

Old Tampa Bay Project
Development of the OTB Integrated Model: Kick-Off Meeting
TBEP Technical Advisory Committee
Tampa Bay Regional Planning Council
4000 Gateway Centre Blvd., Pinellas Park, Florida 33782
Thursday, December 1st, 2011

Meeting Notes

Intro – Holly Greening Major focus to get input on project objectives and management actions

Overview – Holly Greening presentation

Input on priority issues

- 1) Slower seagrass recovery in OTB
- 2) Periodic poor water quality
- 3) Circulation and localized muck accumulation
- 4) *Pyrodinium* blooms, 2008, 2009, 2011

Input:

- Should consider spatial differences in water quality, north of Courtney Campbell likely very different from south.
- Circulation is a problem in OTB as a whole, not just in localized areas
- Results of other projects (tidal tributaries, salinity barriers) will be incorporated into this as appropriate, but the focus of this study is on the open OTB
- Consider other light attenuation factors in addition to chl.
- Consider sediment transport issues, changes/relocations of sediment have been noticed during seagrass transect monitoring.

Input on preliminary objectives

- 1) Evaluate effectiveness of nutrient reduction actions

Input:

- If nutrient concentrations coming in to OTB are relatively low, should focus be on load reduction, or residence time/circulation? Evaluation of nutrient reductions makes sense if chl is causing the problem. Nutrient inputs also from inter-segment transfer, we have good idea of how much this is
- Sediment loading to the water column should be evaluated relative to inputs from the watershed.
- The existing TMDL must be considered.
- When considering actions involving wastewater discharge, consider effects of relocating surface water discharge to enhance flushing. Care must be

taken in this, however. Recall that although point sources are easy targets, it is important to consider what is do-able, additional reuse requires additional storage, moving outfalls is not easily done. Should keep in mind that once an action is discussed and/or modeled, it takes on additional weight, this should be considered when designing scenarios.

2) Improve understanding of nutrient dynamics

Input:

-Chl exceedences driven by higher values north of Courtney Campbell.

-Are canal systems on northeastern side of OTB sources of significant loads?

-Atmospheric deposition of nutrients is a significant source, this must be included in estimation of any loading changes.

3) Evaluate effects of remediating circulation

Input:

-Consider the effects of shorelines/abutments/seawalls on sediment transport and deposition.

4) Evaluate effects of restoring freshwater flow regimes

Input:

-Influence of tidal tributary inputs after removal of salinity barriers, on both freshwater input and flushing times, locally and over entire OTB, and on nutrient loads.

-A single scenario may include several actions combined, such as salinity barrier removal and Lake Tarpon discharge removal.

5) Enhance monitoring capabilities

Input: None

Input on Initial Management Actions for Evaluation

- 1) Redirecting freshwater discharge from Lake Tarpon, Channel A, Channel G, Roosevelt Basin
- 2) Modifying operation of District structures in A and G
- 3) Adding culverts or bridge extensions to bridges
- 4) Redirect existing WWTP discharge
- 5) Implementing nonstructural BMPs
- 6) Implementing other BMPs (regional stormwater treatment areas) in OTB watershed
- 7) Muck removal (dredging)

Input:

-Management Action 1) should be "Redirecting/modifying significant freshwater discharges to/within OTB (Lake Tarpon Outfall, Roosevelt Basin, Alligator Creek, Channels A and G)".

-District has been looking at these as do-able projects.

-Must consider that removal of freshwater inflows also leads to increased residence times. Remember there may well be positive and negative consequences of any action. If the problem is removal of nutrients, then may consider addressing nutrients in the water, not necessarily the removal of the water itself from the system.

-Problem with Lake Tarpon outfall is muck accumulation.

-Should consider Lake Tarpon ASR and other water supply schedules, no one needs water now, but may in 5-10 years. (Currently project is on hold for 3-years).

-Recall that outfalls also work as flood control, when freshwater inflows are redirected away from OTB, they must go somewhere.

-For salinity barrier removal, the District is focused on restoring the hydrograph, not just re-directing freshwater inflows.

-Freshwater inflows to OTB are important to flushing, circulation driven by combination of inflows, tides, and winds.

-North of Courtney Campbell, removal of Lake Tarpon inflows may be important to seagrass recovery.

