RMP Contaminant Fate Workgroup Meeting
July 7th, 2008
San Francisco Estuary Institute
Meeting Minutes
DRAFT

Attendees:

Joel Baker (University of Washington)
Rob Mason (UConn; by phone)
Keith Stolzenbach (UCLA)
Frank Gobas (SFU; by phone)
Barbara Baginska (RWQCB)
Arleen Feng (ACCWP representing BASMAA)
Richard Looker (RWQCB)
Kristine Corneillie (Larry Walker Assoc)
Soumya Srinivasan (Brown & Caldwell)
Patrick Barnard (USGS)
Dave Schoellhamer (USGS)
Mike Connor (SFEI)
Jay Davis (SFEI)
John Oram (SFEI)
Meg Sedlak (SFEI)
Don Yee (SFEI)
Mark Stacey (UCB)
Lester McKee (SFEI)
Craig Jones (Sea Engineering)
Edwin Elias (DELTARES / USGS)
Ed Gross (Consultant)
Sujoy Roy (Tetra Tech)

1. Introductions and Review of Agenda

John Oram convened the meeting at 10 am with an introduction of the goals of the meeting. The highest priority items for the meeting were: 1) update workgroup on modeling efforts, 2) develop long-term modeling strategy, 3) update workgroup on multi-box PCB reports, and 4) update workgroup on development of MeHg budget.

2. USGS Sediment Transport Model

Dave Schoellhamer (USGS, Sacramento) presented the multi-box sediment transport model he and Megan Lionberger (USGS) developed. This is the same sediment transport model that is used by the PCB mutli-box model developed by SFEI. The model is based upon a tidally averaged salinity model originally developed by Uncles and Peterson (USGS). The focus of the talk was on advancements and limitations of the multi-box sediment model, lessons learned from Suisun Bay, and ongoing and future observations used to support model development. An open-file report is currently in review by the USGS. The report documents the development, calibration, and application of the multi-box sediment model. The workgroup will be notified when the report is publicly available. The powerpoint presentation for this item is available on the CFWG web site (www.sfei.org/rmp/rmp_minutes_agendas.html).

Richard Looker asked which limitations are intrinsic to this model versus intrinsic to all models? Dave mentioned the most significant limitation is the lateral mixing of sediments, which is intrinsic to this model. Keith Stolzenbach wondered how large this component is in the overall sediment budget. Dave responded that it is definitely something to fix in future iterations of this model.

Model calibration focused on the erodability of bed sediments. Keith wondered how the erodability constants changed spatially. Dave responded that they varied by 1-2 orders of magnitude, which is reasonable compared to literature. Joel Baker wondered how this

calibration might change given the update sediment loads from local tributaries that SFEI is producing. Mike Connor wondered how much in-Bay erosion compared to external sediment inputs. Dave responded that they are comparable on a few time steps. Over larger time events dominate the signal, so depends on whether the event was a tributary loading event or an erosion event.

Questions were raised regarding the relative importance of wind, waves, tides, and currents on overall sediment transport. Dave noted that wind/wave mixing is similar to tides and these are the dominant forces. Mean currents are small contributors. Spring and summer are the wind/wave seasons.

Discussion then turned to evaluating the predictive capability of a model. Richard wondered if there is a rule-of-thumb for how long into the future you might trust model predictions. The consensus was that it really depends on your objectives. All models are wrong in one way or another, the question is in what situation are they useful. Where do you see leading indicators of where things are going? Craig Jones indicated that if a model is going to be used in a predictive capacity it is important to determine if the right processes are being represented.

Barbara Baginska wondered if a Bay-margins model could be developed. The group consensus was that a Bay-margins model would need to be a component of a Bay-scale model. Margins are significantly influenced by Bay-scale transport processes.

Joel Baker wondered how organic carbon transport pathways in the Bay might differ from sediment pathways. Difficult to make this comparison at this time, though some significant differences are likely.

3. Invited Presentations

Mark Stacey (UC Berkeley) discussed efforts to develop a Bay-scale, high-resolution, 3D model. The current focus of this model is to understand the effects of restoration and climate change on tides, salinity, and sediment in South Bay. This work is funded by the California Coastal Conservancy and involves researchers from UCB and Stanford. SUNTANS is the model being developed. It is anticipated that the model will become an open-source resource available to local researchers and managers. This is a three year project.

Craig Jones (Sea Engineering) presented recent work aimed at "quantifying contaminant fate and transport in San Francisco Bay." Craig stressed the need to develop conceptual models prior to developing any sophisticated numeric models. Doing so helps insure that key processes are included in any model developed. Need complete understanding of hydrodynamics and sediment transport in order to understand contaminant fate. Hydrodynamics of Bay are well characterized. This is not so for sediment transport. Sediment transport studies and modeling have been site/application specific and therefore do not address many of the needs for understanding contaminant transport. Hot spots, for example, may be important to overall Bay water quality. However, the internal processes of hot spots and their exchange with the Bay as a whole are not well understood. Key recommendations are:

1) Develop detailed conceptual models of Bay hydrodynamics and sediment transport based on existing data.

