

Responses to Steve Scott's Comments Made November 21, 2016 on WEST Draft Report from July 27, 2016

Question 1

No response needed.

Question 2

No response needed.

Question 3

Scott Comment:

The degree of certainty of modeling results is highly dependent on measured boundary conditions. The calibration procedures for the HECRAS model were adequate given the available hydrodynamic, sediment, and bed survey data. The flow and stage data sets provided by the USGS were complete for the simulation periods. However, suspended sediment data were lacking for discharges greater than 450,000 cfs, and thus it was necessary to extrapolate the data for higher flows at the upstream boundary (Marietta). Bed sediment grain size data were adequately represented in the model for both reservoirs. However, the erosion characteristics of the mixed sediment beds in the model were not measured, and thus were highly uncertain. Periodic bed surveys in both reservoirs provided adequate trends in bed change to enable an approximate volumetric calibration.

The model results indicate the system is net depositional even for a relatively large flow event such as Tropical Storm Lee (~600,000 cfs). Erosion of the bed mostly occurred in areas consisting of primarily sand, with minimal erosion of areas consisting of a mix of sand, silt, and clay. These mixed sediment areas occurred in channel reaches with the highest velocities and subsequent bed shear for the Tropical Storm Lee event.

Response:

- 1) "...However, suspended sediment data were lacking for discharges greater than 450,000 cfs, and thus it was necessary to extrapolate the data for higher flows at the upstream boundary (Marietta)..." *This is true. Extrapolation was performed using a best fit line, sensitivity to sediment loading was performed prior to calibration, and the overall sediment loading curve (amount and gradations) was adjusted as part of the calibration process.*
- 2) "The model results indicate the system is net depositional even for a relatively large flow event such as Tropical Storm Lee..." *Evaluation of net system mass change is dependent on the time window. The reviewer's comment is correct for the time window encompassing the*

entire storm but seems to imply that the modeled system never experienced negative net mass change. This is not the case. The modeled system was net depositional during the rising and falling limbs of TS Lee, but experienced net scour near the peak of the storm hydrograph. The model predicted negative net system mass change during the portion of the hydrograph above ~575,000 cfs on the rising limb and above ~640,000 cfs on the falling limb (at Marietta), a condition which lasted for a period of about 19 hours.

- 3) *“Erosion of the bed mostly occurred in areas consisting of primarily sand, with minimal erosion of areas consisting of a mix of sand, silt, and clay. These mixed sediment areas occurred in channel reaches with the highest velocities and subsequent bed shear for the Tropical Storm Lee event. It is unclear where the reviewer’s information about the sediment mixtures associated with the areas with the greatest modeled velocities came from the WEST model or from other sources. While it is true that the sand size class accounted for most reservoir mass change during Tropical Storm Lee, which suggests that areas of the bed with a greater proportion of sand experienced more scour overall during that event, the median grain size (D_{50}) of the cover layer at each cross section was not well correlated with the modeled velocity at the peak of TS Lee.*

Some bed sediment mixtures varied considerably throughout the simulation, and the state of the bed at a given location often dictated its response to a particular storm event. Figure 1 compares discharge with the modeled D_{50} of the cover layer for a cross section a short distance downstream of Pequea Creek in Lake Aldred for part of the simulation period. The location was chosen due to the presence of very coarse sands and even some fine gravel at the beginning of the simulation, which makes changes in the D_{50} more distinct. The plots show the D_{50} fining during periods of low to moderate flows (there’s little change at very low flows) and coarsening during periods of larger flows as finer size classes are selectively scoured. The cross section experienced three other storm events of around 300,000 cfs or greater during the year leading up to TS Lee, so the bed was already very coarse when Lee occurred. If the modeled sediment mixture varied so significantly for a single cross section over the course of the simulation, and responded differently to changes in velocity and shear stress depending on the pre-storm bed state, it is probably not advisable to draw general conclusions about the relationships between bed sediment mixtures and hydraulic factors based on TS Lee alone. (Also, this armoring may have limited scour during the event, again illustrating the sensitivity of net mass change during large storms to bed state.)

