MEMORANDUM FOR RECORD 16 April 2007
SUBJECT: Chesapeake Bay Sediment Model Review Meeting

The subject review committee met for the eighth time on 4 April 2007 at the EPA's Chesapeake Bay Program Office in Annapolis Maryland. Presentations were made by Drs. Cerco and Kim on recent developments and status of the sediment transport as well os some other model components. Emphasis was on the sediment transport model.

Cerco reported that development of the sediment model is complete. The structures of the multiple grain-class transport and bed model components are in place and fully operational. Some adjustments to sediment, bed model parameters, and possibly to boundary conditions still are to be made before the model can be called validated and before sensitivity scenarios are run. Scenarios will include reductions in suspended sediment inflows resulting from basin land use and bankloads.

A month-long outage of the Cray XT3 used at ERDC to make model simulations limited the number runs completed since the last review meeting. However, much progress was made. The *M*-parameter concept, whereby erosion depends on the mass of previously eroded material (*M*), was implemented such that *M* was initialized whenever shear stress dropped below a critical value. Bank loads were included into the Bay model using an original parameterization such that the bank loads were related to the local average loads and the daily fractional amounts of water level energy (related to the sum of squared of wave and surge heights) compared to the total for the model period. A parameterization for the effect of submersed aquatic vegetation on resuspension such that shear stresses in SAV areas are related exponentially or linearly to the local biomass of SAV leaves. SAV are treated on a sub-grid scale.

Results from run 117 were presented and discussed. The following are the comments from the three sediment model review committee in the order developed.

Dr. Earl Hayter comments:

1. Use existing spatially variable sediment properties (grain size distribution) data to initialize the composition of the sediment bed throughout the model domain. As mentioned during the meeting, it is imperative that vertical density and shear strength (i.e., critical shear stress) profiles be represented in the layered sediment bed. The Sedflume data should be used to set the critical shear stress and erosion rate for each vertical bed layer.

2. After accomplishing the task described above, I recommend that you spin-up the model as follows: using output from CH3D, run the sediment model for at least one year. Use the bed properties at the end of this spin-up run as the initial conditions for subsequent production runs.

3. For the problem near the Bay entrance where the sediment bed gets completely eroded, you need to specify a reasonable flux of sand coming into the Bay on flood tides as the boundary

condition. I would ask Joe Gailani who in CHL you should talk to (if you do not already know) to get an estimate for this. Maybe Joe is the best person, but if not, he will know who you should talk to. I think that this is an essential step. My guess is that there may be sand waves that are transported into the bay each flood tide, but I am not familiar with the morphology and coastal dynamics in proximity to the bay entrance.

4. To correctly simulate the transport of the noncohesive size class, it is essential that bedload transport be added to the sediment transport model in ICM.

5. In addition to showing plots of simulated and measured state variables, quantitative comparisons between simulated and measured TSS values and salinities should be performed.

Dr. Allen Teeter comments:

1. After checking the model bed shear stresses with Dr. Harris, a more realistic initialization of the bed sediment component spatial distribution needs to be made and cycled through at least several years of hydrodynamics. The bed should adjust to local shear stresses and erode away completely only in isolated areas. I would expect most of the bed area to be in near-equilibrium without appreciable net erosion or deposition over time. Otherwise the assumption of no feedback between depth-change and hydrodynamics will not be a good one. If net bed erosion continues over large areas consider making the surface critical shear stress for erosion a function of local bed mass or thickness such that as the bed erodes it becomes less erodible after M is reset.

2. The ocean boundary condition for sand might be made consistent with sand transport just inside the boundary during flood tidal phase. If the gradient of sand transport were assumed to be zero at the boundary then sand mass in the boundary cell would not change during flood tide. This suggests a flux boundary condition for sand instead of a concentration boundary condition. (The mass needed to accomplish this should be recorded and checked.)

3. The erosion threshold shear stress for the clay fraction used in R117 (0.03 Pa) is on the low side of the expected range. The upper end of the range might be 0.09 Pa. The R117 silt threshold shear stress (also 0.03 Pa) is below the 0.1 to 0.2 Pa I would expect.

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