

San Francisco Estuary Partnership

**Prepping for a Hotter
San Joaquin Valley**

**Derelict San Francisco
Shipyard Goes Soft**

**Committee Approves
32-Action Plan for Estuary**

Nervy Merger

**EBMUD Experiments
with Pipe Replacement**

Mixed News from Eggs

**Local Ocean Response
to Climate Change**

**John Hart Reviews
the Estuary's Divided Heart**

SCIENCE • RESTORATION • WATERSHED • POLITICS • SPECIES • BAY

ESTUARY



NEWS

**JUNE 2016
VOL. 25, NO. 2**

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RIVERS

Getting Ahead of Change in the Valley

On a hot day in a dry year in the San Joaquin Valley, water is already so scarce that there isn't enough to meet all needs. And it will only get worse as climate change makes summers there even hotter and drier. This vast arid valley, stretching from Stockton to Bakersfield and bounded by mountains to the east, west and south, is drained by the San Joaquin River, which flows hundreds of miles from high in the Sierra Nevada to the lowlands of the Delta. Along the way, people dam and divert water for communities and agriculture, sometimes taking so much that hardly any is left for salmon and other wildlife.

"One of the biggest threats of climate change is that we will have even less water," says Michelle Selmon, a state Department of Water Resources climate change specialist based in Fresno. "San Joaquin ecosystems are already stressed. There are only pockets of native habitat left."

After the Friant Dam went in on the San Joaquin River near Fresno during the 1940s, nearly 60 miles downstream ran dry, cutting off the hundreds of

thousands of Chinook salmon that then spawned upstream. Now, more than half a century later, the San Joaquin River Restoration Project is finally rebuilding the historic salmon runs and giving them back a bit of water.

This restoration will also benefit wildlife and people in the valley the river traverses, as well as in the Sacramento-San Joaquin Delta it flows into. And it's just one of the things that can be done today to prepare for tomorrow's climate change. "It's all connected, it's quite a complicated puzzle," says Tom Harmon, a climate researcher at UC Merced.

Even so, this puzzle can be solved. "We need to integrate planning for climate change with planning for water and other resources, and we all need to work together," Selmon says. "Most people have no idea how challenging this is."

Warming will bring more intense rainstorms and more severe floods to California. But just as the San Joaquin Valley can feel like a different world from the Bay Area, other effects of

climate change will be intrinsically different in the two regions. Here on the edges of the Bay, a big worry is that rising seas will swamp the marshes that protect against floods, and push salt water so far into the Delta that water near the pumps will be undrinkable.

For Valley ecosystems, the worst nightmare is rising temperatures. Warming does a double whammy on the Sierra Nevada snowpack that supplies water through the long dry season: the mountains get more rain and less snow, shrinking the snowpack; and the snow that does fall melts earlier, diminishing the water supply in the summer when the need is greatest.

Selmon points out that this is already happening: "California has warmed almost 1.5 °F over the last century and the snowpack has declined 10% — we've already lost 1.5 million acre-feet of water." That's enough for 3 million households for a year.

And temperatures continue to go up. The US Bureau of Reclamation projects that by the end of this century, the Central Valley will be nearly 5 °F hotter. That may not seem like a big deal but it's enough to tip the balance from snow to rain at Sierra Nevada elevations where the snowpack begins. "The snow-rain transition zone is gradually hiking its way upslope," UC Merced's Harmon explains. "California depends on snowpack and it's not a very cold snowpack — that's why the state is so sensitive to climate change."

Today, runoff from the snowpack can last until July. But with the smaller snowpack and earlier snowmelt caused by warming, this welcome replenishment of icy streamflow during the Valley's scorching summer may dwindle to just a trickle.

There's already so much extra carbon dioxide in the air that it's too late to halt climate change. "There are unavoidable impacts already in the pipeline so we need to adapt," Selmon says. There's not much that can be done about the temperature rise, at least in California alone; warming is worldwide so curbing it is an international undertaking.

But plenty can be done about the consequences of warming.

High in the Sierras, researchers are testing a snowpack-boosting method that dates back to the people who

lived there first. "Native Americans were constantly burning and thinning forests," Selmon says. "But, thinking it was a better way to manage them, we did nothing except put fires out." According to a recent study led by Christopher Dolanc of UC Davis, fire suppression has crammed the Sierra Nevada with small trees, more than doubling their density in some places. Dense forests catch snow in their branches, where it skips melting into liquid water. Instead, it evaporates into water vapor and floats away.

Thinning a crowded forest lets more snow fall to the ground, building up the snowpack and swelling runoff into the headwaters of San Joaquin River. A team led by Roger Bales of UC Merced estimates that thinning overgrown forests could yield up to 16% more water and extend snowmelt by precious weeks, calling thinning "one of the few ways that California can address the negative impacts of climate change on water yield and storage in the Sierra Nevada."

Another way is restoring meadows, which can keep snowmelt from rushing down to the Valley too early. Meadows are like sponges, soaking up water fast and releasing it slowly, even into September. But the Sierra Nevada's nearly 200,000 acres of meadows are "one of the most altered, impacted and at-risk landscapes in the range," say Joshua Viers and colleagues of UC Davis. Half the meadows there have been so degraded by livestock grazing, diversions and ditching that the streams running through them are deeper than the floodplains — so they fail to capture much water. Reconnecting the stream and floodplain can reverse that, restoring a meadow's capacity to hold water and release it down to the San Joaquin River through the summer.

After the Sacramento River, the San Joaquin River is California's second longest at 350 miles and its restoration spans the 150 miles between Friant Dam and the confluence with the Merced River. While driven by at-risk salmon, the restoration will also help counteract the effects of climate change—especially flooding.

This part of the river is largely defenseless against large flood events. "Protection wasn't set up because the river is so dry much of the time," says Monty Schmitt, senior scientist and project manager with the Natural



Biologists capture first fall run adult Chinook salmon in November 2012 at the confluence of the San Joaquin and Merced Rivers. They transported the fish around barriers and then released them again in the upper San Joaquin River. Fish passage barriers will be fixed as part of upcoming restoration efforts. Photo: Monty Schmitt

Resources Defense Council. By shifting storms in the Sierra Nevada from snow towards rain, warming will bring bigger floods in the future from storms of a given size. "For a 200-year event, climate change will increase peak runoff into the San Joaquin River by 20%," he says.

Levees along two long stretches that are bottlenecked—increasing the flood risk—will be set back. Besides giving flood water a safe place to go, setting back the levees will make room for thousands of acres of the floodplains that nurture young salmon migrating to the sea.

The river's restoration will also help ease the impact of future droughts—which climate change will likely exacerbate—by recharging some much-needed groundwater. As part of the restoration effort, the river gets back an average of 17% of its historical flows before the Friant Dam went in, or about 300,000 acre feet. So far, about 40% of the water that has been restored to the river has gone

into the ground, where it is banked for dry times to come in the San Joaquin Valley. "Even 10,000 acre feet at the right time can make a world of difference," Schmitt says.

Restoring the San Joaquin River will benefit the Bay Area as well. "Now, virtually no water from this part of the river gets to the Delta," Schmitt says. Returning some of the river's water means more will ultimately make its way downstream to the Delta, where lack of freshwater imperils smelt and other at-risk fish. As Schmitt points out, every drop is welcome. **RM**

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Lower San Joaquin River near its confluence with the Merced River. Photo: Monty Schmitt

ADAPTATION

A Softer Shoreline for San Francisco?

A derelict shipyard, an underused park, and a remnant wetland are the raw ingredients in a new conceptual design for a climate-adaptive park on San Francisco's southeast shoreline. The design — by Gustafson Guthrie Nichol (GGN) — won a design ideas contest sponsored by the SF Recreation & Parks Department, SF Parks Alliance, Trust for Public Land, and Build Inc.: the charge was to “re-imagine” India Basin as part of a 1.5-mile network of shoreline parks known as the Blue Greenway — green for the parks and blue for the water trail that follows alongside. GGN's proposal would transform the site with a “big soft edge,” restoring tidal wetlands and uplands and possibly including a horizontal levee, all designed to create new habitat and add resilience. The plan also gives the adjacent community good access to the Bay for the first time.

“The big soft edge idea is coupled with the idea of bringing people down to experience the water. It's an unusual place along the edge of the Bay in that you have this very shallow, gradual gradient bathymetry in a protected basin,” says Shannon Nichol with GGN. “We softened the edge, removing riprap and fill and restoring wetlands



Section of Blue Greenway plan around India Basin. Map: SF Parks Alliance

and uplands while balancing cut and fill so significant amounts of soil wouldn't have to be hauled in or out.”

While the project is still in a very early stage, creating a horizontal levee is very much a possibility, says Nichol. “To do a horizontal levee here doesn't require as much manipulation of the Bay floor as areas that have been dredged deeply.” A 50-foot stretch of original wetlands remains on the site.

“This is a really special opportunity because things have been preserved here frozen in time,” says Nichol. The boat yard was in use until the late 1990s; rails that were used to slide boats down into the Bay can still be seen in the ground. While boats will no longer be launched on the decaying rails, a new kayak launch will give people access to the water trail, and part of the boatyard may be used for a community program teaching how to build small boats and repair bicycles.

Noreen Weeden of Golden Gate Audubon says India Basin offers one of the few remaining opportunities to do full ecological restoration on San Francisco's shoreline. “It has the potential to have even more birds than Heron's Head and greater diversity of wildlife because it includes open water, wetlands, and uplands.” She hopes the kayak launch will be built in a way that minimizes impacts to wildlife. “When all of the different

proposals came out for this site, one of the things that really stood out was the community's love for the shoreline, the birds and wildlife there, and protecting that.”