2) Identify critical information gaps and describe ways to fill those gaps.
3) Develop numerical and empirical models of contaminants based on existing data.
4) Identify areas/sources at highest risk for human/ecosystem exposure. Identify potential management levers.

These recommendations are best achieved by establishing a model user/developer forum.

Ed Gross (Bay Modeling) presented some of the modeling projects he and his colleague (Michael McWilliams) have been working on. Much of Ed's work uses TRIM and UnTRIM to model Bay hydrodynamics and sediment transport. UnTRIM is an unstructured grid model that allows for grid refinement in areas of interest. The Hamilton ATF was shown as an example. Next, Ed showed how UnTRIM was used with a particle tracking model to better understand flow separation in the Delta. The group discussed how the particle tracking model could be used to better understand exchange processes at the Bay-margin. Finally, Ed presented a tidally-averaged transport model he co-developed with John DeGeorge (RMA). The model allows for multi-year simulations of the North Bay and Delta to be run in minutes or less. The model is currentl being used to understand salt transport in the Delta and potential consequences of levee failures.

Patrick Barnard (USGS) presented recent efforts to understand coastal sediment (sand) transport processes (outside of the Golden Gate). During these studies it became evident that they needed to account for Bay inflows and outflows. Delft 3D is being used to make this linkage. In particular, the model is being used to estimate a flux at the Golden Gate. A number of field studies were performed to help calibrate the model. The largest effort was in Feb 2008 and involved multiple transects across the Gate.

4. Multibox PCB Report

John Oram gave a brief summary of the multibox project and the two reports issued for review in January 2008. The objective of this agenda item was to get feedback from the workgroup as to how to finalize these reports. Key questions to the group were 1) Was the model developed and documented appropriately (i.e., does it include key processes?)? and 2) Is the model appropriate for TMDL use?

Joel Baker asked if the TML is based on sediment or biota PCB levels. Richard Looker responded that sediments are the basis at this point, though the sediment-biota link is the driver. That said, Joel had the following comments:

- Model may be complete enough, since it seems to predict sediment levels reasonably well.
- A congener/homologue model would be better in that it could inform relative importance of various loads. Need to be aware of the limitations and interpretations of the tPCB model.
- This is as far as a single congener (i.e., total PCB) model should go.

Frank Gobas agreed that a congener/homologue model is needed. The food web model is congener specific. If the two models are to be linked, the multibox model must be congener/homologue specific. The advantage of such a linkage would be the ability to link biota to sources.

Richard Looker indicated that there may be a short-term need for the multibox model in TMDL development, depending on the outcome of the state board. It is unlikely that the state board will want the TMDL re-written with the multibox model. Thus, the timeframe for multibox implementation is 5-10 years. Will need congener/homologue model at that time. Will want updates to the model with coring data. One caveat to this is the issue of hot spots and margins. Multibox is not capable of resolving these scales.

Joel Baker expressed concern about the mass of buried PCBs in the Bay. If the Bay is erosional, as is suggested, the buried mass becomes a real issue. Will these PCBs be reworked [while buried] such that they are not bio-available and/or mobile? Need to be clear about the interpretations of the multibox model.

Keith Stolzenbach wondered how the coring results will be incorporated into the model. Will the cores really tell us where the PCB mass is? Need to estimate how much is in hot spots relative to Bay-wide? Arleen Feng seconded that notion and added that the CEP is/was looking at the 'bath-tub ring' around the Bay. Are high levels of PCBs associated with shallow margins? Stormwater agencies are being regulated on onebox model results. Multiox model could alter these regulations. How different are the predictions?

Jay Davis recommended that the multibox reports be finished as a single congener model. A pilot/special study proposal could be written to develop a congener/homologue model. The proposal could include refinement of the PCB conceptual model (as recommended by Craig Jones).

Joel Baker and Frank Gobas agreed that wrapping up the reports as a single congener model is reasonable. However, it will be difficult to publish as a single congener.

Action Item: John Oram to scope out homologue model. If small effort, incorporate into current reports. Otherwise write special study proposal with homologue model and journal publication as final products.

5. MeHg Budget

Don Yee presented a rough MeHg mass budget for the Bay. In summary …

MeHg is a small portion of total Hg. Want a first order model to help identify key sources/processes controlling MeHg. The approach is to incorporate existing RMP data and loading studies with literature production/degradation rates to develop a simple one-box model. A sensitivity analysis was performed to identify key model parameters. Methylation and demethylation rates were most sensitive. Partitioning (Kd) was much less sensitive. A key finding of the model is that changing external loads (within ~1 order of magnitude uncertainty of loads) does not have much affect on model results.

