# Bay Area Ecosystems Climate Change Consortium

**Thursday, April 30, 2015, 10 AM – 2 PM**
**California State Coastal Conservancy**
**11th Floor Conference room, 1330 Broadway, Oakland, CA 94610**

**Meeting Summary**

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**Attendees:**

Hank Ackerman, *Alameda Co FC & WCD*
Julie Beagle, *San Francisco Estuary Institute*
Brian Benn, *Environmental Risk & Financial Solutions*
John Bourgeois, *SCC/South Bay Salt Ponds*
Matt Brennan, *ESA*
*Jenn Fox, *Bay Area Open Space Council*
Adam Garcia, *Greenbelt Alliance*
Robin Grossinger, *San Francisco Estuary Institute*
Andy Gunther, *BAECCC*
Beth Huning, *SF Bay Joint Venture*
*Sara Hutto, *Gulf of the Farallones NMS*
*Tom Kendall, USACE*Daphne Hatch, *Golden Gate NRA*
David Lewis, *Save the Bay*
David Loeb, *Bay Nature*
Jeremy Lowe, *ESA/PWA*
Brad McCrea, *BCDC*
Lisa Micheli, *Pepperwood Reserve*
Sara Moore, *Consultant/NBCAI*
Anne Morkill, *US Fish and Wildlife Service*
*Carl Morrison, *Bay Area Flood Protection Agencies Association*
Sarah Richmond, *BCDC*
Rohin Saleh, *Alameda Co PWA*
Victoria Schlesinger, *Bay Nature*
Linda Tandle, *CEMAR*
Caitlin Sweeny, *SF Estuary Partnership*
Rebecca Varity (?), *AECOM*
Michael Vasey, *SF Bay NERR*

* = via teleconference

1. **Introduction of participants and their BAECCC-related projects**

   Participants introduced themselves.

2. **Review Agenda.** No changes were made to the agenda.

3. **Updates**

   a. **TBC3 – North Bay Climate-Ready Collaboration (L. Micheli)**

Lisa Micheli gave an update on the North Bay Climate Ready project, a collaboration of Regional Climate Protection Authority, North Bay Climate Adaptation Initiative, Pepperwood Preserve, Sonoma Ecology Center, Sonoma County Water Agency, and Point Blue Conservation Science. The goals of this multi-agency, multi-jurisdictional effort are to reduce GHGs by 25% from 1990 levels by 2015, reduce GHGs by 40% from 1990 levels by 2035, assess vulnerabilities, and identify key adaptation strategies. A key strategy is to translate available landscape-level projections of future temperatures and related hydrology into inputs for long-term planning.

Using the modeling approach developed by the Terrestrial Biodiversity Climate Change Collaborative (TBC3) that links downscaled climate change projections with local hydrology using the Basin Characterization Model, different future scenarios were analyzed as part of the regional vulnerability assessment: warm/wet, warm/dry, hot/wet, and hot/dry. For the scenarios, different human responses were also modeled: business as usual, mitigated, highly mitigated, and super mitigated. Key outputs are the percent change in water deficit for the different scenarios. The California Basin Characterization Model (BCM) downscaled climate and hydrology output is available on the California Climate Commons.

Napa Valley Basin Characterization Model Outputs were developed using Napa River Valley Runoff annual values for six scenarios: historic, mitigated-dry, mitigated-wet, warm-moderate, warm-dry, warm-wet, and hot-dry. Graphs and maps were developed showing water supply recharge and runoff projections for mountains and valley floor, change in recharge for high and low rainfall (low rainfall results in losses of 2.5 inches of groundwater recharge per unit area annually), annual values of water supply for Napa mountains, flooding of tributaries under different scenarios, and water deficits on agricultural lands.

Potential native vegetation responses to changing climate, based on the vegetation model developed by David Ackerly at UC Berkeley, were also developed. The Napa County Vegetation Report Summary shows the response of various vegetation communities to 12 scenarios on a scale of increasing temperature. A simple diagram with four squares (warm/more rain; hot/more rain, warm/less rain, hot less rain) were developed as another way to present vegetation response at a landscape scale under different future climates. For example, Oregon Oak in the northern Mayacamas does well in high rainfall scenarios, but declines in low rainfall, and does worse in hotter scenarios, but impacts are not great.

