SOUTH BAY SALT POND RESTORATION PROJECT
Sediment Workshop 2 Synopsis
Workshop Date: March 18, 2005 (9am to 1pm) at the State Building, Room 12

Introduction to the Workshop
This is a summary of questions and comments from attendees of Sediment Workshop 2. This synopsis does not provide meeting minutes, but focuses on the questions and issues attendees had regarding sediment dynamics, modeling, and data needs for the Restoration Project.

Comments provided by Science Team members are considered advisory, and do not constitute peer review. These comments are designed to help the Consultant Team and Science Team collaborators move forward with models or predictive approaches that will provide the best estimate of how South Bay geomorphic conditions are likely to change when restoration is implemented.

Part 1. Update on Landscape Scale Geomorphic Assessment
Presentation
Dr. Kris May, from PWA, presented the preliminary results of the Landscape Scale Geomorphic Assessment (LSGA). She noted that the South Bay landscape will change with or without our restoration. The purpose of the LSGA is to help us understand how the system is likely to evolve with and without the Project. This analysis will help in evaluating the draft Alternatives with respect to the Project Objectives. And, this assessment will help with project decision-making.

This LSGA is not "the" answer to what the landscape will look like in the future. The results are based on a series of assumptions. For example, this assessment assumes that all ponds are opened simultaneously to tidal action. In other words, it does not include project phasing.

The LSGA predicts mudflat and marsh evolution using a sediment budget approach. Specifically, the Uncles-Peterson Salinity Model (as revised by Dave Schoellhamer—the SUP model) is used as a sediment budget tool and to predict long-term mudflat evolution. SUP is a box model of the entire Bay with 2 layers, the upper box for shoals and the lower for channels. Marsh98, another model, is then used to predict marsh evolution inside the restored ponds. Marsh98 uses a Suspended Solids Concentration (SSC) index derived from the SUP model results and existing sedimentation rates from recently restored sites as model input.

Kris addressed how the LSGA changed based on input from the first Sediment Workshop. The most major changes were that PWA adopted a regional approach using the same regions as Foxgrover et al. (2004) (Region 4 is south of the Dumbarton Bridge, Region 3 is between the Dumbarton and San Mateo Bridges, Region 2 is between the San Mateo Bridge and the San Bruno Shoal, and Region 1 is between the San Bruno Shoal and the Bay Brudge), modified the use of empirical data from local restoration sites, and included sensitivity to watershed inputs.

SUP model is calibrated to net bathymetric change between 1956 and 1983 as presented in Foxgrover et al. (2004). The USGS ran the model forward for 50 years using three repeating 10-year outflow scenarios from the Delta representing a normal flow period, a dry period, and a wet period. Dave Schoellhamer modified the SUP model to account for increased velocities and bed shear stress related to increased tidal prism, and the ponds specified for tidal restoration were added adjacent to the SUP model boxes.

Kris used empirical sedimentation rates to develop an SSC index separate from that given by the SUP model and used this empirical data in the Marsh98 model. The rate of accretion or erosion was averaged for 6 local restoration sites from the time restoration began. Some data were collected by coring and some by longer-term monitoring. These estimates are a bit higher than the SUP models predicted SSC index because empirical data are representative of SSCs near breach locations, and the SUP model predicts a laterally averaged value for each model box. This brings up the lateral gradient issue.

SUP predicts that the average SSC concentrations for the top box in Region 4 (far South Bay) would increase over 50 years under the No Action Alternative, concentrations in Region 1 - 3 would decrease.

Question: Why is the initial measurement of SSC higher in Region 2 than Region 4?

Answer: With all ponds in the project area opened to tidal action, SSC still increases but the average concentration is much lower. Part of the reason SSCs are higher in Region 2 than Region 4 is the calibration method. The model is calibrated to net bathymetric change, and to achieve the correct amount of deposition between 1956 and 1983, the coefficients for deposition and erosion were adjusted. This calibration led to a lower SSC than one would expect in Region 4. In addition, the relative area of mudflat vs. channel area in Regions 2 and 4 is not equivalent. Region 2 has a much higher mudflat to channel area ratio, and SSCs are typically higher along the mudflats than in the channel, leading to a higher average SSC in Region 2. The net trends in SSC for both Regions are still valid, and the SSCs are not used directly in Marsh98 but are scaled using empirical data to a SSC value that is more appropriate near a breach location.

Landscape Scale Scenarios were run for the No Action Alternative with Island Pond Restoration, Tidal Marsh Emphasis Alternative (90% tidal marsh), and No Action condition assuming no tidal restoration and on-going ISP operations and maintenance. The analyses predicted morphological evolution at decadal snapshots over 50 years for the three pond complexes and the South Bay intertidal mudflats. Using the results of the SUP Model for each scenario, changes in SSC over time were accounted for in the analyses.