Rob Mason commented that using the same Kd in water and sediment is wrong. Get much higher [MeHg?] in sediment pore water (10x) than in water column. Kd is lower in sediment than water. MeHg into living particles much higher than detritus. Don noted that daily mixing

and re-equilibration of water and sediment compartments in the 1-box model effectively erases any differential between water column and porewater partitioning.

Rob noted the most important things are methylation and demethylation rates. Should be good literature values. May be difficult to use Petaluma marsh data for entire Bay. And similar to Kd, should use different rates for water and sediment. Should also be aware of seasonal methylation rates.

Craig Jones agreed that methylation/demethylation are most important. Should evaluate how these are, or might be, changing across the Bay. Significant variation in sediment anoxia and total Hg exist.

Lester McKee wondered if we should be more interested in storm and biological events. What are the implications on uptake to foodweb?

Joel Baker remarked that if the current view is that MeHg can not be controlled by total Hg maybe it can be controlled by carbon. Rob Mason commented that you can not ignore total Hg in the long-term.

According to Richard Looker, the management strategy is to find hot spots where we might be able to exert more leverage. Wetlands may be important in terms of bio-functions (this is where the fish and birds are). The heart of the TMDL is the linkage between water/sediment and fish/wildlife. Thus, a good food web model is crucial.

Richard wondered if model estimates were compared to data to see if the total mass of Hg on water and sediment are similar between model and data. What is driving the standing stock? Maybe the current model is too simple.

Jay Davis remarked that maybe we should do studies aimed at estimating methylation/demethylation rates. However, as Rob Mason noted, there are numerous literature sources for this information. The question is which literature values are appropriate? Conaway et al was suggested as a source for S. Bay methylation rates. Craig Jones noted that Bruce Jaffe (USGS) should have data on Hg deposition horizons.

Action Items:
The workgroup generally thought that the one box model simplified too much to be publishable as a peer reviewed journal article. It was suggested to publish in a more regional forum such as the CalFed online journal. We will address the elements that can be easily fixed within the context and limitations of the 1-box model, but identify needs and elements that would be best addressed by a more spatially and temporally detailed model.

6. Modeling Strategy
The RMP is in the process of developing a modeling strategy – basically a set of questions and/or issues to guide future modeling efforts. The strategy must address the key needs of the Regional Board. Richard Looker presented the Board's needs as a matrix. This matrix and

accompanying text were distributed as part of the meeting materials. The workgroup discussed the matrix and commented on how best to approach the issues raised.

Keith Stolzenbach recommended using a Bay model as a means to investigate small regions (by nesting and/or grid reinement). Need to see if food web issues are limited to regions of concern.

Joel Baker commented that estuary margins are ignored far too often (here and elsewhere). This is probably where the science is headed.

The group agreed that conceptual models should be developed and should include biologists [to better understand areas of biological concern]. These conceptual models should be as extensive as possible and should be transferable. Can we identify a finite set of configurations of these conceptual models?

Hot spots are definitely of management concern. However, we know very little about the internal processes of hot spots and their exchange with the Bay. Craig Jones mentioned that a great deal was learned by the Hunters Point studies. A guidance document was developed. Craig will circulate this document to the group. Keith wondered if the Army Corp dredge material documents would be relevant as well. Dave Schoellhamer recommended developing 1D models of vertical mixing at hot spots. What scenarios create erosion/deposition?

John Oram wondered what questions could be answered by existing tools? For example, would information regarding residence times be informative. If so, the particle tracking model presented by Ed Gross could be used. Barbara Baginska sees residence time as a very useful metric. Also would like to know what factors affect resident time. URS may have done similar studies for the airport expansion but never published.

Craig Jones recommended collating all existing sediment transport work into one document. Would be extremely helpful to get everyone on the same page. The group agreed.

Joel Baker wondered what other pollutants (besides those listed in the matrix) might be modeled. Pharmaceuticals, nano-particles, …? Richard Looker remarked that RMP modeling needs should not be CFWG centric. Should open the question to other workgroups (e.g., emerging contaminants workgroup). Should describe what type of regimes we need to characterize so we have an idea of the range of modeling issues. Dave Schoellhamer mentioned that the key limitation will be lack of data (physical data such as T,S, currents) at Bay margins.

Action Items:

- Craig Jones to circulate guidance document from Hunters Point. (done)
- RMP staff to develop draft (or outline) modeling strategy.
    - Should include collating existing sediment work into one document.

Next CFWG Meeting: should be after coring data are in … Jan/Feb?