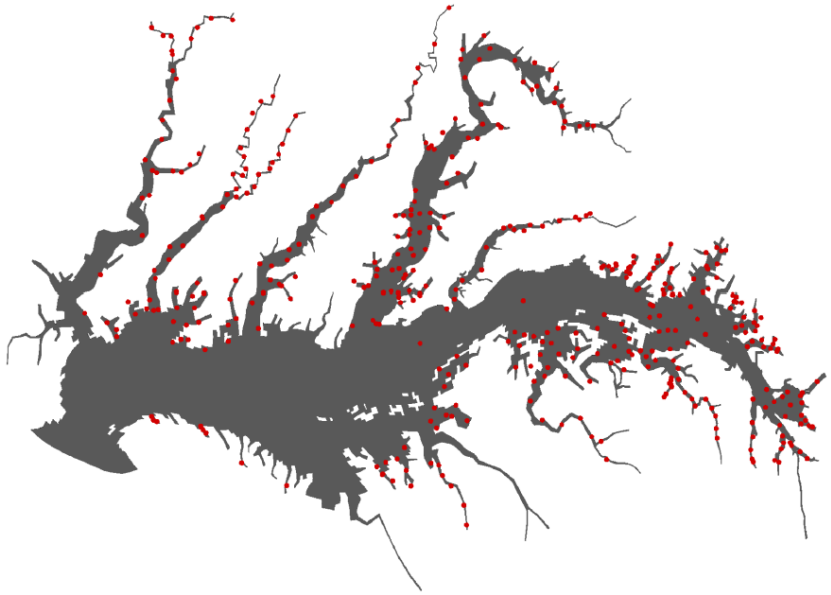
- Land Use Updates Reviewed
  - Land use - review of final land use dataset to be finalized in April, jurisdictions will continue to review decisions into July
- Phase 6 Land Use Target Loads presented
  - Issues to resolve – ongoing over next two quarterly meetings
- Phase 6 Land Segments have been updated with more recent county GIS data
  - The recommendation is to update county subdivisions based on precipitation patterns
- Land-to-Water and Stream-to-River Delivery Factors using SPARROW
  - Process worked for test run. Until information for Phase 6 is more complete, the decisions about replacing regional factors cannot be made

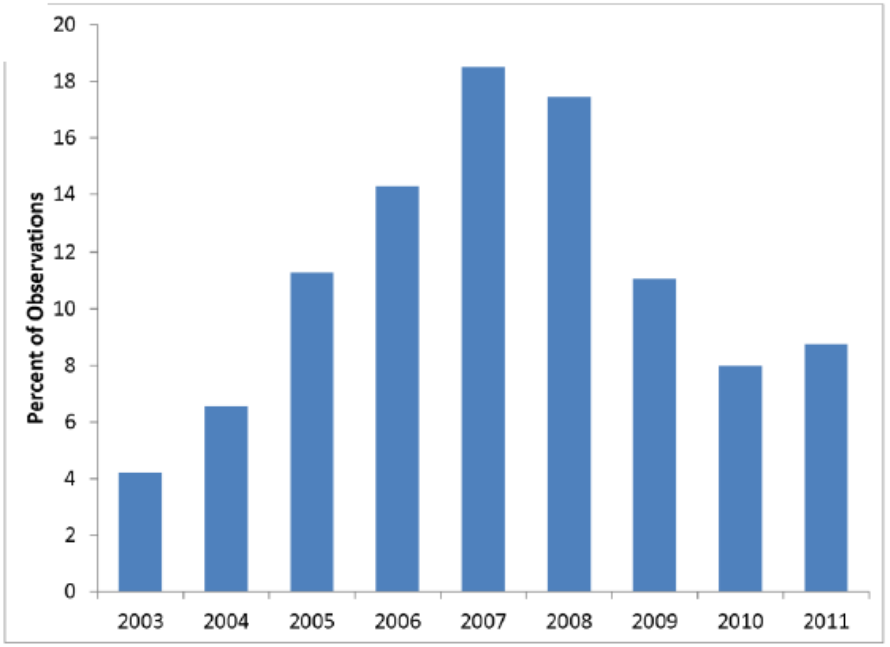
Water Quality Sediment Transport Model

- 2002 to 2011 Simulation
- This is a new base calibration simulation for shallow water assessment to support the 2017 re-evaluation.
  - Move to recent land uses, loads, data.
  - Incorporate bulk of shallow-water data.
- The basic elements of the 2002 –2011 simulation are in place.
- Continued revision with Phase 6 watershed model will inform calibration.
- Evaluating bank loads
  - Simulation of the nutrients associated with shoreline erosion is needed.
  - More to come on this.

