Eutrophication Model Expert Panel Meeting

DRBC Offices
November 2 and 3, 2016

Recommendations and Tasks

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Expert Panel Members

- Dr. Steven Chapra, Tufts University
- Dr. Carl Cerco, US Army COE (retired)
- Dr. Vic Bierman, LimnoTech
- Dr. Robert Chant, Rutgers University

- Tim Wool, U.S. EPA Region 4 (to be appointed)

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Discussed Topics

* Hydrodynamic Model Selection Process
* Complexity of WQ Model
* Model Calibration Period
* Data Collection (temporal, spatial, state variables)
* Data Compilation
* Data Assessment

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Model Selection Process

* Hydrodynamic model capability
  - Wetting-drying capability
  - Overall CPU time

* Readily available water quality model –
  * Use 1 WQ model - focus on WASP8
  - Water quality model capability
    - CBOD vs. carbon
    - Sediment diagenesis
    - Multiple algae (speciation) if necessary
    - Sediment transport – 1 class at minimum

* Technical support availability

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3-D Hydrodynamic Model Next Steps

* Use of the most recent bathymetry (45' channel deepening);
* Use of NAVD88 datum;
* Evaluate CH3D-Z model coding (hard-wired for the Delaware Estuary specific model);
* Resolve water elevation phase lags at Philadelphia;
* Data
  - Identify data sources of tidal elevation and salinity for open boundaries
  - Current velocity data
  - Salinity profile (vertical and lateral)
* Validate CH3D-Z and DYNHYD5/TOXI5 with other timeframe;

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Establish 1-D WQ Screening Model

* Use existing 1-D DYNHYD5 Model
* Link with WASP8 version and evaluate as a screening model (need to resolve source code availability);
* Check Dr. James Martin for sediment diagenesis subroutine if older version (WASP5) is used;
* Start with 1 class ISS and net burial rate to maintain ISS in water column → light extinction coefficient will be a function of ISS, Chl_a, and shading.

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Calibration Period and NPS

* Model calibration approach
  - Select a data-rich time period to develop model calibration (For example: PWD's model: 4/1/2012 ~10/1/2012 & 4/1/2013 ~10/1/2013);
  - EP recommended to run a two continuous year simulation;
  - Use Year 2018 with intensive monitoring for another calibration/verification of the model;
* No watershed model will be developed – most of non-point sources will be captured by tributary monitoring location – EP recommended to contact PWD for SWWM model applicability;
* Loads from the rest of the area will be estimated;

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Planned Monitoring

* 2017:
  * Bi-weekly monitoring at Trenton (COD, Chloride, Ammonia (Dist. as N), NO_2 + NO_3 (as N), TKN (as N), Orthophosphate, Alkalinity, Total Phosphorus, TOC, DOC, corrected chlorophyll_a, TSS, TVS, sulfate, silica)
  * Monthly Boat Run year-round
* 2018
  * Weekly monitoring at Trenton
  * Monthly or higher frequency BoatRun year-round
  * 26 tributaries 8 times (COD, Chloride, Ammonia (Dist. as N), NO_2 + NO_3 (as N), TKN (as N), Orthophosphate, Alkalinity, Total Phosphorus, TSS, Silica, corrected chlorophyl_a, $CBOD_5$, TOC, DOC, TSS, TVS, sulfate, silica)

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Data Collection Recommendations

* Measure primary production in Zones 2, 3, 4, and upper 5 with an emphasis on respiration rates (2018);
* Measure point discharge organic carbon – TOC (2018);
* Extend sulfate measurement to full boat run (2017 – 2018);
* During intensive-monitoring period, perform even more intensive monitoring during critically important period for nutrient control for temperate rivers (2018);
* Post meeting (inferred from general feedback);
  * Add VSS to Boat Run to determine ISS (2017 – 2018);
  * Add organic carbon to Delaware at Trenton twice per month sampling (2017 – 2018).

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Data Compilation

* Continue to develop existing data catalog. Add items including:
  * SOD data;
  * Cape May-Lewes Ferry salinity data;
  * Rutgers PAR profiling;
  * Rutgers Suna nitrate profiles;
  * Rutgers / PWD dye study results;
  * Rutgers boat based nutrient monitoring;
  * Phytoplankton species composition data including:
    * Marshall phytoplankton data, 1990's (Old Dominion);
    * Pembrook seasonal variations in Delaware Bay phytoplankton community structure;
  * Most recent bathymetry data (channel deepening project in Delaware).
* Look for historical data-rich years

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Data Assessment / Evaluation

* Provide plots / assessments for Expert Panel feedback. Including:
  * Plot Zone 2 production as a function of flow
  * Compare loadings & concentrations of CBOD5 and TOC – look at ratios;
  * Contact Chapra to obtain formulas to represent CBOD-5 as carbon;
  * Overplot nutrient concentrations / chlorophyll a / DO;
  * Overplot Secchi / turbidity / TSS / PAR. Chapra can provide equations re light extinction using PAR/Secchi depth/turbidity;

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