TECHNICAL ADVISORY COMMITTEE MEETING #11 - JUNE 6, 2018

Tukwila Community Center
12424 42nd Ave South
Tukwila, WA 98168

TAC PARTICIPANTS

- Ben Cope, USEPA Office of Environmental Review and Assessment
- Allison Crowley, Seattle City Light
- Kevin Buckley, Seattle Public Utilities
- Joanna Florer, Port of Seattle
- Shawn Gilbertson, City of Kent
- Ryan Larson, City of Tukwila
- Greg Pelletier, Ecology Environmental Assessment Program (EAP)
- James Rasmussen, Duwamish River Cleanup Coalition
- Jana Ratcliff, Washington State Dept. of Transportation
- Pete Rude, Seattle Public Utilities
- Jeff Stern, King County

ADDITIONAL MEETING PARTICIPANTS

- Jeff Burkey, King County
- Kathy Conn, USGS
- Curtis DeGasperi, King County
- Elly Hale, EPA
- Katie Kuhla, Ecology Toxics Cleanup Program
- Bo Li, Ecology Water Quality Program
- Rachel McCrea, Ecology Water Quality Program
- Cleo Neculae, Ecology Water Quality Program
- Joan Nolan, Ecology Water Quality Program
- Kevin Schock, King County
- Jerry Shervey, Ecology Water Quality Program
- Ralph Svrjcek, Ecology Water Quality Program
- Justin Twenter, Seattle Public Utilities
- Debra Williston, King County
- Yi Xiong, Ecology Water Quality Program

WELCOME AND INTRODUCTIONS

Joan Nolan, Ecology Water Quality Program facilitator, welcomed everyone and led the group in a round of introductions. She provided a brief reminder of Technical Advisory Committee (TAC) Pollutant Loading Assessment (PLA) goals and roles, and an overview of the agenda for the day. The meeting's objectives included updates on the HSPF model calibration, the screening analysis, and the receiving water modeling approach.

PROJECT UPDATE OVERVIEW

Bo Li started the project update by presenting a quick overview of the team structure involved in the HSPF modeling effort. The team's structure has two components:

1. a *modeling* component, including Ecology (the lead), Ecology's Environmental Assessment Program, Tetra Tech (whose contract ended in March 2018), King County (40% FTE), and the City of Seattle, which serves a reviewing function but may join the team in the future; and,
2. a *water quality database* component, including a database development team

Comment: Have you completed pulling all the data into the database?

Answer: Contractor will work until the end of June to finalize compiling the existing data. At that time all the existing data will be in the database.

Bo presented the project timeline. The next steps for project include QAPP update and empirical loading analysis using water quality data from the database. The current plan is to start the receiving water model in 2019 and to finalize the project by 2025.

HSPF UPDATE

Bo Li presented on the progress that the modeling team has made to update the HSPF model, using modeling information that the City of Auburn shared with Ecology. On the hydrodynamic side, the flow calibration has been successful, with only slight changes of boundaries being necessary. Currently, the team has extended HSPF through Water Year 2016.

Next, Bo discussed the model calibration for sediment loadings. She covered data sources for boundary conditions, upland sediment loading, and reach sediment balance. In terms of instream sediment calibration, the calibration has been done for low flow conditions. Ecology has finished the calibration for 15 reaches. In general, the sediment calibration performed well.

Comment: What is the analytical limit for TSS? What's the minimum level at which the measurement can detect solids?

Answer: In general the threshold was 1 micron.

Comment: If there are non-detects, they tend to be below the model prediction, which suggests that the model is over predicting TSS for this reach. This is fine for the reach but it can have measurable consequences for downstream.

Comment: Even particle sizes below 1 micron are important.

Answer: We understand the concern, but because the graphic is in log scale, it might look like the model is over predicting TSS. The average TSS is much higher than 1 micron. Considering

that, the effect of using 1 micron for non-detect value is small since most of the data is much higher than that.

Next, Bo presented a table that summarizes the calibration performance for the 15 modeled reaches. The exercise looks promising: 5 reaches produce very good results, 6 produce good results, 2 produce fair results and 2 produce poor results. Ecology is looking for input on the ones that are performing poorly. One area is Reach 344 in the Soos. The sediment loading is the limiting factor there and simulation always overestimates. The median and average values from simulations are far apart. The reach has low observed TSS, so any inputs to the system can have a large impact. It is a small reach, however, so maybe when we look at the whole model, it may not make a big difference.

Comment: This may be showing the problem of breaking dataset into calibration period and validation period. Why not using the whole dataset for calibration?

