

San Francisco Estuary Partnership

Nine Teams Design for Rising Sea Levels in Nine Places; A Special Section Reveals Resilient Design in Action

New Report Synthesizes All We Know About Bay Sediment Supply

East and West Coast Sewage Plants Remodel with Storm Surge in Mind

Restoration Authority Greenlights Permitting Integration Team

Corps Explores New Ecological Territory

Mourning Morrison



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ESTUARY



NEWS

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BIG NEWS

EDITOR'S PREVIEW

Live Like There Is a Tomorrow!

If you stand in the wet mud on the bayshore and imagine the water over your head, no matter what size you are you get a sense of the changes about to engulf the San Francisco Estuary. The bay is getting bigger. The more we drive, eat burgers, live like there's no tomorrow, the more the ice melts and the ocean rises. In this special issue, we look decades ahead and imagine how we might adapt.

We start with the raw materials, the sediment we need to elevate our shores and save our wetland habitats and buffers. We move on to vital services, examining how a sewage plant in Novato took rising tides into account in its remodel, and how New York City plants hope to survive the next superstorm. We delve into the conversations and innovations necessary to prepare our most vulnerable shores and communities for a lot more water — the climate change trifecta of an encroaching Bay, rising groundwater, and storm surges, not to mention the rivers now emptying out of our altered atmosphere. We track how the pre-disaster 2017-2018 visioning exercise, the Resilient by Design Bay Area Challenge, amped up these conversations. After all, this is something we can fix.

And being *ESTUARY NEWS*, we don't stop with the Bay. We follow the water upstream till it narrows, describing the latest pre-emptive planning effort in the greater watershed. In this instance, Bay and Delta brains are confronting the vulnerability of the industries, communities, and water export facilities on the Contra Costa shore, and within the Delta proper. We even follow the water as far upstream as Hamilton City, where a failing levee offers a national model of setbacks to recover river floodplain. As we learn in all these stories, it will take more than grey infrastructure to protect our Estuary. It will take living infrastructure too, whether green, blue, or human. It will also take money, strong land use planning, good governance and retreat. This isn't the Wild West anymore, it's the drowning coast.

So don't live like there's no tomorrow. Some of you may have the money but others not, and we're all in this together. Your actions, your votes, your neighbors, all matter. We want to be able to tell our children we did our damndest. Don't we?

ARO

Permitting Made Easier?

Whether it's habitat restoration or climate resilience, projects in San Francisco Bay require federal, state, regional, and local agencies to work together effectively. But with a diversity of legal mandates, policies, philosophies, and constituencies, agencies aren't always singing from the same hymnbook; they differ on issues like habitat type conversion, sediment use, and public access. With a few specialized exceptions like the Dredged Material Management Office (aka the 'DMMO'), little has been done to bring them together. The San Francisco Bay Restoration Authority, which oversees restoration projects funded by Measure AA, took a step forward this June by approving funding (\$650,000 annually for five years) for a Regulatory Integration Team.

"Bay restoration is in a race against time," says Restoration Authority Chair Dave Pine. "We need to establish new tidal wetlands before sea level rise accelerates in the middle of this century. That's why it's so important to bring the regulatory agencies together to fast-track the permitting process and resolve the policy issues that constrain the design and permitting of multi-benefit projects." Brad McCrea, the SF Bay Conservation and Development Commission's regulatory director, says the team will do just that: "There's great enthusiasm because this interagency team is expected to change the way that permitting is handled for restoration projects. In a word—faster."

In a presentation at a Bay Planning Coalition workshop in April, McCrea said that while existing regulatory tools helped stop unchecked development in the Bay, "the processes of the past weren't designed to help us handle the challenges we now face." BCDC and six other organizations, including the US Army Corps of Engineers, the US EPA, federal and state wildlife agencies, and the state Water Board, joined forces to develop a more effective approach to permitting AA-funded projects. The approach includes the Regulatory Integration Team, which will expedite

the review, processing, and issuance of Bay restoration permits, meeting face-to-face 5-10 days per month to streamline the pre-permitting application process, coordinate public outreach, and track accomplishments. The approach also includes a Policy and Management Team to provide oversight and develop a list of policy initiatives, with at least one to be implemented every year. McCrea described the initiative as "inspired by the DMMO, but much more complex." He noted that no agency would give up any of its authority. "This is an iterative process," he added. "We expect there will be a need to adjust."



Clapper Rails. Photo: Rick Lewis

At the BPC workshop John Bourgeois, director of the South Bay Salt Ponds Restoration Project, said the Integration Team would have a target of 120 days from application to permit for simple restoration projects, 210 for more complex projects. "By getting staff together, we'll be able to work through these issues," he said. "If the gears grind, that's for the Policy and Management Team." Concurrent agency-level policy changes, like BCDC's pending revision of its sediment policy to allow using fill to create upland transition habitat, should alleviate some of the potential friction.

"Many people agree that the multi-agency process is not a well-oiled machine," McCrea wrote in an email. "There's sand in the gears, but no single agency can solve the problem on its own. We need to incentivize state and federal agencies to work as a collaborative team, share information faster and better, and jointly help permitting applicants resolve conflicts. Project applicants are tired of waiting while myriad regulatory agencies do independent,

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M O N I T O R I N G

Supply Side Synthesis

It was the kind of windowless room only geeks with devices love. Seven teenagers from a Union City high school robotics class pull their desks together to listen as Cy Keener explains how to build a cheap turbidity sensor. They stare at laptop screens, tap in various codes, fumble with small circuit boards while learning electrical basics from Keener, an artist turned sensor-builder for the Public Sediment team of the Resilient by Design challenge (see page 25). “Almost all sensors we use for environmental monitoring ask the same question — what is the voltage?” says Keener. After connecting up various tiny lights and making them blink, the students hold scraps of paper over them and measure the light penetration — if water is murky with sediment, less light penetrates. Keener is placing simple sensors like those created in the class — which cost about \$100 a pop — along Alameda Creek to try to engage students and communities in citizen science — in making awareness of the path of sediment from hilltop to bayfront more “public.”

“Small sensors are the foundation of big science,” says Phil Trowbridge, manager of the Bay’s Regional Monitoring Program, which has just released a new synthesis report on sediment science. “If we’re going to make a half billion dollar investment in wetland restoration around the Bay, thanks to Measure AA, we need to know if we have enough sediment to do it,” says Trowbridge.

In the report, estuary sediment whisperers David Schoellhamer of the U.S. Geological Survey and Lester McKee of the San Francisco Estuary Institute analyze, update, and synthesize the results of eight bodies of work, ranging

from federal monitoring programs to regional research initiatives such as Flood 2.0, BCDC’s sediment management plan, and Dredgefest. Their conclusions yielded some surprises concerning how much sediment moves from the Sierra and Bay watersheds to the Golden Gate via streams, rivers, flood control channels, and tides, and where it ends up.



Overall the report concluded that net sediment supply to San Francisco Bay from terrestrial watershed sources averaged 1.9 million metric tons per year (± 0.8 Mt/yr) during the period from 1995-2016. “The system is calming down from two huge past disruptions,” says Schoellhamer, referring to hydraulic gold mining and dam building. “The dramatic changes of the past won’t carry into the future unless we have something like a 10,000-year flood.”

While the supply remains somewhat stable, how much stays in the Bay and how much ends up in the ocean remains an enduring question. One data set comes from a USGS sensor array strung along streams, rivers, and waterways between the Sierras and Alcatraz. But no fixed sensor could give readings in the 300-foot deep canyon under the Golden Gate, where sediment, tides, and river outflows all move at different, shifting levels.

To get that data, the Survey’s Maureen Downing-Kunz climbed on the *Questuary* at the tail end of a number of storms, the latest in February 2017 (the same storm that nearly took out the Oroville Dam). “I almost lost my lunch, and dodging the container ships was a challenge,” says Downing-Kunz, who wo-manned the turbulent sampling sweep of the Golden Gate with no crew except the captain.

She timed her 2016-2017 boat trips carefully — given the usual logistical challenges of vessel-driven work — to coincide with other data references to flood conditions like El Ninos and spillage from the Yolo Bypass. She then examined her Golden Gate findings — captured by an acoustic instrument that listens to sediment suspended in the water — in light of data from upstream sensors, tracking the sediment moving down from the Central Valley rivers, past Suisun Bay, and into San Pablo Bay.

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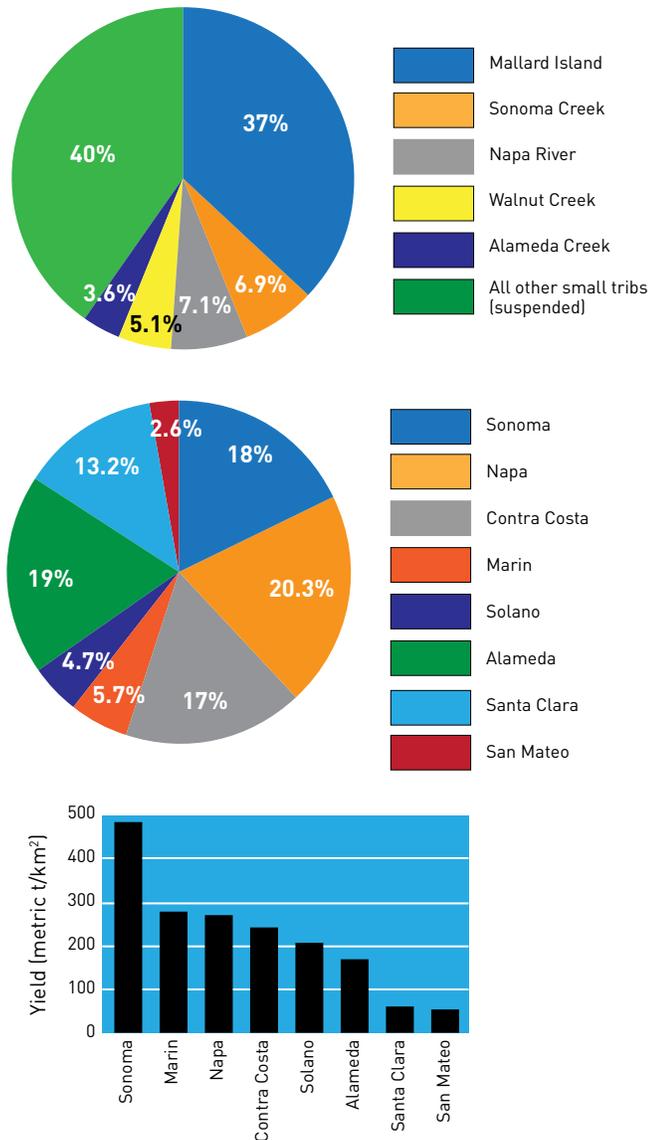
One of Downing-Kunz’ stormy trips on the R/V Questuary, a research vessel out of SF State’s Estuary and Ocean Science Center in Tiburon, captained by David Morgan and David Bell. Photo: USGS

"In 2016, the sediment plume didn't make it to the Golden Gate," she says. In 2017, the plume did not behave as expected. "We think some of the plume had exited the Estuary already, and some was still trapped in San Pablo Bay due to the estuary's two layer flows and tides." (Indeed these and other results confirm that San Pablo Bay continues to be a place where sediment stalls or gets stuck — a good thing for restoration projects on the Estuary's north shore).

In any case, the sediment supply spotlight is slowly shifting from the Central Valley watershed to local tributaries that drain into San Francisco Bay. According to the new report, net supply from the Central Valley (measured at Mallard Island) makes up 37% of the total supply, while small tributaries in the nine counties around the Bay supply 63%. This result is the opposite of what most people would think, given that local drainages are so much smaller than the Central Valley watershed, which covers 40% of California. Of the small tributaries around the Bay, just four drainages, Sonoma Creek, Napa River, Walnut Creek and Alameda Creek are estimated to supply a quarter of the sediment yet of these, only Alameda Creek has an ongoing sediment monitoring program.

Part of the new analysis involved drilling down into what was coming out of flood control channels in the Bay, six of which have good data records, according to the SFEI's Lester McKee. Building on work already done for the joint SFEI-SFEP Flood Control 2.0 project, McKee and his team assessed sediment supply at the upstream head of the flood control channel, within the flood control channels themselves, and downstream from flood control, which could be viewed as supply to the Bay. "The revelation was that, on average, all coarse sediment in our flood control channels, plus a little of the fine sediment supply, is either stored or removed by channel maintenance practices," says McKee.

ESTUARY SEDIMENT LOADS



Top: Net proportional total loads to the Bay from key large tributaries after accounting for storage and removal of sediment from flood control channels. Total load = sum of suspended load and bedload. Bottom: Proportional total sediment loads (pie) and yields (bar chart) by county discharging to the Bay. Source: RMP 2018

After accounting for storage, dredging, removals, and errors, McKee came to the conclusion that the Bay's bedload supply amounts to zero. Never measured before in the Estuary, "bedload" is the heavier sediment that shifts slowly along the bed of the estuary (a different supply source than the fines floating around in the water column). Increasingly, shoreline managers are looking for such material to replenish beaches and create wave breaks. "Since there's little or no supply coming in, or it's caught in our flood control channels until we remove it, we have

to assume that eventually we'll start running out," says McKee.

"Our next step is to develop a more accurate model of how sediment moves around the Bay and into marsh areas," says Trowbridge. To this end, the fledgling RMP Sediment Workgroup is already evaluating a new round of studies. What's really striking, he says, are the new questions and discussions underway in the Workgroup as restoration managers, dredgers, and shoreline landowners talk sediment with water quality managers for the first time. "It's a whole different crowd of people for the RMP, but we all have same goals of a healthy San Francisco Bay," says Trowbridge.

"The make up of the group is a real indicator of change in the RMP," says SFEI's Resilient Landscapes Program director Letitia Grenier. And mapping out all that we need to know about sediment in order to build wetlands as Bay levels climb is a welcome new priority. "We've been like blind women feeling different parts of the elephant, now we all need to step back and see the whole creature," says Grenier.

ARO

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REPORT: www.sfei.org/documents/sediment-supply-san-francisco-bay

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NYC and Novato Sewage Plants Adapt

The city of Novato completed its \$100 million new wastewater treatment plant in 2011. The plant sits in the same place as the old one, only ten to fourteen feet higher. Raising the facility cost a few million dollars, estimates general manager Sandeep Karkal, but it also lowered energy costs dramatically by cutting pumping demands nearly in half. Even more importantly, it helped protect the plant from sea-level rise for at least this century.

"We figured that we needed to address [sea-level rise] in some form, and we took a pretty conservative approach," says Karkal. "We think we're in pretty good shape, even for a worst-case scenario."

Novato is far from alone in thinking about the impact of sea-level-rise on its ability to manage wastewater in the coming decades. Treatment plants along the Bayshore — there are 28 in all — and across our nation's coastline must face this impending threat, which can cause harm in two different ways. First, it increases the likelihood that a plant will flood and potentially fail during an extreme rainfall event or storm surge. On a more gradual basis, rising seas will also degrade pipes and other infrastructure while reducing the plant's ability to discharge treated wastewater by gravity as saltwater climbs higher and higher into the system.

"All of the treatment plants that are along the edge of the Bay ... will be impacted by a combination of sea-level rise and flooding. Some are impacted in the 30-year time frame, while others will be impacted in the 50- or 100-year timeframe," says Dave Williams, executive director of Bay Area Clean Water Agencies, an organization that represents sanitation agencies throughout the region. "It's a matter of time, so you need to be prepared or else you'll be flooded out."

At treatment plants' disposal are a variety of potential remedies, from sandbags to seawalls, sealing holes to raising buildings. Other responses to the various threats posed by sea-level rise include adding new gates to pipe ends that prevent backflows, discharging treated wastewater to upland areas of marshes instead of directly to the ocean or bay, expanding recycled-water programs so that less water must be discharged, and replacing concrete pipes with less corrodible plastic pipes.

Ultimately some plants will be retrofitted, some will be rebuilt, and some may even be abandoned. Each plant's fate is likely to depend its age, size, location, elevation, and treatment volume.

New York City recently discovered just how complex the issue can be. Even before Hurricane Sandy caused more than \$100 million in damages to 10 of the city's 14 treatment plants (and 42 of its 96 pumping stations), the city had begun to prepare its wastewater system for sea-level rise, says Alan Cohn of the Department of Environmental Protection, which oversees New York's water supply and wastewater system.

After the storm the agency redoubled its efforts by preparing a detailed report on vulnerabilities and adaptation strategies at all facilities. Released just one year later in 2013, the report recommends protective measures on an asset-by-asset basis — final settling tanks, substation buildings, chlorine contact tanks, waste gas burners — and estimates the cost of action versus inaction for each. By spending \$187 million across all 14 plants, the report concludes, the city could theoretically avoid \$901 million in damages from a "critical" flood event: a 100-year-flood plus 30 inches of sea-level rise.

Late last year the Department of Environmental Protection announced that work was underway on approximately \$400 million of resiliency upgrades to critical wastewater collection and treatment facilities. This includes raising some equipment above the floodplain, installing floodgates, and waterproofing rooms and buildings. At the North River Wastewater Treatment Plant, the first to be retrofitted, repairs to flood-proof equipment and seal the massive main building were estimated in the report to cost \$17.2 million but potentially save \$94.1 million in damages from a single storm — and avoid \$445.8 million in risk over 50 years.

Here in the Bay Area, Novato is ahead of the curve because its decades-old plant recently needed replacement, says Karkal, and pragmatism and common sense demanded a response to sea level rise.

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SLR-ready Novato Wastewater Treatment Plant. Photo courtesy Novato Sanitary District

Other cities aren't far behind. San Francisco is considering the addition of a "living levee" to its Southeast Treatment Plant, which would protect against sea-level rise while providing habitat and improving resilience (see page 16).

