# Modeling Quarterly Review Meeting
## Estuarine & Ecosystem Modeling
April 26, 2016
CBPO Conference Room - The Fishshack
410 Severn Avenue Annapolis, MD 21403
**Event webpage:** http://www.chesapeakebay.net/calendar/event/23598/

**MINUTES – Day 1**

**WQSTM Calibration to the Phase 6 *Beta* 1 Loads – Carl Cerco, U.S. CoE ERDC**
*Attachment A.1*, *Attachment A.2*

- Carl discussed updates and revisions made to parameters in the WQSTM with a new calibrated hydrology, and also reviewed several comparisons between model runs and measurements for dissolved phosphate and other constituents.
- We are again investigating the role of benthic algae, and the role that it plays in shallow water environments.
- Nitrate has proven problematic to deal with, and there is a persistent excess of nitrate in the bottom of the Bay. The amount that you can denitrify is limited by the amount of carbon that is put into the bottom.
    - One of the datasets that Jeremy Testa has provided is able to produce more denitrification, but it does not completely solve the problem.
    - Lew asked if the nitrate was dependent upon the amount of carbon entering the sediments, or was it based upon a denitrification rate in bottom sediments independent of organic carbon. Essentially, is the denitrification really carbon limited?
        - The bacteria that reduce the nitrate are still trying to oxidize organic carbon and if there is no oxygen, then the need for nitrogen allows them to reduce nitrate. However, nitrate can't be reduced unless carbon is also present for that process
    - In general there is an excess of total nitrogen at the bottom and at the surface, represented by the aforementioned excess nitrate.
- A persistent turbidity maximum in the lower Bay is still unexplained, and isn't in the gyre that was discovered in the past.
- Clinton Gill asked if the phosphorus availability was related to pH. Carl emphasized that pH is not calculated in this version of the model and it would only be an issue in the tidal fresh portions in any event, not in the main stem of the Bay.
- For the most part there are low values expressed in the surface dissolved phosphate for many fresher western tributaries.
- Carl asked whether an adjustment of the reaeration coefficient in order to meet calibration could be justified based on the position in the stream.
- Greg Noe asked if there was any chance that the surface ammonium in James could be due to ammonium desorption from particles, as concentrations of 1 ppt are sufficient to desorb $NH_4^+$ off of particles. Jim Fitzpatrick noted that ammonium isn't sorbed that strongly to particles and matched partition coefficient observations well for his models without this added complexity.
- Gary emphasized that the desire to get the inputs settled in order to move on more effectively with calibration is shared, but is likely to face major hurdles as the partnership discusses and decides upon important questions regarding land use, nutrient application, and BMP inputs for the Watershed Model (WSM). The focus of Beta 3 development is likely to be calibration, coupled

with an understanding that the loads delivered will not necessarily be an absolute indicator of the final values.
- Carl emphasized that consensus is needed on the G1, G2, and G3 particle decomposition splits. At this point, the plan is to take the best guidance regarding reactivity from Jeff Cornwell's experiments, and then apply them to the model.
- Carl agreed that it may be time to look at some series of nutrient limitations in a systematic way, diagnostics on limitation might be of value.

**Progress in the Simulation Shallow Water Processes and Tidal Wetlands – Carl Cerco, U.S. CoE ERDC**
*Attachment B.1*, *Attachment B.2*

- While a complete wetlands biogeochemical model would be ideal, it is not feasible to complete this on any reasonable time scale. Carl then explained the primary processes that are helping to drive a simplified module including the big three: particle burial, respiration, and denitrification.
- Carl also showed a comparison of results from regions with and without wetlands to points where changes in nutrients and hypoxia are affected, and the impacts on the calibration of the WQSTM.
- Zoe Johnson asked if the module presented is the same one that will be used when assumptions of wetlands loss are fully incorporated.
    - Carl noted that this is correct. Once the module is calibrated, the area of wetlands can be changed based on projected wetlands loss and some of the pieces of kinetics based on temperature corrections may be changed as well. It would be fairly straightforward to build in air and water temperature changes for future scenarios.