**4. Group discussion: Search for Mitigation of Sea Level Rise in South San Francisco Bay.**

Rohin Saleh, of the Alameda County Flood Control and Water Conservation District, gave a presentation on initial modeling examining the impact of a tidal surge barrier at the Dumbarton Narrows on water levels in South San Francisco Bay. Andy introduced Rohin by noting that he was not presenting to BAECCC as an advocate of constructing such a barrier, but rather to initiate a constructive discussion regarding such a surge barrier among the larger discussion of alternative strategies to address the impacts of sea level rise in San Francisco Bay.

Rohin started by noting that historically, reservoirs and channels were built to store or convey flood water to the bay to prevent flooding. The design and construction of these facilities were conducted prior to the availability of sophisticated analytical tools to include sediment transport processes as part of the design. Now, more than 60 years later, sedimentation (among other factors) has made maintaining those facilities a tremendous challenge and a costly endeavor. In coming years we will be making similar design and construction decisions with regards to infrastructure related to sea level rise (SLR) in San Francisco Bay. Stakeholders must consider a wide range of solutions and strategies, and carefully analyze the impacts of natural processes so that we can make the better choices in our future efforts than may have been made in the past. For example, a critical impact of the SLR that requires more attention is the effect of proposals for combating SLR, such as the building of sea walls or levees, will have on our drinking water aquifers around the Bay.

Depending on the targeted SLR design elevation, one alternative solution that can provide protection from SLR for both surface water and ground water could be the design and construction of a tidal surge barrier across the Dumbarton Narrows. Such a surge barrier doesn't need to be constructed immediately but rather may be part of a bay-wide plan for the future that could be implemented when the south bay salt pond restoration projects have exhausted their flood reduction effectiveness or when the impacts of the salt water intrusion become impossible to control.

A discussion of this concept is timely due to several factors: FEMA has released an extreme tide and impacts study, the National Research Council has produced an assessment indicating that sea levels in the region are rising, adaptation planning for SLR is underway by different entities around the bay (with some projects already in design stages), and indications of regional impacts due to individual projects around bay that can only be addressed through regional policies.

Questions we should consider include (1) Do we want the future Bay shoreline to be the product of reactive decisions by individual land owners or Bay communities as sea level rises, or part of a regional plan? (2) What is our vision for the future of the Bay shoreline that we can use to plan and design? (3) Can traditional engineering solutions such as seawalls or dikes address all the dimensions of SLR impacts in San Francisco Bay, or are natural, holistic approaches needed? (4) Should organizations that have not traditionally collaborated work together to produce the necessary studies and develop decision matrices that identify potential solutions and tradeoffs?

An analysis by Alameda County and BCDC reviewed local coastal structures or features subject to overtopping (of varying depths and duration) due to sea level rise, and identified many weak links along the county shoreline. Should some of them be fixed? Which ones, when, and using which SLR projection?

Rohin noted that with the complex bay hydrodynamics and challenges such as saltwater intrusion and many other ecological and physical effects of SLR, it is essential to work together and initiate the regional discussion now.

In order to show the regional impacts of various SLR mitigation strategies around the bay, Rohin presented a model that was developed based on the FEMA San Francisco Bay Coastal Study using three levee scenarios: Infinitely high (no ponds or overland flooding; captures maximum tidal/flood height), Existing levees (existing ground elevations for levees and ponds), and No Levees (ponds and overland flow). Using the large 1983 storm event as a baseline, Rohin presented modeling results for the three scenarios with no SLR, and then 50, 100, or 140 cm rise, showing the maximum water surface elevation along the profile boundary. He focused particularly on the difference in tidal height between the Dumbarton Narrows and a point to the south when a tidal surge barrier is inserted into the model. The modeled surge barrier was not blocking the entire Dumbarton Narrows; the central channel was always left open. The surge barrier was triggered by high tides and was only preventing the peaks from entering the south bay while allowing the outgoing tides to move unimpeded.

The modeling results demonstrated a measurable reduction in water surface heights in the south bay behind the barrier. With 140 cm SLR, the barrier could result in water surface heights being maintained approximately at today's heights in the extreme south bay. The model indicated a small rise (a couple of inches) in the region just north of the barrier, which is expected as the blocked incoming tide accumulates in that region.