Jackie Omotalade, with the SF Parks Alliance, concurs. She says the project also has an environmental justice aspect since residents have had to live next to polluting industries for many years, something that is now changing as many of the old manufacturing sites along the shoreline are transformed into housing and parks. “[This project] will finally give

people the opportunity to connect to the waterfront—that's important in any neighborhood but particularly in neighborhoods with such a strong legacy of contamination.” She says residents are also very interested in how climate change will affect their community. “They understand the importance of passive open space — the wetlands — as an adaptation measure for climate change.”

Could the softer shoreline approach be used elsewhere along this urbanized shoreline? The Port of San Francisco's David Beaupre says it might be possible at Warm Water Cove and Crane Cove Park. At Heron's Head Park, he says, a living shoreline/horizontal levee approach could be used to deal with an erosion problem. “The challenge for us is that, if you look at sea level rise, in 20 to 30 years, a significant amount of Heron's Head could be under water. What's the cost/benefit?”

Despite those concerns, says Beaupre, the city, led by the Planning Department, plans to hold a Bay Area Resiliency By Design challenge for sections of the Bay shoreline next year. **LOV**

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PARTNERSHIP

Committee Approves 32-Action Plan

After two and a half years work by 70 organizations, the Estuary has a new *Comprehensive Conservation and Management Plan*. “It builds on our past work but is a new plan with a strong focus,” says Caitlin Sweeney, director of the San Francisco Estuary Partnership, which is championing the new plan.

The 2016 CCMP, due for public release in early fall, is much more succinct than the 1992 and 2007 versions produced by the Partnership. The 2016 plan has four broad goals, 12 objectives, and 32 actions. Each CCMP action includes tasks, measurable milestones, and a list of “owners” and collaborating partners. “It clearly documents what we and our partners will do to implement tasks, and who will help them,” says Sweeney.

The Partnership's CCMP Implementation Committee (IC) greenlighted the plan at a meeting on May 18. The committee currently includes more than 30 members from diverse public agencies and NGOs, as well as from educational, community and scientific organizations. “I really like how approachable and digestible this document is,” says US EPA's Luisa Valiela, an IC member who also represents the federal agency that launched the National Estuary Program, and its requirement for the development of comprehensive management plans for estuaries,

in the first place. The Partnership's 1992 plan had 144 actions. “As part of the overhaul, we really asked ourselves, given the reality of peoples' attention spans and workloads, is there a different way we can still be comprehensive and address the entire Estuary system?” says Valiela.

The plan sets four broad goals for 2050 aimed at sustaining habitats and species, bolstering resilience in the face of climate change, improving water quality and quantity, and building strong public support for Estuary protection and restoration. Actions to be accomplished within the next five years, meanwhile, touch on everything from creating a regional stream monitoring program and sequestering carbon in wetlands to managing predators, increasing the use of recycled water, improving through-system fresh water flows, and integrating nature-based infrastructure into shoreline planning, to name only a few actions.

Framers of the new CCMP also worked hard to make sure it was well coordinated with other important regional plans and efforts, and filled necessary gaps (see also page 7). “We are hopeful that the CCMP will provide a way for policy makers, managers and scientists working in the Bay and Delta to see connections among their efforts and find more ways to work together and learn from each other in the future,” says

IC member Jessica Davenport of the Delta Stewardship Council.

“The great thing about the CCMP is that it takes a broad view of Estuary, and includes our local watersheds, the Delta, wetlands, green infrastructure, legacy pollutants, water supply, and many other issues,” says the Coastal Conservancy's Amy Hutzler, who has also chaired the IC for several years.

Over the years, the atmosphere surrounding Bay and Delta planning, once very contentious, has changed according to early participants. “The success of the CCMP is that we've steered ourselves away from adversarial science to joint fact-finding, and we now have mechanisms in place to be agile in acting as needed, when needed,” says IC member Tom Mumley of the SF Bay Regional Water Quality Control Board.

Mumley is particularly proud that so much has been accomplished in pollution prevention and reduction: “We no longer have any large pollutant red flags, and the heart and soul of future action has to be turning grey hardscape into sustainable greenscape. We've had pockets and pilots of green infrastructure before, but the CCMP calls for turning up the volume on this several notches.”

One of the newest members of the IC comes from a single-issue focused agency but says but he's also learned a lot about other issues sitting in IC meetings. “Working on this made me realize what a wide variety of issues face the Bay today, and how we can't achieve our overall CCMP goals unless we break down our programmatic silos,” says Matt Fabry, who works for the San Mateo Countywide Water Pollution Prevention Program. “The CCMP helps us tie what some people are trying to do in the watersheds with what others are doing at the edge of the Bay,” he says.

In the meantime, national support for the new plan and its legacy was reaffirmed this May when President Barack Obama signed into law the first reauthorization of the National

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Photo: GGN

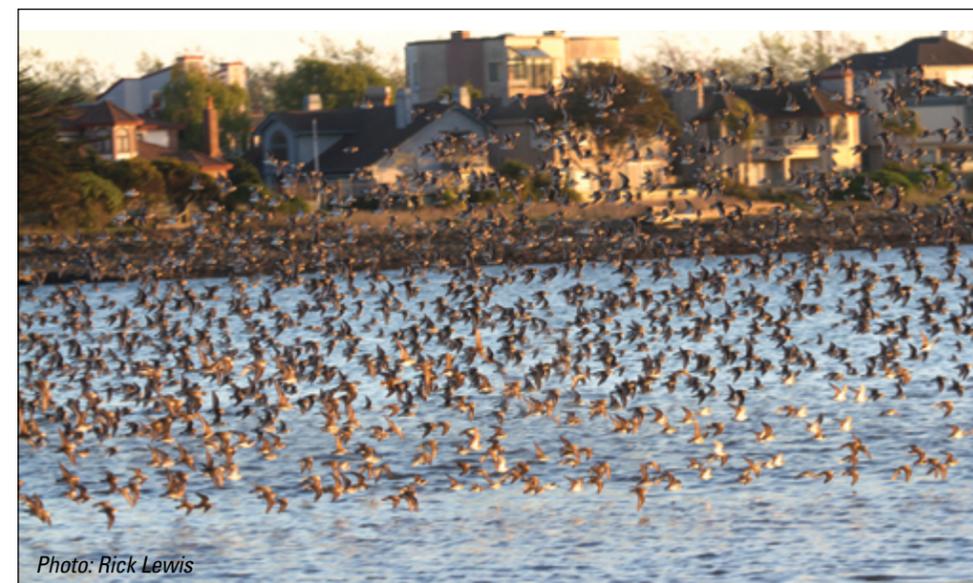


Photo: Rick Lewis

Prioritizing Biological Integrity

With never enough money but plenty of uncertainty about climate change, how can planners and resource managers best prepare the Estuary to adapt? Perhaps with the help of CADS, aka Climate Adaptation Decision Support for San Francisco Bay.

CADS is an analysis and modeling effort led by the San Francisco Bay Joint Venture to try to prioritize how resources (funding, staff, and equipment) might be allocated under two very different climate change scenarios. CADS built on a 2011 workshop sponsored by the California Landscape Conservation Cooperative in which stakeholders recommended that climate change adaptation strategies be better incorporated into tidal wetland restoration efforts. CADS also addresses climate-adaptation recommendations from the 2015 *Bayland Ecosystem Habitat Goals Update*.

During 2014 and 2015, the Joint Venture held workshops and webinars with about 50 scientists and managers in the North Bay, Suisun, Central Bay, and South Bay. To develop conservation goals and recommendations for each region in the face of climate change, they divided the Estuary into six types of ecosystems: sub-tidal and intertidal mudflats; tidal marsh; managed/diked marsh and ponds; upland transition zone; and upland ecosystems, including migration space and watersheds.

Participants agreed that the overarching objective for all ecosystems should be that the biological integrity of the ecosystem as a whole be stable or increase in both the near and long term. Indicators of integrity were chosen: birds were the most popular, followed by plants, fish, and indicators that integrate disparate attributes of the ecosystem. Each group then predicted how factors like sediment, storms, and sea level rise might affect biological integrity, and decided on six different categories of actions that could be taken to improve integrity.

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REGION

Hope and Anxiety in Merger's Wake

Will the upcoming transfer of the Association of Bay Area Government's staff to the Metropolitan Transportation Commission be the first step toward a single body that can boost the integration of estuary-related issues into regional planning? Or will these priorities be sidelined? These are among the many questions raised by the move, which will reshape Bay Area planning in the years ahead.

Many of the objectives identified in the SF Estuary Partnership's new *Comprehensive Conservation and Management Plan for the Bay and Delta* call for regional integration, and MTC's assimilation of ABAG staff could, in theory at least, facilitate them. "This is an opportunity to integrate land use, water resources and transportation planning into one place," says the Coastal Conservancy's Amy Hutzel, adding that water quality, urban greening, wetlands restoration and coastal protection objectives in particular stand to benefit from such integration.

The staff transfer, which will occur in early 2017, is the result of months of negotiations between ABAG and MTC that were prompted by MTC's 2015 decision to withdraw \$4 million in annual funding it has

historically provided to ABAG for land use planning support. MTC intended to take on those planning functions to itself, arguing that the agencies' joint work developing *Plan Bay Area* was hampered by "dysfunction." However, following protests from local governments, labor unions, non-profit organizations and others, MTC postponed the action and, together with ABAG, retained consultant Management Partners to study the policy, financial, management and legal issues associated with the integration of ABAG and MTC.

The consultant analyzed seven options, including ABAG's preferred option, a full merger of the two agencies. However, MTC declined to support that option, and the agencies compromised on Option 7, which calls for them to enter into a contract to consolidate staff functions under MTC's executive director and simultaneously enter into an MOU to explore the creation of a new regional governance body at a future — unspecified — date.