**WQSTM Sensitivity Scenarios – Lew Linker, EPA - Ping Wang, VIMS - Richard Tian, UMCES**
*Attachment C*

- Lew explained that there is a consistent loss of sensitivity in dissolved oxygen to nutrient load changes among all segments throughout the Bay. There is still work to be done to gather further understanding of this lack of sensitivity. This point will be brought back for further discussion in a June workgroup conference call after further analysis.
- Possible causes could be a result of increased shoreline loads, changes as result of the ocean boundary condition, or the change of G3 reactivity rates applied to Phase 6 watershed loads.
- Carl Cerco asked whether the results of this reduced sensitivity could be a result of different timing of management practices, or a factor of different ways in which the loads were changed in the Phase 6 WSM.
- Another possibility to look into is that the observations may themselves also be showing a lack of sensitivity.

**Update on Shallow Water Modeling Workshop – Marjy Friedrichs, VIMS**
*Attachment D*

- Marjy provided updates regarding efforts of partners involved in the two STAC Shallow Water Modeling Workshops held to date, including a review of the differences and capabilities of the models and comparisons among the results.
- Additional experiments will also examine the impact of watershed load inputs and the flux of nutrients at the mouth of the Chester River.
- There is a large issue that was found with utilizing multiple models in a nested grid at the open boundary. One recommendation that came out of a consensus of group recommendations to

adjust for this issue is the use of one grid for the entire domain with a much higher resolution for particular areas of specific study.

**Chester River Shallow Water Multiple Models – Richard Tian, UMCES**
*Attachment E*

- Richard discussed his application of FVCOM to studies of shallow water environments in the Chester River.
- There still lies an issue of coupling physical and biological models to produce a fuller interpretation of impacts to shallow water environments.
- Carl noted that there are multiple explanations for all of these phenomena outlined by Richard regarding intensive chlorophyll growth rates, and while it may be tempting to jump on a bandwagon it is important to be careful when studying an issue.
- Carl also suggested that a method to move chlorophyll down would be an evaluation of dissolved inorganic nitrogen, and look into potential uptake by wetlands or other factors that could affect concentrations.
- Richard referred to Bill's comment regarding nesting across boundary conditions which may help to alleviate some of the issues encountered, but it will be difficult to nest models in real time.
- There was an inquiry regarding the origin of the water quality parameter dataset, and Richard noted that some adjustments to the initial dataset provided by Carl had been made although values of sediment diagenesis and sediment water flux remain unchanged.

**Refinements to the Shallow Water Criteria Assessment – Ping Wang, VIMS**
*Attachment F*

- Ping discussed methods and results regarding the Water Clarity Criteria Attainment used to protect SAV.
- Initially, the criteria for SAV attainment was based upon either having the highest SAV within the past 3 years or having 2.5 times greater than that which was based on clarity vs. SAV relationships that were derived empirically. States could have one or the other of these metrics to pass, but the states then argued that areas meeting water clarity that did not have SAV could be combined in order to reach water clarity standards. This is the basis for the seemingly arbitrary equation, and it is part of Maryland law.
- Data correction methods based on rectifying current method insufficiencies were outlined and the benefits and drawbacks of each were more thoroughly explained.
- The relationship between the shallow and the channel is likely to observe a number of different states. The relationship may be linear or non-linear, but plotting the relationships among different years can help to provide further insight. The method by which the relationship is determined is critical for this issue.
- The $R^2$ value used successfully in the first series of methods for criteria assessment could guarantee failure in the second as well, and there is a need to reevaluate some of the multivariate methods. The population of regression statistics should be more thoroughly studied before a decision is made about the translation to clarity.
- It was determined that there is a need to bring this issue back to the Modeling Workgroup again in July when it is better developed with all three options fully explored.