The preliminary LSGA modeling showed that:

- When only the Island Ponds (A19 – 21) are opened for tidal restoration, there is little change in SSC predicted by the SUP Model in Regions 1 - 4
- When 90% of the ponds are opened for tidal restoration, the primary impact is in Region 4. SSCs initially drop by nearly 50% in Region 4, and sedimentation rates on the Region 4 mudflats decreases by over 50%. Impacts to Regions 2 and 3 are minimal, and no impact is seen in Region 1. Region 4 effectively becomes a more efficient sediment trap.
- Sediment from eroding slough channels (the volume of sediment scoured from silted in slough channels) provided a source of sediment for restoration initially, but over time, this was an insignificant sediment source for restoration.
- Using a constant SSC index over 50 years (run as a sensitivity scenario), derived from empirical data based on the existing local restoration sites, and looking at decadal snapshots over time, the Alviso pond bottoms reach colonization elevations by year 20. But, this is, admittedly, optimistic. In Eden Landing and Ravenswood, the pond bottom elevations reach colonization elevation by year 30. These results assume that sediment supplies will remain constant and that sedimentation rates estimated from small restoration sites can be applied to a large area.
- Using a variable SSC index (updated at 10-year intervals) based on SUP model results, , pond bottom elevations in the Alviso complex reach colinization elevations by year 40. Eden Landing and Ravenswood reach colonization elevations by year 30.
- Using a variable SSC accounts for the scale effect of tidal restoration and provides a more realistic (slower) picture of pond sediment accretion. These results are still optimistic. If wind-wave hindered settling and a potential decrease in tributary sediment input were considered, pond bottoms in the Alviso complex could reach colonization elevations by year 50 instead of year 30.
- The intertidal mudflats in Region 4 accumulate 0.7 m of sediment under the No Action Alternative. Under the 90% Tidal Marsh Alternative the net bed increase is reduced to 0.3 m. Both scenarios outpace sea level rise (sea level rise over 50 years is approximately 0.15 m). However, the No Action Alternative results in a higher net increase in mudflat area over 50 years.
- Preliminary results show that sediment accreting in the ponds is being eroded from the mudflats OR from decreased sedimentation on the mudflats due to direct capture of tributary sediment inputs within the ponds. Sensitivity analyses will be performed to determine the relative importance of each.

- Bathymetric data is needed for Ravenswood Complex Pond R1. Neither the LiDAR survey, nor the USGS wet pond bathymetry survey includes R1.

Comments and Questions on the LSGA and Preliminary Results

- There were many questions about the assumptions for each sediment budget term and about the estimates of tributary load. Tributary data are from 1950-1960s, however, Lester remarked upon new data have been collected since 2000 at Coyote, Guadalupe and Alameda. Laurel remarked on work she has been doing that suggests that much of the sediment passing the Alameda Creek gauge is trapped in the flood control channel and does not make it to the Bay. The LSGA does not include the new recent data and makes the assumption that all sediment from the watersheds gets to the Bay.
- Do we need lots more measurements of SSC or will this not help us with understanding the variability? How will understanding short-term variability help us understand how to achieve the project objectives?
- Will processes change when we open lots of ponds? If so, the coefficients might not be calibrated correctly. Also, how does the noise in the system and changes that will occur when we open ponds affect our predictions?
- Changes in mean bed elevations for No Action in Region 4 show about 0.5m increase in elevation in 20 years for the SUP model. The new LIDAR data also show an 0.5m increase in bed elevation in the last 20 years in Region 4. So model matches empirical results. This increase is out-pacing sea level rise.
- For Region 3 (which includes Eden Landing), the LiDAR data seem to show the east side to be depositional (only 0.2m of change), while the west shore shows no net increase. Also, The SUP model predicts that Region 3 is net erosional.
- How would revisions of the tributary load result in changes in the sediment available for restoration? How will tributary input to ponds affect sedimentation in the ponds or upland parts of ponds? Lester suggested that these issues should be discussed in the write-up on the model assumptions and results even if no analysis is done.
- How would the ratio of sediment supply (watershed: Bay) change as the tidal prism diminished as sedimentation in the restoration pond progressed? Lester suggested that there may be opportunities to encourage phased sediment supply from each source depending on the location (proximity to the Bay) and the sediment quality.
- What is the sensitivity of the analysis to wind-wave resuspension?
- Do we know why we have seen changes in deposition/erosional patterns over time? What are the mechanisms and do they still apply or do other mechanisms apply now?
- Preliminary validation of the UP model with 1983-2004 bathymetric change shows that the model accurately simulates deposition in region 4 but overestimates erosion in region 3. How does that play into this analysis? Dave says that this problem could be addressed by accounting for rebound.
- How does freshwater input affect flocculation? Dave says not important. Anything above a few parts per thousand does not affect flocculation and also that biological processes have already flocculated particles.
- Dave thinks that data on subsidence/rebound should be included in analysis.
- Sensitivity analyses are critical. A key assumption is that the system, with respect to sediment inputs, will not change. If inputs do change, this would affect the results and sensitivity analyses should be included.