Among the first steps in the transition will be the development of a plan to integrate ABAG's work into MTC's organization. "As we put together the work plan it will be important that all of ABAG's programs, including the SFEP, the Bay Trail and the Water Trail, continue to be supported," says ABAG President Julie Pierce, "I have every intention that they will be."

The devil is in the details however, and some observers worry that the institutional support for SFEP and the CCMP may falter under the new arrangement. "I'm a little concerned because I don't think that the future of the SFEP and the CCMP are front and center for the staff and elected officials negotiating the merger," says Hutzel. "We need to make sure that the SFEP and the CCMP aren't afterthoughts, that they aren't pushed to the side during the discussions." **CHT**



Photo: Rick Lewis



ESTUARY asked well-known writer John Hart to investigate and comment on how well the region has succeeded in managing the Bay and Delta as one Estuary since the 1970s, and where the new CCMP, to be released in fall 2016, fits in (see also p. 5).

Two Hearts Beating Not Quite as One

Downstream: Road to the First CCMP

We're waiting now for the short plan with the long name: *The Comprehensive Conservation and Management Plan for the San Francisco Estuary*. That word "comprehensive" stakes quite a claim.

If the CCMP, the work of the San Francisco Estuary Partnership, is the closest thing we have to a master vision for the future of these waters in the era of climate change, it is also just one in swarm of plans and planning efforts purporting to shape that future. How do they all get along?

How does the CCMP fit with the *Bay Plan* and the *Bay-Delta Water Quality Control Plan* and the *Delta Plan*, not to mention the *Delta Land Use and Resource Management Plan*? Is it on the same page with *Plan Bay Area* and the *San Francisco Bay Basin Plan*? How do the *Bay Area Integrated Regional Water Management Plan* and the *California Water Action Plan* fit in? What about California WaterFix and California EcoRestore? For the non-initiate, the contours of the cause can disappear in a cloud of organizations and acronyms and abstractly titled calls to action.

In the following I'll attempt a sort of genealogy of players and plans, and try to answer my own questions: Are these people talking to one another? Do their ideas add up to one way forward, or tug in opposing directions? Is there authority and money to match all the good intentions? Do the pieces fit?

It didn't take me long to confirm one basic split. The effort to grapple with the future of the San Francisco Estuary has always really been two efforts: one centered on the lower Estuary and, by necessity, reaching upstream; one centered on the upper and, by necessity, reaching down. The two tracks influence each other, intertwine, come to share a vocabulary, but never really merge. They diverge, too, in that the "upstream" issues involve powerful interests the whole length of California, as the "downstream" issues do not.

"When we try to pick out anything by itself," John Muir famously said, "we find it hitched to everything else in the universe." The issue that led to a "comprehensive" planning effort for the lower Estuary was not, as you might imagine, bay fill, dealt with very effectively by the San Francisco Bay Conservation and Development Commission from 1969 on. It was water pollution.

In 1972, the Clean Water Act made the preexisting San Francisco Bay Regional Water Quality Control Board a franchise of the national pollution control effort—and poured in \$1.2 billion in federal funds over the next fifteen years to upgrade sewage treatment plants and police industrial discharges.

Together with the advent of the San Francisco Bay Conservation and Development Commission, this investment changed the Bay. The sewage and industrial outflows that had been killing fish and fouling shorelines dwindled. As the cleanup of gross pollution visibly progressed,

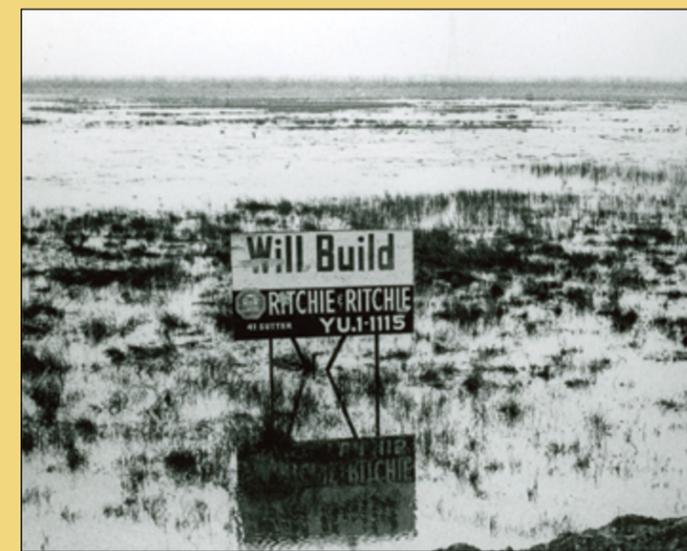
the conversation turned to subtler toxics like heavy metals, and to "non-point source" pollution dribbling out of whole watersheds, including oil and other fluids shed onto roads, pesticides and nutrients applied in gardens and on farms, and the ubiquitous plastic bag.

During this same period, scientists at the U. S. Geological Survey were doing their first real studies of the Bay-Delta system. They were coming to grasp the unity of these waters and sharing what was then startling news: that the health of the Bay depended on flows out of the Delta. "It's amazing how little we knew about the Bay in the late '60s," says biologist James Cloern, still a leader on the scientific scene. He and his colleagues proposed an unfamiliar name for the waters from the Golden Gate to Stockton: the San Francisco Estuary. The word spread.

In 1981, a new group, The Bay Institute, joined the ranks of advocates alongside the older Save San Francisco Bay Association. While Save the Bay stayed on guard against Bay encroachments, TBI looked eastwards toward the Delta and

whole Central Valley watershed. "Save a River for the Bay," it proclaimed.

Two strands — the estuary concept and the need to control a wider range of pollutants — came together in the 1987 amendments to the Clean Water Act. Besides adding a section on non-point source pollution, Congress created a National Estuary Program singling out certain areas for special attention. San Francisco Bay, in its extended sense, was one of these.



Real estate in the Bay, circa 1960s. Photo: BCDC

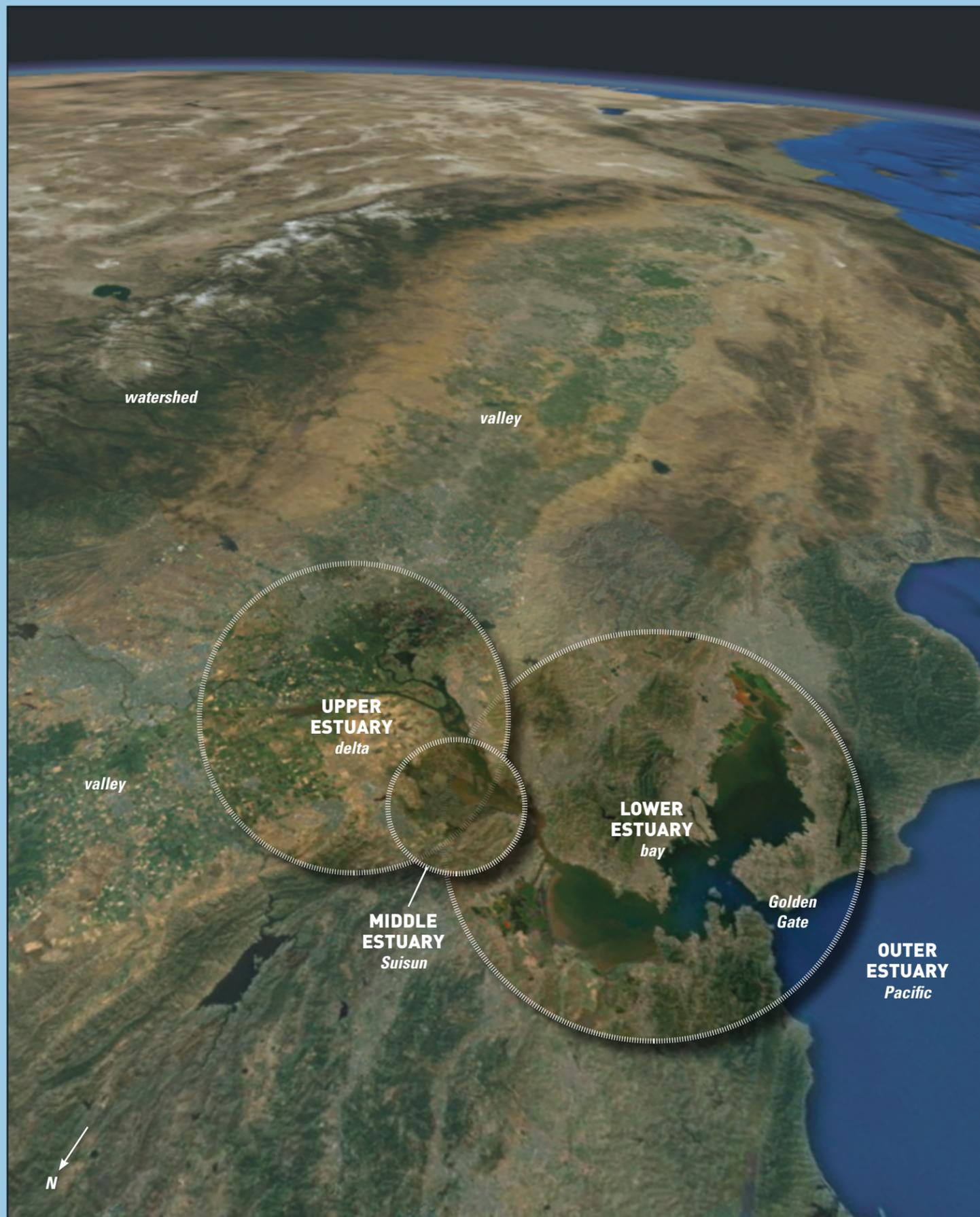


Photo: Amber Manfree

The 1987 law is the source of that mouthful, “*Comprehensive Conservation and Management Plan*.” Each region’s CCMP was to “restore and maintain the chemical, physical, and biological integrity of [its] estuary, including restoration and maintenance of water quality, a balanced indigenous population of shellfish, fish and wildlife, and recreational activities.” In short, it could cover just about everything — by no means limited, for the Bay, to waters west of the Carquinez Strait.