**Minutes – Day 2**

**Phase 6 Watershed Model Schedule Update** – Lee Currey, MDE and Dave Montali, WVDEP

- The working plan was to develop the Phase 6 model by December 2016/January 2017 after locking down all inputs. However, there are several issues that are affecting schedule timing:
    - Historic information regarding BMPs will be provided to the modeling team in September 2016.
    - Expert panels are providing guidance regarding methods for simulating management practices that will also be finalized in September 2016.
    - There will be a 3 month delay in the provision of land use information, which is now officially scheduled to be received on December 1, 2016.
- While information is coming in at different times and the schedule is not ideal, we have instituted a one year review time period for the model.
    - A Beta 1 version of the WSM was released in January 2016. Dave and Gary then held a webinar, and the full documentation was posted to the Modeling Workgroup's website (link).
    - April 27, 2016 is the release date of the Beta 2 model version of the WSM.
    - There is a scheduled release of a Beta 3 version at the July 2016 Modeling WG Quarterly meeting, which will in turn be followed by a Beta 4 version.
- In addition to the internal Modeling WG and jurisdictional review, there will also be STAC reviews of both the WSM and the WQSTM.
- There have been calls from the WQGIT for a three month time period for another fatal flaw review as well with all inputs and land uses locked down.
- Lee asked about different Modeling WG perspectives regarding what would constitute a fatal flaw review and how it might be expected to differ from the ongoing internal reviews throughout 2016.
    - Lee also noted that once targets are released, people are much more vested. There is also concern that the end of the year will come without the model being examined thoroughly, which may lead to "opening up the hood" in the last month of 2016 before the model deadline of January 2017. It is necessary that jurisdictions look at all individual parts of the model throughout this year and convey that information to WQGIT members.
- Comments from Modeling WG Members:
    - Bill Keeling – We don't have the model yet to review, but only have iterations of the model. Until it is completed with all of the various land uses finally inputted and final tweaks to Scenario Builder are made, I don't have the official model to review and I can only review the iterations. I don't see a 1 or 2 month fatal flaw review as sufficient time to review once it's all put together.
    - Jason Keppler – Agreed with Bill's comment and noted that he won't be able to look at the model until the BMPs are in. I will have an educated assumption after that, but need time to make sure BMPs are handled appropriately and would need to begin the review in the early part of the fall at the latest.
    - Norm – I also agree with Bill, and in order to do a good fatal flaw analysis we need to see all the pieces moving together simultaneously. In addition, part of the emphasis on Phase 6 is getting localities involved, making them comfortable, and letting them see all of the ramifications. Draft numbers are good and are part of the fatal flaw analysis, but it is also important to ask if the model is driving the schedule or if the opposite is true. Regarding E3, will we have to come up with entirely new E3 scenarios based on changes to the model with the substantial changes to BMPs? This will present significant challenges and may necessitate at least 6 months of review.
    - Lee also asked jurisdictional members to consider whether they are looking to see how the model is responding or how the process for the model is progressing. Continues