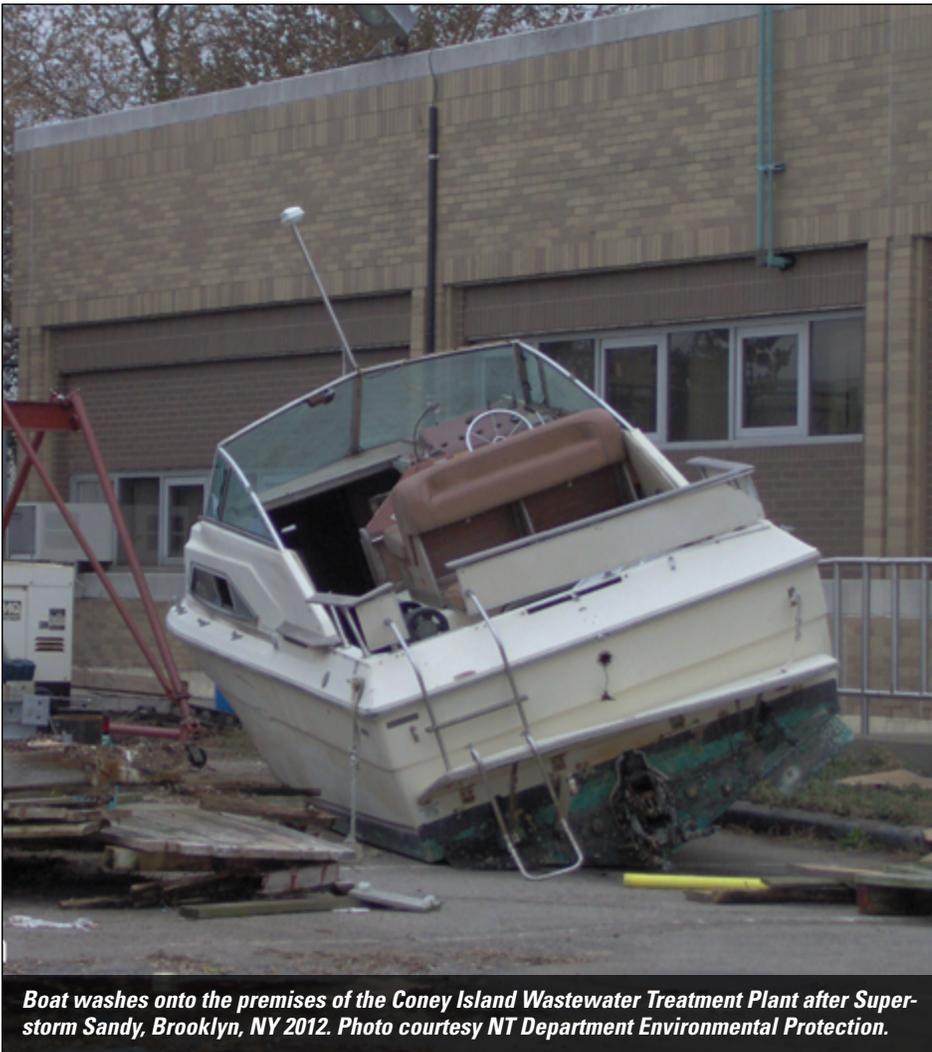
In Sunnyvale, the city's aging wastewater treatment plant is undergoing a total rebuild with flood protection in mind. Over the next ten years, the city will tear down and rebuild the entire thing, says plant manager Bhavani Yerrapotu, with the final product expected to stand at least 60 years. The idea isn't to elevate as in Novato, but rather to rely on walls, including a new flood wall surrounding the facility on all sides — with watertight gates at access points that can be closed when needed — and, beyond that, a shoreline levee being coordinated by the Santa Clara Valley Water District.

Meanwhile, the city of Palo Alto is in the midst of planning to protect its 45-year-old plant. In the near term,

that will include raising electrical equipment and constructing a second outfall pipe to allow more discharge capacity during big storm surges or king tides, says Watershed Protection Manager Karin North.

The city is also exploring the idea of building a horizontal levee to utilize treated effluent directly in front of the wastewater treatment plant and adjacent Palo Alto Airport, which will connect with a larger levee network likely protecting nearby San Francisquito Creek and much of East Palo Alto. The city is better off than most of its South Bay neighbors, North Says, because it has protected the natural wetlands fringing the land. "We're a little bit lucky here in Palo Alto because we actually own all of the wetlands in front of our facility," North says. "So we can buy a little time." **NS**

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Boat washes onto the premises of the Coney Island Wastewater Treatment Plant after Superstorm Sandy, Brooklyn, NY 2012. Photo courtesy NT Department Environmental Protection.

BAY NATURE PREVIEW

Special coverage of the Resilient by Design Bay Area Challenge can be found in both Bay Nature's July-Sept 2018 issue (a big picture overview of the challenge by Zach St. George) and this issue of ESTUARY News (9 sites, 9 visions, 9 communities in detail).

Rise

"Now is the time for cities to rise up, and for regions to collaborate," said Libby Schaaf, Mayor of Oakland.

In 2013, following Hurricane Sandy, the US Department of Housing and Urban Development launched a contest it called Rebuild by Design, inviting architects and design firms to pitch their ideas on how to design a more disaster-ready shoreline in New York City and New Jersey. Now, five years later, seven of the 10 resulting project proposals are on their way to real life.

After Gil Kelly, former director of the planning department at San Francisco, attended a conference about the contest, he returned to the Bay Area wondering if the region could pull off a similar contest. Over the next year, teams of architects, engineers, and designers would identify vulnerable sites around the Bay and propose design solutions.

"The big difference between the New York process and Resilient by Design," says Amanda Brown-Stevens of the Resilient By Design nonprofit, "is that we don't have a huge pot of disaster recovery funds." After the contest concludes, the projects might get built, or they might not.

Andy Gunther, a member of the challenge's scientific advisory panel, acknowledged that possibility for cynicism. "In 10 years, we'll look back and say 'Are any of these designs under construction?'" Gunther says. "I don't know, but I think the designs they create are going to help us think in new ways about the future Bay Area. That is a very valuable product." **ZSG & MHA**

READ THE FULL STORY- Rise
www.baynature.org/rise



Resilient by Design: The Experience

The Resilient by Design Bay Area Challenge bathed the bayshore's future in limelight. The year-long 2017-2018 design exercise, funded by the Rockefeller Foundation, tackled the threat of rising sea levels head on. From the marshes of San Pablo Bay to the shoreline of Santa Clara, groups of landscape designers and architects met with community leaders, officials, and activists to discuss the future of the region's most vulnerable residents and shorelines (see "Rise" at left).

Steps in the challenge process included the selection of nine target sites and nine interdisciplinary design teams, a fall 2017 research phase and a winter-spring 2018 design phase. Along the way, teams were asked to not only embrace what was going on already, in terms of local solutions, but to also be innovative and think on a variety of scales and timelines. Every phase involving interaction between designers, planners, residents, and stakeholders carried the label "collaborative."

ESTUARY's June 2018 issue looks at each location selected by the Challenge, many of which overlap with shorelines managed by our estuary partners, and at the unique obstacles tackled by the respective teams assigned there. The resulting stories, along with tales of the accompanying youth challenge and regional take-homes, all offer glimpses into what was happening in each place, community, and team. The stories appear here in no particular order, and from a variety of writers and voices. Rather than presenting outcomes, this collection seeks to present the experience of the adaptive process, snippets of the Bay's ongoing conversation about living on a warmer globe.

As you might expect in a region with more special interests and municipalities than many, contention often precedes collaboration. No issue carrying this kind of weight can be resolved in a year, and Resilient by Design was never meant to be a final word on climate change adaptation in the Bay Area. Nor was it the first word. Credit must go to the SF Bay Conservation and Development Commission's Adapting

to Rising Tides Program for having the foresight to get started on sea level rise adaptation years ago. The information developed through BCDC-ART's highly collaborative process enabled many of the Resilient by Design teams to create visions for the future based on a solid foundation of science, risk assessment, and multi-agency planning.

The Bay Area Challenge has certainly kindled a conversation about a reality that transcends politics, race, religion, wealth or other issues that have classically divided communities. Idealists might see it as a roadmap to the future. Cynics might call it a hypothetical thought exercise not rooted in economic realities. At least the two sides are talking.

Perhaps the most singular outcome of the year-long challenge has been a new sense of urgency. If we are to shift our communities and urban infrastructure out of the path of flooding and extreme storms, and keep them safe and dry, we have to start now, and do more faster than we have to date. We hope this issue will get you rolling. **The Editors**



S O U T H S A N F R A N C I S C O

Colma Creek Collect and Connect

The scent of fresh corn tortillas drifts through the bustle of Grand Avenue. Traffic grinds slowly along the street while shoppers on the sidewalk clamor at produce displays outside a small market. Several miles to the north, on the south-facing side of San Bruno Mountain, giant white letters read “SOUTH SAN FRANCISCO: THE INDUSTRIAL CITY.”

“That sign has given this city a massive identity problem,” says Richard Mullane, an urban designer with HASSELL, a multidisciplinary Australian design firm involved in the Resilient by Design’s Resilient South City project. HASSELL+, as the team of several collaborating partners is called, is focusing on South San Francisco’s urban core — currently a noisy mess of boulevards, free-ways, warehouses and suburbs that, together, have all but suffocated a small creek that Mullane and his colleague Martin Lee hope, as a key part of their Resilient by Design project, to revive.

The first two people representing HASSELL in the United States, Mullane, from Australia, and Lee, who

is Scottish, sit side by side, each at a laptop in a large, tidy office space at the northwest corner of Grand and Linden. The site — an old bank building — has served as an interface for community members to come in, meet the HASSELL+ team and see their plans up close. On the carpeted floor is an unlikely display of local native plants in black plastic pots as well as a shaggy rug of Astroturf — reminders of what this city just might need most: more green space.

“If we simplified our project down to one thing, it would be that they need more parks, especially along Colma Creek,” Mullane says. “That would create green space that people can use, and area that could flood when the river needs to.”

A young man enters the office, bringing with him the momentary sounds of the street as the glass door shuts behind him. His name, he says, is Ming and he’s here to meet with a business partner to discuss plans for opening a restaurant in this space later in the year. He has arrived early, and Mullane and Lee welcome him to wait in one of the

old bank cubicles until his partner shows up. The planned restaurant, Mullane says later, is to be Italian — something some community members have objected to, since there are already multiple Italian restaurants in the area.

But the culinary influence of a new dining spot may be the least of local citizens’ concerns. For their city — especially its low-lying center — is acutely threatened by rising sea level and flooding. Already, during almost every major rainstorm, Colma Creek overflows its concrete basin, and in the most extreme events, it inundates the city. Mullane expands a photo on his computer screen showing a car, in December 2014, surrounded by frothy gray water up to the door handles.

“That was right out here on Grand Avenue,” he says.

Floods like that one are likely to become more frequent, and more severe, as the Earth warms and the ocean swells. In places like South San Francisco, seawater will push inland and exacerbate flooding during rainstorms. To allow the earth to sponge

up surplus water, HASSELL+ has proposed replacing paved surfaces with more permeable ones — think soccer fields, baseball diamonds and playgrounds — in the floodplain of the creek. They also hope to line the creek — currently contained in a concrete bed like a canal — with native vegetation and a cycling-walking path, all the way from Orange Memorial Park to the Bay.

To complement this linear park system and corridor, HASSELL+ envisions connecting local schools to the streamside parkway via direct bike-friendly travel routes. By this arrangement — what HASSELL+ has labeled their “collect and connect” strategy — the schools would serve as “resilience hubs,” or gathering points during disaster events. On a day to day basis, too, the project could make South San Francisco — already a compact place where distances are small but vehicle traffic thick — into a much more bikeable, walkable place.

This vision for bettering South San Francisco has drawn the encouragement of San Mateo County Supervisor Dave Pine. He has visited the Grand Avenue storefront multiple times and has helped bring the project to the attention of neighborhood businesses and residents.

“They’ve been successful in challenging us to think differently about the creek,” Pine says of HASSELL+. “For most people, it’s out of sight, out of mind, until it floods.”

Pine believes the multi-benefit approach — establishing floodwater retention zones that double as parks — will help win the support of the community and increase the likelihood of getting funding.

Ming, the restaurant partner, leaves the office — but not before pausing for a look at the south wall. It has been covered with a spectacular 15-foot-high aerial photograph of the city, with the open grassy flank of the mountain in the north, the suburbs abutting it, and, along the entire shore of the Bay, industrial

block-shaped warehouses separated from the city by a braided tangle of freeways and rail lines. Post-it notes bearing abbreviated messages written by local residents are stuck to the black-and-white photo. They read, “Colma Creek flooded in the 70s,” “More Dog Friendly Spaces,” “plant rain gardens,” “RENTERS vs. HOMEOWNERS,” “SCARY” and other musings from a cluttered, confused community.

One pink post-it note on the wall has been placed where Colma Creek runs under the 101 freeway. It reads, “NO ACCESS.” Its author’s point is that there is no easy way for a person walking or biking along the creek to directly reach its outlet, thanks to chain-link fences, cement walls, imposing roadways and signs warning passersby against trespassing.

The waterfront isn’t far away — just over a mile as the crow flies — but it’s practically impossible to walk to, and getting there by bicycle involves a harrowing adventure. One must sprint

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Today's SAMtrans depot restored to a public waterfront park, and connected to the water treatment plant for final-stage natural treatment. Vision also features a bay-side swimming pool (inside the circular boardwalk). Art: HASSELL+



HASSELL+ storefront meetings, comment wall and networking with San Mateo Supervisor Dave Pine (right). Photo: HASSELL+

over a freeway overpass and across a dangerous exit lane, hop over a set of treacherous old train tracks and merge across busy boulevards. Finally, after squeezing through a private parking lot, the cement and steel open into greenery, water and birds. A multi-use path — the Bay Trail — skirts along the shore of the Bay. Canada geese squawk, squabble, flap their wings and stretch their necks. Some float in the creek mouth while others stand on the trail.

There are no human users in sight. Still, Mullane believes this very waterfront could be nurtured into the soul of the city — a commercial zone, a transit hub, a cushion against storm surges and an ecological preserve.

“We just need to make this a destination, and we need to create a pathway for people to get there,” Mullane says.

About a mile upstream, at the corner of Linden and the unfortunately named North Canal Street, an explosion of shattering glass from a recycling plant drowns out the roar of boulevards, the nearby airport and the freeway. Here, in the heart of “the industrial city,” native plant restorationist Ariel Cherbowsky Corkidi seems out of his element. His long hair blows past his face in the gusty afternoon wind as he stands at a steel railing over the sullen, concrete-lined waters of Colma Creek.

“It’s often hard to believe this is the same creek as up the one that begins up there,” he says with a nod at the mountain.

Cherbowsky Corkidi, who helps run a small organization called San Bruno Mountain Watch, dedicated to protecting and restoring the wild slopes overlooking the city, has been collaborating closely with the HASSELL+ team by leading high school students on tours of the Colma Creek water-

shed, from its headwaters, down the mountain and almost all the way to the outlet, just east of the freeway and rail line. Each tour has included a visit to the HASSELL+ storefront, where many of the students have posted messages on the wall photo.

Today, Cherbowsky Corkidi is accompanied by a Mountain Watch intern named Maria Meyer. They are here to take water samples from the creek and test them onsite. Mullane has provided the pair with the testing kits, and he has requested measurements of several parameters — nitrates, calcium and salinity. The nitrates are a barometer for polluted runoff from the many upstream acres of cemeteries and golf courses; the latter two will give the HASSELL+ team — thinking about rising sea level — an idea of how far inland saltwater currently intrudes from the Bay.

For Cherbowsky Corkidi, the South San Francisco Resilient by Design project has the alluring potential to not just improve the city’s resilience but also restore an ailing creek — and one he knows intimately. He has spent many hours in the upper reaches of the watershed, where open scrubland still harbors native ecosystems and clean water. He wants to transfer the biodiversity of the mountain, including native plants grown at San Bruno Mountain Watch’s nursery, to the lower miles of the creek. This vision falls in line with the HASSELL+ project.

“The mountain is our resource, with the seeds and the water we need to bring back the lower watershed,” he says. “We just need to break up the concrete.”

To take their water samples, the Mountain Watch pair lower a coffee mug tied to a string of yarn. Reaching the creek, after all, isn’t possible.

“You’re not really supposed to touch the water, and you’re a criminal if you do,” Cherbowsky Corkidi says. “It’s a strange relationship to have with a little creek.”

The beleaguered stream runs west all the way to Orange Memorial Park in an unnaturally straight line, paralleled by cement, no-trespassing signs and traffic. Downstream, it disappears from sight into a jungle of warehouses and concrete bridges.

Meyer pulls the filled cup back up and over the rail as Cherbowsky Corkidi preps the testing vials.

“It’s just water,” he says.

In his office, Mullane stands at the giant wall photo, taking in the full scale of the challenge. Major obstacles face the project — like coordinating the input from numerous public agencies that manage rail lines, highways and water. Airport officials, while very supportive, have expressed slight concern that birds — especially large ones — attracted to a restored waterfront could pose a navigation hazard.

There is much to think about, a great deal to do, many people to call, see and email. Mullane needs to go — he has a meeting with CalTrans in Oakland — and Lee has an appointment down the peninsula.

But in a moment of bright clarity, water’s relationship with geography and gravity seem to show a luminous path forward.

“It’s actually very simple,” says Mullane as he closes his computer and grabs his coat. “I mean, we know where the water wants to go.” **AB**

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N O R T H B A Y

Common Ground on a Grand Bayway?

State Route 37, the traffic-choked and flood prone highway traversing the northern Bay Area, has recently hit a new gridlock: an impasse between stakeholders about how to fix it.

"I think both sides acknowledge the sheer urgency and need to do something quickly, but they are entrenched," says landscape architect Erik Prince, speaking of the restoration groups that want the best solution for the abundant habitat and species surrounding the highway, and the transportation agencies who want the easiest fix for traffic. "There's no unbiased third party that has agency to help bring everyone together. It's almost like they need a mediator. [Our team] can be that."

Last January, the Common Ground team participating in the Resilient by Design challenge was assigned to do just that — bridge the divide over SR-37 with a design that achieves the dual goals of a resilient landscape and a highway meeting the North Bay's transportation needs. So the team members, composed of principal architect Tom Leader and landscape architects Prince, Kushal Lachhwani, and Thor Andersen hit the road to figure out how to find that balance. The four estimate they travelled 4,500 miles over the past six months, piling into Andersen's road-worn 2006 Subaru Outback to meet stakeholders, hold

workshops, and participate in public events in North Bay communities from Santa Rosa to Rancho Cordova. "It's been a lot of miles," says Prince, over laughter and groans by his team members.