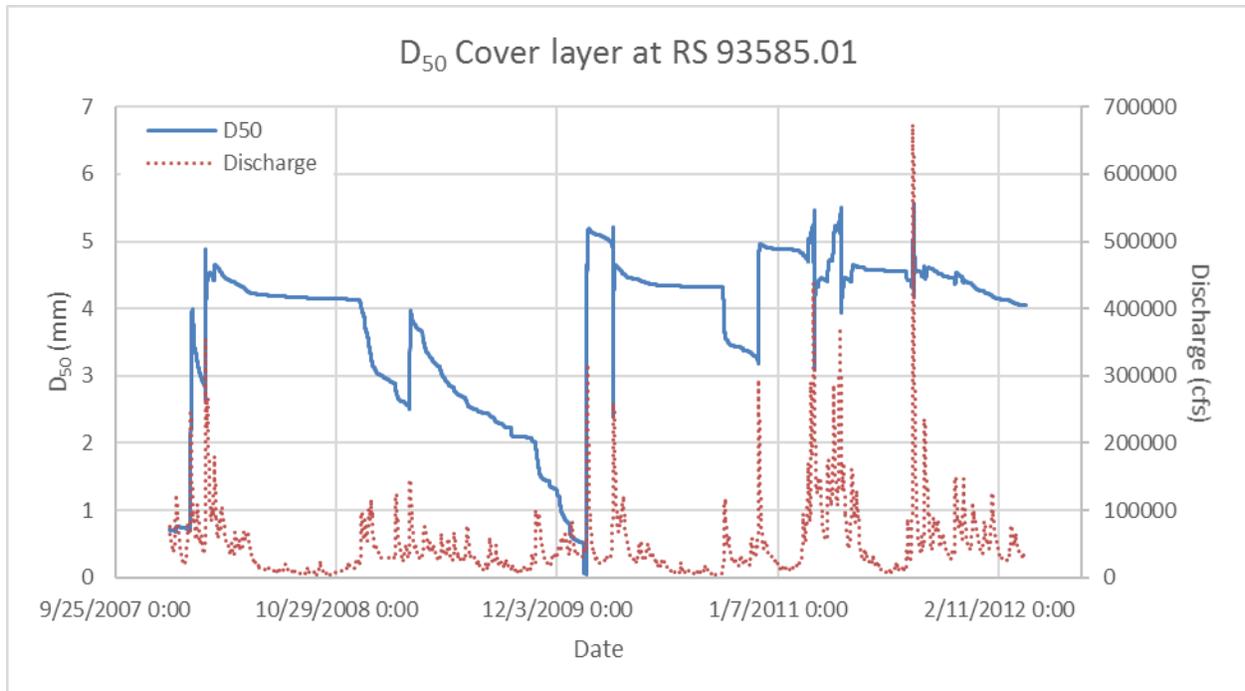


Figure 1

Question 4

Scott Comment:

The modeling approach was appropriate and model results reflect sorting of the bed based on the volumetric calibration. However, the potential bed scour load range due to infrequent large storms should be represented by model simulations that vary the highly uncertain bed erosion coefficients. The Water Quality models used to rout [sic] sediment to Chesapeake Bay should consider this range of scour loads in their simulations.

Response: We agree that users of the modeled results should consider ranges of scour loads for given discharges, given both the uncertainty in the model inputs and the variation in the modeled results based on factors such as reservoir bed state. While there is uncertainty in the selected cohesive bed parameters, their values were carefully selected within a reasonable range as part of the calibration and verification process. Varying them and re-running the model would certainly affect the resulting output loads, but it would also mean that the model would no longer be calibrated to bed volume change.

Question 5

Agree with comments, no response needed.