The preparation of this plan was the charge of a “management conference,” which promptly named itself the San Francisco Estuary Project (later Partnership). Federal funding was routed through EPA and the Association of Bay Area Governments. Offices were first at EPA, then at ABAG, and finally at the Regional Water Quality Control Board.

Upstream

In the Delta, meanwhile, biologists were belatedly examining the effects of a huge decision made a decade earlier: the launch of the State Water Project. In the late 1960s, the SWP joined the federal Central Valley Project in shipping water southwards from the Delta. Might the combined withdrawals of fresh water harm fish? Might they suck salt water in from the west? In 1970, four water and wildlife agencies formed an Interagency Ecological Program to weigh these effects. Its field of vision was at first limited to two resources: striped bass, a favorite game fish; and the brackish duck marshes north of Suisun Bay, perhaps to be threatened by saltwater intrusion. In an ever-shifting landscape of agencies and studies, the IEP has been a hardy perennial, though of course its focus has broadened.

The State Water Resources Control Board, which unites pollution control responsibilities with oversight of the state’s crazy-quilt water rights system, was also trying to catch up to events. In 1978, the board issued the first of a series of momentous and hard-fought decisions governing the operation of the two water projects. Decision 1485 required that the operators maintain certain salinity levels at various points along the Bay-Delta gradient, releasing water from upstream reservoirs, or curtailing

exports from the project pumps near Byron, to do so. Everyone, more or less, sued, and it took a few years even to establish the principle that the federal Central Valley Project was in fact subject to state rules.

The First Estuary Mind Meld

How did these efforts interface with the emerging Estuary Project? Not very much or very well. The state was slow to adopt the new language of estuarine connectedness, and its agencies participated in the Estuary Project only on condition that their authority over the rivers not be called into question—as, under the Clean Water Act, it might have been.

The first *Comprehensive Conservation and Management Plan* nevertheless proceeded. When the CCMP appeared in 1993, it held an aspirational list of 144 action items, mostly clustered around the lower bays but also reaching far up the inland rivers. A lasting contribution was to

introduce to the world the indicator called X2: the point, measured in kilometers inland from the Golden Gate, at which salinity at depth has dropped to two parts per thousand. For various reasons, it was already clear, the estuary is healthier when X2 lies well west, that is, when fresh water flows through and out of the Delta are strong. Though the plan only called for further study, the mere mention of the topic drew indignant dissents from water agencies and a demurrer from Governor Pete Wilson. The Governor nonetheless signed off on the CCMP, and within a few years X2 was recognized as the best single measure of adequate seaward flows.

Next Steps on Pollution

If the Estuary Project had little support in Sacramento, it was downright chummy with the San Francisco Bay Regional Water Quality Control Board (which has hosted its offices since 1993). Having almost won the war against gross pollution and twice revised its *Water Quality Control Plan, San Francisco Bay Basin*, the board was ready to make its move on heavy metals and synthetic chemicals: the invisible toxins that, piling up in the food chain, keep us from eating too much bay-caught fish. But action was frustrated, as the CCMP noted, by skimpy information about the sources and travels of these pollutants.



Fish kills were fairly common around the Bay before pollution controls gathered steam. Photo: BCDC

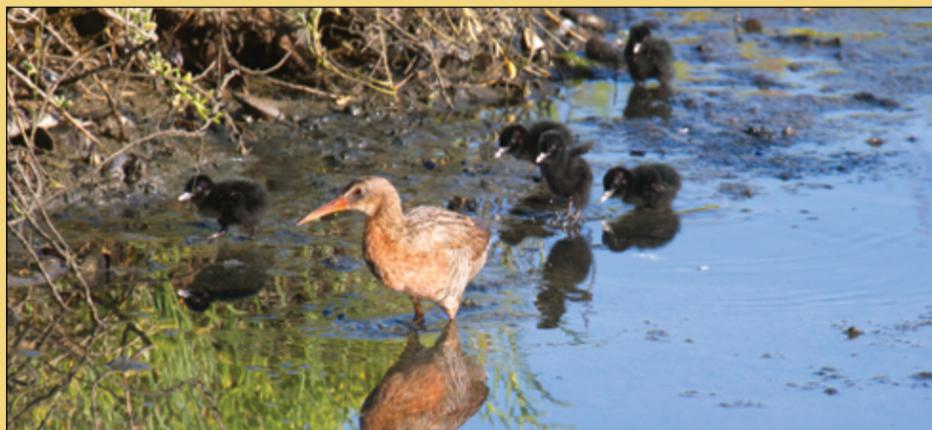
In 1992, the board set out to fill the gap with a Regional Monitoring Program, collecting more data, on more substances, at more points, than had hitherto been possible. Dischargers would pay the bills; the sampling would be done by a new entity, the San Francisco Estuary Institute. In the decades since, the RMP has provided the basis for regulations on well-known toxic substances, like mercury, selenium, and PCBs, and on new or newly understood ones, like the chemicals in flame retardants and stain repellents. SFEI, meanwhile, has outgrown its initial task to become one of the major sources of information about the state and evolution of the Estuary.

The Suisun Bay Overlap

Suisun Bay and the extensive brackish-water marshes north of it have been a border region, sometimes aligned with the lower Estuary, sometimes with the upper. The area is in the jurisdiction both of BCDC and of the Delta Stewardship Council; it is covered by both Baylands Ecosystem Habitat Goals and EcoRestore; it is split on complicated lines between the Bay Area Joint Venture and its inland counterpart the Central Valley Joint Venture. "We share Suisun, that's a good thing," says Josh Collins of SFEI.

Keeping salt water out of these marshes, mostly diked and managed for ducks by hunting clubs, was an early focus of the Interagency Ecological Program. Urban encroachment was the other recognized threat. In 1977, the Suisun Marsh Preservation Act added the area to jurisdiction of BCDC. The commission would guard the area's existing land uses; the landowner-based Suisun Resource Conservation District, assisted by DWR and the U. S. Bureau of Reclamation, would see to water management. This arrangement codified the duck-centered status quo, despite murmurs from biologists who wanted to see more areas restored to tidal action — and in the face of the mounting physical pressures of soil subsidence (due to oxidation during the months when managed marshes are dry) and heretofore gradual sea level rise.

Since then a slow rethinking has occurred, given a sharp nudge by the federal agency Biological Opinions of 2008-2009. In 2014, the stakeholders, led by the federal agencies, adopted a *Suisun Marsh Habitat, Restoration and Management Plan* raising the targets for tidal restoration to some 6,000-7,000 acres in Suisun alone. Threats to the peace and quiet of the marsh remain (see Buckler, p.18).



Endangered Ridgway's rail, with chicks, in tidal marsh habitat. Photo: Rick Lewis

Marshland Mission

The CCMP's most striking and implementable proposal was the wholesale restoration of the Bay's historic ring of marshes. Many of these had not been actually filled but only diked off, for salt ponds, agriculture, or hunting clubs, and were recoverable. For the next fifteen years, much of the Project's energy would flow down this channel.

In aid of the great project, the San Francisco Estuary Institute set out to build a detailed picture of what the bay's margins had once been like. This "historical ecology" work was reflected in the blueprint titled *Baylands Ecosystem Habitat Goals* (1999). This called for some 100 square miles of former marshes, about one third of the total that once existed west of the Delta, to be reconnected to the tides. Another 45 to 60 square miles were to be restored as non-tidal wetlands.

The claim was staked. At the center of the effort to carry it out is another made-to-order umbrella body, the San Francisco Bay Joint Venture. Organized in 1995 under the authority of the U. S. Fish and Wildlife Service, this partnership links nearly all the public agencies and private organizations with an interest in restoration projects around the Bay. Since it published its Implementation Plan in 2001, the SFBJV has received steady, if modest, federal funding. Unlike other joint ventures, which focus solely on migratory waterfowl or at most on birds in general, this one explicitly covers all animal life.

As marsh restoration projects stepped up from tens of acres to hundreds to thousands, a problem became apparent. Many of the

diked-off lands had lost several feet of soil due to the decomposition of bay-bottom mucks exposed to the air. Reintroducing water to overly subsided fields would yield deep ponds, not shallow, shifting waters where cordgrass and pickleweed could thrive.

Here another late-century problem-solving effort intersected neatly with marsh restoration. The Army Corps of Engineers, responsible for maintaining shipping channels, had been accustomed to dumping most of the dredged sediment inside the Bay, at sites where tidal currents were supposed to take it out to sea. They didn't. In 1982 it was discovered that a great underwater mound had accumulated at the favorite dumpsite near Alcatraz. The Corps joined with BCDC and the state and regional water boards to look for a better way. In 1999, they agreed that, after a transition period, no more than 20% of the sediment would be dumped inside the Bay; at least 40% would be used in marsh restoration and other habitat projects; and the remainder would be barged out to sea. Looking back in 2013 at this Long-Term Management Strategy, the agencies could report that in-bay discharge had declined on schedule, and that 44% of sediments had gone to "beneficial use."

The Sea Level Challenge

A remarkable record. But, as so often happens with environmental matters, the problems were evolving as fast as the solutions, if not faster.

In 2005, BCDC Executive Director Will Travis read a *New Yorker* article about the prospect of dramatic sea level rise. The topic was not new

to the agency — the *Bay Plan* had mentioned it since 1989 — but he asked his staff for a fresh examination. It soon became apparent that even a moderate rise would be very bad magic for the shoreline zone and its people and wildlife alike. The Commission published maps showing areas at risk, and was accused of scheming to expand its jurisdiction. Plan amendments in 2011 dropped the maps but kept the relevant language. At about the same time, the agency launched its program "Adapting to Rising Tides," a kind of floating planning conference, introducing local governments and other "stakeholders" to possible responses.