Answer: During the calibration, we are using the whole dataset for calibration. Breaking the dataset into two periods, it just made the calibration process a little easier by using more recent data for calibration. This is a good point, for the reaches that don't have a lot of data, it makes more sense to evaluate the whole dataset for calibration.

Bo pointed out that for Reach 710 (Longfellow Creek), the model doesn't predict a strong TSS trend and the calibration consistently underestimates the TSS.

Comment: Do you have any other reaches that are more urban than this?

Answer: Yes, Reach 604 is also within the Duwamish Watershed. It is located on Duwamish River, performs better than this. However, Reach 604 is located upstream of Reach 710 and Ecology is not sure whether the watershed associated with Reach 604 is more urbanized.

Comment: When you increase the sediment supply, do you change it based on the land cover at the watershed level or is the change reach specific?

Answer: It is reach specific. Reach 710 involves a much smaller sub-watershed.

Comment: How do these results compare to other sites? Looking at the log scale does it dampen some results? Are errors of 200% or more acceptable?

Answer: Ecology got the format from Tetra Tech and it's a standard process. We look at the reaches to see what doesn't work. We use the log because changes to small concentrations can have large impacts. As a reference, the field data from Seattle has errors with factors of 2, there were uncertainties in sampling data, and it is normally acceptable to have this level of uncertainty in field data. Compared to other similar modeling work, it is acceptable to have this level of errors.

DISCUSSION OF RECEIVING WATER MODELING APPROACH

Bo presented a comparison between two EFDC models and referred to the *Green-Duwamish Pollutant Loading Assessment (PLA) Receiving Water Fate and Transport Model Development Update, 6/5/2018*, handout for more details. There are two EFDC models, one is King County's version for food web modeling, which has both a toxics and a sediment component. The other is the Anchor QEA model that is based on King County's Model and was used by LDWG (Lower Duwamish Waterway Group) for Lower Duwamish Waterway RI/FS. The QEA model only models sediments, not toxics. The QEA version of EFDC model has smaller grids, more classes, more sediment bed layers, and longer simulation period.

Comment: Based on conversation with Bruce Nairn at King County, there is a grid generator for King County's EFDC model. King County's EFDC has its own grid generation files. Ecology got those from Bruce Nairn to start the sensitivity analysis.

Bo brought up the issue of funding, which will have to be considered when making a decision about which receiving water model Ecology will use for the PLA. The EPA is considering funding the Salish Sea Model (SSM) next year. Ecology is also looking at alternative funding sources internally.

Next, Greg Pelletier (Ecology EAP) presented the pros and cons of using an EFDC model versus the SSM. The arguments are listed on pages 4-5 of the *Green-Duwamish Pollutant Loading Assessment (PLA) Receiving Water Fate and Transport Model Development Update, 6/5/2018* handout.

Comparing the two models, Greg pointed out that SSM uses a parallel model simulation, while EFDC doesn't. This is acceptable for a simulation modeling a short time span, but not feasible for 30-year simulations. Ecology would have to scope out how much it would cost to add parallel processing capability to EFDC. Alternatively, decoupling the hydrodynamics from other modules to decrease processing time may be an option.

Comment: Do we need a model with such a fine grid structure? We are constrained by the law of conservation of difficulty: one model is easier but runs longer, another is more difficult but faster to run.

Greg followed up by saying that the SSM is not an open source model, while EFDC is more open source. Ecology has the source code for the SSM but could not share it.

Comment: Can the SSM always be used, as long as you want to use it?

Answer: Yes, but if someone from outside asks us to share it so they could use it, we couldn't do it.

Comment: Can Ecology modify the code?

Answer: Yes.

Comment: How many years into the future are we going to be looking at?

Answer: As a reference, the remediation will take at least 7 years, for PLA, we are planning to complete the modeling works by 2025; for modeling scenario questions, it depends on what we are looking for, we might be able to answer some of those questions earlier than 2025.

Comment: What are the timeline and costs for implementing each model?

Answer: The model development is expected to take about one year but, in the case of the SSM, since it cannot be run in Windows, we need access to computers that run Linux OS. Currently we are using PNNL's Constance cluster. The costs to engage PNNL could add up to a considerable amount, which would mean that Ecology may have to consider moving it to another cluster. In addition, in order for us to have access to PNNL's cluster, we would have to involve PNNL in a significant way. They can't just host the model, they would have to be part of the project. At this point, Ecology has some funding but not enough to support PNNL's involvement.

Comment: What could the cost be to support toxics model of the SSM?

Answer: About $300,000 to get the work started.

Comment: Have you compared the cost estimate of each model?

Answer: No. The project team will work with PNNL and the modeling team to estimate the cost required for the development of EFDC and SSM.