And much of that travel has been on SR-37. Lachhwani estimates that the team drove the congested bayside road over fifty times; often trying to plan meetings around the fierce rush hour commute. Along the way, the team came to appreciate the area's history and beauty, from Tolay Lagoon with its sweeping shoreline view from Mount Tam to Mount Diablo, to the ghost town of Wingo, with its dilapidated cabins and old bridges looking as if it came straight out of Westworld, according to Lachhwani. And all those miles led to meetings with all types of people; from grizzled hunters who grew up in the marshes to representatives of the powerful Metropolitan Transportation Commission.

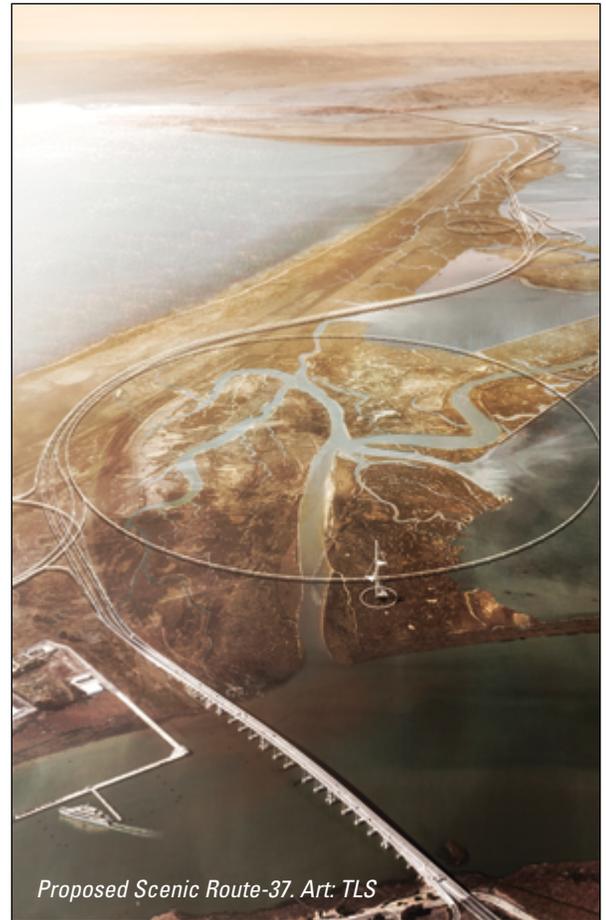
"Committing to a long-term process is like getting roommates, or driving across country in a car with different people," says Leader of the team's effort to draw on as many

local viewpoints as they could. "You'd be throwing away a lot of value by having a single-minded agenda. These [stakeholders] don't have license to think broadly about this but we do, and that's what we can bring that hopefully will be a game changer."

The Common Ground team is attempting to tie together all these stakeholders, viewpoints, and natural areas in a way that has never been done before — a tall order to achieve in six months, given that decades have been invested by all sides in advocating for improvements to the beleaguered highway.

"This is about bringing those interests together to figure out what we can do as a value add to this project," notes Andersen. "We aren't presenting something that everyone will love one hundred percent, but we are advancing a design that has something for everyone."

The team's overall design is spooled and woven from the knowledge and ideas collected in all those miles and meetings — a concept reflected in its braided cable image.



Proposed Scenic Route-37. Art: TLS



Photo: Karl Nielsen

continued on next page



On the ground, the team proposes in part to revitalize places like Wingo as a gateway to the baylands for residents and tourists, replete with experimental landscape features such as “hyper-accretion gardens” that would connect the traditional sinuous, U-shaped water channels via a levee. This adapted terrain would allow sloughs to safely flood subsided land and deposit sediment, growing marsh habitat like a garden over time.

The rift between environmental goals and transportation needs is mirrored in the Common Ground group’s overall decision to design two separate alternatives: one mimicking the highway’s current alignment but elevated twenty feet high; and another projecting what a relocated SR-37 would look like. The latter option proposes to rebuild the highway on stable northern ground where it would skirt the North Bay’s sprawling complex of connected wetlands and open space; rather than today’s road which bisects marsh near rising tidewaters.

According to Prince, a “eureka moment” occurred when the team asked the hydrology and sedimentation experts how the area and the road was going to respond to sea level rise over the next hundred years. “There were crickets in the room,” says Prince of the deafening silence that followed. “It’s such a vast area

with complex hydrology, there are so many unknowns. So it’s more of an adaptation type of strategy — learning to work with the landscape that will change. How do we do what we need to while getting out of the way?”

No matter the alignment, the design concept includes a rebranding of the area as an attraction for residents and tourists alike, in order to engage them in one of the last long stretches of undeveloped shoreline in the Bay Area. The Common Ground team calls their future vision “the Grand Bayway,” describing it as scenic road through a sort of ecological Central Park that they believe could be an attraction similar to Point Reyes or Elkhorn Slough.

“We see the Bayway as a beautiful piece of engineering that responds to the North Bay’s topography and space,” said Leader during a May 2018 presentation. “Our highway design tries to be beautiful, delicate and light, and engage with the topography of the sloughs.”

As part of their public engagement, the team worked with Susan Schwartzberg from the Exploratorium to develop a fold out “Explorer’s Guide to the North Baylands” map to highlight the area’s historical and natural sites.

“[Their design] really did open up our thinking with how to build a

constituency for the wetland restoration,” says State Coastal Conservancy Project Manager Jessica Davenport, who has been coordinating a group of agencies and organizations advocating for a conservation and restoration-friendly fix for SR-37. “They showed us that it’s not just something that’s good for the environment, but something that people can enjoy.”

Though consensus on how to fix SR-37 still hasn’t been reached, the vision of what the area could be has expanded — and its potential keeps everyone at the table and working together. “If we can get our act together, these lands [around SR-37] will have a second chance for renewal — to be like they were two hundred years ago with grand marshes that Richard Henry described as having a ‘sky blackened with birds’ and salmon jumping into your lap,” points out Leader. “The shoreline isn’t just a margin, it’s central to life.” **INP**

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S A N R A F A E L

Elevating a Canal, City, and Community

Pickleweed Park occupies most of a small peninsula at the mouth of San Rafael Creek. Like much of the low-lying land behind it, it was once a tidal wetland. To its east is a narrow band of surviving marsh, and beyond that the open Bay. But immediately to its west, sitting just above or even below sea level, are tens of thousands of people, including many of Marin's poorest. Save them, Bionic Team realized, and you save San Rafael.

A year ago, when the Resilient by Design challenge was just beginning and teams were touring potential study sites, Marcel Wilson of San Francisco landscape architecture firm Bionic started with a question.

"We built a team around an issue, not a place," he says. "Our question at the time was, 'What are the lowest areas that need help first, and why?' If the Bay Area doesn't respond in these places, in which it's abundantly obvious, then how are they going to respond to the rest of them?" This line of thinking led to five potential hot spots, Wilson says, "but San Rafael in our opinion needs it the most."

For the Latino and Vietnamese immigrant residents of the Canal district, sea-level rise is an existential threat — not by the end of the

century, but now. Projections indicate that the area behind Pickleweed Park along the south bank of the San Rafael Canal, which juts inland about a mile and a half, could see severe flooding with just ten inches of sea level rise.

After studying the city and its strengths and vulnerabilities, Bionic Team developed a plan: an innovative way to preserve the city for everyone, in an ecologically sound manner, by elevating parts of the city, redeveloping others, and, ultimately, retreating from portions of the existing shoreline. The team's ambitious proposal hinges on five near-term — and feasible, Wilson stresses — pilot or catalyst projects to both buy time and set the stage thematically for San Rafael's continued evolution throughout the century.

"The easiest solution ... would be to ... gate off the creek, raise the levees, and proceed with life as it's known today," Wilson said when unveiling Bionic Team's proposal at the RbD final presentations. "But to continue with this paradigm would compound risk. It would further separate the city from its waterfront. It would eradicate coastal habitats and ultimately become obsolete, leaving fewer options for future generations.

"Finding a new paradigm is the challenge for San Rafael," he continued, "and we think the paradigm is life with the Bay."

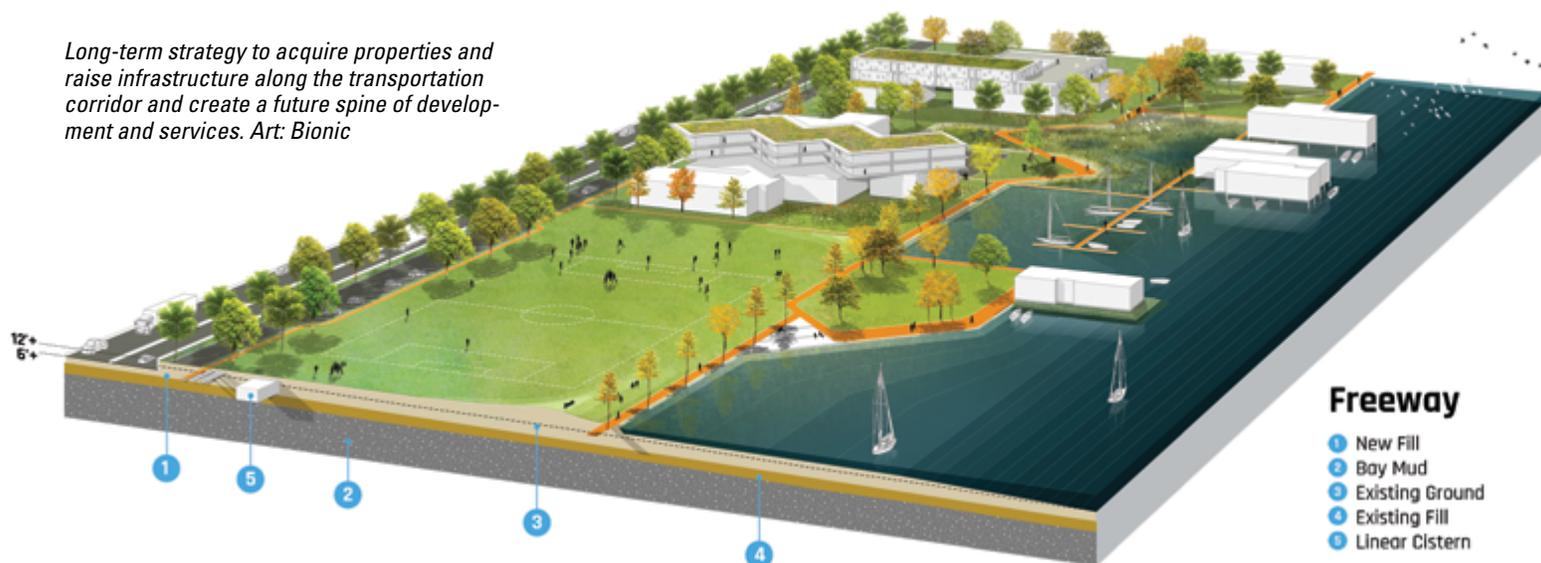
If nothing is done, life with the Bay will come soon — as early as 2030, according to a recent county report — and not on San Rafael's terms. Already the Canal district relies on a network of pumps to stay dry each winter; built atop a former mudflat and actively subsiding, it's a bathtub with a dozen drains. Sea-level rise could soon render Marin's densest neighborhood all but unlivable. And since many can't afford to live anywhere else in the county, displaced residents could be lost for good.

Such a fate would be disastrous for the entire city, which serves as Marin's county seat and economic engine, and not merely because it would lose the labor and culture generated by one of its most vital neighborhoods. If the Canal district floods, so too could the adjacent 101-580 freeway interchange, a critical transportation corridor for arguably all of coastal Northern California that helps this city of 59,000 play an outsized role in statewide commerce, tourism, and transportation.

Commercial districts and light-industrial areas surrounding the Canal community are also in harm's way. Later in the century, downtown San Rafael and its new Sonoma Marin Area Rapid Transit (SMART) station would be next. In all billions of dollars worth of property and infrastructure are at risk.

continued on next page

Long-term strategy to acquire properties and raise infrastructure along the transportation corridor and create a future spine of development and services. Art: Bionic



Proposed Class-I Bay Trail bikeway on Canal Street doubles as a raised levee, providing flood protection and access routes during high water, and incorporating raised and upgraded utilities. Art: Bionic



"Everything flows through this place, and the region needs to value San Rafael and its infrastructure as it does San Francisco and its seawall or Oakland and its deepwater port," Wilson said during the presentation.

If San Rafael is a bellwether for the Bay Area's success at staving off the worst effects of sea-level rise, then so too is humble Pickleweed Park for San Rafael. Sports fields and a playground provide vital open space and recreation opportunities on the edge of the Bay and the Canal district. The park's newer community center and frequent events help build cohesion within neighboring communities, which many experts consider a key factor in climate resilience. If Pickle-

weed continues to thrive throughout the century, there's a good chance the Canal and Downtown districts do, too. If Pickleweed Park becomes a casualty of sea-level rise, San Rafael may still survive, but projections indicate it will be crippled.

That's why Bionic Team proposed upgrading and protecting what it considers San Rafael's most resilient existing infrastructure as one of five near-term "catalyst" projects. The park would gain new fields and facilities, an upgraded pump station, and a restored marsh. Perhaps more importantly, in a disaster it could function as the city's emergency response center.

The significance of Pickleweed Park to San Rafael is also what brought Wilson and colleague Sarah Moos Thompson, local schoolkids and community activists, and several hundred regular folks, strollers and all, to the park's picnic tables one Saturday morning in March. They came to talk floods: floods from rainfall if pumps were to fail, and floods from storm surges and sea-level rise if the canal were to spill over its banks.

Bionic Team in particular sought not so much to educate, says Moos Thompson, a senior associate with Bionic, as to listen and to learn. "All of these people live in San Rafael," she says. "They know where flooding happens, and where traffic and



Photo: Kingmond Young

congestion happens. We don't want to presume that we know that information, so we think it's important to ask those questions and hear from people who live there. What do they want to save, and what do they need to make their lives better in the near term?"

Also at the fair, students from nearby Laurel Dell Elementary School spent the morning interviewing community members about sea-level rise. One resident revealed she'd learned that day just how much the Canal neighborhood is at risk of flooding. Others, including fellow students, explored ways of preparing or raised concerns that their own homes would flood. In a separate exercise, Laurel Dell fourth-graders imagined paddling boats to school.

Hosting the event required collaborating with local organizers and experts like Shirl Buss, a San Rafael-based architect and urban planner who led the students' efforts through a UC Berkeley-based educational program called Y-Plan (see page 32); and Douglas Mundo, a longtime Canal resident with strong connections in the Latino community who was key to attracting so many locals to the fair.

Through the disaster-resilience nonprofits ShoreUp Marin, which Mundo co-directs, and Canal Welcome Center, which he founded and still leads, he helps draw low-income, Spanish- and Vietnamese-speaking community members into broader discussions about disaster-preparedness, climate adaptation, and infrastructure — the sorts of conversations from which the voices of the marginalized are often absent.

Even after the RbD challenge has closed shop — after all, the timeline was too short to do all that needed to be done, Mundo says — he'll continue to advocate for Canal residents and fight against displacement. "We are interested in ensuring the underserved community in the Canal district can understand what's going on, provide feedback, and raise their voices when the community is not fully being taken into consideration," Mundo says. "We hope that people will get more engaged and say what is best for them and for their community and for the families that live and work here."

Another key contact for the team was Jeffrey Rhoads, an architect and executive director of the organiza-

tion Resilient Shore, which supports collaborative solutions to sea-level rise in San Rafael. In other words, he helps wrangle stakeholders, of which there are many due to the reach and severity of projected flooding: business and maritime interests, environmental groups, the sanitary district, the school district, landowners, immigrant communities.

"All of them have different needs and objectives, but all of them have a stake in adaptation," Rhoads says. "The challenge is to get people to come together and to learn together; that should drive a planning and design process, where a number of different alternatives are ultimately developed."

flood protection and elevate underground utilities; and installing floating islands along the canal to further create habitat and reduce erosion, as well as encourage the city to face and embrace the waterway.

Perhaps the most controversial part of Bionic Team's plan will be to allow some hazard-prone parts of the city to flood — in other words, to return the land to the Bay, though floating or raised structures could technically remain — in a gradual process facilitated by subsidies and incentives. The city, county, and state will also need to lead through policy creation, property acquisition, and



Pickleweed Park as an emergency response center during a disaster. Art: Bionic, RbD

After a year of work, one of these visions comes from Bionic Team. By the end of the century they see a city with elevated structures, floating homes, and canals in place of streets. They see a revitalized shoreline with new wetlands and improved public access. At the middle of it all they also see a new multi-benefit structure providing flood protection, recreation, mobility, habitat, and more, a central spine along which everything else is aligned.

But first, starting as soon as possible, along with upgrading Pickleweed Park the team proposes building new affordable housing on an underutilized site south of the canal that will also provide flood protection, parking, and a new marsh; expanding an existing pilot project off the San Rafael shoreline to absorb wave energy, reduce erosion, and provide habitat through constructed reefs; completing the Bay Trail through San Rafael to double as

rezoning, creating additional potential friction points.

With the RbD process now officially ended, Bionic Team plans to remain a presence around town. On the horizon are more public meetings, grant-funding cycles, and an update to San Rafael's general plan. "We'd like to continue to work with the city on their resilience thinking," Wilson says. "We're trying to show how invention and creativity has agency to crack some of these really difficult situations." **NS**

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I S L A I S C R E E K

Hyper-Creek Mediates Hazard Sandwich

Offered iconic locations like Fisherman's Wharf, Crissy Field or Mission Creek, the Resilient By Design team BIG + ONE + Sherwood opted for Islais Creek, a watershed not on most tourist itineraries. "This was the place closest to home that needed the most love," says Bry Sarté of Sherwood Design Engineers (San Francisco, New York City, and Houston), part of a consortium that also includes Bjarke Ingels Group (Copenhagen and New York) and One Architecture & Urbanism (Amsterdam and New York).

Situated between trendifying Dogpatch and struggling Bayview-Hunter's Point, the Islais basin is "the biggest watershed in San Francisco, and it's been totally abused," Sarté continues. "It's also the home of the most disadvantaged community in the city." Add periodic flooding, sea level rise, and earthquake effects on liquefaction-prone fill, and you have what he calls a "hazard sandwich." Building resilience to climate change while addressing job loss and displacement won't be quick or easy. The Islais team has proposed a constellation of pilot projects to

kick off a long-term process toward a resilient Islais Creek basin.