Among these responses was the buffering of naked urban shorelines and levees with entirely new marshes. Unlike prior wetland projects, these would require building a substrate for wetland plants by placing fill in open water. The thought of deliberately dumping material in the Bay, after decades of struggle to keep it out, has required an adjustment on the regulators' part. What once might have been decried as "bay fill" is now welcomed as "shallowing." And in-bay disposal of muck is looking like a not-so-bad idea, if just the right locations can be found.

The restorers of historic marshes also find themselves in a race against sea level rise. Marshes established in the next few years will, with luck, have time to adapt, thickening themselves in response to rising tides and also shifting inland where undeveloped land adjoins. But wetlands begun after about 2030, scientists fear, may not be able to keep pace with sea level, and will be overwhelmed.



The Water Board's Tom Mumley chairs a meeting with SFEI staff Marcia Brockbank and Joan Patton, as well as EPA's Luisa Valiela and others on the 2007 revision of the CCMP.

A compounding problem is the overall lack of sediment from the much-dammed feeder rivers. Bay waters are growing clearer, which is now understood to be a bad thing. The shortage means that every goopy bucketful dredged from a shipping lane or flood-prone creek is precious. Yet finding good homes for displaced sediments is not so easy. The first round of big restorations is about over; only the Montezuma Wetland Restoration project in Solano County is still taking mud. And ocean dumping, the Army Corps complains, is almost mandated by federal rules requiring disposal in "the least cost and environmentally acceptable manner." "That standard," says Amy Hutzel of the Coastal Conservancy, "is the nut we have to crack." Hope is waning that Congress will change it in this session.

The New CCMP

The CCMP underwent a tuneup in 2007, but, with the clear onset of climate change, a major revamp was in order. In the last several years, several building blocks have been put in place. The *Subtidal Habitat Goals Report* of 2010 looked at the scientifically neglected world of underwater habitats, especially eelgrass beds and native oyster reefs. In 2015, along with a Habitat Goals revision entitled *The Baylands and Climate Change: What We Can Do*, the Partnership produced the latest of three *State of the Estuary Reports*, reflecting decades of work on how to take the system's ecological temperature. Now comes the *Comprehensive Conservation and Management Plan 2016*.

The CCMP is not well represented by its legally mandated title. It is

not actually a plan, if that word implies any element of coercion. It is rather an ambitious work program, a to-do list for 28 partners labeled as task "owners" and dozens of other "collaborators." As for comprehensiveness, this version actually narrows the focus geographically, as compared to the 1992 plan, and it focuses on a shortened list of perhaps more achievable ambitions. Compared to prior versions, "there are fewer ornaments on the tree," says Sam Ziegler of EPA Region 9.

On some pages the draft CCMP reads like a prologue to something more committing. Many of the 32 specified "Actions" consist largely of setups for concrete steps to come. There are calls for further studies, conferences, the formulation of best practices. There are research projects to be completed, reports to be disseminated, tools to be refined, grants to be targeted.

Yet the plan has a hidden power in the form of its authorship. Thirty-odd members of the Management Committee, including agencies with very real authorities, have signed off on this program. As the record of the last decades shows, this kind of consortium can function surprisingly well. ABAG, the Water Quality Control Board, the Bay Commission, the Army Corps of Engineers, the state and federal Environmental Protection Agencies, the Coastal Conservancy — these have worked matters out, in thousands of hours of meetings, with little publicly visible jostling. "It's easy to take the helm," says Caitlin Sweeney, the new director of the Estuary Partnership, "when there is so much trust built up over the years."

In one respect this CCMP opens new territory. Several of its proposals apply to near-shore urban zones outside the jurisdiction of BCDC. It also focuses attention on the creeks and small rivers that drain to the lower Estuary. The very first action is to develop a "watershed approach" to Bay issues. True, this is cast in terms of process, framework, criteria, pilot projects. But in even broaching this subject, the plan confronts an interest as potent as the California water establishment: the territoriality of the region's one hundred and ten local governments. As Marc Holmes of The Bay Institute puts it, "This is the last taboo."

Non-threatening though it strives to be, at a couple of points the CCMP does hint at something more than sunny cooperation. It does so by invoking *Plan Bay Area*.

In climate change legislation passed in 2008, the Association of Bay Area Governments and the Metropolitan Transportation Commission were instructed to write a regional plan aimed at cutting carbon emissions from vehicles by concentrating development and beefing up transit. First published in 2013, *Plan Bay Area* specifies zones that are favored for growth and others to be kept free of building altogether. While local governments do not have to amend their own plans to match, those that don't will miss out on certain subsidies. *Plan Bay Area* is due for a second edition next year.

At two points, the CCMP hitches cars to this controversial engine. In response to the "rising tides" problem, Action 15 urges that shoreline protection be accomplished with marsh buffers or in other ways that are good for wildlife. To this end, the *Plan Bay Area* update should have a section on shoreline resiliency, and "lay the groundwork for a more comprehensive resiliency effort." Action 23 calls for improved water management — conservation, recycling, stormwater management — and suggests covering these matters, too, in *Plan Bay Area*.

Plan Bay Area draws fire not least because it is the work of boards that, while appointed largely from the ranks of county supervisors and city council members, are not directly chosen by the public. Even as these two agencies flirt with a merger, a

bolter thought is once again being heard: that regional powers should be vested in a multi-purpose regional government with a popularly elected board (see *Merger Anxiety*, p. 6).

At the May 6 Spring Summit of the business-oriented Bay Planning Coalition, speaker after speaker complained that existing governmental setups are not going to do the job in the era of sea level rise. "In the Bay Area our challenge is of governance and funding," said SFEI's Warner Chabot. "We're going to have to have a real plan," said Allison Brooks of the Bay Area Regional Collaborative. "Somebody's going to have to take the lead." "The only solution is to create a vision for the whole bay," said landscape architect Kevin Conger. Just who would do these things remained unclear. For all its strengths, the CCMP is not such a plan or vision.

The question is: Can the great metropolis wrapped around the lower Estuary respond to the challenges it faces in the era of climate change with the balkanized governance system it now has?

One of the virtues of the June 2016 Measure AA parcel tax to fund a restoration authority was the training it afforded us in larger-scale thinking. As Save the Bay's David Lewis remarks, "We never before had a chance to get a region-wide vote on a regional matter."

Delta Deadlock

If the Lower Estuary community is scrambling, perpetually but with some success, to adjust to a changing world, their upper Estuary counterparts often seem stuck in an endless loop of old controversies, revisited but not resolved, as physical challenges grow.

As the water projects increased their draws and the biotic health of the Delta began an obvious decline, the State Water Resources Control Board continued its struggle to set rules for river flows, a process again and again begun and again and again derailed.

In 1993, on petition by environmental groups, the Delta smelt was listed as Threatened under the federal Endangered Species Act. This brought the federal authorities thundering onto the Delta scene. In 1994, the two big water agencies, the Department of Water Resources and the U. S. Bureau of Reclamation, and the two big wildlife agencies, the Department of Fish and Game and

Regional Land-Use Rules in Action

Regional, rather than strictly local, land-use controls are always controversial. But it's interesting to note that the entire San Francisco Estuary is now enveloped in zones of limited but real regional control.

BCDC, of course, came first. Its jurisdiction extended to tidal waters west of the Delta and to a shoreline strip one hundred feet wide. Later, Suisun Marsh was added to its purview. It is an odd side-effect both of sea-level rise and of marsh restoration that the agency's jurisdiction creeps landward. Some voices have proposed that BCDC be given responsibility for the whole zone threatened with inundation — an idea from which the agency itself recoils.

In the 1980s, as cities on the edge of the Delta expanded into it, concern about development of this flood-prone and agriculturally valuable landscape

mounted. In 1992, the Legislature created a Delta Protection Commission with the authority to overturn development approvals in a large region mapped as the Primary Zone. Unlike BCDC, the Commission does not review all projects in its area, but acts following appeal. The lines set in the Commission's first *Land Use and Resource Management Plan*, published in 1996, have held. In a region that powerful agencies seem to regard as an object to be fought over, the Commission has also functioned as a voice for the Delta in itself.

In 2013, similar controls were extended to the rest of the Delta, the peripheral Secondary Zone, where the pressure to build has been highest. Under the *Delta Plan*, the Delta Stewardship Council can block development approvals on land not already firmly committed to urbanization.



Early meeting concerning the formation of the Delta Stewardship Council and the origins of the Delta Plan. Photo: DSC



Liberty Island in the Delta. Photo: Bird's Eye View

the U. S. Fish and Wildlife Service, joined assorted others in a consortium known as CALFED. It promised a fresh start, and an infusion of federal money, to accomplish two things at once: the steadying of California water supply and the ecological restoration of the Delta and, indeed, the entire estuarine system. "Getting Better Together" was the slogan of the day.

For quite a while, all bets were on CALFED, which was institutionalized as the Bay Delta Authority in 2002 and blessed by Congress in 2004. A swarm of pilot habitat improvements, mostly in the Delta but also some downstream, were carried out. A science branch became the locus of much important research. In this era the Water Board succeeded in promulgating a new water rights decision, D-1641, in 1999, and new salinity rules, in 1995 and 2006.

The Delta, however, continued to founder, undergoing what scientists call an aquatic regime change. CALFED itself was not far behind. It had no real power over its strong-willed constituent agencies, and its initially generous funding waned. The Little Hoover Commission complained of "a governance system that cannot . . . withstand the hurricane-force political pressures of water policy in California." A reboot in 2005 was unsuccessful. The program limped on for a time, a sort of Holy Roman Empire of the water map, before it quietly dissolved.

