Information Needs and RMP Studies to Address Them

Water Board

Sediment Dynamics: Need better information on erosive and depositional areas, flux from erosive areas, recovery/degradation of depositional areas and depth of the active layer.	▪ **Modeling strategy** o Flexible grid model of the Bay and margins (2010-2013+) o Margins conceptual model (2009) o Modeling forum (2010-) [proposed] ▪ Schoellhamer SSC monitoring
Sediment toxicity: Need information on what is causing sediment toxicity in the Bay. Copper SSOs require follow-up on observed (1993-1999) toxicity of Grizzly Bay sediment samples to development of bivalve embryos. TIE results reported in 2003 indicated copper as cause of toxicity. Investigate techniques for conducting TIEs for pesticides (collaborate with SCCWRP)	▪ Causes of Sediment Toxicity element (2009, 2010 [proposed]) ▪ Molecular TIEs (2010) [proposed] ▪ Sediment Toxicity (Annual S&T) ▪ *Copper not specifically covered* ▪ *Pesticides not specifically covered*
Benthos: Need process to evaluate benthic indicators in the Bay that includes local benthic ecologists, regulators and stakeholders.	▪ SQO assessment study (2008-9, 2010 [proposed])
Small Fish: Need analysis of PCBs and Se as well as Hg.	▪ **PCB Strategy** o PCBs in small fish study (2010 [proposed]) ▪ *Se not covered*
Sport fish bioaccumulation: Need to determine trends of selenium concentrations in fish with a particular emphasis on sturgeon. Need baseline data for sturgeon to assess the progress toward attainment of the proposed fish tissue target and to collect	▪ Selenium included in 2009 sampling, all fish species

evidence of bioaccumulation in fish. Need additional data on tissue concentrations of different species and life stages.	
Dioxin – refer to Dioxin Strategy and RMP subgroup discussions	▪ **Dioxin strategy**
Copper: Copper has been linked to impairment of the olfactory system of salmonids in freshwater. It is not known if this is a problem in the estuary, but this must be investigated as well. NPDES permits require dischargers to conduct or cause to be conducted studies on this issue.	▪ Copper in salmon study (2010 [proposed])
303(d) Listed Sediment Hotspots – Conceptual Model/Impairment assessment needed for San Leandro Bay and Oakland Inner Harbor hot spots.	▪ San Leandro Bay being addressed through Aquatic Science Center proposal ▪ *Oakland Inner Harbor not covered*
Bay Margins (includes "hot spots"): There are a number of locations in the Bay that are on the 303(d) list due to elevated concentrations of one or more contaminants (PCBs, mercury, sediment quality, PBDEs, others) and, while there may be elevated tissue concentrations throughout the Bay, there are localized zones of high sediment and biota concentrations. The overwhelming majority of these locations are at the Bay margins where sources currently enter the Bay, historical sources once entered the Bay, or historical activity contaminated the site. These regions present questions that may be treated with models. The models developed to date for the Bay through RMP are more concerned with large spatial and temporal scales. The Bay Margin areas require modeling sediment and contaminant transport at much finer temporal and spatial resolution. A high priority for the Water Board is to develop a model that could be generally applied (subject to the availability of suitable inputs) to Bay margin areas rather than one "tuned" to a particular site. The types of questions that a fine-scale model might address are:	▪ **Modeling strategy** o Margins conceptual model (2009) o Flexible grid model of the Bay and margins (2010-2014+)

▪ What is the fate of contaminants (mainly contaminated sediment) that enter the Bay in the vicinity of a particular Bay margin contaminated site and that are already present at the contaminated site? This question involves physical (locating zones of deposition, and modeling transport process), chemical (rates of transformations), and biological (food web uptake) processes in the Bay margin interface. ▪ What is the effect of certain management interventions at the site (remediation, source control, etc.)? ▪ What is the trajectory and pace of recovery for the site under various management scenarios? It is understood that this type of model entails a substantial field observation program. Perhaps such a model can be built in stages of incremental sophistication while, at the same time, confirming with managers and stakeholders the necessity of taking each additional step in model complexity.	
Local Tributaries : Local tributary monitoring studies for mercury, PCBs, copper and PBDEs designed to: 1) support Bay Margin modeling 2) to begin model development to be able to assess watershed loads and 3) to assess progress on applicable TMDLs. For PCBs, need sufficient and representative local tributary monitoring plus development of predictive model to provide refined assessment of loads from watersheds/storm drains and determine spatial and perhaps temporal patterns. Need information on the status of nutrient loads from small tributaries. Need monitoring studies for loading estimates of selenium in S. Bay tributaries.	▪ **Small tributaries loading strategy** o Guadalupe River modeling (2009) o Zone 4 Line A monitoring (2009, 2010) o Guadalupe Hg monitoring (2010 - SCVWD funded) o Guadalupe piggyback (2010 [proposal]) o Guadalupe triennial monitoring (2013? S&T [proposed]) o Develop Multi-year Watershed Loading Sampling Plan (2009) o Monitoring of Representative Watersheds (2010- [proposed]) o Land Use Sites: Scoping of Needs and Monitoring (2010- [proposed]) o Dynamic Modeling of a Representative