polling other states. Trying to determine difference in review of processes versus our final take on how the model functions.
    - This cannot be fully assessed until all the pieces are in place – Norm.
    - Bill Keeling – Part of the reason for P6 is that we identified flaws in Phase 5, until P6 is complete how can I even review it to make sure that the issues have been fixed? Lee – this is debatable
- Ted Tesler – My greatest concern is ensuring that localities are only addressed once regarding outputs from scenarios so that PADEP doesn't have to repeatedly turn around and notify them regarding what has changed in the model. I do see the progression of Phase 6 as a phased approach and the process should get started as soon as possible.
- Dave – Before the final version (including final scenarios and targets) it is kind of a calibration sort of question concerning how well the model is performing compared to observed loads. It would be good to kick off discussions regarding hockey stick, E3, etc., so that targets could be done when we come out with new final draft Phase 6 model. Whatever I review in October would only have the land use change, and I will be looking at inputs and outputs to the model to determine how it affects level of effort. It might have been nice to know draft targets in March which could help answer the question: how fatal is the flaw?
    - Bill Keeling – Is the discussion of targets related to targets to river basins like we've done before or this concept of local targets? I have real problems with taking this model that is most likely inadequate with basically the same segmentation and county inputs and seeing how it can support river basin targets at a sub-county level. River Basin targets are a separate story. Lee noted that this point is a separate discussion more related to targets.
- Dinorah – From the MDE perspective we are looking to work with Ross Mandel, and we have already been reviewing the process to examine the methods for BMP simulation, the functions of regional factors (that now go by a different name), and the finer aspects of the modeling processes which we believe can also be reviewed now by everyone. Does not think that we need to extend model review period further. We can have the planning targets together with the fatal flaw review. By April of next year we will have had an entire year to look at the modeling process.
- George Onyullo – We will be mainly focusing on input/output, and looking at input targets. This discussion about fatal flaws that may be too generic, and we need to really define what the threshold is for the flaw to be fatal and what needs we should be focusing on. The District will mainly focus on what draft target loads and how those inputs translate to other locations.
- Hassan Mirsajadi – We have started reviewing what has been produced so far. There will be a more thorough review of the model once everything is complete. One of the ways that they will check the validity of the model results is to check to see what matches with field observations. We want to check final model results with that data to see what is matching with Delaware's monitoring program.
- Lew – Representing EPA's position: when developing state basin targets we will include the Phase 3 WIPs. Will these other scenarios be included with the WIPs? We will have an early look about what is going into the state basin targets, adjustments are expected to be extremely minor. We have said to the public that we will have a 2017 assessment, and there is a danger of missing that target if we continue to push back the schedule. For the modeling WG, it is imperative to define what constitutes a fatal flaw. There are other policy GITs at the Bay Program, but the Modeling WG is a technical group that looks for technical fatal flaws. We should therefore focus on these technical aspects and trust in the governance of the Bay Program to settle other questions.

- Dave – No matter what we want, this fatal flaw review will likely be applied to everything, not just the model. It may be good to put a couple of extra months on that and call it a fatal flaw review, but it will really be about getting everyone familiar with what will be expected of them and put them in place to finalize parts.
- Jason Keppler asked if the Modeling WG currently has a schedule or outline chart of milestones and model completion over a certain period of time. It may be beneficial to see how the work at the BMP expert panel and the work at the Agricultural WG level ties in and how all of this is laid out.
    - Gary noted that there was such a schedule outline that ended in September 2015, and that we are well past many of those deadlines. There has been a more fluid process, and there have also been other outlines from 2012. Any time a group meets, things change a little bit and it has been difficult to keep track of scheduled moving parts. The best place to look currently is the TetraTech page that was developed for the WQGIT.
- Alisha asked clarifying questions regarding scheduled inputs. The expectation for inputs for all panels is still September, meaning that targets would come out in the spring in the April time period. The only change in the inputs is the land use portion, which is scheduled to be received December 1, 2016.
- Bill Keeling agreed with a previous comment in that the Modeling WG should be the one that determines what technical fatal flaws are and that we should be the ones that determine what the model actually operates at. Bill also referred to the prior history regarding fatal flaws picked out by the partnership between Phase 5.2 and Phase 5.3.0 that were overruled by EPA, and asked how EPA defines fatal flaws.
    - Lee – That's a fair question, and as a reminder we need to define technical sufficiency and be careful in avoiding moving too much towards policy.