WQSTM

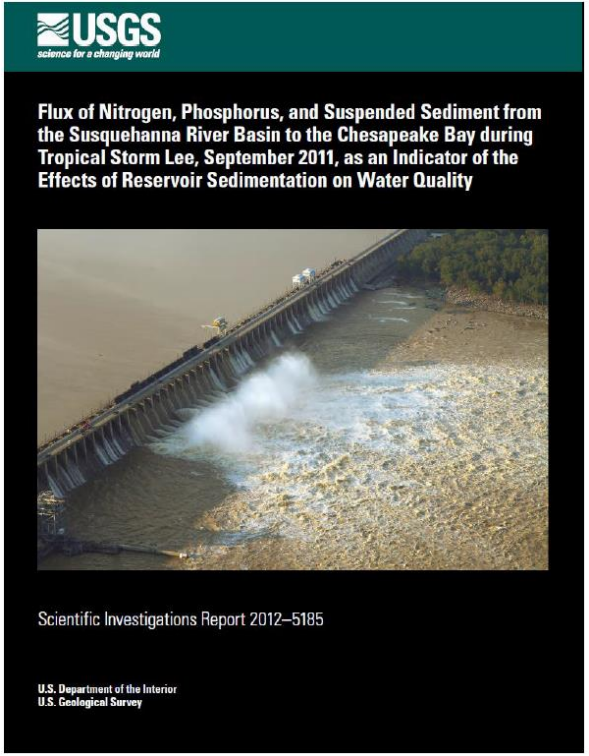
- Improve local water quality simulation
- Need a model from 2003 to 2011 to capture shallow water data
- 84,000 useful observations
- Now running 2002 to 2011 as calibration focus

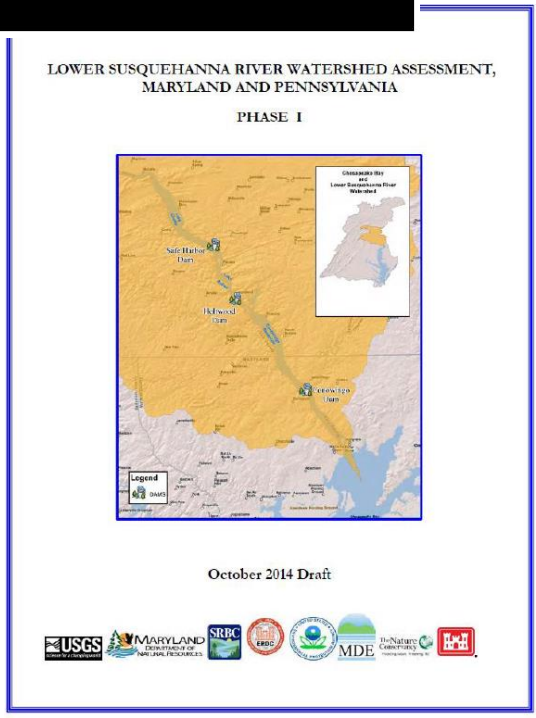




Conowingo Infill

- Current uncertainty
  - The nutrient concentrations during scour events, which is dependent upon the nutrient content in bottom sediment.
  - The biological availability of scoured nutrients is a factor contributing to uncertainly.
- Watershed model
  - Simulate time variable infill
  - Looking to USGS and UMCES for updated information
  - Additional monitoring/modeling for moderate flows
- Water Quality Sediment Transport Model
  - Additional monitoring to be inform bioreactivity of scoured sediment and associated nutrients
- Schedule
  - Need the monitoring information by the end of 2015 to update the models
  - Revisit watershed model calibration method with support from USGS
  - Early 2016 – Incorporate monitoring into WQSTM





