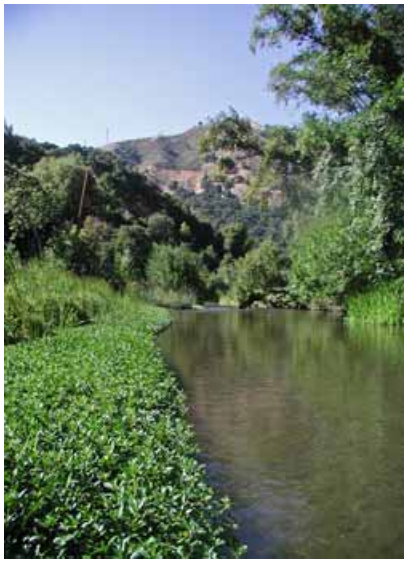
Alameda Work Trickles On

by Ariel Rubissow Okamoto

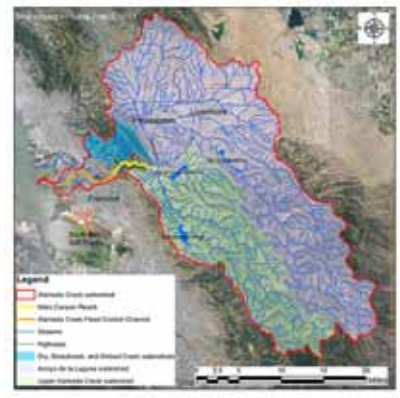
Driving down 680 from San Ramon to Pleasanton — with its prettily paved and groomed burbs — you wouldn't guess that this was once a shallow lake and willow marsh. Indeed little trace is left of the vast freshwater swamp called Tulare Lake, just over the East Bay ridges, which once collected all the runoff from Livermore and San Ramon. This marshy ecosystem filtered the rush of water from winter storms so that by the time it exited into the narrows of Arroyo de la Laguna, mingled with Alameda Creek, and spilled into Niles Canyon, it wasn't an unmanageable torrent. But the development of farms and towns on top of this wet spot dramatically changed the hydrology of the northern reach of a vast watershed draining into San Francisco Bay. "When it rains, Niles Canyon gets crazy, there's so much water, so fast," says Tim Ramirez, natural resources manager for the San Francisco Public Utilities Commission, which owns large areas in the watershed.



Niles Canyon. Photo by Brian Sak.

Of course the loss of the lake happened more than a century ago, and since then throughout Alameda Creek's 640-square-mile watershed dozens of other wet spots have been drained, dams built, creeks buried, and channels reshaped. "The watershed is huge and complex, and all these changes, compounded over time, have left us with a long and arduous path to getting it to function more naturally again. We're going to need the full cooperation of every partner to reach our goals," says Carol Mahoney, a planner for Zone 7 Water Agency out in Livermore.

The creek is the biggest tributary to San Francisco Bay that isn't fed by snowmelt. Its northern sub-watershed is more urbanized while the southern portion is more ranch and recreational open space– but it all comes together in Niles Canyon. Downstream of the canyon, creek waters speed through 12 miles of federal flood control channel– designed to protect Fremont and Newark from high waters caused by rains and tides. In this lower reach there are drinking water intakes, inflatable barriers, steps in the stream called grade control structures, and areas where sediment collects on the bottom. "It's a big tricky creek that has every kind of problem we face in watershed management statewide somewhere along it," says Ramirez.



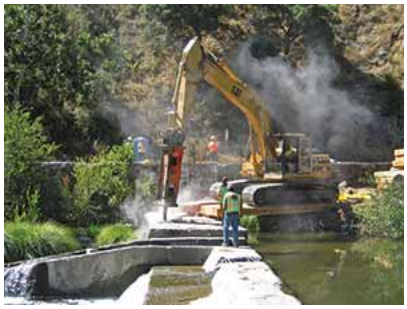
Alameda Creek Watershed

Right now numerous entities are planning extensive and expensive changes to the creek to improve the creek's hydrology and ecology. The biggest ticket items may be billed to Alameda County coffers – but other state, regional, and local agencies are on the hook too. Many of these efforts, if properly strung together, could make Alameda Creek a state-of-the-art example of watershed restoration in much-altered systems. Indeed the creek may be the first Bay-Area test case of the federal government's next generation policies concerning the alteration of the nation's flood control infrastructure, and of a local county's struggles to put this new mindset into practice.