On Beyond CALFED

In 2006, on the ruins of CALFED, the familiar roster of water supply and wildlife agencies launched the Bay Delta Conservation Program. One of its two thrusts was to improve water export plumbing by constructing an "isolated conveyance facility"; this became Jerry Brown's "twin tunnels." At the same time, it promised to do wonders for the ecosystem, both by eliminating the distorted flows that have helped to decimate the fish and by embarking on vast wetland restorations and other ecosystem repairs, a sort of Habitat Goals East. These solutions were to form one grand package, meeting the requirements of both state and federal Endangered Species Acts for a long time to come.

In 2014, however, the Fish and Wildlife Service declared that it lacked enough information to issue the requested 50-year permit under the Endangered Species Act. As a result, the program was split into two parts. The tunnels plan went on to review as California WaterFix; a more modest habitat improvement plan, emphasizing actions doable in the short term, became California EcoRestore.

The WaterFix planning process is grinding forward, with the initial decision expected this fall. If adopted by the Department of Water Resources, the lead agency, the plan will have to run a gauntlet of approvals including

the State Water Resources Control Board and now also the Delta Stewardship Council.

In 2009, the Legislature directed the State Water Board to get moving on another review of flow standards, essentially unchanged since 1995, when the Delta had seemed much healthier. As a preliminary, the board was asked to determine what flows the ecosystem actually needed. Completed on schedule in 2010, this report gave the board's weighty blessing to a familiar conclusion: that fish need much more water, especially in the spring and summer, than they are getting now.

That was a benchmark. Now the process moves on to the weighing of interests that will result in enforceable rules. As ever, this has proved a slow business. A new *Bay-Delta Water Quality Control Plan* was scheduled for 2011, then 2014; it has now been delayed to 2018, a target date the new CCMP endorses.

This delay has an odd effect. Long before adopting the new flow standards, the Water Board will be called upon to decide the fate of WaterFix, applying the older rules. "Completion of the Board's [flow] work is essential for fully informed decisions on the BDCP," the federal EPA opined in 2012. Yet there is no legal requirement for "plan before plumbing," and Steve Moore, a member of what is generally considered the "greenest" water board in history, insists that his colleagues will not hesitate to tighten the rules after a construction start.



Photo: Rick Lewis

The Delta Reform Act of 2009 also brought into being a formal successor to CALFED: The Delta Stewardship Council. This body inherits the double charge of stabilizing water supply and restoring ecosystem health, while paying due attention to the value of the Delta as a place in its own right. Its first *Delta Plan*, published in 2013, is part local study and part statewide water policy manifesto. Unlike its predecessor (and unlike the Estuary Partnership), the Stewardship Council has certain real though artfully delimited powers. Actions that violate 14 specified policies — for land use, for ecosystem restoration, for flood control, and also for some water matters outside but related to the Delta — can theoretically be appealed to the Council. A WaterFix go-ahead will certainly draw such an appeal. Whatever the Council decides, the game will end in the courts.

The Plans Compared

The Delta Plan and the new CCMP are certainly the two broadest visions for the Estuary. Each is centered in its own realm, but each radiates to the other. While the CCMP's provisions are directed mainly at the Bay, it also endorses certain actions in the upper Estuary. The *Delta Plan*, for its part, makes no claim to cover the lower Estuary, yet its language on water supply actually implicates much of California, including the zone downstream.

Comparing the actions and milestones of the CCMP with the performance measures of the *Delta Plan*, it is clear that the lines of communication have been open. Each plan, for example, calls for the restoration of 8,000 acres of tidal wetland in the Delta, a number going

back to biological opinions issued in 2008 and 2009 by the National Marine Fisheries Service and the Fish and Wildlife Service. Each endorses more work on one of the few aquatic habitat successes in the region: the Cache Slough complex in the northwestern Delta, including flooded Prospect and Liberty Islands and the Yolo Bypass.

Both plans take up the huge problem of land subsidence in the western and central Delta (vastly more dire than at points downstream), and recommend "tule farming" as a way of reversing it (and sequestering atmospheric carbon), specifying similar acreages. Both urge completion of a study of Delta levees (without mentioning the painful proposition that some Delta islands may be indefensible in the climate-change future). Both look to the Water Board to resolve the issue of flows; neither ventures an opinion on the issue of conveyance. (If the Governor's WaterFix should go off the rails, the latter question will land squarely in the lap of the Delta Stewardship Council.)

The Big Water Picture

Maybe the most interesting overlap between the plans, though, is in the way they seek to influence water thinking in general.

One of the goals of the Delta Reform Act of 2009, and of the *Delta Plan*, is to take some pressure off the Delta by lessening the state's reliance on it for water supply. All water agencies tapping the Delta or the rivers in its watershed are supposed to show that they are on track to take less, either in absolute terms or as a percentage of their total supply. This mandate absolutely extends to the Bay Area, where the biggest water suppliers all draw either from the Delta or from the mountain streams that feed it. The plan promotes regional self-reliance through conservation, stormwater capture, better groundwater management, and wastewater recycling: a package widely endorsed these days, notably in the Governor's California

Water Action Plan of 2014. All of these ideas are reflected in the CCMP. They also take their place in the *San Francisco Bay Area Integrated Water Management Plan*, a set of goals and grant-making guidelines adopted by local water agencies and partners (including SFEP) and last updated in 2013.

Even if the current drought should ease, the long-term need to move toward what is being called One Water — the management of fresh water, stormwater, groundwater, and highly treated wastewater as a single, inseparable flux — can only intensify.

Do the Pieces Fit?

Let's give (and accept) some credit: A great deal is being done, by a great many good people, to improve the outlook for the San Francisco Estuary. Many problems would be far worse today if timely actions had not been taken in decades past.

Yet decades future are looking perilous indeed, and we have to step up our game.

For the lower Estuary, there is substantial agreement about what needs doing. What is slowing things down is the fragmentation of responsible agencies and the need to force practically any significant action through the fine mesh of local interest and, often enough, local inertia. When power is dispersed and money scarce, it is hard to get people to pay attention. Hence the endless calls for coordination; the task forces and "partnerships"; the multiplicity of sparsely attended meetings.

For the upper Estuary, the challenge is a bit different. Here the obstacle is deep disagreement about fundamentals: the allocation of available river flows, the shape of future water supply plumbing, even the physical future of the Delta itself. Stasis seems likely to persist until some painful and deeply controversial decisions are made.

The machinery grinds on. We learn. We do some things. We solve some problems, shy away from others. The Delta deteriorates. The water rises.

Do the pieces fit? Sometimes. In some places. Better than once they did. But not yet nearly well enough.

JH

INFRASTRUCTURE

EBMUD Experiments with Pipe Replacement

On average, underground water distribution pipes can last about 100 years. The East Bay Municipal Utility District (EBMUD) owns and maintains roughly 4,200 miles of them. And it replaces about ten miles per year.

At that rate it would take four centuries to replace the whole system: an approach one could charitably call unsustainable even if all the pipes were brand-new today. But parts of EBMUD's system, cast-iron pipes inherited from forgotten, now-defunct water agencies, date to the late 1800s.

After EBMUD formed in 1923, it continued installing cast-iron pipes through the 1950s, then switched to predominately asbestos-cement for the next three decades. Newer pipes are made of plastic or steel. Today the agency's oldest 2,400 miles of cast-iron and asbestos-cement pipes account for the vast majority of its leaks, which last year numbered 1,156, far surpassing an industry benchmark of 20 leaks per 100 miles per year.

"We have a lot of pipe. About half of it is old. And it's leaking," says district spokesperson Andrea Pook.

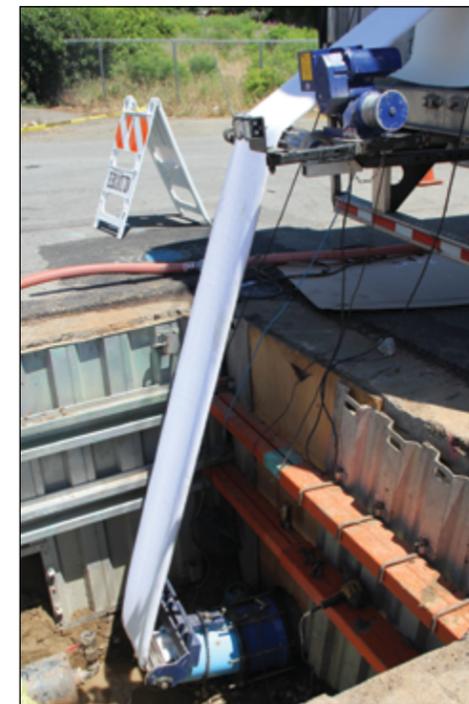
Serving 1.4 million people in Alameda and Contra Costa counties, EBMUD is far from alone in contending

with aging, sometimes neglected infrastructure. Water and sewer agencies of all sizes nationwide find themselves in similar straits. Just consider Flint, Michigan, and all the attention it has drawn to the potentially dangerous lead pipes still coursing through many of our cities and towns — or the recent gas leak in Southern California. And that's to say nothing of our nation's crumbling roads and unsafe bridges.

"We're very good at engineering and construction, but we sort of forget as engineers that things, once they're in the built environment, require maintenance and someday even replacement. That's something that I think we as a country are going to learn in the next ten years," says Margo Schueler, construction and maintenance superintendent at EBMUD.

"We've got some catch-up work to do," adds David Katzev, senior civil engineer. "We the industry, we the nation, we the society need to think differently about asset management."