A wide-ranging discussion then ensued. Several key issues were raised:

- The model could be refined to examine if the reductions in tidal height south of the barrier, currently estimated using one point in the middle of the extreme South Bay, would be different along the edges of the Bay.
- It was noted that the extreme South Bay could be one of the locations in the region least in need of this strategy because of the existing and planned wetlands restoration activities. Rohin noted that the modeling does not include any impacts of wetlands restoration on tidal heights, and that they are working on the model to include those effects.
- Are there other natural infrastructure solutions/projects that could impact any solutions implemented in the South Bay? It is important to model the region-wide impact of all shoreline changes.
- How does the SLR problem change for future generations if no work is done around the bay edges as SLR continues? Can near term solutions be adapted to future levels of SLR?
- A tidal gate could be a temporary, short term solution depending on the level of SLR and whether or not the final number is close to or substantially greater than 140 cm.
- How do we deal with SLR beyond 140 cm where a gate would be potentially closed for every tide? Are we still faced with the longer term question of armoring and/or retreating? Are we capable, as a community, to take actions that accrue over 100 years?
- How do the actions we take in the next few years either preserve or eliminate options for Bay Area residents in the future?

**5. Group Discussion: Design Objectives for Adapting San Francisco Bay and its Shoreline to Sea Level Rise**

Jeremy Lowe (SFEI), Matt Brennan (ESA), and John Bourgeois (SCC) gave a presentation and led a discussion about response strategies for SLR that focused on planning assumptions, potential impacts, and design objectives.

Jeremy noted that past shoreline modifications have been designed to optimize specific components of the bay system such as salt production, flood risk management, wildlife restoration, or water quality. We now recognize that strategies are available that can generate benefits across multiple Bay uses while being designed for evolving Bay conditions. Examples include the South Bay Salt Pond Restoration Project, East Bay Dischargers Authority shoreline assessment, and the San Francisquito Creek Joint Power Authority's "SAFER Bay" project. Solutions to increase future resilience will likely focus on increasing scale and complexity. However, we need to be clear about resilience "of what?" and "to what?" in order to develop optimal designs.

The Bay is a complex system, so changes of individual system components will frequently result in unforeseen changes elsewhere. Four key issues for the design of shoreline projects are: (1) we should not alter the assumptions upon which are based a large number of projects and programs without understanding and accepting the consequences, (2) accepting that a large number of Bay-scale projects may be on the horizon, (3) the challenge of increasing the resiliency of the Bay system to reduced sediment supply and climate change, and (4) building the capacity to assess the resiliency of the Bay as a whole system, not component by component.

Given these issues, is there a subset of resiliency strategies that can be identified where it can be agreed that implementation will help optimize system-wide preparedness for SLR?

John Bourgeois discussed the South Bay Salt Ponds project where restoration is considering many factors including hydraulic mining, delta modifications, development/fill, dredging, reservoir operations, subsidence, as well as sea level rise. John showed a long-term trend for Santa Clara County Groundwater from 1910 to the present, which documents subsidence of about 13 feet in San Jose between 1915 and 1970, but none since then. John also noted that despite an overall decline in sediment transport into the Bay, there is active sedimentation in the South Bay, with new tidal marsh has been forming along the eastern shore.

John also presented how transitions zones interior to the marshes, which represent the zone into which marshes can move as sea level rises, are essentially gone (*e.g.*, lost to development). The marshes are in dynamic equilibrium with the Bay but can they keep pace with moderate sea level rise? If the tidal range gets compressed, the marsh loses the low range transition zone.

Matt discussed the Eastern Schelde Storm Surge Barrier in the Netherlands, which was built in 1987 and resulted in the tidal range being compressed. High tides were lowered, so high marshes were lost, low tides were raised and the intertidal mudflat drowned, and wave energy was concentrated in a narrow band which increased erosion of the marsh edge. This demonstrates the impact of tidal suppression on intertidal habitat.

A barrier has been proposed for the Golden Gate (*BayArc Storm Surge Barrier*), conceptualized as a device that is raised at the highest tides, and then lowered for all other times. This type of barrier will need to be raised more often as sea level rises. The average time between closures is only once every 100 years with present tidal heights, rising to once every 2 years with 12 inches SLR and once every 15 hours with 55 inches SLR.

Thus, nearing the end of this century a Golden Gate barrier would be up more than once a day, vastly altering inundation regimes in the estuary. This would impact (among other things): survival of plant species that create estuary habitats, depth of the water on the marsh and hence the geomorphic evolution of the channels, the amount of wave energy and habitat erosion, the rate of sedimentation and hence the elevation of the habitat, and the accretion of marshes as sea level rise. Bayland habitats would be squeezed with upper elevations fixed by the closure of the barrier and lower regions being drowned by higher low water (marsh becoming mud flat).