-Relatively long residence times can be very sensitive to small changes in freshwater inflows, large flow changes are necessarily needed to get significant changes in residence time.

-Changes in freshwater inflows may change relationships between loads and OTB water quality.

-Being able to run model is a way to provide objective analysis of problem, to determine magnitude of consequences, can address alternatives that make a difference.

-There is a huge range of conditions inter-annually, need to ensure this is addressed. Consideration for large-scale climatic events [dry vs. wet years/pulsed flow events/prolonged climatic events (e.g. 3-4 years of drought/wet conditions)] may need to be considered for future modeling scenarios.

-Remember because of our rainfall, we have natural pulsing of runoff that effects system, we need to ensure this is built in to our modeling effort, consideration of both negative and positive effects of pulses.

-Not only lot of variability in runoff and loadings, but the order of variability very important. To address this, we're looking at ~ 10 yrs of simulation (1996-2007), so will have very dry, very wet periods.

-Can't forget costs and permitability in consideration of actions.

-There is consideration of a large line to move reuse to Pasco, out of the OTB watershed.

-Consideration will be given to muck dredging, and potentially to dredging to improve circulation. (An additional action #7 to be considered).

-Return on investment will have to be considered in evaluation of the net ecological benefit

-Consideration should also be given to structure operation, discharge from Lake Tarpon structure can be from top or bottom.

-Most of A and G discharge over the top of the structure, structure removal may increase muck deposition.

-Must also consider outreach to communities within watershed, especially those where non-structural BMP management actions may be implemented.

Additional TAC Input via e-mail:

-Enhance/restore oyster reef habitats as a means to improve water quality conditions in the bay (biofiltration)

Assessment of Estuarine Response - Tony Janicki presentation

-What are important response variables? Over what spatial and temporal scales? Have to account for spatial and temporal variability.

-When we define variables, we'll have to define appropriate spatial and temporal scales.

-In assessing these, anticipation of future monitoring must also be taken into account. Key ecological attributes should be things we're already monitoring, already have a history and understanding. Are there other things we need to be measuring?

-For seagrasses, consideration of not just aerial extent, but also consider depth limit, patchy/continuous metrics, species/bed composition (including influences of attached algae)?

-Should differentiate between model parameters (water quality) and response (fish population). Need to know model variables as well as responses. There are differences in monitoring water quality and response (fish populations). The challenge will be having the model of hydrodynamics and water quality, linked to a response group (fish populations/assemblages). Each level of population, structure of population, is related to model output.

–Benthos, as well as fish, points to environmental conditions. Responses of fish and benthos will have to be considered in permitability. Are fish and benthos populations an issue? We have to define the desired end result. Is it to maximize populations? We have fish and benthos data going back 20 years for analysis.

–Seagrass also both a response and a permitability issue. Have to know effects on fish, benthos, and seagrass. The District would like to know about seagrass growth rates and productivity. If these are slower in OTB, want to know. An issue in TB is increasing presence of *Caulerpa*.

–Important to consider esthetics as well, such as water clarity and bottom type. Consider this project in terms of resource use (human-use component), we have to couch results to build public and political will.

–DEP and USF have a working algorithm for chl in TB with remote sensing, wet and dry season. Have massive data, we can work with this project to help, look at attenuation coeffs.

–Primary things to consider in muck accumulation: Muck is from copepods, which feed on algae from blooms fed by fertilizer. We know little about zooplankton, little about benthic algae.

–Have to consider what we can simulate with the Integrated Modeling System and get a quantifiable response.

–Should consider pulse vs. distributed nutrient loads, the mechanisms for delivery, and speciation.

–In terms of blooms, important to understand algal groups involved. Including past trends/changes in species composition.

–DEP can start building such a dataset.

–EPCHC can put this type of info together as well, has 70s plankton community data.

–No mats of *ulva* or *gracilaria* any more, macroalgae not such a problem anymore.

–“Do-ability” has to be considered during the assessment of management action feasibility, and the models ability to simulate effects. However, there is concern that this may limit the assessment of future management actions and scenarios that may be implemented further down the road (i.e. >20 years). Envision that not all ecological attributes will be evaluated only with model. Have to consider if we have sufficient data, then can we simulate it? Some of these things we’re not going to be able to address. Have to identify where we’re going.