Part 2. Update on Bathymetry

Presentation

Dr. Bruce Jaffe gave the update. First, Bruce noted that bathymetric data collection should be completed by March 25. Tidal reduction of data will be done in April. If we keep the tidal gauges going, that would be very beneficial. The gauges themselves cost about $20K each.

These bathymetric data for the Project have been collected:

- For ponds with water, USGS used a "pole" method from a floating craft
- For dry ponds and other exposed surfaces such as mudflat LIDAR from an aircraft was used.
- For deep-water parts of the Bay, Sea Surveyor used acoustic methods to determine depth.

With respect to LiDAR, over 250 million data points were collected. Data updates will be needed as problems are found. Masking out over-water points and merging with other bathymetric data should be done by summer. Data will be publicly-available and will be very attractive. Kris and Michelle need data before fall and want a preliminary combined data set.

USGS took more than 150 samples for sediment grain size analysis between October and December 2004. Seabed classification data was also collected by Sea Surveyor and is being analyzed in April and May, 2004.

USGS is also looking at 2m long gravity cores to determine what sediment size will be available if erosion occurs. Will do C 14 dating and try to do a pre-settlement sediment budget. Also doing a Sedflume analysis.

Time scales of concern and connection to other parts of Bay will determine if sediment deposition/erosion are in equilibrium for the South Bay. For example, for Central and South Bay, mudflats are eroding. Equilibrium is an important assumption of the LSGA model that might not be correct. Tidal flat equilibrium is a function of tidal range and wave height. But, we don't really know how these factors are affecting or will affect South Bay mudflats.

Comments and Questions on Bathymetry Update

- What are the processes driving erosion and deposition trends? For example, to what extent are climate change, rates of tectonic subsidence and rebound, and anthropogenic changes responsible for trends? We should consider using methods to get at these questions. Lester discussed the long term climatic trends over the past 125 years and the possible sediment supply associated with mining, agriculture and urbanization and suggested that these or other watershed factors could account for the bathymetric changes observed.
- Laurel suggests a short-term research idea is to determine how major sediment supply and storage has changed in the large south bay watersheds during the last 150 years and link these data to changes in land use and depositional history for the South Bay bathymetry that Jaffe has developed.
- Where were the 150 samples taken by USGS surface samples of the bay bottom? How were the samples distributed, i.e., mudflats, deep channels, near the outlets of the major channels? Is it possible that some samples can be retained for trace element analysis? This could be useful for comparison to upland watersheds.
- Would it be useful to have a program coordinated to analyze trace elements in suspended sediment from the major tributaries at their gage sites during the same year that they are deposited in and analyzed for the bay? Would it be useful or even possible to add inert markers of some sort to the suspended load of tributaries to determine where the sediments are distributed in the bay?
- Laurel suggested that there could be a large difference in the amount of sediment supplied at the present versus the 1960's to early 1970's for the Alameda Creek gage at Niles Canyon.
- A project to supplement information for restoration of the South Bay Salt Ponds could be to look at the relative contribution of sediment from different tributaries and the distribution of that material. For instance, we could use trace element analysis for determining what percent of sediment is of Bay versus tributary origin.

- Dave suggests a short-term research idea is to collect data on any localized slough and mudflat changes that have accompanied smaller restoration projects.
- Bruce suggests a mudflat equilibrium versus disequilibrium study.
- We need sediment and water outflow data from below existing, which are too far upland to understand the amount of material supplied to the Bay by local watersheds.
- Perhaps we could combine Fred Nichol's short-term mudflat change data with Bruce's long-term data to get a better handle on short-term variability and its effects on net deposition or accretion.
- Is it possible that net sediment movement could have been landward to fill tidal sloughs or build marshland rather than seaward out through the Golden Gate?

Next Meeting

We will have third meeting of the Sediment Workshop, on June 27, which will focus on the role of tributary inputs in the South Bay sediment budget.

Sediment Workshop Attendees

Steve Ritchie, South Bay Salt Pond Restoration Project
David Schoellhamer, USGS
Lester McKee, SFEI
Jim McGrath, Port of Oakland
Kris May, PWA
Michelle Orr, PWA
Laurel Collins, Watershed Sciences
Jessie Lacy, USGS
Lynne Trulio, San Jose State University
Dilip Trivedi, Moffatt and Nichol
Fred Hetzel, Regional Water Quality Control Board
Liang Xu, Santa Clara Valley Water District
Jen-Men Lo, Santa Clara Valley Water District
Thomas Bawden, USACE
Bruce Jaffe, USGS
Don Woodrow, USGS