Islais isn't their first joint venture. After Hurricane Sandy, BIG and ONE collaborated in New York City's Rebuild By Design initiative, developing the "Big U," a proposed hybrid of seawall and parkland for Lower Manhattan. BIG, writes Jeff Goodell in *The Water Will Come*, is known for its "playful, slightly surreal buildings." Between them, the two firms have been involved in projects from China to Canada: restaurants, urban ski slopes, museums, hospitals, high-rises. They joined forces with Sherwood for the Resilient By Design competition.

"In New York people had just experienced Sandy, and the projects there had a very engaged community because they had been through a lot," ONE's Matthijs Bouw recalls. "San Francisco, with no immediately preceding disaster, necessitated a look at a longer time frame and a much larger area."

These days Islais Creek is mostly invisible, culverted and paved over between an open reach upstream

in Glen Canyon and its outfall in the Islais Channel near Third Street. But holly-leaf cherry trees — "Islais" is a Hispanicized version of their Native American name — once lined this historically sizable creek's banks. After the Gold Rush, creek water irrigated the Bayview produce gardens of Portuguese, Italian and Irish growers. Soon, befouled with sewage and offal from the slaughterhouses of Butchertown, Islais became the kind of creek you don't want to be up without a paddle. After 1906, its channel was "reclaimed" with rubble from the earthquake and fire.

Then came the modern Port of San Francisco, the treatment plant that handles 80% of San Francisco's wastewater, and the Hunters Point Naval Shipyard, closed since 1974 but still a pivot of controversy over a questionable cleanup. The city's largest remaining African-American community grew around the shipyard. Many residents hold some of the 22,000 local jobs in the production, distribution, and repair (PDR) sector, and there's a thriving arts scene. But parks and other amenities are scarce, the shoreline is mostly inaccessible, and freeways make formidable barriers. The neighborhood bears the scars of its industrial history, with some 200 contaminants identified by the EPA and higher rates of pulmonary disorders (including childhood asthma) and other diseases than the city as a whole. Recurrent floods are only a taste of a future of higher sea level and extreme weather events,

and rising groundwater levels in a substrate that's mostly fill amplify the risk of earthquake damage.

How do you repair the environmental harm, restore the creek, protect the Port from the rising Bay, preserve jobs that would be lost in a full-retreat scenario, and connect Bayview-Hunters Point with the rest of the city? The team began by enlisting community partners, notably Resilient Bayview and the local chapter of the A. Philip Randolph Institute, and launching a marathon of neighborhood events. "We met with everyone who would take the time to meet with us," recalls Sarté. APRI's Jackie Flin describes sessions with "grandmothers, grandsons, fathers, the youth who will be impacted 10 to 20 years from now."

The designers also analyzed current land use in the Islais basin, 650 acres of it city-owned. That led to the insight that space was being used inefficiently, and that vertically stacking PDR operations would make room for parks and open water. It also helped crystallize ideas for the pilots, first steps in a decades-long process.

One pilot, with potential funding through the Public Utilities Commission's capital improvement program, reinvents the Southeast Treatment Plant with a "Living Levee"—a mash-up of the living shoreline and horizontal levee concepts—and vegetated treatment ponds. "It's a great opportunity to pilot secondary and tertiary forms of treatment along the creek itself while changing the plant from a complete block within the neighborhood to a destination," BIG's Jeremy Siegel explains. Living Levee precedents include the East Bay's Oro Loma facility. Configured to let upstream flows move through an elevated berm network, it would protect against sea level rise while functioning as an adaptive edge. Along with decking over the plant, the levee would provide badly needed parkland: what

Sarté calls "a place for living, a social ecosystem."

The Islais Creek Gateway pilot at Pier 80, now home to a mural-covered grain elevator, would combine tidal marsh restoration (potentially eligible for Measure AA funding) to buffer storm surges with stacked shoreline work facilities (see below right). Like nearby Heron's Head, the marsh should attract wildlife, although probably not the European white storks shown in an artist's rendering. Other pilots include a River Park along Cesar Chavez Boulevard, with consolidated vehicle yards along a daylighted Islais Creek; water reservoirs and affordable housing near the Alemany Farmer's Market; a modernized food-and-logistics version of the San Francisco Produce Market; and an innovation center at Warm Water Cove. After the pilots comes a suite of medium- and long-term projects. "We see the medium-terms built or underway by the mid-2050s," Sarté forecasts.

It's a blend of hard and soft approaches to resilience: on the hard side, raising the seaward edge of the Port lands; on the soft, re-creating tidal wetlands and the stormwater-retention function of Islais Creek. The designers talk about working down from the top of the watershed as tidal marsh expands inland, creating habitat corridors. The new "hyper-creek," as they call it, is the link. "It's a hybrid of a lot of different things, [where] urban, social, ecological, infrastructural systems all connect," says Sarté. Adding job creation, affordable housing, recreational amenities, and improved public transit will offer social connections to parallel the ecological ones.

City agencies seem supportive: Port and Planning Commission officials and the city's Chief Resilience Officer joined the design team for the rollout. Speaking for the basin's

biggest landholder and potential host to several pilots, Port Resilience Program Director Lindy Lowe sees no conflict with current uses. "One thing I like about the way they took the challenge on is that it's not either industry or ecology," she says. "We can do both; let's test out how." At this point, the Port isn't committing to hard options like seawalls and is working with other stakeholders to identify priorities and possible solutions. As for public access, Lowe notes some Port-owned parks are underused; expanding that would require "creating connections and services that will make it an appealing open space."

For many at the team's neighborhood workshops, gentrification and displacement were more immediate concerns than climate change. The ghosts of the Fillmore and South of Market—the first destroyed in the name of urban renewal, the second transformed from a low-rent hood to a pricey tech hub—haunt any discussion of large-scale change in San Francisco. "It's important to acknowledge urban development in the last decades hasn't worked well for this community," says Bouw. "There's deep suspicion about promises made and not fulfilled in the past." The team believes their outreach has paid off. "It's helping to build trust and community," Sarté says. "People are engaged and interested, excited to have their voice heard, even activists who are used to stopping projects." APRI's Flin credits the team for "having those hard conversations prior to talking about kayaks." What's proposed is ambitious and not without risk. For Bouw, though, "Not doing anything is not viable." **JE**

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Photos and art: BIG+ONE+Sherwood



Photo: Kingmond Young

M A R I N C I T Y

A Peek into the Beautiful Future?

When Terrie Green speaks, whether it's on stage at the SF Jazz Center or from a lunch table at MLK Bayside Elementary, she commands attention. Green is the co-director of Shore Up Marin, a local environmental justice organization, and as she'll tell you, she's lived in Marin City for 69 years. She understands Marin City's assets and needs because she lives with them firsthand. Regardless of who Green is addressing, she speaks to everyone as an equal. It's "straight talk," as one Resilient By Design (RbD) panelist notes. When she addresses the final RbD showcase on May 17, she sucks the air out of the SF Jazz Center. "What we need is folks like you all, you all sitting in the room right now. When I talk about champions, we need folks to just get up out of their comfort zone, do something different, embrace the communities like ours in Marin City," requests Green.

The "comfort zone" of business as usual has never served Marin City well. Now, Green and her community have their sights set on building an entirely new paradigm, in-house. They, along with RbD's Permaculture + Social Equity Team (P+SET), are trailblazing a community-led design process for resiliency planning.

Addressing RbD's international panel of judges, Pandora Thomas introduces her design team's work by posing a question. "What does it look like in resiliency planning when community voices take the lead?"

Thomas heads up P+SET, which has partnered with the Marin City community in the Resilient By Design challenge. She also feels like part of the community; these folks are her friends, her people. The brand of resilience that Marin City espouses is non-negotiable local.

"We must know from where we came in order to move forward," says Thomas, speaking of the centrality of sankofa in building resilience. Sankofa, a Ghanaian Twi word, refers to place and history.

Marin City is predominantly African-American, and as locals frequently mention, it was originally a ship-building community. Many people who live in Marin City today are descendants of WWII shipbuilders; many were barred from leaving by redlining and racial covenants.

To build local capacity in Marin City, P+SET held a community course that covered permaculture design and advocacy literacy. The permaculture course taught locals to assess flood risks and then apply natural strategies to prevent floods. Looking around Marin City, its flooding problems come as no surprise; the city bears an obvious resemblance to a bowl, with runoff flowing down steep mountain slopes on three sides. From the other direction, Richardson Bay overflows Highway 101 to flood the city. The flood zone includes the school, churches, apartments, shopping center, and the only entrance and exit into Marin City.

As P+SET's permaculture class shared, certain natural strategies, if applied and kept up by the community, could help with the flooding problems. Class participants considered everything spanning brush plugs, rain gardens, rain cisterns, curb cuts, and more. All of the strategies help to slow, store and sink water, which diverts it from flooding.

The classes took place at the local elementary school. The day I observed was like a family gathering. People showed up in sweatsuits and T-shirts. When they spoke, they dealt in straight talk. Black faces filled the room. There was no hustle or fronting; no competition. A sense of urgency was palpable, but it was quiet and focused. People had gathered for a shared reason: to protect their community — the family and friends that surrounded them.

At one such class, a woman named Connie arrived with her daughter and her daughter's daughter. She showed up to look out for them, but she says it is also important for her daughter to "take up the torch" to protect the Marin City they call home — from acute storm events, or gentrification. Three generations is a profound investment in Marin City's future. Carrying the torch means making sure surrounding municipalities take this community's needs seriously.

When Shore Up Marin's Green says "legitimacy is an issue, a question, a need" in a class discussion, everyone in the room understands what she means.

Tucked away from the road, it is easy to miss Marin City driving past it. Much of the city's public housing was built shortly after WWII and infrastructure problems are commonplace, like the runoff drain pipes that are too small to prevent flooding. Added together, the problems in Marin City are more than just nuisances. On the CalEnviroScreen 3.0 map of environmental risk, Marin City clearly stands out from its surroundings, a light chartreuse to the rest of Marin County's dark green. A low income community of color in a predominantly white affluent county, Marin City has experienced comparatively lower family incomes, lower life expectancies, health disparities and major disinvestment over the years. These disparities translate into a 31-40% range of risk, while the

neighboring Mill Valley falls into the 1-10% range of risk.

It turns out resilience looks different depending on where you're positioned — be it in an at-risk community, in a county office, or at an international resilient design event. At the the RbD showcase at the San Francisco Jazz Center this May, it looked like an international, cosmopolitan mixer abuzz with networking. People sported hip business casual and sipped the Ritual coffee provided. A clear majority of white faces looked out from the crowd. Sitting through the final Resilient By Design showcase, and listening to the various design teams present, I realized that the meaning of resilience is contested.

Mainstream resiliency planning tends to be oriented around the future — what new risks are coming? What new impacts will emerge? However, I observed that in the community, the focus is wider, with more awareness of the past and how it informs the present. In Marin City, this means feeling the rootedness of the tight-knit community.

What good is effective flood mitigation for the community if its mem-

bers can no longer live in Marin City because of gentrification? Or perhaps more to the point, what would it mean for community members to apply their permaculture training to retrofit Marin City and then get displaced? As Zared Lloyd, a permaculture course participant put it, "if we fix it, we should own it."

P+SET has worked with community members to develop a people's plan. The plan articulates community needs and serves as a foundation for planning. It's a starting point for agencies, developers and designers to work with community from the outset of any project. According to P+SET designer David Cody, such a plan is "truly inclusive with the needs of everyone met" and is a step towards making community-led design a part of business as usual in resiliency planning.

Allison Brooks, executive chair of the RbD board, is aware of the critique that RbD inherently assumes expertise lies outside a community. In response, she draws an analogy: if climate vulnerability were a toothache, "you'd go see a dentist," she says. In Brooks' view, why not solicit the expert knowledge and resources of international designers, engineers and architects?

For many communities, acceptance of outside power coming in gets complicated when a community's self determination is threatened, or when displacement via gentrification is already a looming threat. But in this case, Marin City invited P+SET to work with them, which helped set up a foundation of mutual trust and respect. According to Shore Up Marin's Terrie Green, "It's a real relationship that says we care about your community. We don't normally get that from groups."

As Thomas explains it, "no longer is there this idea of only experts coming in to save us and save the Bay Area. Now it's the homegrown expertise partnering with other

experts, starting with the homegrown people living with these issues, experiencing them day by day." P+SET's goal, in helping to cultivate local expertise, is to build something sustainable.



Photo: Karl Nielsen

Terrie Green speaks in Marin City.

The people's plan for Marin City is a living document that outlines community-designed solutions to local issues. Currently, it includes six intervention sites, but it will evolve as the city changes and solutions get implemented. Marin City aims to get the people's plan officially incorporated into standard planning process, which would give local residents a voice in any major project from the beginning.

In the past, the onus has always been on the community to find and attend agency meetings and town halls in order to advocate for themselves. Advocacy can be "a full-time job" for community members quips Thomas. The people's plan flips the burden of responsibility. "This has never happened before," says Green.

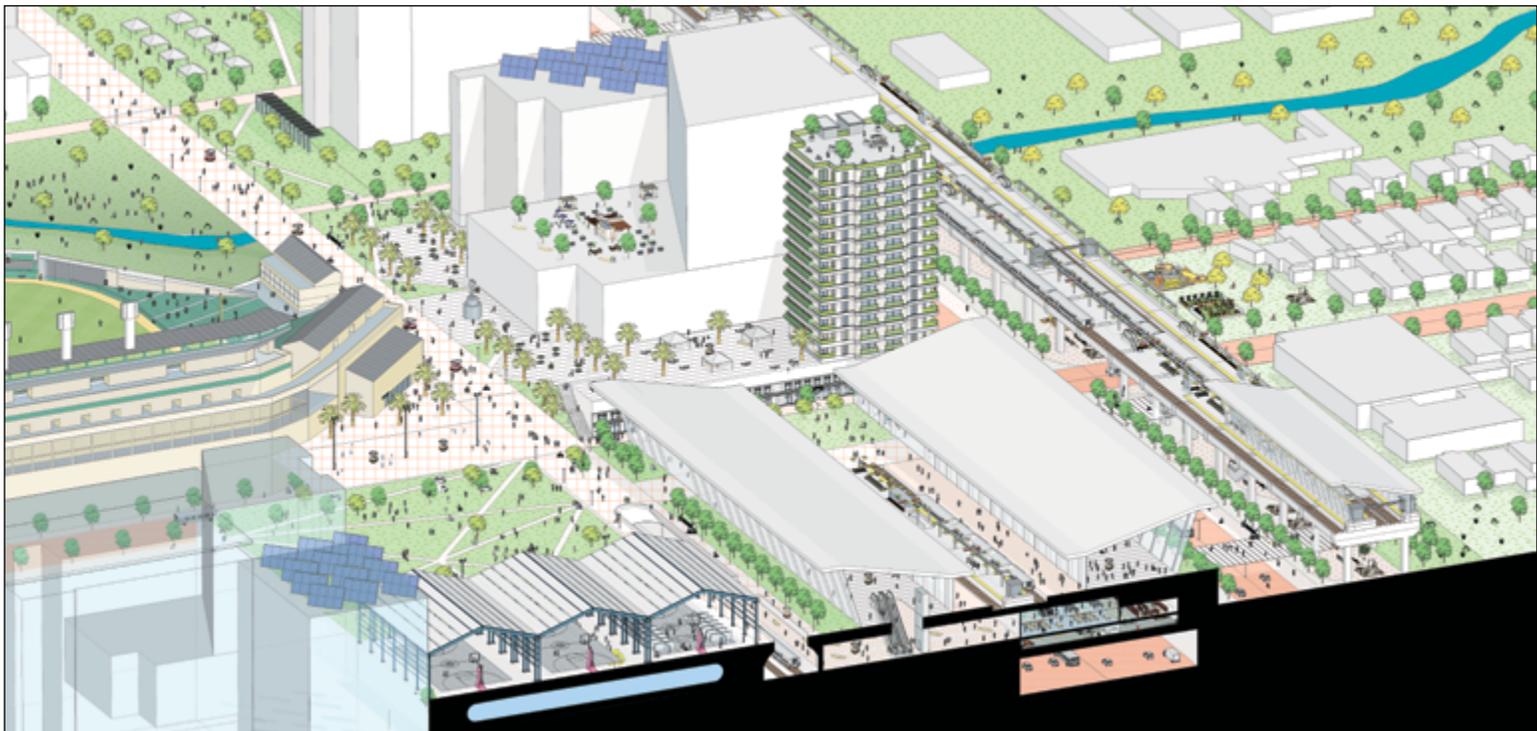
Representatives of the flood authority, Marin County Supervisor Kate Sears and others are publicly supportive of Marin City's innovative work. Kelly Malinowski of the State Coastal Conservancy hopes it represents "a paradigm shift in planning" and "a peek into that beautiful future." Impressed with their work, she has reached out to Green to encourage Shore Up Marin to apply for a grant. If funders are taking the initiative to reach out to Marin City (rather than the other way around), perhaps some part of the paradigm is beginning to shift. **AMYB**

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PEOPLE'S VISION: www.resilient-bayarea.org/regional-resilience/
RELATED: www.shoreupmarin.org



The team examines an undersized storm drain in "the bowl" of Marin City. Photos and art: P+SET



S A N L E A N D R O B A Y

Three Cities Confront Common Estuary

The All Bay Collective's Claire Bonham-Carter likes to tell the story of when her team met with Oakland Mayor Libby Schaaf to discuss flood vulnerability and resilience around the San Leandro Bay. 'Where's that?' asked Mayor Schaaf.

Understanding that most local residents, and the mayor, refer to San Leandro Bay as "the estuary" was just one of the many lessons learned by the All Bay Collective team and their community partners during the Resilient by Design challenge.

"[The San Leandro Bay] has three different cities as stakeholders — the City of Alameda, the City of San Leandro, and the City of Oakland," explains Bonham-Carter, a native of Kent, England and principal at the international consulting firm AECOM. "It has massive infrastructure — the Oakland airport, the BART station, two major roadways, the Union-Pacific/Amtrak [rail] lines, the Coliseum and Oracle stadiums ... I don't think there's another site which has such complexity in it."