SCREENING ANALYSIS

Bo Li presented the results of screening analysis to identify the most appropriate classification of sediments that will be used in modeling. The modeling team used three methods:

a. Scaling analysis, which is a mathematical method.
b. Mass balance, which is a box model.
c. Sensitivity analysis, based on King County's EFDC model. The model's results represent average outputs at the watershed scale.

Based on the analysis: 1. three sediment classification (2 cohesive + 1 non-cohesive) is recommended by project team for future PLA modeling. 2. Under existing conditions, the sediment is the largest PCBs source to the water column. After the cleanup (PCBs = 2ppb), both lateral and green river will be significant sources. 3. The PCBs in the water column is most sensitive to the modeling processes/parameters that describe the pollutant transportation from sediment to water.

Kevin Schock (King County) discussed how the scaling analysis was used to understand how increasing the sediment classes from three to five impacts modeling outputs under different conditions. The analysis found that the increase in sediment classes changes the particle distribution by 24% for mass fluxes into the sediment bed. The change also results in a decrease of 3.44% in the PCB mass in the water column.

Comment: Did you keep the same K for all classes?

Answer: No, they were different for sand and silt.

Yi Xiong (Ecology) added that different sediment classifications have an impact on the settling velocity and other sediment transport related parameters used in modeling.

Bo Li pointed out that reducing the number of cohesive sediment from 2 to 1 changed the output significantly, while using more than three sediment classifications did not significantly improve the model performance.

Comment: What were the assumptions related to organic carbon for different sediment classes?

Answer: They are based on literature, but for different classifications of the same type of sediment, the parameters were held constant because we didn't have an empirical reason or enough basis to do so and tried to implement the analysis in an easy way.

Comment: What happens to other constituents, other than PCBs?

Answer: We don't have any other constituents in the model currently, but the results can be generalized.

Next, Kevin Schock presented the pathway evaluation, which is a simple analysis to identify the primary pathway for PCBs. For the analysis, he used the four compartments in the LDW Food Web Model, a steady state model to calculate PCB concentration. Concentrations for each box are characterized by the pathway concentration and the fraction of contributing pathway flow into the box. The outputs show that laterals and sediments are important sources of PCB concentrations after the cleanup.

Yi Xiong presented a series of output charts from EFDC model runs that tested the sensitivity of PCB concentrations to various scenarios including upstream discharge, open boundary condition and lateral loading. Yi also explain the concept of water age and how it is a useful tool to predict the change of PCBs concentration in the water column. Basically, the greater the water age, the slower the water circulation, and possibly the higher the PCBs concentration. The results, which were averaged for the water column, showed that PCBs concentration in the water column is highly sensitive to upstream discharge, especially low flow condition. The downstream open boundary elevation will influence water column PCBs concentration as well. It looks that there is a good correlation between the simulated LDW averaged PCBs concentration and water age.

Comment: Does the water age match up with the contamination level in the sediments?

Answer: This is for water column. The sediment bed has a different behavior, time scale and initial PCB concentrations, but you can use these results to see if it matches.

Bo presented the results of several modeling scenarios with 7 lateral PCBs concentrations and 3 initial sediment bed PCBs concentrations. The sensitivity analysis showed that concentrations of PCBs in the

water column are sensitive to lateral sources, especially when the sediment concentration is low, and to concentrations in the sediment bed.

Comment: You are presenting simple concepts in a complicated way. You need to link them to other parts of the work.

Answer: We are showing the directions we are exploring and don't have final answers. We will utilize the results that we learned here and apply it in our future modeling works. For example, we will compare the modeling assumptions, inputs and results with our coming empirical loading analysis.

Next, Bo discussed the ranking of sensitivity of different parameters included in the model.

Comment: Is the empirical loading analysis in progress?

Answer: Yes.

NEXT STEP

Comment: When are decisions going to be made about the models?

Answer: We would like TAC member to give us feedback about the comparison of SSM and EFDC from technical perspective by the end of the month and our project team will work on the funding requirement for each model and present it to TAC at the next TAC meeting early next year. So, the final decision will probably be made at the next TAC meeting.

Comment: Will the funding sources will be different for EFDC and SSM?

Answer: Yes, for the EFDC it will probably be from Ecology. For the SSM, EPA will potentially provide the initial funding for the development of the toxic module of SSM. We will need to find other funding sources to continue the project if we choose SSM.

Comment: Will we get to see the timeline and costs ahead of time?

Answer: By the end of the month Ecology will gather the feedback from a technical perspective. It will take more time to get the funding information for each model. We will send the TAC additional information about both models ahead of time and the next TAC meeting will be a good venue to discuss.

Comment: Please weight the pros and cons, because some are less impactful.

Answer: That is a good idea and we will evaluate it and see if it is possible.