EPA/CPG Model Collaboration Meeting
September 25th 2012
Summary and Action Items (DRAFT)

Participants:

EPA: Ray Basso, Eugenia Naranjo, Stephanie Vaughn, Alice Yeh, Ed Garland, Larry Sanford, James Wands, Jim Fitzpatrick, Paul Paquin

CPG: Rob Law, Han Winterwerp, Leo Postma, Rooni Matthew, Rafael Canizares, Peter Israelsson, Ricardo Petroni, Tal Ijaz

TSI: Cliff Firstenberg, Pravi Shrestha

Note: Summary below follows the outline structure, not actual discussion order. The meeting ended at 3:30 p.m. with several agenda items deferred to the next meeting. The next meeting is tentatively scheduled for November 13, 2012, at the HDR|Hydroqual office in Mahwah, New Jersey.

1. Introduction:

- Stephanie Vaughn presented the agreed upon new format for the EPA/CPG Model Collaboration meetings, which aims to make the meetings more effective. This change in format is in response to CPG's request for formal feedback from EPA on CPG's ongoing RI/FS model development for LPR/NB (since EPA has a formal oversight role). It is also intended to address EPA's desire for faster responses to model-related questions posed to CPG.
- Under the new format, CPG will prepare a draft meeting summary that will be distributed along with all presentations. The draft meeting summary should be submitted by CPG to EPA within 5 business days, and EPA should return comments within 5 days of receiving the draft meeting summary.
- Presentations should be exchanged either during the meeting or in the days following the meeting.
- In addition, CPG will submit a technical memo in October on the sediment transport model status along with the codes, for formal comment by the EPA.
- EPA also requested R. Mathew's presentation from the June 2012 meeting.

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2. CPG Progress:

- Sediment Transport Modeling Update
  - Presentation Topics (R. Mathew):
    - Brief review of recent CPG model refinements including minor bug fixes. This did not result in any noticeable changes in the results.
    - Overview of ongoing projection simulations: Baseline and FFS Alternative 3.
    - Model results with CPG parameterization showed significant infill of the navigation channel after 16 years baseline projection, and rapid infilling of the dredged channel in FFS Alternative 3.
  - CPG Main Comments:
    - There are some differences in dredging schedules between CPG and EPA projections. It was previously discussed that the EPA and CPG consultants that developed the schedules should meet in order to identify the differences in their approaches.
    - The CPG "continuity correction" was not used in the FFS Alternative 3 results shown at the meeting, but has been implemented in ongoing projections; this approximates bathymetric feedback to shear stresses well and allows reduced run-times by decoupling the sediment transport simulation from the hydrodynamic simulation. Predicted infill rates are expected to be lower once the continuity correction is incorporated.
  - EPA Main Comments:
    - Has the CPG simulated the EPA construction schedule for Alternative 3? CPG responded that this has not been simulated; only the schedule developed by the CPG consultant (CH2M Hill) has been run.
    - Has CPG compared model infilling/scour over calibration or projection to that inferred by Han in bathymetric analysis? CPG has yet not done this comparison, or an analysis of how infill rates may have varied by year.
    - E. Garland requested a description of the continuity correction, which was provided by R. Mathew.
    - The continuity correction does not replicate shifts in salt front location due to infilling.

  Next Steps:
    - Develop a CSM of sediment transport in Newark Bay

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    - Review current model performance in Newark Bay (e.g., TSS data, maintenance dredging data)
    - Continue with projection runs
  - Action Item:
    - Compare sediment transport model predictions to bathymetric differencing conclusions about system behavior.

- Refined Analysis of Bathymetric Differencing
  - Presentation Topics (H. Winterwerp):
    - Presentation focused on systematic correction needed for 2008 bathymetry.
    - Review of major conclusions from last collaboration meeting (see June 2012 presentation for details), to provide context for why the 2008 correction is critical.
    - Based on the bathymetric analysis, the river shows a very limited response to discharges below 6,000 cfs.
    - A systematic correction of approximately 0.3 feet is consistent with multiple lines of evidence, including rock outcrops, sunken cars, and sonar targets.
  - EPA Main Comments:
    - What about noise in the data comparisons?
    - The analysis seems sound and the noted systematic offset seems appropriate; position to be confirmed once EPA has had time to review the presentation and discuss internally.
    - Several comments on "cyclic areas" of erosion/deposition imposed by geometric features such as flow obstructions or channel irregularities:
      - Are there cores in cyclic areas?
      - What materials are filling cyclic areas?
      - What is relevance of cyclic areas to modeling?
  - CPG Main Comments:
    - Although there is some noise in the results, CPG (H. Winterwerp) concludes that the analysis supports a systematic bias of about 0.3 feet, perhaps +/- 0.05 feet.
    - The work to identify the areas of the river that exhibit cyclic behavior and comparison to cores has not yet been completed.