But to Colin Miller, the thoughtful and frank coordinator of the Oakland Climate Action Coalition and commu-

nity advocate in the All Bay Collective project, the flood vulnerable mega-infrastructure isn't what makes the area unique.

"I think it's the people that really make it special," says Miller. "East Oakland residents are already resilient because they have survived decades of redlining, disinvestment, and neglect that are the result of targeted, systematic racism. East Oakland is the last frontier of gentrification in Oakland, given the housing market right now and the fact that there still is a significant majority of people of color who have been able to stay."

Miller and the other All Bay Collective community advocates — Marquita Price from the East Oakland Collective, Beth Teper from the Brewer Dellums Institute, Merritt College, and Greg Jackson the founder of Repaired Nations — pushed the All Bay Collective team hard from the start to consider equity and social justice in all aspects of the project.

As a result, the team considered ideas large and small, from moving the low-lying Interstate 880 inland and turning it into a tunnel; to smaller projects such as developing a range of indicators for the community to use to assess future project proposals and alternatives.

"One of our big ideas was to realign and cover the I-880. The freeway is only one foot above King Tide level today, so Caltrans is going to have to do something significant soon. Realigning the I-880 would not be easy or cheap; but would have the added benefit of re-connecting the East Oakland community with the shoreline, and of putting a major contributor to poor air quality



underground,” says Bonham-Carter. (see graphic left, showing multi-modal transit hub concept, with I-880 underground). “But we’re also thinking about the governance and financing that you’re going to need to have some of these things happen.”

In addition to working with the community organizations, the All Bay Collective included Kristina Hill and Nicholas De Monchaux at the University of California at Berkeley; and Janette Kim and Neeraj Bhatia from the California College of the Arts, who contributed different components of the project.

The overall result developed by the collective is a concept called “the Estuary Commons,” which proposes to build tidal cities — pre-assembled housing units floating on excavated lagoons, able to adapt to rising waters and safe from liquefaction and contaminated soils (see rendering below left). According to the team, cooperative financing and governance structures such as community land trusts and geological hazard abatement districts can be used to prevent potential gentrification and displacement that often occurs with large investment and improvements to vulnerable areas.

But a huge part of the process was working with the community advocates to realize how the All Bay Collective’s design concepts would actually work amid the realities that East Oakland faces.

“I think [the team] understood there was a housing crisis, but they didn’t fully grasp the importance of acknowledging the potential for displacement and gentrification as a result of [their proposal for] floating tidal cities, for example,” says Miller. “We were advocates seeking to educate the very well-intentioned people in the All Bay Collective group who were not as

familiar with what the people’s lives in East Oakland are actually like.”

One part of this education was pointing out the inequity inadvertently built into the regional Resilient by Design process itself, where teams had to focus on research and site selection first. Only during the design phase in the last four months of the process did community input ramp up in the rush to completion. There were a lot of ups and downs, and a few stand-offs along the way.

“It was a slow start for us to get engaged with the East Oakland communities,” acknowledges Bonham-Carter. “We recognized at the beginning that five months is a really short amount of time to get input, to co-create, to develop relationships and understand the issues more.”

Another frustrating component of the design challenge process for the East Oakland community organizations was the disparity in funding.

“The design teams are given \$250,000 [by the Rockefeller Foundation], whereas community groups are offered about \$40,000,” points out Miller, which for Oakland was split between fifteen organizations. “Think about the inequity in that assumption that community groups don’t have expertise that’s worth paying for; and that we have to donate our time to a process that we had not been invited to participate in until the last several months.”

Bonham-Carter points to the positive relationship the team has since formed with the community advocates, and optimistically points out a long list of opportunities and benefits the collaboration has produced, ranging from the “In it Together” game (see page 22 and photo lower right) community groups can use in their planning work, a checklist of community indicators to assess proposed project resilience and

equity, and above all the multiple new partnerships that have formed around the project.

“There are commitments from UC Berkeley and the California College of the Arts to talk to community-based organizations in order to base their studios around community needs,” she says. “We’re committed to continuing to work with the community to enable conversations going forward for our concept and other planning efforts around San Leandro Bay.”

But Miller is less clear regarding any tangible benefits the Resilient by Design process has left for the communities. “Umm, I think the game might be useful,” offers Miller, after a pause to think. “Hopefully we can use that in our planning process. The community indicators tool could potentially be useful — I think it remains to be seen.”

Like Bonham-Carter, Miller points out the relationships formed during the process is a benefit. However to Miller the benefit is not for advancing the team design, but helping East Oakland community organizations prepare for their recently received transformative climate communities grant, which aims to place communities in the center of the planning process.

At the conclusion of the Resilient by Design competition, an extravagant soiree held at a former airplane hangar converted to an Alameda winery’s event space, the All Bay Collective members accepted a commemorative plate from Henk Ovink. The Netherlands judge exuberantly complimented the team on having “the most Dutch” design, likely referring to the concept of floating homes and cooperative financing, which have been used in the Netherlands.

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Floating cities rendering and community engagement photos: All Bay Collective

While the Dutch are leaders in flood design worldwide, and while Ovink surely intended it as a compliment, the comment did seem a little out of sync with local fears about gentrification. Late this May, however, community groups did agree to continue working together towards building a more climate ready Oakland. "At this point, the [Resilient by Design] process has forced us to organize with each other more quickly than we might have otherwise," says Miller, pointing out

a positive outcome. "[East Oakland community organizations] got practice working with each other, and in building relationships and trust. And relationships with individuals that have been part of the All Bay Collective team as well will prove fruitful and continue. Hopefully members of the team will continue to collaborate." **INP**

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RELATED: **Communities Confront Water and Gentrification in the Coliseum Zone**
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CLOSEUP

Game Night at the Coliseum

It was game night at the Coliseum, and many of Oakland's heaviest hitters were there. Except the game wasn't at the Oakland Coliseum, but at the Coliseum BART station. The heaviest hitters weren't power hitters swinging at baseballs, but rather community leaders and environmental activists taking cuts at sea level rise.

On Thursday, May 10th, members of the RbD challenge's All Bay Collective set up shop in the Coliseum station's main vestibule and unveiled a new game: "In It Together."

The game uses objective-based, cooperative gameplay to foster dialogue about climate change's effects

on the neighborhoods surrounding San Leandro Bay. With each player representing a region around the Bay, such as Alameda, East Oakland, or the Oakland Airport, the game's progress quickly becomes an interlocking mesh of alliances, promises, and compromises.

"It's a role-playing game," says Janette Kim, All Bay Collective team member and co-author of "In It Together." From an educational standpoint, the purpose of the game is to "view goals from somebody else's perspective."

Part of the challenge lay in balancing a community's immediate needs with long term resilience as the bay shoreline encroaches. "We played the game with some high schoolers," says Kim. "They could see how hard it was to balance day-to-day challenges with long-term goals." For example, she re-tells, while schools and grocery stores

thrived under this high-school leadership, communities soon found themselves battling much higher shorelines.

Holding the event at a BART station lent it a sort of stark poignancy. Careful in-game attempts at traversing cross-city politics were frequently drowned out by the roar of trains on the overhead track. Commuters seemed tired and few paused to inquire about the event.

"Community engagement is the last piece of the puzzle," says Colin Miller, coordinator of the Oakland Climate Action Coalition. His concern was perhaps best summarized by a middle-aged black woman leaving the BART station. She spent a few moments shouting towards the event table, putting a stop to the game demo while people looked on. She left quickly, and there were no further incidents, but the criticism seemed

clear: "I don't know what this is, and I don't care to."

Without a constant, open dialogue, says Miller, "there's the possibility for well-intentioned efforts to exacerbate existing problems. The heart of the question is ensuring the people [in East Oakland] benefit from changes made."

MHA

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Photo: Sara Laffleur-Vetter



A new form of urbanism for Silicon Valley — protective, porous, interactive and biodiverse. Art: Field Operations

S O U T H B A Y

Swaps and Sponges Create Absorbing Plan

Tucked between Palo Alto, Menlo Park and the Bay, East Palo Alto is in some ways a microcosm of Silicon Valley's most pressing social and environmental issues. Long home to low-income, primarily minority communities, the city now faces development pressures, rising rents and the displacement of longtime residents thanks to the area's housing shortage and the proximity of technology behemoths such as Facebook. And as one of the lowest-lying communities in the Bay Area, East Palo Alto is also ground zero for sea level rise in the southern part of the Bay.

Although located at the northern end of the 20-mile stretch of South Bay shoreline that was the focus of the Field Operations Team's Resilient by Design project, in many ways East Palo Alto is at its heart. Much of the public engagement effort that was central to the Team's work was focused on East Palo Alto communities, and the Team's recommendations for moving ahead are designed to ensure that the city's vulnerabilities are a priority.

The Field Ops Team's design, entitled the South Bay Sponge, uses nature as the primary mechanism for adaptation and resiliency. "Nature is one of the South Bay's most effective tools for addressing sea level rise," says the Field

Ops Team's Richard Kennedy. "The sponge metaphor conveys the idea behind our proposal." The design calls for a network of marshlands, restored salt ponds and new tidal wetlands stretching from Menlo Park to Santa Clara and tying into existing efforts such as the South Bay Salt Pond Restoration Project and the work of the San Francisquito Creek Joint Powers Authority. To manage freshwater flooding, the plan would replace the area's channelized creeks with absorptive micro-deltas and retention basins. "It's visionary and thought-provoking," says the Bay Area Restoration Authority's Dave Pine. "The size and scope is far beyond our current thinking."

John Bourgeois of the State Coastal Conservancy believes that the scope of the project is valuable, but also carries inherent limitations. "The value of the Team's work was in looking at the broader scale, putting together concepts and projects that are already underway and trying to fit them into a more holistic vision. But because they were working at a such a large scale, they didn't get into the details the way some of the other RbD teams did."

Possibly the most ambitious aspect of the plan is its call for land use swaps that move structures away from the water's edge to create

high-density, transit-oriented development further inland and make way for new absorbent landscapes that also connect communities to the Bay. Pine for one thinks realizing that vision would be politically challenging. "These are significant land use adjustments, and for them to be implemented would require substantial government involvement. It's hard to see it happening entirely voluntarily."

In a related concept that addresses the scarcity of soil for large-scale projects, the plan also calls for "soil swaps," whereby soil from low-lying, underdeveloped areas is used to create higher ground for development and protection, and the low-lying areas become parts of the Sponge (see online RbD-Technical Jewels slide show). Kennedy notes that Google, which is looking to build a new campus that has ecological values, has just purchased more than \$800 million in property in Sunnyvale's Moffet Park and has more than \$1 billion in leases at Moffet Field, creating an unprecedented opportunity to apply land swap and soil swap principles.

"This scale of work needs an enormous amount of public support," says Kennedy. To communicate both the threat of sea level

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rise and the proposed solution, the team undertook an ambitious public engagement effort that included the Sponge Hub (see below), an Air-stream trailer wrapped in florescent green, sponge-textured vinyl. Every weekend during the past winter and spring, the Sponge Hub visited farmers markets, churches, high school sporting events and locations along the Bay Trail, giving out green cotton candy. “The Hub was just weird enough to draw people in and open their minds to the conversation about sea level rise,” says Kennedy.

Because East Palo Alto is the South Bay city most vulnerable to sea level rise, much of the outreach effort was focused there. Unlike in other communities encompassed by the project, many homes are located right along the Bay’s edge, and the city already suffers severe flooding along San Francisquito creek during heavy rains. Nevertheless, “most East Palo Alto communities were not aware of their vulnerability” to sea level rise, says Violet Saena of Acterra, a Palo Alto-based education and advocacy group that worked with the Field Ops team on public outreach. Andrea Baker, another community engagement liaison for the project agrees. “Many folks living East Palo Alto are dealing with day-to-day issues of resilience—housing, transportation, homelessness, education. It’s difficult to get folks to focus on sea level rise because there are so many more pressing survival issues facing that community.” One challenge is that the city itself does not have the institutional capac-

ity to raise awareness of the threat. “The city does not have financial resources; it also only has one person who deals with environmental issues,” says Saena.

In addition to taking out the Sponge Hub, the Field Ops Team also held dozens of community meetings, workshops and discussions. The meetings featured interactive techniques such as graffiti boards and a “Make the Edge” table, which let participants use cards representing different land uses to create a vision for the shoreline. A water table featuring natural sponges, pool noodles and melting ice cubes provided children with a chance to learn about sea level rise and explore the absorptive qualities of different materials.

Despite the challenges, Saena says she thinks the project has made “a lot of headway” bringing the community together around sea level rise. “Once we got their attention we found that the community is very proud of what they have done around ecology and environmental issues, especially getting the Cooley Landing Park and Education Center built,” says Baker. (Cooley Landing is built on reclaimed landfill; when it opened in 2015 it gave East Palo Alto residents shoreline access for the first time.) “What we heard was, we want to maintain this and we want to be sure that there is a place for our community to come out and enjoy nature.”

Encompassing two counties, six cities, one water district and five federal agencies, the Sponge is “the epitome of a jurisdictional challenge.



Photos: Kingmond Young

The next step needs to be to find a way for different jurisdictions to collaborate on the way that they prioritize projects and acquire funds,” says Kennedy. Possible mechanisms for such collaboration include a new Special District, a Joint Powers Authority, or simply a multi-jurisdictional Memorandum of Understanding. Without such collaboration, he says, “everyone is competing for the same pot of money and the same supply of soil, and those communities that are under-resourced are going to be at a disadvantage. East Palo Alto will be left behind.” **CHT**

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A L A M E D A C R E E K

Harnessing a Watershed for Public Sediment

Car keys have a way of disappearing into places you can't see or reach. For Amy Evans's teen son back in the 2000s, that place was the bottom of Alameda Creek.

He'd left the keys lying on a towel while he and his friends jumped off the railroad bridge downstream of Mission Boulevard into the water. You might not think Alameda Creek — which drains a 660-square mile watershed between Livermore and Union City — would have any places deep enough for swimming. Since the early 1970s, the lower 12 miles of creek have been widened, flattened, straightened and lined with rock. Most of the year there's only a trickle of water in this yawning cavity of capacity. But in a couple of spots large inflatable dams — designed to collect creek water to recharge groundwater — back the trickle up into appealing lakes for local youth with little to do on a summers' day.

When the keys slipped between the rail trestles, the kid went to fetch a big magnet from his basement in the town of Niles. There was still a smear of cracked mud on the floor down there from the famous flood of '55, which also filled the neighbors backyard fish pond, according to Evans. Her son dangled the magnet off the bridge and reclaimed the keys.

This little creek memory is just one of many the RbD Public Sediment team has collected in its efforts to "unlock" Alameda Creek. The "key" for this team is sediment — raw material everyone now needs at the edge of the Bay to raise marshes so shorelines can withstand sea level rise. The "locks" are upstream dams and downstream sills installed to slow flows in the lower reaches of the creek (now a US Army Corps flood control channel). "We're designing a suite of special structures, a mix of living and constructed features,

to move more sediment and create a dynamic new equilibrium for the creek," says team leader Gena Wirth, a friendly but intense New Yorker from SCAPE Studio.

Of course when this team visits community gathering spots it doesn't start conversations with talk of "sediment." Wirth's teammate Claire Napawan, a UC Davis professor of landscape architecture, often begins by asking where people live or if they have a good recipe for trout.

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If steelhead trout, once plentiful in the Alameda Creek, can move up and down the channel, so can sediment — hence the fish focus. To date, Napawan has recipes for trout tacos, trout marsala, trout head hot sauce, and trout ceviche, a cuisine that reflects the South Asian, Indian, Afghan, and Mexican communities that live around the creek in Fremont, Newark and Union City.

Control District and Union Sanitary's general manager, Paul Eldrege.

Wirth wants to know if Eldrege has enough wastewater to help move mud from Don Castro reservoir, in the neighboring watershed, or from a dredged material staging area at nearby Lagorio Pit (she's done her homework), down to Alameda Creek and Eden Landing. She's been looking for sources of sediment both in the

improvements but helped open the engineers' eyes to the potential role Alameda Creek's watershed could play as a sediment supply flagship project for regional sea level rise adaptation.

One thing Saleh had wondered for years was what kinds of plants could grow in the channel that would be high enough to shade fish in a trickle of creek mid-summer, as well as flexible enough to flatten in a big winter storm. On an April day, Wirth, Saleh and a team of plant experts climbed down into the creek to find some good candidates. The scout party mapped patches of poison hemlock, cattails, willows and other species. Saleh smiled when he saw her sketches on screen at a public meeting the next day.

Vegetation in a flood control channel means different things to different people. To the Army Corps, woody species like willows slow down water and reduce flood capacity and must be removed, and agencies like Saleh's are on the hook for expensive removal work. In engineering-speak the "roughness co-efficient" of vegetation affects how much water and sediment move through a channel. "The Corps wants a smooth slippery environment," says Wirth. Her team helped Saleh identify "lay-down species" in the flood terrace, like perennial grasses.

Working back and forth over the last few months of the resilient design challenge with three big stakeholders — Alameda Flood Control, the South Bay Salt Ponds Restoration Project, and the East Bay Regional Park District — the team steamrolled multi-benefit thinking like a freight train.

"I really enjoyed the enthusiasm, the energy, the boundary pushing, the community involvement they brought to Alameda Creek," says Hank Ackerman. "They made some of our dull, boring, engineering work seem exciting. They lit a fire."

In the last few months, as Public Sediment has honed their big picture plan and pilot projects for the lower watershed, they also tried to ground it firmly in the planning work that had already been done. The team embraced Saleh's rationale that the mouth of the creek, and the eroding wave and wind-lashed shore on either side of it, needs some kind of buffering land mass, for example, but wanted to push the landscape design envelope.

"Fish are not always something people care about protecting, for some people it's just dinner," says Napawan, with a twinkle and a lesson in her eye. "But lots of the seniors around here remember fishing in the creek, or having to eat fish on Fridays if they are Catholic. We're looking for ways to make the watershed culturally relevant to the residents."

On the day I hear the car keys story, Napawan is holed up in a senior center full of Filipino women on their way to a dance class. She's got recipe cards, story cards, maps, a hand-made creek atlas in three languages, and a 3-D model of the creek on a table. She invites the visitors to stick pins and rubber bands in the model to show places they think are important in the area or the creek.