–We can monitor things that can’t be simulated.

- We have to use data already existing, can't do long-term monitoring for this project.
- Do we know the status and availability of EPA/TetraTech integrated watershed/hydrodynamic/water quality model for our use? DEP will see if they can get it. The WASP model they're using doesn't have sediment diagenesis model, RCA does.
- Task 2 will determine if we have enough data to drive hydrodynamic model.
- EPCHC could measure bridge flows that may be helpful in model checking. (Enhancing estimates of flow through bridge spans)
- Portions of the model, especially water quality, need to be caveated appropriately. For example, there's not a lot of information on grazing rates in Safety Harbor. We need to be very clear about assumptions, levels of confidence in input data for rates.
- EPA/TetraTech may be interested in comparing their model to our modeling efforts.
- We want to address what we expect response would be to management actions.
- Need to ensure that hydrodynamic models properly account for groundwater inflows, vertical structure in horizontal flows. We have to understand the physics of the system, if everything else is going to make sense.
- If we know something is important, then we know we have to resolve it with the model, spatially and/or temporally.
- For the TBEP, one of the things we'd like to see from this model is what are the factors associated with the rate of muck accumulation in Safety Harbor.
- For blooms, residence time very important. Have to evaluate how modifying flows from Lake Tarpon would affect residence time and blooms. Definition of residence time needs to be established (e.g. modeling water age in the system).
- Water quality model needs data on chl, CDOM, TSS, turbidity, other light attenuation factors, DO, salinity, nutrient speciation
- We also need to know about nutrient sources (and speciation).
- Related to seagrass, we gain and lose 100s of acres, and we don't know how or why. Perhaps we need to find out if there's a seed bank out there that allows seagrass to act as they do. Can't get through modeling, perhaps, but maybe District can get to this. Helps us understand how patterns occur. The District has been looking at higher resolution mapping, may be able to investigate. EPCHC doesn't look for rhizomes, may be missing this as monitoring doesn't include it, this may be opportunity to enhance monitoring efforts in the future.

-Residence time - Lots of different ways to estimate residence time, including water age. A multitude of definitions exist for residence time, will be important consideration.

-Will have to have data/measure components of light regime.

-It will be challenging making linkage between habitat suitability and available fisheries information, since other factors also influence these relationships. Link between water quality and fisheries likely to be made via empirical approaches, linking fish to DO, salinity, chl, using empirical relationships, then using model output to put into linkage. We'll be predicting habitat availability/suitability, not fish populations directly.

-Changes to estuarine fish populations should be focused on structure, not necessarily size (i.e. abundance).

Project Objective – Tony Janicki presentation

-Task 1 Draft report will include management actions, potential scenarios, important endpoints, key ecological indicators.

-For evaluation of model, we'll be looking at a hindcast (70s data) to verify that the model is behaving appropriately, see if it reproduces observed responses.

-There is a distinction between "management action" and "scenario". We may want to look at several management actions simultaneously in one scenario.

-In Task 2 report, we'll know what the various scenarios are, we'll come up with relative rankings of scenarios, must consider permitability

-We're looking at doing 10 scenarios. If there is a combination of actions you'd like included in a scenario, please email Ed Sherwood with reasonable combinations of management actions that would define a scenario.

-As nitrogen load is reduced, it becomes more of a question on nutrient species-specific reductions to elicit a response in the estuary. This gets to the availability of nitrogen, organic takes longer to become available, so source of N important. Residence time into months could make it available.

Modeling Approach – Tony Janicki presentation

-10-year model domain will incorporate extended wet and dry periods, climate variability. As for climate change, we're not going to be taking into account temperature changes and the effects on species. The 10-year sequence allows us to examine some climatic cycles (e.g. effects of El Nino/La Nina years) . The temporal model domain may have to be extended if we decide to include the bloom period, but the concern is can we actually simulate *Pyrodinium*? Possibly address by empirical approaches in a similar manner as the fisheries dynamic questions.

Patrick Tara – Description of INTB. Current model calibrated 89-06, calibrated for stream flow/base flow, aquifer water levels.