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    - Cyclic areas are presumably filled by a combination of coarse and fine material, with the coarser material transported downstream mainly by bedload, and the finer material transported upstream by estuarine processes.
    - The impact of cyclic areas should be taken into consideration when evaluating sediment transport model-to-data agreement because the behavior of these areas will for the most part not be captured by the model, due mainly to the model's grid resolution. The number of grid cells that are involved in this process will be identified to assess the importance of these processes in interpreting model results.
  - Action Items:
    - EPA to confirm their acceptance of the proposed systematic correction of 0.3 feet.
    - CPG to continue analysis of cyclic areas or erosion/deposition.

- Incorporation of Simplified Organic Carbon Tracking in the Contaminant Fate and Transport (CFT) Model
  - Presentation Topics (L. Postma):
    - Numerical results indicate a number of differences between ST-SWEM and the organic carbon simplification predictions. See presentation material for details. However, the source of the differences and the impact to the CFT model are understood. Some differences such as algal concentrations were shown to not strongly influence CFT model predictions. Other differences had more influence on CFT predictions (e.g., parameterization of mixing, treatment of sediment transport model's deposition/erosion fluxes) but once these were made consistent in the numerical tests, the two approaches generate highly similar CFT model predictions.
    - The existing ST-SWEM implementation seems to be overestimating the algae concentration in the water column, and therefore, the POC. Therefore, trying to reproduce ST-SWEM results as a measure of the OC simplification performance might not be a valid approach.
    - The implementation of the agreed upon OC simplification is therefore considered successful and complete by the CPG.
  - EPA Comments:

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  - Several clarification questions were asked on the noted differences.
  - EPA (J. Fitzpatrick) agreed with all the comments related to algae and the proposal on how to treat and simplify algal processes, including the observation that algae-related carbon might not be a significant issue at this site.
  - Concern was raised over the use of static data-based organic carbon content in the bed, as opposed to dynamic model-predicted values. Two reasons in particular were noted. First, the approach does not close the carbon mass flux balance. Second, the approach does not allow simulation of the organic carbon build up following cap replacement, which may preclude the model from accurately predicting recontamination following capping. The latter is the main concern from EPA.
  - Concern was also raised that the 1-year test simulation was too short and should be extended to the 15-year calibration period.
  - Ideas were put forward on longer test simulations that could be run, but there was not consensus among EPA representatives on whether they should be performed with the EPA or the CPG sediment transport/CFT models.
  - EPA proposed carrying out a sensitivity test of the OC content in the bed to understand the importance of using the data-based values or the simulated values. E. Garland indicated that EPA already completed tests in which the amount of the OC in the bed was doubled and halved, and concluded that the perturbation had minimal impact on CFT model results.
  - EPA agreed to consolidate OC simplification concerns and recommendations in written form following the meeting.
- CPG Comments:
  - The treatment of bed organic carbon reflects the agreement that was reached, as detailed in the June 27, 2011 memorandum from CPG (L. Postma) to EPA (D. Di Toro and J. Fitzpatrick).
  - The impact of the static bed OC assumption to the CFT model predictions should be mild in all cases, and applying a data-based value is not necessarily less accurate than using a carbon balance or even a full ST-SWEM simulation.
  - EPA has not demonstrated the ability of ST-SWEM to reproduce measured values of sediment bed organic carbon. Therefore, it is not clear that ST-

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SWEM would be able to accurately predict the buildup of organic carbon on top of an engineered cap.
    - The impact of organic carbon assumptions on the recontamination of a cap can be assessed via bounding calculations.
    - The CPG requests that EPA clarify its concerns and recommendations in written format following the meeting, for CPG comment.
  - Action Items:
    - EPA and CPG will review the details of the agreed upon organic carbon simplification approach, as laid out in the June 27, 2011 memorandum from CPG to EPA.
    - EPA will submit written comments to CPG outlining concerns on the organic carbon simplification and recommendations for further testing.
    - CPG will comment on EPA concerns at or before next collaboration meeting.
    - EPA will investigate ST-SWEM model-to-data performance in the LPR, to inform its suitability as a metric to evaluate the performance of the simplified organic carbon approach.
    - Pursuant to a review of (1) the carbon model computation of carbon in the sediment, (2) results of a 2x organic carbon sensitivity run and (3) the memo mentioned by Leo Postma during the September meeting, Jim Fitzpatrick concluded that the algal portion of the organic carbon model could be eliminated and the simplified approach recommended by the CPG used.