The City of Los Angeles, for one, recently accelerated its water pipe replacement rate by two and a half times. It's doing this largely through the use of open trenches, which is just how it sounds: dig up the street from



EBMUD feeds Aqua-Pipe sleeve liner from trailer into pipe, then injects resin while a winch pulls from the other end. The sleeve installed at Glenn Avenue in San Pablo was pulled 525 feet through a 12-inch asbestos cement pipe. Photos: EBMUD

one end of the targeted segment to the other in order to pull out the old pipe and install the new. Simply put, it's disruptive.

EBMUD is trying to find a better approach, in part by learning from what other agencies have done well — and perhaps not so well. "We want to do it differently, be more efficient, more environmentally friendly, and more collaborative with the public," says Schueler.

Discovering what that means is the goal of its new Pipeline Rebuild program. Officially launched this past January, the effort includes a series of short-term pilot projects designed to test alternative materials and construction techniques that may allow the agency to catch up on its backlog of deferred maintenance, and eventually prescribe a more manageable path forward.

At various locations in Richmond, San Pablo, Lafayette, and Walnut Creek, for example, EBMUD will spend the summer testing a technology known as cured-in-place pipe — specifically a product called Aqua Pipe that's widely used in Canada and a handful of American cities.

continued on next page



Marina Park in Richmond, where installation of Aqua-Pipe avoided the disruption to park services of extensive trenching. Photo: EBMUD

Santa Clara Tracks Leaks and Creaks

If many of EBMUD's water pipelines are at or near the end of their lifespan, the Santa Clara Valley Water District's are merely approaching middle age. But its managers are already preparing for the inevitable: more leaks in the short term and replacement in the long term.

The water wholesaler delivers drinking water through 125 miles of large-diameter pipelines measuring up to ten feet across to a dozen private and municipal retailers throughout Santa Clara County, who themselves serve approximately two million people.

In stark contrast to EBMUD's predicament, Santa Clara's oldest pipes date to roughly the Summer of Love — not the invention of the light bulb. They have an average age of about 40 years.

"Since our pipelines are relatively new, in the '90s and prior to 2000 the maintenance program was preventative maintenance: exercising valves, going in vaults and making sure everything looks good, and replacing things as needed," says engineering manager Erin Baker. "As pipes got older, we did start seeing some leaks, so we started a more comprehensive inspection and rehabilitation program in the early 2000s."

Since then the district has inspected — often by draining and climbing right inside — nearly 90 percent of the system, averaging eight miles per year. "What we really want to work toward is getting a better idea, as the pipelines are aging and getting closer to end of life, of when we're going to have to start replacing them," Baker explains. Because whether that's 20 years away or 50, it's coming. **NS**

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EBMUD, *cont'd from page 15*

It's essentially an interior liner that crews use to construct a new pipe within an old, failing one. Because excavation isn't necessary, Aqua Pipe can be installed at a rate of up to 2,000 feet per day.

Later this fall, EBMUD will launch a separate pilot to evaluate another trenchless technique known as pipe-bursting, in which cast-iron pipes are broken from within by pulling a conical metal "head" through the pipe and chasing it with a new pipe. This technique is widely used for sewers, but more challenging for water lines.

A third pilot in Richmond will involve using restrained-joint connections between pipe sections, as opposed to the more common bell-and-spigot push-together fittings, which can offer additional stability during minor seismic disturbances and the opportunity to employ narrower trenches, saving time, money, and materials.

Carol Mahoney, an integrated planning manager for the Zone 7 Water Agency in Livermore, says EBMUD could also partner with cities to make street-level improvements and add green infrastructure like plantings and swales in some cases where pipeline repairs require tearing up the roadway. This piggybacking of benefits could bring additional funding opportunities, too.

Other initiatives of the Pipeline Rebuild program, which will run four years and should lay the foundation for the utility's maintenance regime for decades to come, include GPS mapping of underground pipes, streamlining collaboration between design and construction teams, and staffing work crews more flexibly to improve efficiency.

Together, these technological and procedural improvements should help the district dig itself out of the hole in which it finds itself, once and for all. "Our point is that we need to do it now," Pook says. "If we don't, it will be worse later." **NS**

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Top: Pocket in Aqua-Pipe sleeve made up of two layers of fire hose-like material, the inner impermeable and the outer permeable. A water-safe resin is injected between the two layers, allowing the sleeve to be fused against the inner walls of an existing pipe.

Middle: Sleeve liner being pulled by winch through middle of three short trenches dug for the Glenn Avenue installation (a technique similar to using a safety pin to rethread a drawstring). It took over an hour to pull the sleeve through 525 feet, and ensure even distribution of the resin.

Bottom: Finished lined pipe.

Photos: EBMUD

MONITORING

An Eggfull of Estuary

Birds' eggs don't lie. Just as thinning eggshells once revealed how DDT was affecting peregrines and pelicans, the eggs themselves are now telling scientists how long-lived some contaminants are in the Estuary and where they are the most problematic.

A report just published by the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) summarizes contaminant concentrations in eggs collected between 2002 and 2012 from two fish-eating species high in the Estuary food chain, double-crested cormorants and Foster's terns. Double-crested cormorants are considered a sentinel species for open water; Foster's terns for shallow-water habitats on the Estuary's margins, including wetlands and managed ponds.

"Many of the contaminants we studied can affect the birds' rates of survival," says SFEI's Jay Davis. "Many are toxic to embryos if concentrations are high enough — just like in humans, the early developmental stages in birds are very sensitive."

Some of the egg data in the new report — from 2006, 2009, and 2012 — has never been published before. The report also includes data collected annually as part of a Coastal Intensive Site Network (CISNET) study in 1999-2001.

The good news, says Davis, is that concentrations of PBDEs, a flame retardant, in cormorant eggs collected from multiple locations around the Estuary have decreased over time, as have DDT and dioxins.

The news about PCBs is not as good. "PCBs are lingering at a level where they could be affecting the survival of embryos," says Davis. "The Richmond Bridge cormorant eggs had high concentrations." Yet the highest concentrations, a legacy of past industry, were found in the South Bay. PCBs were used in transformers and other electrical equipment from the 1930s through the 1970s, as well as in building materials.

The stain repellent chemical PFOS was also higher in cormorant eggs from the South Bay than from the North Bay. While PFOS

concentrations in the most recent sampling were lower than in previous years, suggesting a possible decline, the levels found are still worrisome, says Davis. "Cormorant eggs sampled in one year were above the 'no-effect' level, reaching a level where we start to be concerned."

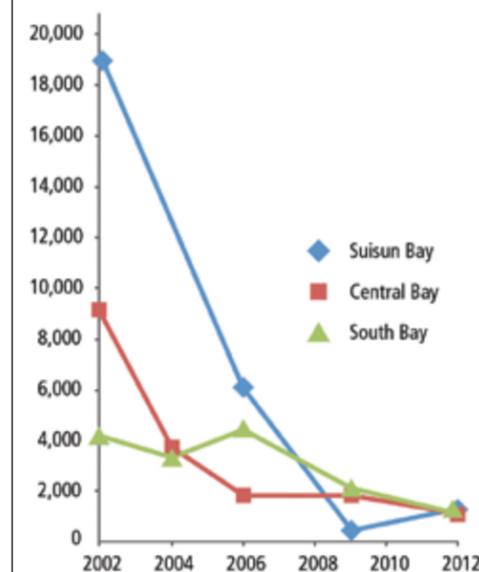
Mercury, a legacy pollutant from the mining industry, has decreased in cormorant eggs from the South Bay (Don Edwards National Wildlife Refuge) over time. On the other hand, it has increased in eggs from the Richmond Bridge.

Forster's tern eggs tell a different story about mercury. These terns forage primarily in wetlands along the fringes of the Estuary, where methylmercury, the toxic form that biomagnifies, is produced. High mercury concentrations were found in eggs from both North and South Bay sites. This is of huge concern to researchers.

"Forster's terns are by far the most contaminated species of bird breeding locally," says Josh Ackerman with USGS, who has studied mercury in Estuary birds for over a decade and published numerous studies on his findings. "Seventy-nine percent of tern eggs sampled in the Estuary have mercury concentrations over toxicity benchmarks. That puts the terns at high risk for reproductive impairment."

When mercury levels in birds reach a toxic level, explains Ackerman,

NANOGRAMS PER GRAM OF LIPID



Bay cormorant eggs are less contaminated as a result of the PBDE phase out. Source: RMP

the birds begin to "de-methylate" or de-toxify some of the mercury in their livers, using valuable metabolic energy in the process. Ackerman has found a strong correlation between tern eggs collected from around the Estuary and embryos "mal-positioned" in the egg, meaning that it is harder for the chick to break out of the egg. "We have some evidence that mercury may be influencing parental behavior, including nest attendance. We've also found that tern eggs that fail to hatch have higher mercury levels than randomly sampled eggs that are still viable." **LOV**

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Forster's tern nest. Photo: Josh Ackerman

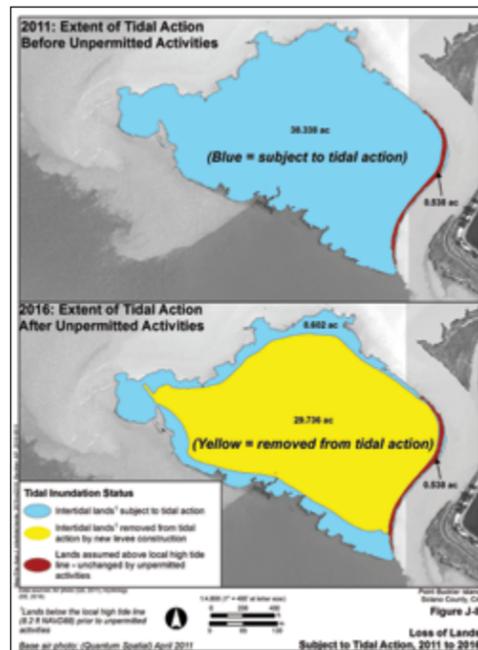
REGULATION

Buckler Brouhaha

While Bay Area voters showed their support for wetlands by passing Measure AA, an ironically different story has been playing out at the edge of the Suisun Marsh: what longtime observers call the largest intentional loss of tidal wetland in decades.