"It's a very large system and funding is finite. If they don't get it right, and the water floods someone's California real estate, then the consequences can be severe," says Dale Bowyer, an engineer with the San Francisco Regional Water Quality Control Board.

Improvements in the Works

Over the last couple of decades, many have sought to tweak the creek's plumbing so it's better able to support fish, absorb floods, and supply water to local communities.



In 2006 the San Francisco PUC removed Sunol and Niles (pictured) dams from Alameda Creek, alleviating public safety concerns and providing steelhead and other fishes' access to upstream waters. Photo: Brian Sak.

In tributaries upstream of Niles Canyon, the San Francisco Public Utilities Commission (SFPUC) has removed several small dams and recently began a fish-friendly upgrade of its larger Calaveras Dam. SFPUC is also releasing more flows for fish. "It's a pretty hot watershed in summer, so cold water inputs from Calaveras can help us maintain deep pools where fish can survive," says the State Coastal Conservancy's Brenda Buxton, whose agency has taken an active interest in improving watershed management along the creek.

Erosion control is another big issue upstream, especially with sediment collecting in the flood control channel below. SFPUC is working with the Alameda County Resource Conservation District, Zone 7, and other federal and county partners to address significant bank erosion in places like Arroyo De La Laguna. "It's become this very flashy stream with deep incision during storms – the bank sometimes retreats as much as two feet in one year," says Leslie Koenig, an RCD biologist.

Arroyo de la Laguna has become so incised there is little chance to reconnect the creek with the natural floodplain. So partners have been strategically placing rock weirs in the Arroyo to divert flows away from banks, slow water velocity, and create back pools for fish. They've also employed some soft bioengineering fixes – building a willow log crib wall at Verona Bridge in Pleasanton, for example. "We chose this site not only because of the erosion problems but also for its visibility and educational value." At the bridge, bikers and strollers can read about how storm water from upstream influences stream flows.

Slowing down the floods of runoff from upstream could help the creek function more sustainably, but to do so will require softening the pavements in Livermore, Pleasanton, Dublin and San Ramon, among other low impact development (LID) and green infrastructure actions. Creeks in the watershed also flow through golf courses, some with culverts or riprap that increase the speed of flows, others that are allowing their greens to be used as floodplain. "Flows are so huge from this valley LID alone won't be able to attenuate them," says Koenig. She hopes other solutions will come out of the Alameda Creek Watershed Forum and Arroyo de la Laguna Collaborative. "Our goal is to do more than just soft band-aids," she says.

Inflatable dam in Alameda County flood control channel. Photo by Brian Sak.

Downstream there are projects to help steelhead over barriers and around dams, and to slow flows and cool water temperatures. The creek comes out of Niles Canyon into the service area of the Alameda County Water District. Here the district impounds water using inflatable barriers, and then uses it to replenish a groundwater basin where they have local water supply wells. The infusion from the creek helps repel seawater intrusion from the nearby Bay, but the barriers and other in-channel structures are a problem for threatened steelhead migrating through the system.
To help juvenile fish on their way back out to the Bay, the district designed and installed a fish screen system for its off-stream diversions. The screens are drums that can be rolled in and out of the water on tracks depending on flow levels. “The watershed is so flashy and carries so much debris, we have to remove the screens during high flows,” says the water district’s Eric Cartwright.

The district is also partnering with public works on a fish ladder so steelhead coming upstream can get over the inflatable dams and grade control structures. “It’s a very complex design, the ladder has to operational during a wide range of scenarios, passable to fish both when the barriers are up or down, and also when they’re inflating and deflating. Most fish ladders provide access over fixed structures,” says Cartwright. The screens are in place but the ladder is still awaiting various approvals. “Because it’s a flood control channel, there’s a whole extra layer of permitting. It’s also not our usual water supply project where we are providing mitigation, it’s our first purely environmental project. We’re trying to do our part to help the fish so we can continue to access our water supply,” says Cartwright.