STAC Workshop Proposals

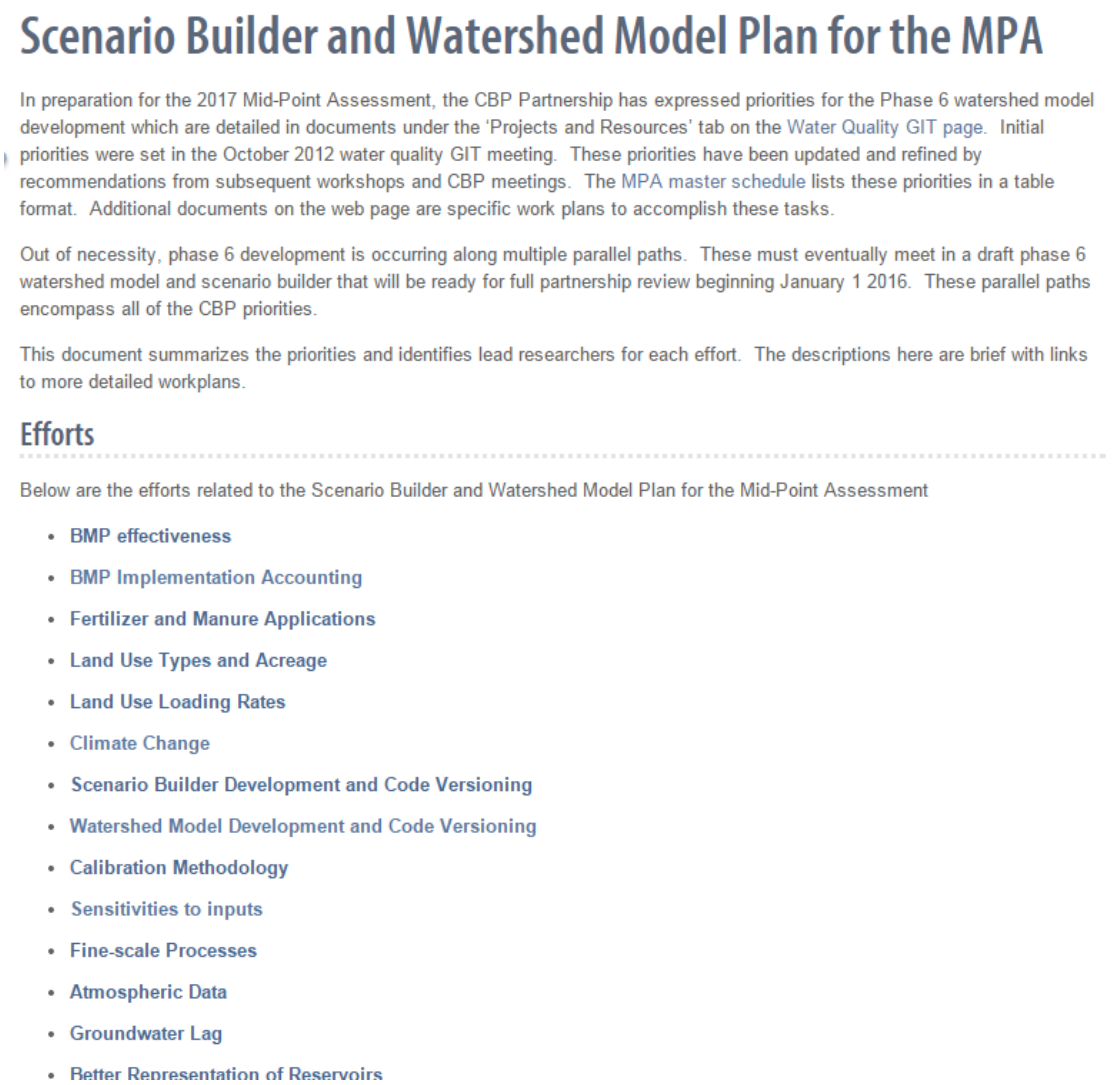
- Climate Change
  - Being proposed jointly by the Modeling and Climate Change Workgroups
- Uncertainty Analysis
  - Suggest joint proposal by Water Quality Goal Implementation Team and modeling WG
  - Define a process
- Conowingo Infill
  - Incorporation of new monitoring for mid range flows and bioreactivity
- Deadline: February 11, 2015 – Wed of this week

Tracking

- Scenario Builder and Watershed Model Plan for the MPA (tracking webpage)

Per WQGIT Request, record of Modeling WG Decisions available from January meetings

- Rainfall
- Sediment Calibration
- Nutrient Sensitivities
- Targets
- Landuses
- Lag times
- Regional factors
- Conowingo
- …



Scenario Builder and Watershed Model Plan for the MPA

In preparation for the 2017 Mid-Point Assessment, the CBP Partnership has expressed priorities for the Phase 6 watershed model development which are detailed in documents under the 'Projects and Resources' tab on the Water Quality GIT page. Initial priorities were set in the October 2012 water quality GIT meeting. These priorities have been updated and refined by recommendations from subsequent workshops and CBP meetings. The MPA master schedule lists these priorities in a table format. Additional documents on the web page are specific work plans to accomplish these tasks.

Out of necessity, phase 6 development is occurring along multiple parallel paths. These must eventually meet in a draft phase 6 watershed model and scenario builder that will be ready for full partnership review beginning January 1 2016. These parallel paths encompass all of the CBP priorities.

This document summarizes the priorities and identifies lead researchers for each effort. The descriptions here are brief with links to more detailed workplans.

Efforts

Below are the efforts related to the Scenario Builder and Watershed Model Plan for the Mid-Point Assessment

- BMP effectiveness
- BMP Implementation Accounting
- Fertilizer and Manure Applications
- Land Use Types and Acreage
- Land Use Loading Rates
- Climate Change
- Scenario Builder Development and Code Versioning
- Watershed Model Development and Code Versioning
- Calibration Methodology
- Sensitivities to inputs
- Fine-scale Processes
- Atmospheric Data
- Groundwater Lag
- Better Representation of Reservoirs

Thank You

Questions?