Jeremy concluded the presentation by highlighting the need to develop regional design objectives for all aspects of the Bay – water quality, flood risk management, ecosystem restoration, public access navigation, etc. Can we agree on a set of requirements and assumptions that we can use to define a subset of acceptable strategies? He proposed that BAECCC develop a “white paper” on this topic, starting with what we accept as true presently, and then derives a set of interim guiding principles for new projects in the Bay through a distillation of existing guidance, plans, policies and regulations that society has already agreed to. For example, we’ve already decided that expanding wetlands is beneficial to the region; the question is where and how. In the longer term, we need to integrate understanding of the complexity of the entire Bay system in order to establish the most useful design objectives.

Several interesting points were raised in the subsequent discussion:

- CHARG is gathering information on future projects and environmental solutions. Perhaps there is a place for temporary engineering fixes that can buy time for more permanent solutions (both natural and built infrastructure).
- If a barrier holds a water level, then the system can't evolve. The Dutch are caught in building higher and higher barriers. Now, they must have barriers and levees because there are no wetlands to mitigate SLR.
- Decisions made today will affect the future. What is the vision for the future of the Bay? Do we allow the Bay to expand now? Are we buying time or postponing a chaotic time for future generations?
- BCDC is trying to come up with solutions but we will always be "in the middle" of projects and efforts—there will always be projects in the pipeline. It will be challenging to find the "sweet spot" or the confluence of resilient strategies since more variables need to be included in the analysis. A planning process can help articulate what's important to people. It could be helpful to know where the "sweet spot" *isn't*.
- Everything we're doing now is focused on maintaining the existing levee line; what are the creative ideas beyond this strategy?
- Compared to four years ago, the number of resiliency projects and programs in the region has exploded. It may be difficult to establish a set of guidelines given the rate of project/program development. It is essential that dialogue among interested parties be maintained to help shape consensus understanding.
- A lot of development is still being built in the wrong place. FEMA maps have to be updated. Even without forums or dialogue, two factors will drive solutions: (1) what there is money to build, and (2) what regulations will or won't permit.
- It would be useful to bring together whatever we can to try to articulate the values of communities. For example, millions have been spent to create recreational opportunities and wildlife refuges along the edge of the Bay because that is highly valued. Communities need to be given a way to embrace or engage how valued shoreline uses can be maintained as sea level rises, because they will have to invest to maintain these uses.

**6. Updates (continued)**

**a. North-central California Coast and Ocean Climate-Smart Adaptation Project.**

Sara Hutto, Ocean Climate Specialist for the Gulf of the Farallones National Marine Sanctuary, gave a presentation on the Climate Smart Adaptation Project for the North-central California Coast and Ocean.

The project goal is to protect and maintain healthy ecosystems by enhancing the resilience of species, habitats, and ecosystem services to the impacts of climate change through collaboratively developed adaptation actions that are feasible, effective, and nature-based. The geographic scope is from Año Nuevo (San Mateo County) to Alder Creek (Mendocino County just north of Point Arena). The project has engaged over 30 different organizations and agencies.

There are two questions this project hopes to answer: (1) How vulnerable to climate change are the species, habitats, and ecosystem services that we care about (vulnerability assessment), and (2) What can be done to limit or reduce vulnerability (adaptation planning).

Phase 1 of the project involved two workshops to begin developing answers to these questions: workshop 1 was held February 11, 2014, to define focal resources, and workshop 2 was held June 10-11, 2014, to assess vulnerability of these resources. Participants provided information on 44 focal resources and then developed a vulnerability assessment score for each based on exposure and sensitivity to climate change and non-climate stressors and adaptive capacity.

NOAA will release the Vulnerability Assessment report in May. Sara showed examples of vulnerability assessment results for habitats, species, and ecosystem services resources, (*e.g.*, offshore rocky reefs, kelp forest, pelagic water column, water purification, flood and erosion protection, and carbon storage sequestration). The report will be used to develop management strategies to reduce vulnerability. Multiple plausible futures based on the most uncertain and impactful drivers of change will serve as the framework for adaptive management strategies. The working group, which met in late April, created 12 scenarios; a subset will be used to provide the most creative and divergent strategies. Focus is on three vulnerable habitats: beach/dune, estuaries, and rocky/intertidal. The working group will meet throughout the year to develop and prioritize strategies; recommendations will be presented to the Sanctuary Advisory Council at their November 2015 meeting.

7. **Review of action items, other business.** No items.

Jenn Fox noted that the 2015 Open Space Conference will be held on Thursday, May 14. Registration is here. Program is here.

8. **Adjourn.** The meeting was adjourned at 2 p.m.