The important thing about all these props is that they are "incomplete," she says. "Our team approach is to think of the community as a set of experts in their own right, they live there, they've invested there, they have a degree of local knowledge we can never match," says Napawan. "We have to value that as much as we value the time we spend with ecologists and flood control experts."

On another afternoon I drive down to the Union Sanitary District to observe a meeting where the "experts" are all wearing blue blazers. On one side of the table sits Wirth and colleagues Brett Milligan and Rob Holmes of the Dredge Research Collaborative; on the other side engineers Rohin Saleh and Hank Ackerman of the Alameda County Flood

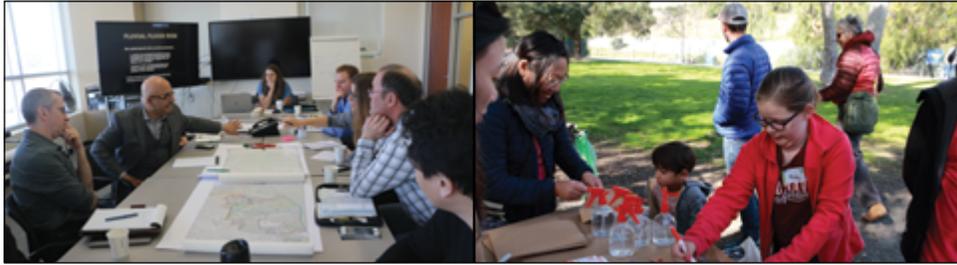
main channel, and in surrounding areas, to do both a one time big lift for the wetlands and to keep up a trickle down the creek.

Wirth draws a few squiggly lines on a pad showing the basics, and the engineers scoot in closer. The talk is of capacities and velocities, pipe diameters and millions of gallons per day, discharge permits and emergency outfalls. There's a nexus between the team vision and Ackerman's idea to lay a sediment sprinkler hose along an East Bay Dischargers' pipeline and "dribble the dirt" out to various drowning wetlands. Everyone seems comfortable with each other and the language — designers and engineers alike. Wirth is masterful among the men, listening but always leading back to the big picture. In the end, Eldrege offers his water — no small thing in parched California. In the end, it may not be quite enough to move mud.

When RbD first began working various bayshore sites "with their dog and pony show," Alameda County's Saleh wasn't sure it was worth his time to help out. He'd spent two decades developing the science and engineering needed to fix his flood control channel. How could these outsiders accomplish anything meaningful in such a short time? He was in for a surprise.

"This team's learning curve has been extraordinary," he says. They asked him what the missing pieces in his research were, and then filled them. They embraced the district's history and long-standing plans for channel

Photos: Public Sediment



“We’ve added a dynamic edge we’re calling a ‘pebble dune,’” says Milligan. As waves come in, the bigger pebbles and cobbles on the edge “restack vertically” rather than shifting along shore, protecting the land mass from erosion. “Together they deflect the tidal energy at the mouth of the creek so it can behave more like it did before flood control,” says Milligan.

There was also much back and forth with the flood control district and the restoration project, for example, over how best to breach levees and allow the creek and tides to enter Eden Landing salt ponds. “We wanted a bigger breach further upstream to move more sediment,” says Milligan. Working through the options and the risks of flooding to nearby communities, they all eventually settled on a South Bay Salt ponds project idea of fortifying a “mid-complex” levee stretching from north to south through the Eden Landing ponds. “This gives us all the chance to do things in stages, first we breach the outer ponds, then adaptively manage them until we can breach the inner ones,” says Milligan.

The team also sketched some inspiring visions of how to get local residents more up close and personal with the creek. “A wide variety

of people live around the creek but there are not a lot of places to cross, or touch the water, so it can be more of a barrier than a connection point,” says Wirth. Team sketches show mudrooms and floodrooms for public gathering nested in the levee tops and surrounded by biodiversity hot spots, as well as new seasonal trails down to, and along, the bottom of the channel (see below). Who takes on the management and liability of those trails, if ever built, was a big topic in the stakeholder discussions.

Ask the locals what kind of access they want around their creek and their vision is a far cry from the kind of “Euro-canal” images that appear in glossy Architecture magazines, says Napawan. Kids want open spaces away from parents to explore and hang out with friends. Adults want easy spots for family time, dog walks, and cultural events involving nearness to water.

Any urban creek is a natural draw, no matter how much concrete people have to clamber over. At the senior center event, Aria Ysit, an ex fire- and planning-commissioner of Filipino descent, recalled outings with his grandmother to fish, and whole camps of farmworkers living along Alameda Creek while commuting to local fields.

“If kids can’t get into these watersheds or go fishing, I worry about how they’ll relate to nature in the future, will they be good stewards?” says Ralph Boniello, one of the team’s community partners from the Alameda Creek Alliance.

Of course disasters like hurricanes and floods have a way of showing everyone what counts. Scholars studying factors in community bounceback after the recent Japanese quake-tsunami-melt down trifecta found that “it wasn’t how much water they had, or who had the best infrastructure or warning system,” says Napawan. The number one indicator of post-disaster resilience was how well people knew their neighbors.

“We think it’s possible to balance all demands on the creek — flood control, fish, people, sea level rise — in a more sustainable way,” says Wirth. The key may just be down there in the mud at the bottom of the creek after all. **ARO**

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Art: Public Sediment



Small lot housing integrated with neighborhood scale wastewater and new urban tree canopy that filters air and water. Art: Bionic

N O R T H R I C H M O N D

Building Equity in the Urban Fabric and Forest

The neighborhoods in North Richmond grew up with city's famed shipyards during World War II, when African American workers arriving from the Midwest and the South were steered toward the low-lying baylands on the outskirts of downtown Richmond. Along with the shipyards, situated at the city's deepwater port, railroads and the oil and gas industry also started operating full tilt. When you stand in most places in North Richmond today, you can literally see and hear this legacy. Sometimes, depending on the day and direction of the wind, you can even taste the refining of fossils and the processes driving climate change.

The impacts of dense industrialization in a community of color over several generations have resulted in rates of asthma and poverty are well beyond state and national averages. So for the community of North Richmond the idea of resilient design means something completely different than it might mean in other parts of the Bay Area (see also pp. 18-22).

And it was exactly these environmental justice concerns that attracted the San Francisco design firm Mithun to North Richmond for the recent Resilient By Design

challenge. "[We wanted] to team with communities hit with cycles of disinvestment and facing the most impacts of climate change," says Tim Mollette-Parks, a project manager with Mithun.

Mithun realized early that they needed community guidance if they wanted to add to the work already undertaken in North Richmond. So they collaborated with a community advisory board made up of local leaders and advocates, and called the collaboration the Mithun Home team (Home Team for short).

The Home Team decided that local adaptations to climate change had to reach beyond ecological restoration or infrastructure improvement, and tackle the on-the-ground, day-to-day needs of the North Richmond neighborhoods. "This kind of project has to address the health and wealth of the community," says Juliana Gonzales, the executive director of the Richmond-based Watershed Project and a community advisory board member.

Geographically, North Richmond is defined by its borders. On the land side, it's hemmed in by the four-lane Richmond Parkway, the Chevron Richmond Refinery, a landfill, a wastewater treatment plant and a growing

warehouse park. On the bayside, it's flanked by its massive marshes (the recently restored Dotson Family Marsh and the Wildcat Creek Marsh) and by miles of shoreline.

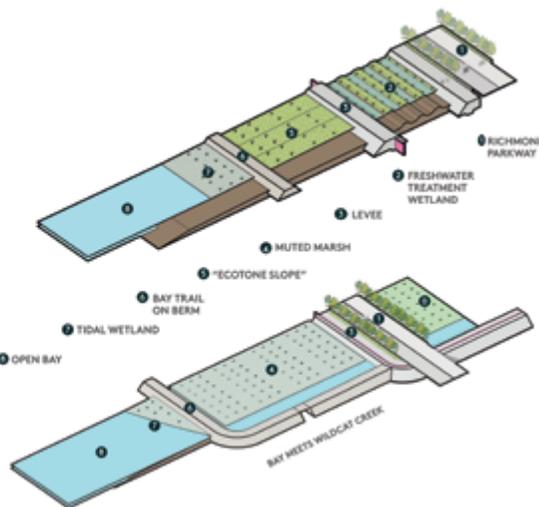
The Home Team developed a framework of four concepts to address what the community has identified as priorities for resilient design. "A big headline, conceptually," says Mollette-Parks, "was the idea of filter. So we are looking at a comprehensive urban forestry strategy that can create a sense of place, mitigate air quality concerns, and build resilience based on community health." From a water quality perspective, an urban forest can also help slow and filter stormwater runoff.

Resilient design in North Richmond also addresses the physical separation, in some cases by the Richmond Parkway, of neighborhoods from the shoreline, a recurring community concern. One idea the Home Team had to reconnect neighborhoods to the Bay is to create a pedestrian bridge over the parkway. The





HIDDEN HABITATS:



bridge could not only serve as a way for people to cross the busy highway safely, but it could also be designed and built to act as a gateway into the community. This gateway could help strengthen a sense of place.

Locals jobs are another big concern for the community. Increasing North Richmond’s connectivity, green infrastructure, and urban canopy would create planting and maintenance jobs for the community and foster hyper-localized and resilient economic activities. A strong fabric of this kind of work already exists in Richmond, through organizations such as of Urban Tilth, a job training and food security group that helps communities build gardens, and others.

Access to affordable housing was another, overarching, concern identified by the Home Team, especially as it relates to future resiliency. “We started looking at direct synergies,” says Sandy Mendler a principal designer with Mithun. “In the long term it’s really about using home ownership as a social justice tool for people

who have been excluded from wealth building.”

And herein lies the rub: After decades without investment, will significant improvements to infrastructure and access to the shoreline create economic forces that will cause community displacement? In the instance of North Richmond, this is not some kind of thought exercise. It’s beginnings are already underway. “In recent years the neighborhood has been transformed by the closing of the low-income housing,” says Gonzalez. Unless it’s dealt with proactively, this problem is only likely to get worse.

“We want to invest in green infrastructure, shoreline resilience, and affordable housing,” says Mendler. “If we don’t do this together we’ll have the same problem of gentrification as other places in the Bay Area, that leads to more poverty and to more carbon emissions.”

Since the city and the county own large swaths of land in the area, the Home Team is working with officials on rezoning to increase density and

provide opportunities for live/work situations. The Home Team is also exploring how to model new investments after social impact bond programs already successfully being used to turn derelict properties in other parts of the city into opportunities for first time homeowners. Another idea gaining steam is for an urban land trust that would enable homeowners to build equity while limiting speculative development. Such steps would also provide vehicles for communities to have more of a say in what future redevelopment plans look like.

North Richmond is no stranger to master plans and grand visions. The community has been working for decades to restore its marshes and creeks, and to create more access to its shoreline. What’s different about the Resilient by Design project is that thinking about restoration and resilience in economic terms really maps with community concerns.

While the Resilient by Design process did help identify strategies for developing affordable housing in North Richmond, and the idea has community support, what comes next is not as clear.

“It’s pretty intuitive that when we look at shoreline resistance we can’t have pockets of nice restoration and pockets of pollution or neglect,” says Mendler. It’s the same with housing, if we rely exclusively on the market we get pockets of affluence and pockets of poverty. It’s time to rebalance that in this community.” **DM**

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VISION: www.resilientbayarea.org/north-richmond/

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Left to right: Horizontal levee, community gateway, and community activities. Photos and Art: Mithun Home Team

P E R S P E C T I V E

Reflecting on the Rush to Resilience

After listening to the final RbD presentations for all the teams, attending the closing roundtables and speeches, and reading this issue, the Bay's top environmental history writer John Hart reflects on take-homes.



In the heyday of Bay fill, in the early 1960s, a University of California planning professor named Jack Kent had a modest proposal: could not the cities that were busily building out into the tidelands at least get together to agree on a future final shoreline?

Half a century later, we are looking at nine plans of a very different sort, each promising to adapt a piece of the Bay margin to a world of higher tides, rising groundwater, and more frequent flooding from streams. At least six of the plans center also on disadvantaged communities now occupying those threatened littorals: the Canal district of San Rafael; Marin City north of the Golden Gate; San Francisco's Bayview; South San Francisco; East Palo Alto; East Oakland; and North Richmond.

Listening to the presentations at the May 18 Resilient Bay Summit, I was alert, like Kent, to possible conflicts among them. There were none. For one thing, the proposals do not adjoin; for another, these planners are too smart to push ideas that would obviously harm the neighbors. There is scarcely a seawall in the bunch. "Horizontal levees," oyster reefs, widened flood plains, and

marsh restorations abound. If, by some magic, every proposal were realized tomorrow, we would surely be in a better place than we are today.

Of course, like all good challenges, the Resilient by Design Challenge raises a flock of questions.

CAN EVERY INHABITED PLACE BE PROTECTED? It was a basic tenet of the competition: planners must focus on "keeping communities in place and vibrant." These plans deliver. The poor neighborhoods now further threatened by climate change will transform but, if these visions come to pass, not a one will be lost. Key facilities will be protected and key roads elevated. Housing and businesses will be rearranged to cluster on raised ground, or, in several plans, on floating pads. The housing stock will be protected and expanded, yet gentrification will be simultaneously avoided. The stark possibility that some areas will simply become uninhabitable in time goes barely acknowledged. One planner I buttonholed admitted, "Many of these solutions may only work for fifty years."

WILL THERE BE ENOUGH MUD? Along with the upward creep in sea level predictions, we're coming to grips with the shortage of silt and sand. Are rivers and creeks bringing down enough sediment to build all these additional marshes and living levees? The Public Sediment team, in its plan for lower Alameda Creek, seeks to capture more of the grit coming down that stream for the adjacent Baylands, reducing the need for dredging in the channel itself. Something similar needs to be done on every Bay tributary. But

even perfect harvest of stream sediments may not be enough. The team working on the South Bay Sponge offers the idea of a Soil Swap in which not only sediment but upland earth will be moved about, building a flood-safe elevation here, scooping a tidal basin there. There would be a corresponding Land Use Swap, a transfer of development rights on a vast scale, concentrating structures on the safest ground.

WILL THERE BE ENOUGH MONEY? Disasters always unlock funding; paying for prevention is the hard thing. None of these plans come with price tags, but several teams pointed hopefully to planned expenditures that could be repurposed. The South Bay Sponge, for example, could use some of the billions now slated for Army Corps levee projects that would be trimmed. At San Rafael, Marcel Wilson of BionicTeam observed, most of the buildings will be replaced in the next fifty years anyway; it's a matter of organizing to do it right. At the end of the Resilient Bay Summit, the Bay Area Council stepped up to promise \$10 million in private funds for California adaptation projects by September, vital seed money indeed. Yet, any way you figure it, the coming tab looks huge.

CAN COMMUNITIES MOBILIZE FAST ENOUGH? We heard it again and again: to make good things happen, the neighborhoods themselves must both grasp the new threat and develop the power to influence solutions. Each Resilient by Design planning team found its own ingenious method of reaching, informing, and gathering ideas from local people.



Photo: Karl Nielsen

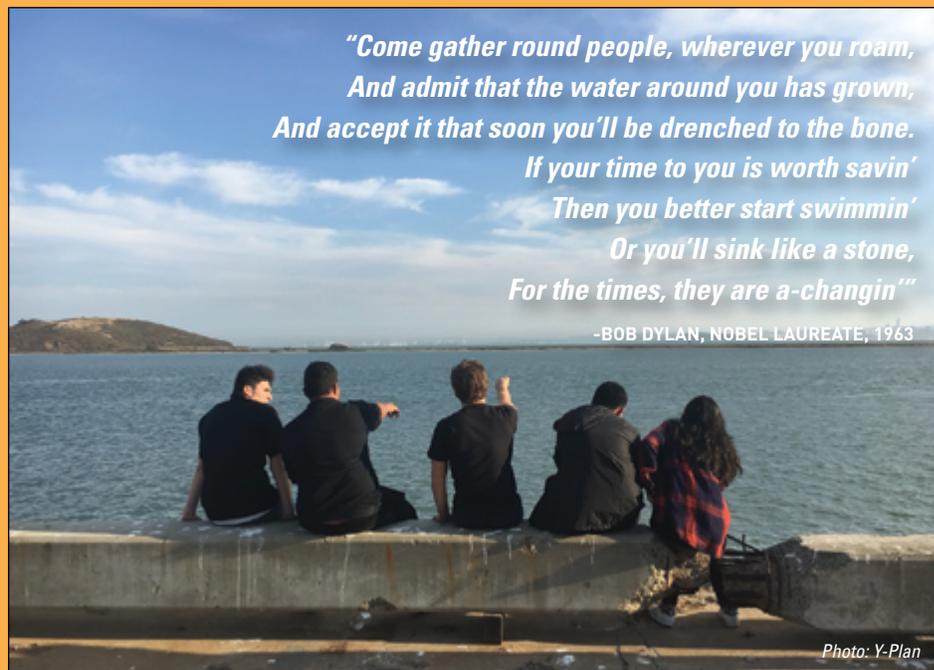
Yet — because community groups were brought in late and got a small slice of the total funding—the reception was sometimes cool. A notable exception was Marin City, where the community approached the planning group Permaculture + Social Equity, not the other way around. The plans (relatively small in scale here) took shape in the context of an eight-week permaculture or ecoliteracy workshop that also focused on advocacy skills. But this bootstrapping process is in a race with time.

CAN OUR GOVERNMENTS RISE TO THE NEED? Perhaps most fundamentally, these plans demand that we develop new organizational muscles. This challenge seems least daunting where a project lies within the purview of one or two local governments. This is the case in the Canal, in Marin City, in North Richmond, and in the Islais Creek basin in San Francisco. In South San Francisco, the Resilient South City proposal can feed directly into an upcoming revision of the local General Plan. In other instances, numerous cities and sometimes several counties are involved. And always there hovers overhead a swarm of regulatory agencies, each regional in scope but each devoted to a narrow purpose or zone, intervening like Olympic deities in the planning struggles below.