	Watershed (2012 [proposed]) o Sampling to Observe Trends in a Subset of Representative Watersheds (2014- [proposed])
Mercury Modeling Needs: Follow-through required on mercury strategy**.**	▪ **Methylmercury** o **Mercury strategy** ▪ Methylmercury mass budget (2009) ▪ Methylmercury model development (2011 [proposed]) ▪ **Total Mercury** o **Modeling strategy** ▪ Margins conceptual model (2009) ▪ Flexible grid model of the Bay and margins (2010-2014+)
Pyrethroids: Need some level of monitoring and trend assessment - coarse assessment and evaluation of Bay Margin loading and toxicity.	▪ Pyrethroid monitoring of sediments (Annual S&T) ▪ *Not monitoring tributaries or water column for pyrethroids*
Dioxin/PAHs: These contaminants can be grouped together for the purpose of the modeling discussion. Both of these pollutants have a strong nexus to air quality. For both, it is probably the case that historical loads were much greater, there is a substantial legacy component, and atmospheric deposition and subsequent runoff is a main factor in sustaining Bay concentrations. Especially for dioxins, there is little hope for developing a more sophisticated model because the data needs are so pronounced. For both contaminants, the recommended approach is to pursue observational programs aimed at getting more information to	▪ **Dioxin strategy** o Sport fish (2009) o Surface sediment (2008 [on hold pending funding], 2009, 2012 [proposed]) o Water (2009, 2011 [proposed]) o Bird eggs (2012 [proposed]) o Cores (2008 [on hold pending funding]) o One-box model (2011 [proposed]) o Small trib loadings (2009, 2010-2011

characterize the patterns of impairment and linking this information to the simple box models. There may be a need to develop food web models for TMDL linkage. And, there is possibly a role for linking the Bay box models to air quality models and watershed models as well. For dioxins need some level of monitoring and trend assessment - coarse assessment and evaluation of Bay Margin loading and toxicity as well as air deposition monitoring/modeling connection.	[proposed]) o Delta loadings (2010 [proposed]) o Atmospheric deposition (2009) o Food web model (2012 [proposed]) ▪ PAHs o Water (Biennial S&T) o Sediment (Annual S&T) o Bivalves (Biennial S&T) o NOAA fish threshold study (2008-2009) o *No specific plans for modeling* o *No overarching strategy or other plans*
Legacy Pesticides: Based on the CM/IA report produced by SFEI, the state of impairment is such that model development specifically for legacy pesticides is not warranted. Concentrations in the Bay have been declining, and the Bay appears to be on its way to recovery. However, monitoring has shown that areas of contamination exist in near-shore locations in the Bay and in localized areas in the watershed. Thus, legacy pesticides may be a candidate for modeling as part of a Bay margin modeling strategy. Find local sources or major small tributary pathways. Need trend monitoring.	▪ **Modeling strategy** o Margins conceptual model (2009) o Flexible grid model of the Bay and margins (2010-2014+) ▪ *LPs not on analyte lists for loading studies* ▪ Trend monitoring o Water (Biennial S&T) o Sediment (Annual S&T) o Bivalves (Biennial S&T) o Sport fish (Triennial S&T) o Bird eggs (Triennial S&T)
Selenium: The TMDL will rely on two linked models – a transport model adapted from the Uncles and Peterson salinity model and the selenium bioaccumulation model developed by Presser and Luoma. There is no urgent need for additional model development, but the Water Board would encourage SFEI to develop the capacity to maintain and run these two models in the future for adaptation of the selenium TMDL in future years. Need	▪ SFEI is participating in TMDL model development ▪ Xx “need to quantify conceptual model…” xx unclear what this means for RMP ▪ *Selenium speciation in RMP water sampling not covered* ▪ *Selenium speciation in RMP sediment sampling*

to quantify conceptual model to determine how efficiently selenium enters higher aquatic food web and to understand impact of selenium in bottom sediments on zooplankton and bivalve uptake. Need to expand selenium analysis in the water column to include selenate, selenite and particulate selenium to support modeling. Need to measure selenium speciation in sediment to support modeling of selenium cycling, interchange, and bioavailability.	*not covered* ▪ Small tribs loading stategy (loads monitoring) ▪ Mallard Is loads monitoring (2005, 2006, *not covered in 2010*) ▪ Selenium included in 2009 sport fish sampling, all fish species

Missing topics:
PBDEs
Emerging Contaminants
SQO Data and Tools