**Summary of Phase 6 Progress over the Last Quarter - Gary Shenk, USGS and Gopal Bhatt, PSU**
*Attachment G.1*, *Attachment G.2*

- Gary reviewed the timeline and model structure of Phase 6, reviewing deadlines and progress made to date.
- Phase 6 Beta 2 documentation will be posted next week on the Modeling Workgroup webpage, with the exception of section 10 which will take a bit of extra time to complete.
- It is expected that in the Beta 3 version of the model (to be released in July) the modeling team will focus on updating the calibration methodology.
- Alisha Mulkey asked about whether or not large acreage BMPs were part of the Beta 3 schedule in terms of panel updates.
    - Gary noted that this depends on when they come in. Bill Keeling said that they are currently in Phase 6 Scenario Builder, and that there is a whole slew of USDA BMPs that are not reportable including those associated with tillage.
- Lew suggested that the workgroup consider whether there is a need for Beta 4, which would include inputs from September.
    - Dave agreed that the Modeling WG would definitely need a Beta 4 so that there would a point to review that contained no changes apart from the land use.
    - Lee and Gary also concurred with others to present all results before the final land use change. Dave also noted that the Modeling WG will need a near final beta WSM to answer some of the questions regarding climate change and the Conowingo.
- Bill Keeling suggested that Gary's model timeline slide proves that time shouldn't be spent reviewing multiple iterations, and is his reasoning for holding off on a review until efforts are closer to producing a final model.

    - Gary noted Bill's point, and emphasized that in between that basic hydrology and the final numbers that are available for decisions, there is a lot of wiggle room in what can be reviewed.
    - Lee asked whether the Modeling Team could provide guidance regarding what points could be reviewed at each point for the Beta versions that are released.
    - Gary also argued that throughout the partnership there are several points that are being reviewed currently.
- Bill noted that he had waited for a significant period for sensitivity analyses completed for SPARROW, assumptions for how to deal with particular inputs, and made a formal request for that data for review. Gary said that those data could be provided.
    - Gary also noted that assumptions made of interest to Bill were based on an early version of Phase 6 land use, and differed slightly from those generated by the USGS.
- Dave asked about the possibility of keeping open a timeline for comments following the webinar to be held explaining points of Beta 2, and whether it would help to have an open ended comment period or to set a deadline.
    - Ted Tesler said that it would be better to keep the comment period open-ended with a series of iterations.
    - No comments have currently been received.

- Gary began his presentation on sediment and the unexpected progress that has become attainable with the help of Greg Noe.
- Although there has been a great deal of discussion about nutrient factors, there has been comparatively little exploration of the way in which sediment is simulated. Gary explained how sediment is simulated differently from nutrients, and the greater influence exerted on the simulation by land to water factors since RUSLE2 provides initial estimates from edge of field points.
- A stream source ratio (SSR) that is negative does makes some physical sense as it indicates that there are areas where streams are accumulating sediment. However SSRs that are greater than 1 do not make physical sense as it would indicate a negative stream source load. The proposal put forth in the documentation would cut off a lower and upper bound for SSRs.
- The agreement between two estimates of sediment delivery ratios from CEAP at an 8 digit HUC level in the upper Mississippi and the Chesapeake Bay Watershed was remarkably close, and allowed the modeling team to develop and apply a metric of interconnectivity ratios to the WSM.
- Bill Keeling asked about the use of RUSLE2 to determine spatially averaged values for points like slope steepness and management practices, and the danger of utilizing particular averaged parameters that would contradict guidance provided in the manual for the RUSLE2 model.
    - Gary explained the different spatial resolutions used for RUSLE2 inputs, emphasizing the 10 m scale of slope length which is of primary concern in determining changes to sediment loading. The way in which the inputs have been addressed by focusing on 10 m resolution data for slope length is a better approach to tackle concerns of non-linear responses that Bill raised.

**Phase 6, Beta 2 Calibration – Gopal Bhatt, PSU**
*Attachment H*

- Gopal highlighted some of the changes that have occurred in the change from the Beta 1 to the Beta 2 version of the WSM, and how the changes have affected model performance.