Take the case of the Estuary Commons plan, centered on San Leandro Bay but covering parts of Oakland, San Leandro, and Alameda. To make this vision real, each city has to rethink its traditional plans and also its traditional habit of going it alone. As Alameda mayor Trish Spence remarked, “We’re still in the middle of updating our golf course, as in spending millions of dollars. And go look at the plan. Our golf course, underwater!” The Oakland Airport, BART, CalTrans, the Coliseum Authority, and sundry regional bodies must also be on board with any program like this.

A second sort of institutional void often gapes at the bottom, not the top: a lack of neighborhood-level bodies to define and speak for community needs.

To overcome such obstacles, the plans posit a number of new government mechanisms: Commu-



*“Come gather round people, wherever you roam,
And admit that the waters around you have grown,
And accept it that soon you’ll be drenched to the bone.
If your time to you is worth savin’
Then you better start swimmin’
Or you’ll sink like a stone,
For the times, they are a-changin’”*

—BOB DYLAN, NOBEL LAUREATE, 1963

Photo: Y-Plan

nity Benefit Districts, Joint Powers Agreements, and a South Bay Mutual Benefit Resiliency District. (A little known tool is the Geologic Hazard Abatement District, which under state law has extraordinary powers.) Even in the Islais basin, entirely within San Francisco, a JPA might be required — among City departments! But all such arrangements have the effect of further complicating what one juror called “the jurisdictional cornucopia” of the region.

Indeed, government, or “governance,” was a recurrent theme. Who, in the end, will make these projects go, prioritize funding, screen for conflicts, fill in the spaces among these promising plans, make sure that disadvantaged communities don’t lose out again in the quest for solutions? A region-wide, authoritative blueprint for threatened shorelines seems a necessity, but can anyone create such a thing? The Bay Conservation and Development Commission comes to mind, but BCDC, the product of an earlier planning revolution, has no interest in fomenting a second one.

Collaboration is the word of the day. In the noble attempt to think and work together, ever-new groupings, task forces, councils are formed. The Bay Area’s alphabet soup of agencies and entities gets thicker. Pity the poor citizen trying to keep track of it all! In most cases, however, the existing power relationships are sacrosanct.

In a new Regulatory Integration Team, we are assured, “No agency gives up any authority.” The new BayCAN, “a network of networks,” has the slogan: “By local government, for local government.” It’s a double message: everything must change, yet no one will be made uncomfortable.

We must hope but also wonder: can a “network of networks” really do what must be done?

Despite perennial resistance, the facts keep nudging the region toward some less fuzzy form of centralization. The latest candidate for a guiding role is the Metropolitan Transportation Commission, which is building upon its real if indirect power as the arbiter of regional road and transit funding. Not perhaps the ideal vehicle, if the pun may be excused; but it is the vehicle we seem to have.

Near the end of the Resilient Bay Summit, the current chair of the commission, Jake Mackenzie of Rohnert Park, offered a stark, unscripted, assessment: “[We] are going to require a degree of regional cooperation that has not existed up until now. ...Unless we get some form of logical regional government, you are going to be a long time waiting for these visions to be realized.” **JH**

Y O U T H

Making Youth Perspectives Count Beyond an Educational Exercise

On a windy Thursday way up in the Oakland hills, Meghan Johnston's tenth graders filter back into her classroom at Skyline High School after lunch, then busy themselves putting the finishing touches on presentations they've been working on all semester: solutions for problems brought on by sea level rise in their own communities. Gwyneth Adam and James Palacio are among the first to present their idea, a complex of floating solar panels in San Leandro Bay. The panels would rise with the water level and wouldn't take up space in an area where land is in high demand, and the water would keep the solar panels from overheating, they say, arguing that the idea "both prevents sea level rise and endures it." After the presentation, staff from Y-PLAN, an educational arm of the UC Berkeley Center for Cities + Schools, lead a discussion with Adam, Palacio, and their classmates, asking them to identify stakeholders and think about factors like how their project might affect wave action and water flow.

This is about more than a school project. Neither the project nor the kids would be here if not for Y-PLAN, which has been leading youth urban design programming in the Bay Area for almost two decades. This time, they've partnered with Resilient by Design to create a parallel design challenge eliciting youth perspectives on the complex issues surrounding sea level rise. "We don't

see it as just a program; it's a strategy and set of tools to make authentic engagement with young people in city planning possible," says Deborah McKoy, Y-PLAN's Executive Director. "Our work is 50 percent working with young people and 50 percent working with adults in power to understand how they need to learn to work with young people."

In the course of the yearlong partnership, McKoy and her colleagues have encouraged RbD to embrace a philosophy outside the norm of similar design challenges, which can treat youth involvement as a chance for kids to gain skills, rather than to make substantive contributions. "It's typical for people to say 'Oh, we're having a conference: here's a youth panel, here's a youth workshop,'" McKoy says. "It sits at the margins." Instead, Y-PLAN's RbD program has emphasized that empowering kids to speak up is essential for cities searching for viable solutions to climate change.

A few weeks after Adam and Palacio give their presentation at Skyline, they join representatives from 12 schools from cities as far north as Richmond and as far south as East Palo Alto for a regional summit of classes participating in the program, which is held at the Alumni House at UC Berkeley. There, civic leaders from their communities gather to listen to students present projects ranging from self-sustaining tiny homes and sea level sensors

to emissions-free bus systems and extended greenways and boardwalks. "I've never felt this listened to," Adam says. "This is a chance to be heard by a lot of smart people with power, and we don't get that very often."

Connecting with kids like Adam and Palacio is especially important because of their role in giving voice to local issues and spreading new ideas, McKoy says. At Alumni House, the gathered government representatives—including Daniel Hamilton, Oakland's Sustainability Manager; Diana Sokolov, who works with the Mayor's Office in San Francisco on sea level rise; and Sequoia Erasmus, Richmond's Director of Community Engagement—clearly want to connect in a more meaningful way, too. During a panel of students and government representatives, Erasmus says she thinks Y-PLAN exemplifies one way she and her colleagues could better listen to the needs of people on the ground.

Hamilton of Oakland, also on the panel, agrees, saying, "The normal way this stuff is written is that we have a plan and say, 'Here, what do you think?' But that's not engagement." He points instead to the Oakland Climate Action Plan, which was written using the ideas of more than 60 neighborhood groups, as an effective example. "They said, 'No, here's our plan. What do you think?'" he tells the audience. "Y-PLAN is training you to do that."



Photo: Y-Plan



Photo: Karl Nielsen



In fact, Hamilton feels kids are actually easier to work with than adults when it comes to resilient design. “Local government tends to operate in silos, but big topics like climate are silo-busting,” he says. “The kids do this naturally. They don’t think in siloes.” That makes kids more imaginative and more likely to express unconventional ideas than adults with entrenched worldviews. Kids also tend to have smaller worlds, making them laser-focused on the needs of their neighborhoods and able to make more specific, more actionable, suggestions that naturally connect climate resilience with other social justice issues. Ask an adult what Oakland needs, and you get might a watered-down answer that tries to solve too many problems at once, Hamilton says. “But high schoolers would say: this neighbor-

hood needs a community center with a skate park, and also we need community gardens because people in this neighborhoods are food insecure.”

Many design challenges struggle with how to transition from the flurry of activity during their culminations and the months afterward. RbD has faced similar difficulties, with efforts to nail down future plans stretching well into the spring. But Managing Director Amanda Brown-Stevens says some of the project’s local stakeholder working groups are planning to continue their work, and RbD’s Finance Advisors are working with the San Francisco Bay Conservation and Development Commission on a series of funding workshops, set to begin in July. And meanwhile, seeking continuity in their parallel challenge, McKoy and Hamilton met

this spring to talk about how his office can continue to engage with Bay Area students and their ideas.

It’s not just lip service: Hamilton says he’ll keep the RbD youth summit proposals in mind as he begins to work on Oakland’s new Energy and Climate Action Plan and to maintain his new relationships with Oakland students through Y-PLAN. He even plans to incorporate their feedback and ideas into this year’s community conversations about sustainability. “The timing is great for these students to have their work count,” he says. **ALG**

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Y-PLAN <https://y-plan.berkeley.edu/>



Photo: Karl Nielsen

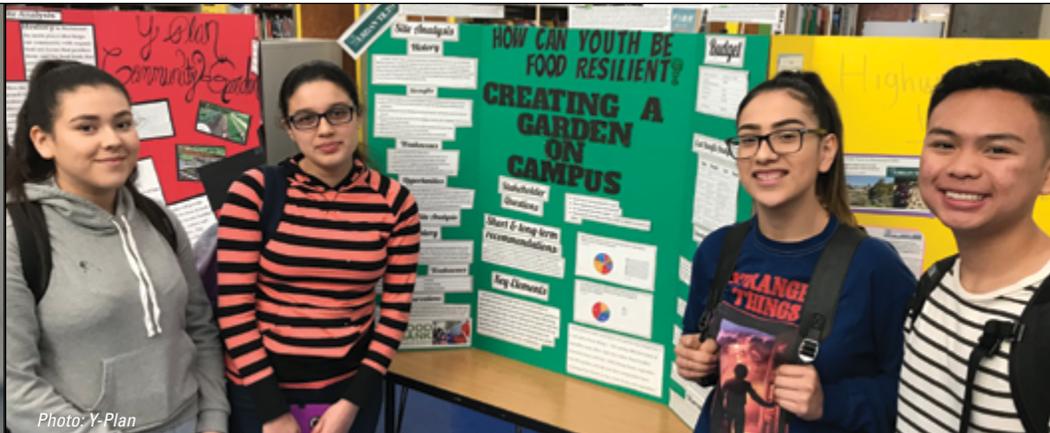


Photo: Y-Plan

R E G I O N

Glimmers of Baywide Intent

Like all organisms, the San Francisco Estuary is a living system with many connected and interdependent parts. When it comes adapting to rising seas, that means that a wetland on one shoreline will help absorb rising water for all shorelines. It also means trouble if one city builds a five-foot shoreline levee while another builds one that is seven feet high. “We need to get resource agencies sitting down together figuring out how to address current and future flood risk, making sure that the approaches they develop are aligned,” says Port of San Francisco Resilience Program Director Lindy Lowe, who in her previous job helped nurture the SF Bay Conservation and Development Commission’s sea level rise planning initiative *Adapting to Rising Tides*.

The Resilient by Design challenge, which ended a whirlwind of activity around sea level rise this May, only reinforced the need for coordination. Local governments, flood planners, and shoreline communities alike are all now imbued with a newfound sense of urgency about taking action, or at least finding out what their neighbors are up to on the bayfront.

Although there is no single collaborative body coordinating adaptation across the region, there are several connect-the-dots projects moving forward. Perhaps the most promising is the Bay Area Climate Adaptation Network (BayCAN), organized by Kif Scheuer at the Local Government Commission and Bruce Riordan at the Climate Readiness Institute, with

input from a steering committee of about a dozen agencies.

BayCAN’s motto is “By local government, for local government,” says steering committee member David Behar, the climate program director for the San Francisco Public Utilities Commission. “Having a place where local government leaders can gather and share information, learn from one another, and hear what’s working and being tried elsewhere is critically important as the adaption enterprise moves forward,” he says. The organization’s mission statement says that the network will help “coordinate an effective and equitable response to the impacts of climate change on water, public health, ecosystems, fire, and our shorelines.”

BayCAN’s partners include state, regional, and federal agencies, as well as nonprofits and other interested parties. “In many ways, BayCAN will be a network of networks, something that will stitch together many initiatives and many levels in ways that enhance collaboration across all boundaries,” says Behar. BayCAN, which officially launches in July, is part of the Alliance of Regional Collaboratives for Climate Adaptation (ARCCA). Behar says the network is looking forward to partnering with other initiatives, such as the San Francisco Bay Coastal Hazard Adaptation and Resiliency Group (CHARG)—which is refocusing its efforts to provide engineering and technical support to collaborative climate change adaptation—as well

as the Bay Area Open Space Council, Bay Area Health Inequities Initiative, and Bay Area Regional Reliability, among others.

Regional collaboration is also moving ahead on several other fronts. Since January, the San Francisco Estuary Partnership, the Association of Bay Area Governments and the Metropolitan Transportation Commission have been housed under one San Francisco roof, creating myriad opportunities for both formal and informal information sharing and cooperation. At the same time, MTC and ABAG have launched the Horizon Initiative, to collectively brainstorm with the public, local officials and sister agencies on how the region might be affected by a range of outside forces — including sea level rise — as a precursor to developing Plan Bay Area 2050. Horizon will be a comprehensive planning effort that will look at transportation, housing, economic development, resilience and the effects of emerging technologies, says MTC’s Brenda Kahn. Meanwhile, BCDC’s ART program is shifting from the study of pilot shorelines to Bay Area-wide assessments, and partnering with other interagency projects, including the Bay Area Regional Collaborative, ABAG’s Resilience Program, MTC’s Climate Change Program and the California Coastal Conservancy’s Climate Program. Some of their shared ideas about current priorities (six multi-agency coordinated actions and 4 case studies) can be found in BARC’s *Raising the Bar on Regional Resilience* (2018) report.

Funding is, as always, the elephant in the room for all these efforts, but there are signs of progress there, too: In June California voters approved Prop 68, which authorized \$4 billion in general obligation bonds for state and local parks, environmental protection and restoration projects, water infrastructure projects, and flood protection projects. Another water bond, the Water Supply and Water Quality Act of 2018, will appear on the November ballot; that measure would provide nearly \$9 billion for California’s water infrastructure, including watershed restoration (see also page 2). **AMG & CHT**

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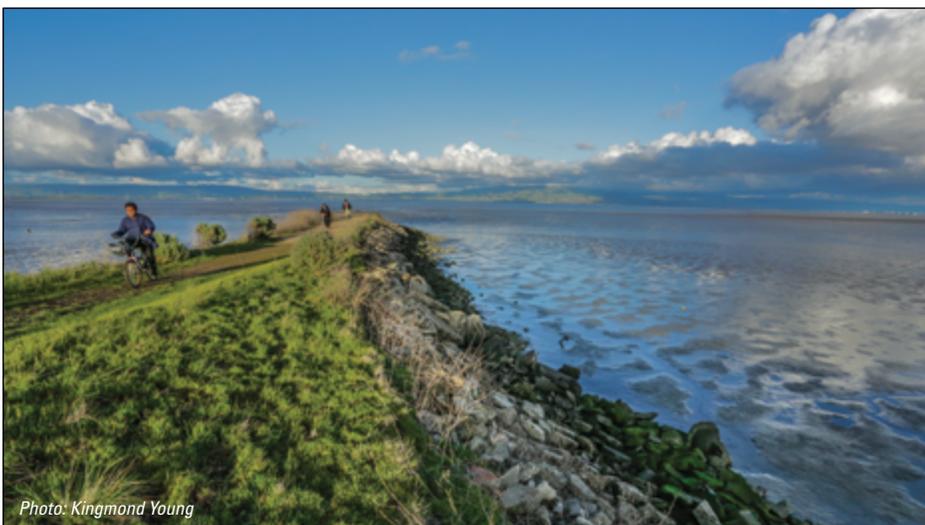


Photo: Kingmond Young

L E V E E S

Corps Explores New Ecological Territory



Southern half of the newly reconnected floodplain. Photo: TNC

A levee replacement project near the small town of Hamilton City, alongside the Sacramento River, is breaking ground as the first project that the US Army Corps of Engineers has approved based in part on potential benefits to an ecosystem, rather than solely on flood-damage reduction, says Ryan Luster of The Nature Conservancy, which has been instrumental in launching the project.

"We've been told this will be a national model, once it's completed," says Lee Ann Grigsby, who is a Hamilton City resident, and president of Reclamation District (RD) 2140, the public agency that was formed to manage the project. She has been active in the effort to replace the aging private "J" levee for decades.

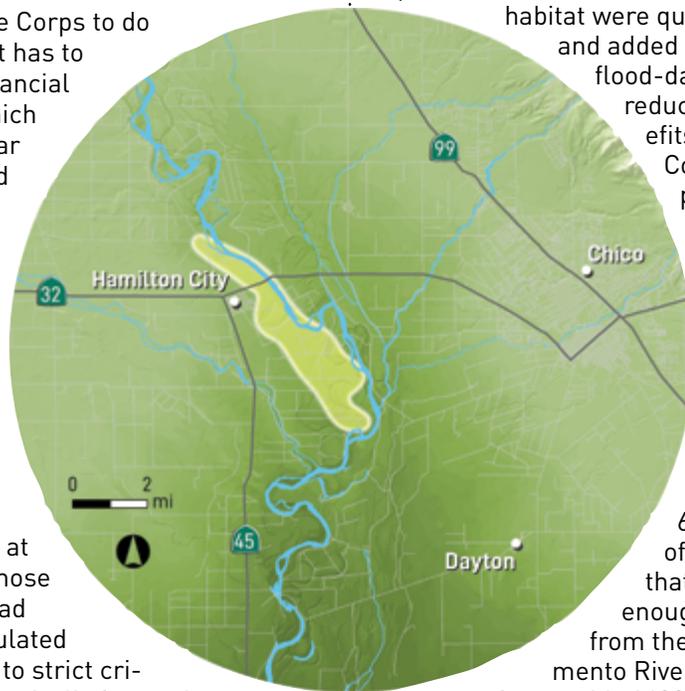
Built in 1906, the "J" levee flanked the west bank of the Sacramento River with the intention of stopping its floods and meanders. However, local landowners have reported losing over 100 acres to the river regardless, says Grigsby.

"They built the levee [with whatever material they could find] — so on the north end it is mostly sand, and that is where it is failing the worst. We don't think we could get through another winter," she says. "If you look at pictures from [both] 1970 and now, the river has completely rerouted — even with the levees."

With construction that fails to approach modern standards, recent estimates gave the "J" levee only a 66% chance of withstanding a 10-

year flood — even with the assumption that substantial flood-fighting efforts would be made. The town has been evacuated six times in the last 25 years due to flood fears; but despite repeated pleas from local residents, that wasn't enough to authorize repairs, according to Army Corps regulations.

"For the Corps to do a project it has to meet a financial test, in which every dollar they spend has to be matched by at least a dollar in potential benefits from the project," says Luster. Furthermore, at the time those benefits had to be calculated according to strict criteria that typically focused exclusively on flood damage savings; other benefits — such as those to wildlife or habitat — could not be considered. Because Hamilton City is small, rural, and not affluent, the potential flood damage costs never met the minimum.