Brett Cunningham – Description of adding water quality to INTB. Will perform check on water quantity again, but the INTB has been under a lot of scrutiny for MFL development. It will be important for us to develop a BMP coverage prior to putting into HSPF. It is expected that management actions like fertilizer management will be addressed via modification of EMCs. This can also be done by direct BMPs, but it's simpler to adjust EMCs. We'll do land use comparisons over the model period, but we don't expect much change in watershed BMPs. We'll use actual flows from WWTP. The model gives discharge from groundwater system to OTB, and we have estimates for groundwater chemistry. Floridian aquifer discharge to the bay may be significant.

Steve Peene – Description of ECOMSED. We'll design the grid to answer specific questions, potentially use nested grid(s) if necessary. For example, we may want to do a nested grid for the Lake Tarpon outfall, or we may want to include this area in the main grid. Calibration for transport will be to salinity. The model allows particle tracking. The existing bathymetry, include recent LiDAR, is sufficient. Definition of the questions is required first, then we'll know if the data are sufficient to address the questions. The Army Corps will be doing some additional dredging in OTB, we've reached out to Port Authority and the Corps. We won't be doing morphological modeling as part of this, the bathymetry in the bay doesn't change much except for dredging and perhaps in depositional/mucky areas.

Jim Fitzpatrick – RCA description. Benthic microalgae are not in the model construct now, we may include this, perhaps we can borrow from Chesapeake Bay Model, Cerco's algorithm. We may need some short-term field data to parameterize effects of wind on sediment resuspension. There aren't a lot of sediment nutrient flux measurements, but we have model coefficient set which recreates conditions across a range of estuaries.

Kellie Dixon – Light Modeling description. This work, and other habitat modeling work, is external to the INTB/ ECOMSED/ RCA model suite, will utilize output from the models to evaluate expected responses. For the light model, we've planned to use TN as a surrogate for epiphytes, we can also use salinity, empirical relationships exist to estimate epiphyte dynamics.

Tony – Habitat Models description. Habitat suitability modeling will be done by building relationships between probability of occurrence of some condition and the related water quality conditions. This is environmental favorability modeling, and will be done based on fish and benthic data collected, we've developed a benthic index already.

Jim Fitzpatrick – Uncertainty discussion. One of big questions is issue of uncertainty. There is a difference between skill assessment and calibration and uncertainty. There will be uncertainty in watershed model, and in the inputs to ECOMSED and RCA, and in the output from ECOMSED and RCA. We think it's important to know the orders of magnitude of uncertainty. We will still have to do sensitivity analysis. It could be that uncertainty analysis shows large divergence very quickly, and we have to use sensitivity analysis to create acceptance of the model suite. The water quality simulation spatial domain will be the same as for the hydrodynamic model. The water quality model output will be used to calculate extinction coefficient for the light modeling. Loading to the remainder of the bay

will be from work done previously for TBEP. We will estimate residence time with particle tracking.

All – Discussion of uncertainty. It may be possible to get an idea of what's causing uncertainty, and then can design monitoring to address. It should be recalled that what we'll be doing is based on change in condition, not absolute condition, so even if model uncertainty of absolute solution is large, the model can still be used to assess net change. We also know there is uncertainty in the drivers used as input to the model.

All - Discussion of model spatial domain. Whole bay grid will have higher resolution in areas of importance (OTB), lower resolution in rest of bay. Could consider running water quality only for OTB, but wouldn't save much time, as rest of bay is relatively low resolution. In addition, may want water quality model later over entire bay. Including entire bay in model domain allows us to keep boundary at mouth of bay, far away from supposed effects of management actions. Model also includes nutrient speciation, so any assumptions made of speciation at the boundary (mouth of Tampa Bay) should be sorted out appropriately by the time these conditions affect the mouth of OTB. If necessary for calibration process, could consider possibility of using domain only half way down Middle Tampa Bay, if needed to save time and resolve any solution time problems.

Charles Kovach – Discussion of satellite work. Light attenuation being studied by running flow-through sampling across the bay to compare to satellite results. FDEP can do grab sampling if needed, FDEP would like to work with EPCHC to do flow-through sampling between stations during routine sampling. Satellite flyovers are 1-2 times/day. The relationship between satellite and surface data has been calibrated for turbidity.

NEXT STEPS

- Get revised presentation (Holly's) to all for review and comment
- Get out preview of data available, for review and comment on any additional data available
- Prepare draft report for Task 1 prior to Jan 20 meeting.

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