- In previous iterations there was a good simulation of hydrology across the watershed, but changes were also implemented to help improve the simulation even further.
- Another improvement made revolved around the Mead Westvaco Industrial point source facility in Jackson Creek.
    - A significant underrepresentation of the simulation was seen, but was limited to the low-flow regime. That indicated that the loads were underrepresented due to point sources in the area. As an example, at one observation station upstream of Jackson Creek, the concentration dropped significantly, which led the modeling team to believe that there was a significant underreporting of the point source load that severely limited the ability of the model to capture the observed load.
    - WRTDS was used to simulate the concentration and estimate this load, and that was compared to the reported load from the point source facility. These two varied significantly.
    - It was also known that actual reporting from the point source facility earlier in the dataset was non-existent, and an assumption was made in Phase 5 to make up for those earlier years. In Beta 2 the WRTDS loads described above were used instead for the period of 1985-1996 and replaced the assumed values.
    - Lew noted that this change represented a difference in loads equivalent to 2 million pounds of phosphorus in the James River, which also fell in the critical 1991-2000 time period.
    - As expected, this change significantly improved the model's ability to better capture the trend and seasonality of the loads.
    - Lew also reminded the workgroup that the modeling team will continue to work with colleagues from Virginia, Ning, and any other partners to ensure that all parties are satisfied with the approach used to correct the point source data.
- In Beta 1 there was no assignment of stream to river factors for point source facilities. There are approximately 8,000 facilities and the modeling team is now able to calculate (using SPARROW) what that delivery will look like specific to each discharge outfall for each facility. The motivation to adjust this based on the location of outfalls which may potentially be situated a significant distance from a Phase 6 simulated river reach. It is expected that there would be some reductions in small streams when moving from the outfall to the river and the modeling team wanted to capture that.
    - Lew asked about the relative difference of loads delivered based upon this change. In documenting these changes, it might help to add in the load change calculated.
- Guido Yactayo put in significant work cleaning up the water quality monitoring station dataset that helps to inform the calibration process.
- Gopal was successful in running rSAS for the entire Chesapeake Bay watershed, which helps to simulate the groundwater nitrate transport. Some of the issues with the simulation observed along with the computational demands meeting with the development timeline need to be better determined.
- Further comparisons of WSM delivered loads against WRTDS estimates showed improvements in Beta 2 as compared to Beta 1.

**Assessment of Bank and Flood Plain Nutrient and Sediment Loads – Greg Noe and Peter Claggett, USGS**
*Attachment I*

- Greg reviewed the floodplain network of 42 sites in place to measure flood blank erosion and deposition, as well as the N and P attached to those sediments to measure fluxes.

- Overall, floodplains are accumulating more sediment than banks are eroding across the 42 sites, indicating that floodplains are trapping more than banks are eroding.
- Because reach scale geomorphology is not available everywhere, a set of regressions were also completed using watershed attributes. There are numerous approaches possible for predictions of trapping and erosion throughout the watershed
- The smallest site is around 10 $km^2$ and the smallest is $2^{nd}$ order, but most small sites are $3^{rd}$ order streams.
- There are currently no data for the Appalachian plateau, but the recommendation is to apply the averages from the valley & ridge and Piedmont areas.
- Gary suggested that it may be best to angle towards a universal approach wherein banks and floodplains are kept separate in moving forward since the entire watershed is not represented by the monitoring sites. This would result in a shallow regression with a high intercept.
- Translating bank loads down to local sources could produce a wide variety of changes that may seem minor at the basin scale. It is also important to note that the best predictor of these loads is the change in land use over time
- This topic will be brought back to the Modeling Team for further refinement and then presented again at the July quarterly meeting as well.