Beginning in 2014, John Sweeney, the new owner of a former duck-hunting club site called Point Buckler Island, rebuilt the levee around the 51-acre island, drained the interior, and dumped excavated soil on the marsh to create what he bills as a kitesailing resort for high-end clients. In the process, habitat for endangered wildlife and fish species was destroyed or impaired. Although the owner also calls it a duck club, there's no visible evidence that he's managing it for waterfowl.

Fighting a phalanx of federal, state, and regional agencies, Sweeney claims Point Buckler's history as managed wetland allowed extensive unpermitted work. The agencies argue that the site had converted from managed to tidal wetland through the negligence of previous owners and was therefore protected, and that Sweeney's actions undermined years of effort to build trust among stakeholders in the marsh.



His failure to go through the established permitting process could result in a \$4.6 million penalty from the Regional Water Board and an additional \$952,000 fine by the Bay Conservation and Development Commission. **JE**

Read the in-depth, extended version of this story online at www.sfestuary.org/estuary-news

PRIORITIZATION, *cont'd from page 6*

Next, they considered how resources should be allocated in both the near term (2015-2029) and long term (2030-2050). Each subregion developed two allocation options for each time frame: one for a "rosy," or more optimistic, future scenario, and one for a more pessimistic situation.

For the more optimistic scenario in the short term, in general each subregion team gave the most resources to tidal marshes, followed by managed wetlands, upland transition, and migration space (with some sub-regional nuances and caveats). In the pessimistic short term scenario, tidal marsh and managed wetlands were prioritized again for most sub-regions. Of the actions, protecting acres of habitat and managing sediment were given the most resources.

For the longer term, optimistic scenario, managed wetlands were the most popular in Suisun and the North Bay, with the Central Bay team allocating more resources to subtidal habitat, tidal marsh, and upland transition, and the South Bay team fairly evenly dividing resources among all habitats, with just a bit to watersheds. Under more dire conditions, the Suisun team allocated most resources to tidal marsh and upland combined, followed by managed wetlands; the North Bay team gave the most to upland transition, followed by migration space and managed wetlands; the Central Bay team allocated the most resources to migration space, followed by upland transition and tidal marsh; and the South Bay team fairly evenly to tidal marsh and upland transition, followed by managed wetlands.

Perhaps the most surprising result, according to the project's final report, was that even with all of the uncertainty about climate change and resources, participants still recommend that scientists and managers plan as if there will be an increase in resources and that the worse-case climate change scenario won't happen. The second phase of CADS will show how recommendations from the subregions can inform local-scale adaptation strategies. **LOV**

<http://climate.calcommons.org/cads>

EDUCATION

Deliquescent Summit on Ocean Climate

Walking in the door of the fourth Ocean Climate Summit this May and finding Amy Hutzel, long-time chair of the committee in charge of implementing a conservation plan for the San Francisco Estuary, I asked her what she was doing out of her watershed? "Dipping my toe in the Pacific," she said. "For a while now, we've been working to build partnerships inland and offshore. It's all one estuary."

The water may be hotter in the Delta and colder in the Pacific, but scientists continue to reveal strong relationships and exchanges between the watershed, the estuary, and the ocean, and now, more than ever, with the atmosphere above them. Lots of things flow downriver and out the Golden Gate, or slosh back and forth between the Gulf of the Farallones and San Francisco Bay: nutrients, fish food, sediment, parcels of deoxygenated water, plastics, contaminants, juvenile crabs and flatfish, to name a few hitchhikers. Now all these things loom larger for water and resource managers, as rising sea levels promise to thrust the ocean deeper than ever into the heart of California.

"What we're doing here is bringing the different communities of practice together," said Maria Brown of the Greater Farallones National Marine Sanctuary, primary sponsor of the summit, in remarks at the all day May 17 event.

The summit was attended by 141 resource managers, scientists, and activists concerned about the impacts of climate change on the ocean outside the Golden Gate. The enthusiasm for learning and sharing was palpable all day, even as attendees enjoyed brief lapses of attention staring out at a San Francisco waterfront view

of swimmers, kayakers, ferries, and tankers traversing the chop stirred up by the breeze off the Pacific.

"The energy in this room, the collaborative spirit, the solution oriented approaches, are just awesome," said the self-described "suit" from Washington DC brought in to open the event. Speaking about how the Bay Area's work has been recognized nationally, even internationally, as a collaborative model, John Armor, acting director of NOAA's marine sanctuaries program, said: "We need to use these marine sanctuaries, as places in the public spotlight that people care about, to communicate the need for solutions to our climate crisis."

Over the course of the day, four major panels presented topics ranging from steps to climate-smart plans, policies, and funding to why 100,000 Cassin's auklets died of starvation in 2014 and how the Army Corps of Engineers is trying to engineer more

with nature than against it. Breaks between sessions included opportunities for attendees to provide input on various climate adaptation strategies pasted on the walls with blue tape. Highlights and take homes of all presentations over the course of the day can be found in the online extended version of this story.

At the close of the day, Maria Brown reiterated how much the community of climate-concerned people had grown, evolved, and become more climate-savvy than climate-smart.

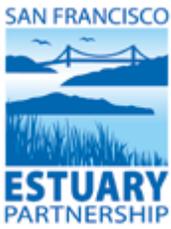
"In the eight years since our first ocean climate summit, there's been an amazing shift in knowledge and perspective," said Brown. "After hearing that in the last 50 years our climate has warmed more than in the last two millennia, any of us could have thrown up our hands and walked away. But this summit tells me that if a small group becomes engaged and wants to think hard about something, they can change our future. We're not victims, we're allies." **ARO**

Extended story online: www.sfestuary.org/estuary-news

Ocean Climate Summit Presentations: <http://climate.calcommons.org/aux/2016OceanClimateSummit/products.htm>



Ceramic nest boxes from Año Nuevo near Santa Barbara that may provide a model for new nest boxes being tested for the warming Farallon Islands. On the Farallones, wooden nest boxes have been used since the 1970s but get hot during high heat events. The project is supported by the Cosco Busan oil spill restoration funds and Point Blue donors.



San Francisco Estuary Partnership
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San Francisco Bay and the Sacramento-San Joaquin River Delta comprise one of 28 "estuaries of national significance" recognized in the federal Clean Water Act. The San Francisco Estuary Partnership, a National Estuary

www.sfestuary.org

Program, is partially funded by annual appropriations from Congress. The Partnership's mandate is to protect, restore, and enhance water quality and habitat in the Estuary. To accomplish this, the Partnership brings together resource agencies, non-profits, citizens, and scientists committed to the long-term health and preservation of this invaluable public resource. Our staff manages or oversees more than 50 projects ranging from supporting research into key water quality concerns to managing initiatives that prevent pollution, restore wetlands, or protect against the changes anticipated from climate change in our region. We have published *Estuary News* since 1993.

ESTUARY News

June 2016, Vol. 25, No. 2

www.sfestuary.org/estuary-news/

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COVER PHOTO *Building material of the Bay's future.*
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Finding NEMO

This spring the California Department of Fish and Wildlife unveiled a new, searchable public database for tracking non-native species in the state's coastal waters. California's position as a hub of international trade and shipping leaves it especially vulnerable to invasive species, which often arrive in ballast water or attached to the hulls of ships or recreational boats.

The California Non-Native Estuarine and Marine Organism (Cal-NEMO) database includes information about the biology, ecology, distribution, occurrence and impacts of more than 200 introduced species. "The new website is much more user-friendly than the old one," says Fish and Wildlife's Steve Foss, noting that it features detailed graphics and interactive maps. Although currently limited to invertebrates and algae, Foss says Cal-NEMO will expand to include fish and aquatic plants. Foss says Cal-NEMO's information on the Bay and Delta is particularly robust. "We do annual sampling there, so new data is added regularly."

The new website, which was developed in collaboration with the Smithsonian Environmental Research Center, replaces the California Aquatic



Exotic marine amphipod that probably arrived in San Francisco Bay via ship's ballast water or hull-fouling communities.

Non-Native Organism Database (CANOD), which had been collecting invasive species data since 2000. The Cal-NEMO database can be found at: <http://invasions.si.edu/nemesis/calnemo/intro.html> **CHT**

CCMP APPROVED, cont'd from page 5

Estuary Program (NEP) since it expired in 2010. His signature will allow the US EPA and the 28 individual NEPs, including the San Francisco Estuary, to continue to support the conservation of estuaries around the United States.

Senator Sheldon Whitehouse (D-RI), who championed the bipartisan legislation in the Senate, released the following statement on the signing: "The National Estuaries Program

helps to improve beautiful natural places and key economic assets like Rhode Island's Narragansett Bay. The program now stands on firmer footing for years to come."

A couple of hoops remain for the new CCMP to jump through—namely final signoff by the San Francisco Estuary Partnership's Executive Council and the US EPA. Once all the i's are dotted and the t's crossed, the latest, most comprehensive plan for improving the health of the entire Estuary will debut to the public and provide useful guidance on how to tackle the next big issue for one: rising sea levels.

This June, the CCMP's habitat and nature-based approach to climate change adaptation along the shoreline got a big boost when voters approved Measure AA on June 7, with its \$12 Bay Area parcel tax.

"The CCMP foresees the creation of wetlands and other habitats along the Bay shoreline, along with other actions to increase resilience for the wide variety of communities in the Bay Area. This will require considerable funding from many sources, and the new funds accruing to the Restoration Authority have the potential to serve as a great catalyst," says the SF Bay Conservation and Development Commission's Larry Goldzband. " **ARO**