Along the 12 miles of the flood control channel at the bottom of the creek, the County is also trying to be strategic about improvements. The channel, originally designed by the US Army Corps of Engineers, has to have a very high flood capacity in order to drain such a large watershed. But sediment keeps collecting in the channel, requiring maintenance dredging to protect flood capacity, as well as state and federal permits to scoop the sediment out of the way.

To address this, the Alameda County Flood Control District proposes to optimize the existing channel. “We found a way around the problem by designing a sustainable low flow channel, and sizing it based on nature and hydrology and sediment transport modeling. We’re helping a naturally formed low flow channel by widening it in some places and making it deeper and steeper in others,” says Rohin Saleh, chief hydraulic engineer for the District. The plans he’s crafting are designed to flush sediment out faster and reduce water levels during high flood events, as well as help fish. “We’re close to finding the sweet spot,” he says.

At the bottom of the flood control channel near the outfall of Alameda Creek, meanwhile, the State Coastal Conservancy is eager to breach levees between the channel and its salt ponds around Eden Landing (between the two south Bay bridges). With more connectivity to the creek and the Bay, the restored ponds may serve as estuarine transitional habitat and nursery grounds for outmigrating steelhead smolts. “The issue we’re wrestling with is how big to make our breaches. We don’t want to exacerbate flooding,” says the Conservancy’s Buxton.

The flooding won’t just be coming from high tides or big runoff events in the future either. Both the flood control district and the Conservancy have been worried about rising seas as well. The District has been floating the idea of adding a land mass on the inner, salt pond side of the Bay’s outermost dikes – not something that has gone down well in the past with those trying to protect the Bay from infill. But in the face of sea level rise, a number of local scientists and environmental groups have been talking up a new style of “horizontal levee” with a broad backside, and the District has its own version on the drawing board.

“A land mass is a more dynamic physical separation between the Bay and the internal system than a big levee wall, and more adaptable to the ups and downs of tides, storm surges, and sea level rise,” says the District’s Saleh. “If this frontal system is not there, then the salt ponds will gradually become part of the Bay as sea level rises. In addition, if we breach levees in an optimized manner we get more storage in the ponds, which damps the effect of extreme tides and reduces the peak elevation of the tides so less water gets pushed up into the vicinity of coastal developments. By the time high waters reach the residences inland the water level could be 3-4 feet lower than it was on the edge of the Bay. So the project could provide flood protection and restoration at the same time, it’s self mitigating.”

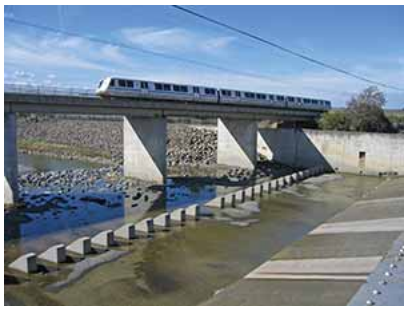
The Hunt for Sediment Sources

Many of these plans hinge on solving the issues with sediment building up in the wrong places as the creek carries it down to the Bay. Getting good science on where the sediment was coming from was paramount when watershed planning and improvement efforts began to heat up around the mid 2000s. To this end, various partners set up a sediment forum and launched a research effort by the San Francisco Estuary Institute.

Surveys in the watershed between 2005 and 2012 suggest 100,000 metric tons of sediment comes through Niles Canyon annually, according to the Senior Scientist Lester McKee. The majority of it arrives from the Livermore Valley and Arroyo de La Laguna side of the watershed, while on the other side a lot of the sediment produced is then trapped in San Antonio and Calaveras Reservoirs.

A follow up survey done for the District revealed that smaller, steep tributaries near the flood control channel, such as Dry, Stonybrook, and Sinbad Creeks, are producing a disproportionate amount of sediment relative to their size, and of the kind of coarser material that collects in the flood control channel. “That’s a macro sediment budget,” says McKee.

McKee also collected data with geomorphologist Sarah Pearce showing that the geometry of the channel is dynamic. Flood flows create variable areas of scour and deposition across the bed. And the position of the low flow channel migrates through time within the levees that confine the larger flood control channel.



"Dragon's teeth" under the BART weir. These concrete blocks break up high flows and slow velocities in the flood control channel. Photo by Brian Sak.