**A HEC-RAS Representation of Lakes Clark and Allred – Marty Teal and Jon Viducich (WEST Consultants)**
*Attachment J*

- As a review, West consultants are under contract to develop a HEC-RAS model of Lakes Clarke and Aldred. The model simulation ran from 2008-2015, the calibration period ran from 2008-2013, and the verification period ran from 2013-2015. The bathymetric survey was carried out in 2013. The simulation period did include large storms such as Tropical Storm Lee as well.
- The idea was to provide sediment rating curves at three locations. The finalized sediment transport calibration was also completed, and the model is currently under peer review.
- Gary had previously noted that it would be neat to know which parts of the curves were most important, which would show the relative importance of various flows in overall transport for the modeling simulation. Jon created and presented a discharge integrated mass output plot for each of the locations to demonstrate this relative importance of the rating curves.
- Larry Sanford asked if there was a way to tell how much of the sediment flux was based on scour versus transport.
    - There is a way to do that, which would involve more mass output balance that has not yet been done at an hourly time scale.
- The modeling intent is to utilize this in the Phase 6 WSM and it is hoped that STAC will make the same recommendation during their review of the model. Some parts of this will probably be included between now and the release of Beta 3.
- Rating curves that have already been sent will be those that are documented in the report.
- Carl Cerco asked what the WSM will do with this information.
    - The modeling team can calibrate its processes to these results and can in effect use them directly and most likely calibrate to them. The former assumption of dynamic equilibrium in the upper reservoirs is still of interest to determine whether that can reproduce the results found over a long term period.
    - Need to run a flow time series through the rating curves to determine the net trapping. This work has already been done by WEST Consultants for the time period of 2008-2015, and the results came out pretty well. However, the results still need to be sent to the Bay Program.

- The Modeling Team can expect the documentation to be made available at a later date as it is being fleshed out in tandem with the STAC peer review. There will probably be some interaction between the draft report and the peer review process and that could be made available to the Modeling Team.

**Lower Susquehanna River Impoundment Modeling Studies – Jim Fitzpatrick/Mark Velleux (HDR)**
*Attachment K*

- Jim Fitzpatrick and Mark Velleux provided updates as to where the modeling process stood before, how they have improved resolution to capture bathymetry and resolve depth changes without slowing down the model's run time and increasing the computational burden.
- The model keeps the water elevation fairly constant as dam operators are keeping the outflow at a very narrow range. There is not an elevation driven boundary condition in the model, it is all specified as a model outflow.
- Jim described pieces of the sediment flux model in more detail, outlining the preliminary computations from the standalone sediment flux model. This is similar to the efforts led by Jeremy Testa, separate from HDR's analysis. This is an attempt to generate a mass balance method to determine estimates of depositional fluxes to sediments based on outputs from the CBP WSM.
- The sediment oxygen demand in the model was found to be greater than estimates provided by both Walt Boynton and Jeff Cornwell.
- Carl asked if the model adjusted downwards the particulate inorganic phosphorus (PIP) that was entering at the upstream end, but retained it at the downstream end based on the observations that he provided.
    - Jim stated that this was correct, though another way to do this would be to add PIP to particulate organic phosphorus from the WSM and then provide the splits between those phosphorus species.
    - Carl and Jim had a further discussion about the split percentages of PIP and comparing the model results as they relate to historical observations and other outfalls.
- This topic will be brought back to the Modeling WG, likely at a May conference call to follow up on some of the other work that was unable to be presented at this quarterly meeting.

**ADDENDUM: CONOWINGO PHOSPHORUS DISCUSSION**

- In terms of the long term loads out of Conowingo, 15% of total phosphorus (TP) is PIP.
    - Gary suggested that if this is the case, then this would likely be measuring time averaged concentrations. When the Modeling Team was previously modeling the Conowingo they were looking at a black box where long term loads of TP showed that 15% was phosphate. When that pool is simulated by a single box, there is not much residence time which contributes to a great deal of numerical dispersion.
- Jim stated that most of the phosphorus still entering the model is inorganic phosphorus which provides problems with the calibration. A big key finding is the shift in percentage splits of G2 and G3, the inorganic phosphorus may be a red herring that's proving difficult when calibrating.
- Gary suggested that perhaps the best thing to do may be to take TP from the WSM and let Jim manipulate them as he will.
- A follow-up Tuesday meeting with the Modeling Team could review some of these issues, and would also include Exelon representatives.

**MEETING ATTENDANCE**

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|---|---|---|---|
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