- Response to EPA Comments at the June 2012 Model Collaboration Meeting
  - Question: Is the erodibility of Sedflume cores within cyclic areas different than cores from other areas?
    - CPG Response: No clear trend is evident in the erodibility index (plot shown by R. Mathew).
    - Follow-up Action Item: Consider the hydrograph preceding Sedflume sampling, to perhaps inform interpretation (recommendation from L. Sanford).

- Qualitative Report on 2012 Bathymetry Survey Field Effort
  - CPG Main Comment (R. Law): It is ongoing and CPG expects completion by

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October 12.
  - The multibeam survey is completed. Two thirds of the single beam survey is also completed.
  - Since the 2011 post-Irene survey the river has experienced one event of approximately 6,000 cfs.
- Qualitative Report on Low Flow Surveys
  - The first three CWCM events have been validated.
  - Event 4 has been completed (spring tide, low flow) but is not yet available.

3. CPG Areas of Current Focus:
   - Impact of tidal erosion/deposition on contaminants in the parent bed
     - Presentation Topics (R. Mathew):
       - An overview of past CFT model update presentations and past discussions of the low-flow tidal erosion/deposition ("tidal pumping") effect was given.
       - The CPG considers the present rate of decline of surface sediments due to this effect to be unrealistic. This was illustrated using the original RCATOX code to simulate 2,3,7,8-TCDD; predictions indicate that the 0-10 cm sediment contaminant inventory in the lower 8 miles is almost entirely depleted by the end of the 15-year calibration period (half-life of about 3 years).
       - Recent code tests were presented to further characterize the behavior, which persists even after CPG's efforts to increase vertical grid resolution and limit mixing to the surface sediment layer. Although further model diagnostics are being pursued, simply increasing the resolution of the RCATOX near-surface bed layers does not appear to strongly reduce the behavior under present parameterization.
       - The mechanism for the exaggerated decline may generally be attributed to some combination of: 1) concentrations on resuspended particles is unrealistically high (e.g., due to unrealistic exchange between a surface fluff layer and the parent bed or exaggerated particle mixing within the parent bed); and 2) concentrations on depositing particles is unrealistically low (e.g., due to equilibrium partitioning in the water column). However, the precise combination of effects is not clear at this time, and warrants further investigation.

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    - The investigation into model behavior will continue. Additional next steps include simulating the CWCM period to constrain the flux to the water column and investigating the model-to-data performance of the long-term calibration in the sediment bed, to guide refinements in this area.
  - EPA Comments:
    - A similar depletion has been observed in the EPA model. However, numerical tests indicate that the effect is attenuated if an initial vertical gradient is imposed on bed concentrations. Also, in EPA's model calibration, this decline is offset somewhat by episodic scour events from high flows, which replenish the surface sediment mixed layer (10 cm).
    - To the extent that equilibrium partitioning is a major factor, a practical solution may be tricky since non-equilibrium partitioning models are not common in contaminated sediment modeling for Superfund sites.
    - EPA has not run the 2011/2012 CWCM sampling periods to assess model-to-data performance.
    - EPA agrees that improving the representation of tidal resuspension/deposition is a good area of focus for CPG model development efforts.
  - CPG Comments:
    - CPG requests WY 2012 hydrodynamic and sediment transport inputs to support planned CWCM period simulations.
  - Action Items
    - EPA will work on generating 2012 hydrodynamic and sediment transport inputs.
    - CPG will continue investigation into this issue and provide updates at future collaboration meetings.

- **Refinement of TSS and Contaminant Boundary Conditions Based on CWCM Data**
  - Presentation Topics (P. Israelsson):
    - An overview of the LPR/NB model boundary condition needs was given, along with CWCM and CARP sampling stations.
    - CPG's understanding of the current approach used by EPA to specify model boundary conditions was presented, based on the 2007 CARP modeling report (HQI 2007).