McKee says that once in the flood control channel, some of the sediment gets deposited behind sills, the inflatable dams, and the grade controls, pillars, weirs and other constrictions as water velocity speeds up or slows in relation to changes in channel gradient. The District is trying to figure out how get those water velocities — what scientists call stream power or the energy gradient within the creek — to be a little more consistent down the length of the channel. If such consistency can be crafted, more coarse sediment will make it out to the Bay, reducing dredging costs and creating more habitat within the channel.

Meanwhile, the salt ponds being restored at the foot of the creek will need a steady supply of sediment to keep building up their marsh to the water levels associated with sea level rise. "From our perspective, the more sediment coming down the better. We want to reconnect marshes to long term sediment supply sources so they can be sustainable," says the Conservancy's John Bourgeois.

The Best Laid Plans

SFPUC staff electrofishing near Sunol Dam prior to its removal. Photo by Brian Sak.

Most of the improvements described so far are still inside computers rather than on the ground or in the water, and many partners are impatient to knit them all together and start construction. "The hopeful thing is that there are only a handful of public agencies responsible for Alameda Creek," says SFPUC's Ramirez.

One bottleneck right now seems to be the need to apply for a federal 408 permit to alter the flood control channel, not to mention who puts up the millions it will take to pay for it. Though the "408" is an old permit type focused on levee safety, the Army Corps recently made some changes in how it works based on what happened during Katrina and Sandy. Some projects must not only go through local Corps approvals, but also then be reviewed by headquarters in Washington DC. Asked for a comment on Alameda County's plans the Corps' Greg Brown wrote: "As a Regulatory Authority, we review each application on its merits within Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. From the personal perspective, I think the concept is a positive trend." Brown is Regulatory Project Manager for U.S. Army Corps of Engineers San Francisco District.

FEMA too weighs in on the federal side, and the local office is currently redrawing its flood insurance rate map for the region around Alameda Creek's mouth. The new map should be out within six months, and depicts where there is a 1% annual chance of flood in any given year. "If you look at FEMA's flood map today, there are no high hazard areas along Alameda Creek because of the channel and levees," says FEMA engineer Eric Simmons. "That doesn't mean there isn't risk. People behind levees need to know that flooding can always happen, but the likelihood is less than along San Francisquito Creek in Silicon Valley, for example."

As part of a new federal push to respond to coastal hazards, FEMA recently developed a flooding model for the entire San Francisco Bay coastline, and worked closely with Alameda County to refine that model so it could be applied to Alameda Creek projects. The County, in turn, has been looking at future sea level rise conditions, and updating FEMA's model. "It's been a mutually beneficial partnership. We share data and leverage off of each others work," says Simmons.

These are all positive signs that old-style, heavy-handed, flood control attitudes may be getting a real makeover. “What we learned in the past 70 years with all these flood control projects is that every time we try to simplify a complex natural process we suffer for it in the long term. In reality it’s a complicated dynamic and you need to design a system that works naturally with the breathing of the Bay, in and out. This is not a conventional approach, but we have been able to show FEMA that the natural system is working, and we should build on it instead of dismantling it and building something we think is better,” says the Alameda County Flood Control District’s Saleh.

Local water quality regulators, meanwhile, are watching proposals to improve Alameda Creek with interest, as they work to restore more natural filtering and ecosystem functions to urban watersheds in the Bay Area. “The fact that county flood control has come round to these new concepts so rapidly, and that the Corps seems to have blessed it nationally, is a landmark event. It’s new-age thinking, and we’re very happy to see that,” says the Regional Water Quality Board’s Dale Bowyer.

In the end, all these practical details can’t hold a candle to the moment captured on video more than a decade when two steelhead nicknamed Bonnie and Clyde made a commando crawl up the flood control channel on U-tube – a video that went viral. “Alameda Creek is one of our best chances in the Bay to bring back steelhead,” says the Coastal Conservancy’s Brenda Buxton. “If we can’t do it here it may be next to impossible at other locations. It’s a logical place to put this effort into it.”

RELATED LINKS

Alameda Creek Historical Ecology Study

Creek Sediment Forum

Central Valley Flood Protection Board Levee Maps

Alameda Creek Alliance, Northern Arroyos