UNCERTAINTY ANALYSIS

- The Scientific and Technical Advisory Committee of the Chesapeake Bay Program (STAC) has recommended completing an uncertainty analysis of the Chesapeake Bay model in 2005, 2006, 2008, 2011, and 2013 and to date no uncertainty analysis has been completed. This is clearly a failure to follow partnership instructions.
- As discussed with Gary Shenk multiple times, STAC recommended in 2013 (most recent recommendation) that an uncertainty analysis be completed with this version of the model and communicated transparently with the public. It has not been completed and CBP has not submitted a legitimate argument to not complete an uncertainty analysis prior to any results being published. Stating it is too complex is not a legitimate scientific reason, as STAC has made clear.
- Because an uncertainty analysis has not been completed by CBP the partnership States cannot implement the best policies, management practices, etc. to address real and accurate concerns.

ACCURACY/PRECISION/SIGNIFICANT DIGITS

- Many output numbers are to the tenths, hundredths, and thousands decimal places with many significant digits. Because many of the input parameters have unknown certainty and/or are estimated through other modeling, there is question whether the output data should have this many significant digits. We suggest CBP verify the significant digits in each output parameter. It seems improbable that N and P load estimates can be extrapolated to the significant digits documented in the different scenarios. A large number of significant digits gives the perception the output is very accurate with no scientific backing for the significance.

CALIBRATION

- Documentation in Section 10 is confusing and graphs of the correlation of the initial model outputs to the actual observed data are not presented. Figures 10-11, 10-12 and 10-14 show the sites and relative number of observations, but there is no documentation of the correlation of the data from the model and the data from the observed points prior to model adjustment and following model adjustment. The narrative then graphs Phase 5.3.2 vs. Phase 6 and discusses its correlation with WRTDS. As described in the documentation neither model has an uncertainty analysis completed. So the model may be precise (Phase 6 correlates to WRTDS after model adjustment), but there is no verification that the model output is accurate or to what degree it is accurate. It is suggested that the initial calibration run be graphed against observed data and the calibrated model be graphed against observed data and presented.
- Also, there is no documentation of what input parameters and model parameters were modified to get Phase 6 to correlate with the observed data. For transparency reasons this information should be included in the documentation.
- Is nitrogen and phosphorus emanating from groundwater included in nitrogen and phosphorus estimates in the Phase 6 Model output? If not and the calibration is adjusting water quality output to observed water quality input, then the calibration is placing large quantities of nutrients back on the current activities that are unrelated to actual nutrients applied and nutrients making it to the water resource from those applied today. So, current model estimates are assuming much larger quantities of nutrients from today's activities going to the bay based on farming activities that took place 10-30 years ago.
- The calibration methodology assumes cropland is the highest loading land use and then portions the other large land use categories (pasture, developed, and natural) off of this. This calibration

methodology seems to be circular logic as it starts with observed WQ data being dissected for large land uses only to be calibrated back to that same original observed data.

APLE

- An uncertainty analysis has not been completed on the modified, Bayesian APLE model constructed by CBP; therefore its accuracy cannot be verified.
- Soil Phosphorus Data used to calibrate the model is not well documented. The Section 3.0 documentation notes years and College or organization that collected/analyzed the data, but nothing further. Where were these samples obtained from? Who sampled? What methods? The main concern is these samples were most likely not random and are biased due to the reasons for sampling and specific items the sampler was attempting to look at. If they are biased it could significantly impact the accuracy of the average phosphorus calculations for that area.
- There are many counties that have no data. Using adjacent or counties near the county with no data to assume soil phosphorus in that county is not scientifically valid. Urban turfgrass issues have been brought to CBPs attention previously and the response was there was not enough data spatially to estimate turfgrass N and P concentrations. Soil P estimates using APLE are in the same category. APLE and the observed data are not adequately understood spatially to utilize the method throughout the Chesapeake bay region. Otherwise it is suggested that CBP add turfgrass N and P estimates based on real data similar to the estimates for Soil phosphorus. Studies have shown 87 lbs/acre N applied to turfgrass. Phase 6 of the model estimates 10 lbs/acre and assumes this is a 1:1 rato of turfgrass need to turfgrass uptake. If that is the case 9% of the Chesapeake Basin is underestimating turfgrass nitrogen applied by 70 lbs/acre vs. turfgrass need. This would substantially impact the calibration of the model (see above).

SCENARIO RUNS

- Several scenarios were run to understand some of the impacts when modifying scnearios. When E3 was run for the Eastern Shore the sediment load was calculated to be -700,000 tons. How is this possible?
- Applied nutrients vs. crop needs for several counties are estimated to be up to a 5.7 ratio in the Tableau Visualization Tool. This seems improbable if not impossible. Manure would have to be stacked more than foot high across the entire farm. Please explain how this was developed.