"Every time they were approached, the Army Corps would look at it and say, 'Well we can't because the cost of building a new levee exceeds the flood damages that would be prevented,'" Luster says.

The Nature Conservancy became involved in 2000 at the request of the local community, which had spent years advocating for a solution to their persistent flooding issues. In 2002, new Army Corps guidelines permitted ecosystem benefits to be taken into the accounting, Luster says. Those guidelines are what finally allowed for a feasible solution to the community's flooding problems. Today, one section of the new levee has been completed, and restoration of the newly created floodplain began this May.

"This is a model project to show the benefits of shifting from hard-scaped levee protection projects to more broad floodplain recovery throughout the country," says Adrian Frediani, current TNC manager of the project. "The idea is that natural infrastructure often outperforms man-made infrastructure."

Once benefits to red-tailed hawks, riparian forest, and scrub-shrub habitat were quantified and added to the flood-damage reduction benefits, the Army Corps approved the project. In 2016, work began on a renovation that — once complete — will include 6.8 miles of levee that is set far enough back from the Sacramento River to allow for roughly 1400 acres of floodplain, restored with native plants. Eventually, Grigsby says, the restored floodplain will also be used for hunting, fishing, and other forms of recreation.

continued to back page

P L A N N I N G

Vital and Vulnerable?

Delta Contemplates Climate Change

Traveling up the Estuary through the Carquinez Strait past Pittsburg and Antioch, where the Delta runs into the Bay, urban skylines give way to oil refineries and chemical plants. Further on, the scenery turns to rolling gold hills dotted with windmills and cows, and seen-better-days towns. The shorelines between here and Clifton Court Forebay — where the State Water Project pulls water to pump south — are different from those of the Bay: Some look like riverbanks, while others echo the flat marshlands of the Delta that were here before dikes and pumps claimed them for farmland, much of it now subsided behind deceptively fragile levees — levees that can and have ruptured all too easily, and that are now especially at risk from rising water levels.

With its pivotal role in California's ecology and economy, the Delta's ability to adapt successfully to climate change and sea level rise will have an enormous influence on how well the state as a whole adapts. Until recent months, however, adaptation planning in the Delta has lagged behind efforts in the Bay Area. Now, a handful of initiatives aim to change that.

"Most of the climate vulnerability work in the Delta so far has focused on water resource management, not the array of other potential impacts and what that might mean for the region," says the Delta Stewardship Council's Kate Anderson. "We are increasingly aware that climate change will influence our ability to achieve the coequal goals of the Delta Plan. We identified the need to develop a Delta-side climate vulnerability assessment as one of our 2018 priorities." In May the Council released a Request for Qualifications to conduct such an assessment.

The Council has also begun working with the SF Bay Conservation and Development Commission to conduct an Adapting to Rising Tides (ART) project in eastern Contra Costa County. A previous ART project along the western Contra Costa shoreline

stopped at Pittsburg, where BCDC's jurisdiction ends and freshwater flows begin. "We saw how the ART process [had been useful] in the Bay and thought it was great at bringing in stakeholders and getting them more familiar with the research and science," says Anderson, who notes that the process is also valuable for raising awareness of the risks that disadvantaged and vulnerable communities face from climate change.

"Contra Costa is an important county to be looking at in the context of rising tides because it's the place where the Delta hits the Bay, and where twin tunnels would come out if they happen," says county Sustainability Coordinator Jody London. And of course, there is the water infrastructure at Clifton Court. "It will be interesting to look at how the State Water Project will be impacted by climate change," says BCDC's Adam Fullerton.

The project will be different from previous ART projects for several reasons, says Fullerton. For one thing, the landscape to be studied is very different from that around the Bay (see map p. 7). "There are big cities — Pittsburgh, Antioch and Oakley — right on shoreline, but there is also quite a bit of less developed, low-lying agricultural land right along the shore." Levees are also a big concern. "Bethel Island is entirely protected by levees, and there are many areas where levees are a really big piece of the protection we need to consider," he says.

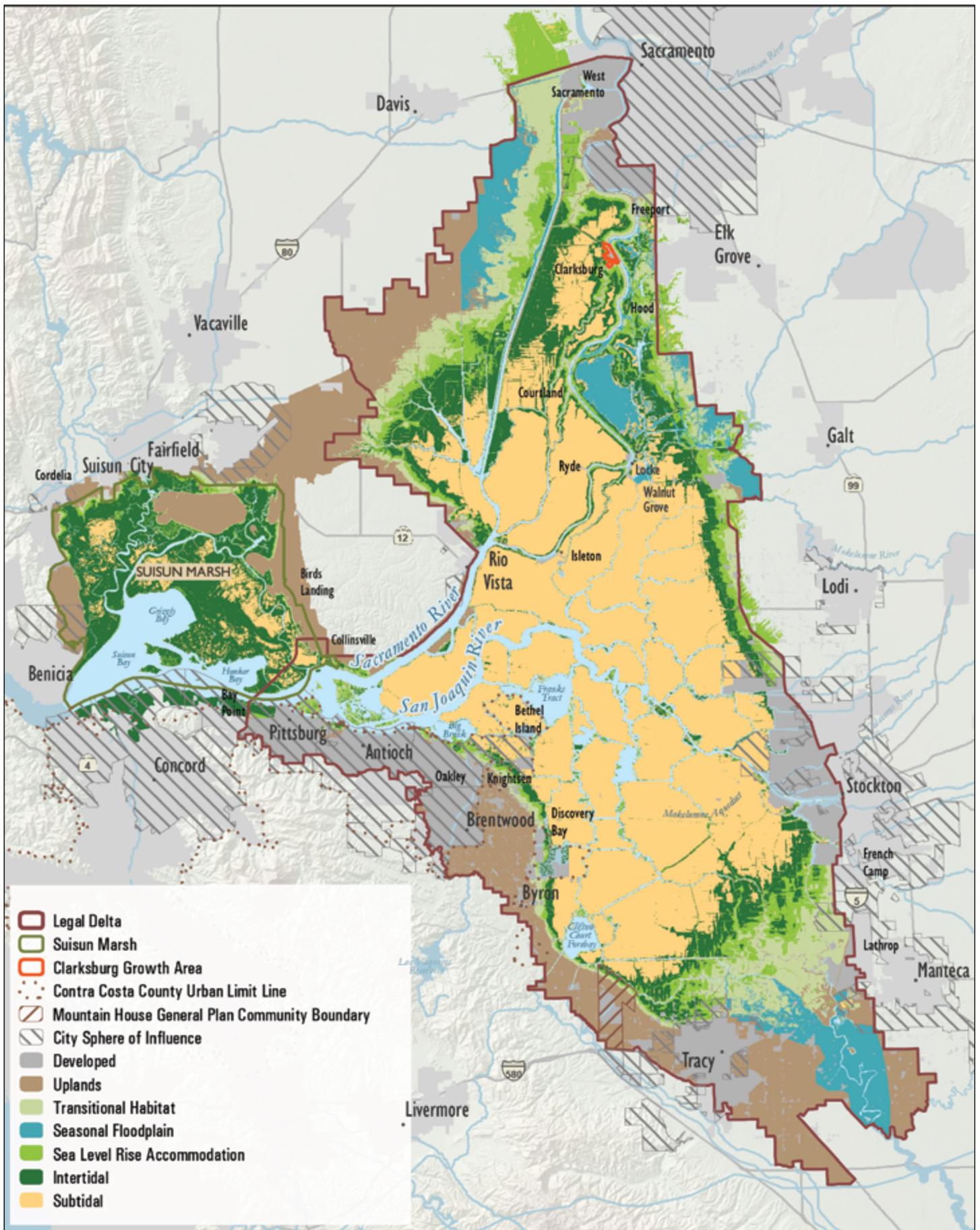
Another important difference is that although the shoreline is still tidally influenced and sea level rise will have an impact, riverine waters may have the biggest initial impacts. As there is very little modeling yet about how sea level rise will interact with broader Delta hydrodynamics, that is one of the project's first tasks. "We are hopeful that the work on the eastern Contra Costa levee and shoreline will be useful for the broader regional vulnerability assessment," says Anderson.

In a related effort, this spring the Council released a paper synthesizing the best available science on the likely impacts of climate change on the Delta. The paper is one of three developed to inform pending amendments to Chapter 4 of the Delta Plan, which focuses on protecting, restoring and enhancing the Delta's ecosystem. (The other two papers synthesize current understanding of existing ecological stressors on the Delta, and on management of the Delta ecosystem.)

Among the paper's most important takeaways, says the Council's Ron Melcer, is that the Delta could become a refuge from warming for some species. "The amount of water on the landscape and the proximity to marine influences [make] the Delta cooler than the rest of the Central Valley," says Melcer. The relatively cooler air temperatures are expected to persist, and will keep water temperatures lower as well. Species that actually reside in the Delta will benefit, but those that only travel through it, such as salmon, will not, Melcer notes. Indeed, another finding of the paper is that because climate change will alter precipitation patterns, it will likely become much more difficult to manage water releases from the reservoirs to help migrating fish. Last year's Oroville Dam spillway failure gave us a taste of future reservoir management challenges.

Melcer stresses that to realize the benefits of the Delta as a climate refuge will require true restoration, including reconnecting floodplains and marshplains to tidal and riverine waters (see also page 35). "Sea level rise constrains where restoration is really going to be feasible in the future and subsidence constrains where it is feasible now," he says. "You can't reconnect tidal marsh in the Central or Western Delta—it's too far subsided. Even if we were to do subsidence reversal and use managed wetlands to the best of

continued to back page



Delta Habitat Types Based on Elevation: Intertidal and sea level rise areas could be suitable for subsidence reversal.
 Source: Delta Stewardship Council 2018

A P P R E C I A T I O N

The Quiet Go-To Guy

Carl Morrison

When Carl Morrison died in a crash of his small plane near Petaluma, on April 6, 2018, the press noted the loss of a family man, Civil Air Patrol commander, Marine Corps veteran, and pious Mormon. But the shock ran also through the world of Bay Area flood control and water agencies, for whom Morrison had become an indispensable facilitator and go-between.

nor was he trained in hydrology or any related discipline. He lived in San Diego County; he was a PR man and a lawyer, skills he acquired during a twenty-year career with the Marine Corps. He became a Californian with his last posting, to Camp Pendleton, where he served as base public affairs officer. On retiring with the rank of lieutenant colonel, he set up offices in southern California, working



Morrison surveys East Bay parklands and site of new AQPI radar on a February 2017 hike. Photo courtesy SCWA

“Over the years he developed a relationship with every single person in the state that had anything to do with water resources,” says Mitch Avalon of Contra Costa County. “He roamed the landscape,” adds Avalon’s colleague Mark Boucher. “It was always, ‘I talked to this guy at the Department of Water Resources, I talked to this guy at the National Marine Fisheries Service, I’m going to see this person anyway.’” “There are so many issues that you could spend your life going to meetings and webinars,” Roger Leventhal of Marin County chimes in. Morrison saved everybody time by knowing the actors. “You need someone like that.”

This vital link in the Bay Area water scene was not a local resident,

for government agencies and private clients. His interest in environmental matters seems to have grown out of a taste for order and efficiency. His wife Mary writes: “[He was] able to recognize how much more could be accomplished with the different agencies working together.” His first northern California customer was the Dublin-San Ramon Services District, followed by the Zone 7 Water Agency, the Sonoma County Water Agency, and many, many more. He would sometimes speak for three or four of these at a single meeting.

As his Bay Area business expanded, Morrison eased his commute by training as a pilot and acquiring a small plane. This made him almost uncannily mobile. People marveled

at how many places he seemed to be. “There must have been more than one of him,” says Napa County’s Rick Thomasser. In a sense there *were* two of him: Morrison, and his 1990 Mooney M20J propeller aircraft.

After 2002, demands on his time intensified. That was the year the Legislature passed the Regional Water Management Planning Act, nudging water, sanitary, and flood control agencies to get together, region by region, to plan for the liquid resource they dealt with in contrasting forms. As part of that effort, the region’s flood control agencies, which had traditionally worked in isolation, formed the Bay Area Flood Protection Agencies Association (BAFPAA). Avalon, its first chair, immediately began drawing on Morrison’s help. “Carl was our fixer,” he says. “When we had an issue with the Corps of Engineers, he set up a conference call to smooth things out. When we had problems with permits from the Regional Water Board, he set up quarterly meetings.” People thought of him as the association’s executive director, though the role did not exist.

In 2014, Morrison helped to launch a still broader organization called the Coastal Hazards Adaptation Resiliency Group (CHARG). This grouping includes not only the local flood agencies but also state bodies like Department of Water Resources and federal actors like Federal Emergency Management Agency. A recent National Academy of Sciences report praised CHARG as the sole organization in the Bay Area that brings together staff from all nine counties and all levels of government. In 2015, CHARG and the Association joined forces for their annual conference; Morrison largely planned the event and moderated half the panels. To quote Mitch Avalon again, “Carl was the glue that held us all together.”

As part of work on the Bay Area Integrated Regional Water Management Plan, Morrison got early exposure to the recently recognized phenomenon of “atmospheric rivers.” These fire hoses of Pacific moisture, taking aim at rather narrow wedges of California, account for a major share of our water supply—and our flood miseries. Forecasters have tended to overlook these because they come in at about the 5,000-foot level; traditional Doppler radars scan at 10,000.



Such an atmospheric river pushed the Sonoma County Water Agency's Lake Mendocino to worrisome levels in 2013; unsure how much more rain was coming, the Army Corps of Engineers dumped thousands of acre-feet of water that would be sorely missed in the twelve dry months that followed. "Better forecasts might have allowed us to keep more of the water," says Grant Davis of SCWA. With Morrison's aid, the agency took the lead in planning a regional system of X-band radars to peer into the critical lower level of the atmosphere.

Wearing his two hats, as representative of SCWA and the flood districts, Morrison was invaluable in Sacramento; he gets much credit for the state's \$19.84 million funding of what is called the Advanced Qualitative Precipitation Information system. The first new radar, at the Penitencia Water Treatment Plant in San Jose, began sending data last September. "That was Carl's project," Davis says. "It will probably be his legacy."

If such radars had existed above Oroville Dam earlier in 2017, they could have helped managers brace themselves for the wetter-than-predicted atmospheric river that hit in February, overstressing outflow structures and threatening to flood the city of Oroville (and potentially parts of Sacramento) with uncontrolled releases. Needless to say, the state has installed them now.

A man of formal habits, Morrison never dressed down for fieldwork. Tramping riverbeds or hiking washed-out fire roads to potential radar sites, he stood out among his booted and jeans-clad colleagues in dress shoes, suit, and tie.

His peers might smile at that, but they cherished his other qualities: his absolute reliability, his deftly deployed humor, his unfailing courtesy. A board interlocutor might be addressed as "esteemed chair." "He

bragged," says Contra Costa's Mark Boucher, "on other people." Yet the former man in uniform was not entirely concealed. "He was self-deprecating about it," says Marin County's Leventhal, "but you really could notice it. Now and then he would give you that Marine Corps look."

On April 6, an atmospheric-river storm took aim at Sonoma County. Morrison had flown in for a North Bay Watershed Association meet-

ing. The rain was no deterrent to this experienced, instrument-rated pilot. Just what happened as he took the air on his return trip south may never be known.

What is certain that the Bay Area water community, now scrambling to fill the void Carl Morrison left, will miss a man who was on everybody's radar screen. **JH**



Morrison (left) climbs 1,000 feet in all-weather attire to the Rocky Ridge radar station. Pictured here with Chandra Chandrasekar, a radar expert from Colorado State, Rob Cifelli from NOAA, and Carol Mahoney from Zone 7. Photo courtesy: Contra Costa County Public Works



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 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.

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PERMITTING, *cont'd from page 2*

isolated reviews of their projects. The regulatory world needs to innovate."

McCrea says next steps include raising matching funds to complete the Restoration Authority's appropriation, drafting and executing agreements with the regulatory agencies, and assigning and hiring staff for the team.

Pine notes that voters have approved funding for restoration and climate change adaptation through Measure AA and just-passed Proposition 68. "The permit integration team gives us the regulatory support to deliver what the voters have approved," he says. **JE & CHT**

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New Legal Article!

Cherishing the Coast: California Goes Long — An in-depth look at California Coastal Conservancy accomplishments in more than 40 years on the job. Golden Gate University Environmental Law Journal, Vol 10, Issue 1.

<https://digitalcommons.law.ggu.edu/gguelj/vol10/iss1/2/>

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HAMILTON, *cont'd from page 35*

At roughly 180 miles inland from the Delta's many failing levees, Hamilton City is well away from tidal influences so sea level rise is not a concern. However, the new levee is expected to add resiliency to withstand the effects of flashier rainfall and increased flooding that are predicted as the climate changes.

"This project shows how you can restore an ecosystem and reduce flood damage in the same space, and benefit both people and nature," says Luster. "By opening up a floodplain you allow more room for the river and reduce [the risk] of flood damage to people living in the area. At the same time, you are letting river processes function more naturally and restoring habitat needed by a whole suite of species."

For Grigsby and other residents of Hamilton City who have expended countless unpaid hours working toward a new levee, the fact that the project is nearly halfway complete is success enough.

"It's going to work," Grigsby says. "It got approved, and that is amazing." **JC**

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CLIMATE, *cont'd from page 37*

their ability, it wouldn't catch up to sea level rise. We are too late." But, he adds, "there are other parts of the Delta where this would work. We have to hone in on where it makes sense to do this reconnection."

The ART project and the Delta-wide vulnerability assessment will be carried out concurrently, with the hope that by end of 2019 "we can go to the Council with a thoughtful product that incorporates stakeholder input, reflects best available science, and identifies specific high-priority options for adapting to the changing climate," says Anderson. Fullerton adds that in this era of limited budgets and bandwidth, "I hope that as these adaptation actions unfold we will identify the easy lifts, where we can start addressing the vulnerabilities of sea level rise in actions that are ongoing, so that it doesn't become an emergency later on." **CHT**

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DELTA CLIMATE REPORT:

deltacouncil.ca.gov/sites/default/files/2018/04/Climate_Change_%26_The_Delta_Public_Draft_03232018.pdf

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