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    - Initial thoughts on possible boundary condition refinements were presented, to be evaluated as more data become available.
    - Near-term next steps include setting up boundary conditions for the 2011/2012 simulation using the present EPA boundary condition approach together with CWCM data when available, and testing sensitivity of model predictions to the boundary conditions.
    - Evaluate prediction of particulate/dissolved concentrations used in present approach when high volume CWCM data are available,
  - EPA Comments:
    - There have been updates to the contaminant concentrations used to compute boundary conditions since the time of the 2007 CARP report, although CWCM data have not been included yet.
  - CPG Comments:
    - CPG requests the updated boundary condition approach for use in the 2011/2012 simulations.
    - When available, CPG requests RCATOX boundary condition files from EPA for this period.
  - Action Items:
    - EPA to provide updated information on the boundary condition approach, including loading functions.
    - Evaluate prediction of particulate/dissolved concentrations used in present approach when high volume CWCM data are available,

- **Refinement of Sediment Initial Conditions Based on SSP Data and Bathymetric Difference Mapping**
  - This topic was deferred to the next EPA/CPG model collaboration meeting due to time constraints.

4. **Conference Call on Proposed Newark Bay Sedflume Data Collection QAPP**
  - Additional participants via WebEx: Jason Magalen (SEI), Len Warner (Louis Berger), Elizabeth Buckrucker (USACE), Carlie Thomson (Tierra).
  - Presentation Topics (J. Magalen; L. Sanford):

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  - To guide the discussion, J. Magalen provided some introduction and presented proposed core locations and supporting maps, including predicted hydrodynamic shear stresses and 2,3,7,8-TCDD surface concentrations.
  - Summary: 24 cores to be collected (12 sites + duplicates); five locations with grab samples to create slurry consolidation cores to ground truth the erosion data.
  - L. Sanford also presented some Newark Bay sediment transport system understanding conclusions based on Sommerfield and Chant (2010).
- CPG Comments:
  - There was a lengthy discussion of possible improvements that can be made to the program by considering its objectives and the best use of funds to achieve those objectives. For example, channel cores may not be of much value to quantify contaminant remobilization since these are recently deposited soft material and not indicative of legacy contaminant inventory. If interested in the upstream "conveyor belt" effect of the tidal pumping and estuarine circulation, then moorings to measure the flux might be a better use of funds. Sedflume cores will not provide information about this process. Sedflume cores are better focused on determining stability of shoals and sediments in the northwest bay near the LPR mouth (i.e., a deposition zone, Kearny shoals). If the goal is consolidation profiles, then samples in the channel become more relevant.
  - Two major questions to be addressed: (1) What is the interaction between the LPR and NB? (2) If the shipping channel is a conveyor belt, then how stable are the subtidal flats?
  - Sedflume should be used for erosional purposes, not depositional areas.
  - Erodibility of the shallows by wave action and movement of that sediment to the channel is potentially of major importance.
  - CPG will provide written comments on the proposed sampling program on or about October 1.
- TSI Comments:
  - TSI emphasized the need to consider the value of each core in supporting program objectives, given the cost of each additional core (total cost is presently estimated at about $400,000).

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    - TSI requested a core-by-core justification to support choices made, and suggested developing a table of characteristics versus location to clarify the rationale and the need for each core.
    - TSI questioned why the 2,3,7,8-TCDD surface concentration seemed singled out as the COPC used in core placement.
  - EPA Comments:
    - Good discussion; will take into consideration; please send summary notes as follow-up.
    - Goals of consolidation cores:
      - Parameterize consolidation model
      - Reduce unexplained variability from *in situ* cores
    - 2,3,7,8-TCDD was not the only COPC used; PCBs, DDT, and Hg were also considered
  - Action Item:
    - CPG will submit formal comments to EPA on or about October 1.
    - CPG will review data from near the mouth of the Hackensack River.
    - CPG will be sent ACOE data so they can determine if sediments within this reach had been dredged.

5. Newark Bay

- Although some system understanding and modeling data needs discussion occurred during the Newark Bay QAPP discussion, this agenda item was deferred until the next EPA/CPG Model Collaboration Meeting.

6. EPA Presentation

- FFS Modeling Status (A. Yeh)
  - Refined projection simulations are ongoing (results were not shown).

- Model Updates (J. Wands)
  - The model projection updates include:
    - Release of solids associated with dredging has been incorporated into the sediment transport model simulations.

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  - The representation of cap material has been revised in the sediment transport model simulations.
  - It was explained that the EPA model recycles the 15-year simulation representing post remedy conditions for the rest of the projection run, assuming that no additional maintenance dredging of the navigation channel will take place.
- Revised results were not presented.

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