

**BAY AREA WATER SUPPLY AND CONSERVATION AGENCY
BOARD OF DIRECTORS MEETING**

April 11, 2018

Correspondence and media coverage of interest between February 13, 2018 and April 6, 2018

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Article: Advice on Voluntary Settlements for California's Bay-Delta Water Quality Control Plan: Part 3: Science for Ecosystem Management

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Article: Advice on Voluntary Settlements for California's Bay-Delta Water Quality Control Plan:
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Date: February 13, 2018
Source: California Water Blog
Article: Advice on Voluntary Settlements for California's Bay-Delta Water Quality Control Plan:
Part 1: Addressing a Manageable Suite of Ecosystem Problems

Water Infrastructure:

Date: April 4, 2018
Source: Bay Area News Group
Article: Stronger together: The Bay Area's newly linked water lifelines

Date: April 3, 2018
Source: Safety Management Systems
Article: Case Study: Oroville Spillway Response Update

Date: April 2, 2018
Source: Sacramento Bee
Article: Southern California water agency backs off plan to finance both Delta tunnels

Date: March 29, 2018
Source: San Francisco Chronicle
Article: LA is deceiving itself if it thinks it doesn't need delta tunnels

Date: February 27, 2018
Source: Water Deeply
Article: Californians Are Struggling to Pay for Rising Water Rates

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Last snow survey: State to squeak by

San Francisco Chronicle | April 3, 2018 | Peter Fimrite

The storms of March may not have rained glory on the state, but they dropped enough snow on the Sierra to greatly improve the drought situation and, with another storm rolling in this week, water resources officials believe thirsty California will make it through the year.

The Sierra snowpack, known to water resources officials as the state's frozen water supply, is 52 percent of average for this time of year — not great, but a lot better than it was in January and February, according to the California Department of Water Resources.

The April snow survey conducted Monday is a vital gauge of how much drinking and irrigation water is available in California because it represents the peak measurement before the snow starts melting.

The snow in the Sierra and lower Cascades provides as much as a third of the water in the state. The runoff goes into California's sprawling network of aqueducts, which supply water districts throughout the state.

That supply will be helped out when the stormy remains of typhoon Jelawat roll in Thursday, dousing California and topping off its reservoirs, but the storm isn't expected to change the situation much.

The state uses metal tubes to calculate the depth and water content of the Sierra snow at 250 locations, including historic Phillips Station, just north of the Sierra-at-Tahoe resort south of Lake Tahoe in El Dorado County. Surveyors there found 32.1 inches of snow Monday, with a water content — which is what drought-worried officials care about — at 12.4 inches, or 49 percent of the long-term average for that location going back to 1941.

"While we had a good March, it was not adequate to get us up to a really good outlook with respect to the water supply," said Frank Gehrke, chief of the California Cooperative Snow Surveys Program for the Department of Water Resources. "The great advantage of this year, compared to other years with a similar snowpack, is that because we had such an abundant snow pack last year, our reservoirs are above average, so that gives us that cushion."

Snow surveys are taken during a 10-day window around the first of every month, from January to May, and are combined with electronic measurements from more than 100 locations to gauge California's drinking water supply for the year.

The snow level more than tripled over the course of a week in early March and kept rising. Still, it isn't close to a year ago when the snow water content was close to double the long-term average.

The snow at Phillips, which is traditionally measured in view of the media, was 39 percent of average a month ago and 24 percent of average in January. A year ago at this time, the water content at Phillips was 46 inches, or 183 percent of the average.

Last month's storms provided a major boost to the central part of the Sierra, including the Lake Tahoe area, where the water content is now 60 percent of average for this time of year. The storms weren't quite as helpful in the northern part of the state, where the snow-pack stands at 43 percent of average. It is 50 percent of average in the southern Sierra.

Taken together, that's 52 percent of average statewide.

The coming storm, which originated near the Philippine Islands, is expected to pound the Bay Area from Thursday evening through Saturday, spattering the Bay Area with unseasonably strong rain and ruining what had been a balmy spring just as Bay Area residents were pulling out their beach towels and lounge chairs.

"We're looking at, believe it or not, another Pineapple Express taking aim at the Bay Area," said Steve Anderson, a meteorologist with the National Weather Service. "It's a very late-season storm. It's a little bit unusual. Typically, we tend to be coming out of that cycle about now, but it's lingering on one more time."

The leading edge of the storm is currently about 1,000 miles off the coast and can be seen on satellite images stretching across the Central Pacific past Hawaii.

It is expected to drop between 3 and 6 inches of rain on the North Bay through Saturday, with Santa Rosa and Cloverdale, in Sonoma County, and Kentfield, in Marin County, getting the worst of it. Some communities along the Russian River could get as much as 7 inches.

As much as 4 inches of precipitation is expected to fall in San Rafael; 3 inches in Napa, Half Moon Bay and Santa Cruz; and 2 inches in San Francisco and Concord. The storm means at least one game of the three-game series between the Giants and Dodgers, beginning Friday in San Francisco, is likely to be rained out.

These types of sustained subtropical storms, known as atmospheric rivers, are considered rare in April.

"We're talking 48 hours of some significant rainfall," said Mike Pechner, of Golden West Meteorology. "That is twice the amount in some areas of the normal April rainfall."

With snow levels around 8,000 feet, he said, the rain could mix with snowmelt and cause local flooding in the Sierra foothills. State water resources officials said they are determined to prevent the kind of flooding that happened during rain storms last month at Moccasin Dam in Tuolumne County.

In the long term, though, it is a good thing for reservoir levels in California.

"This will be a good time to collect water," Anderson said.

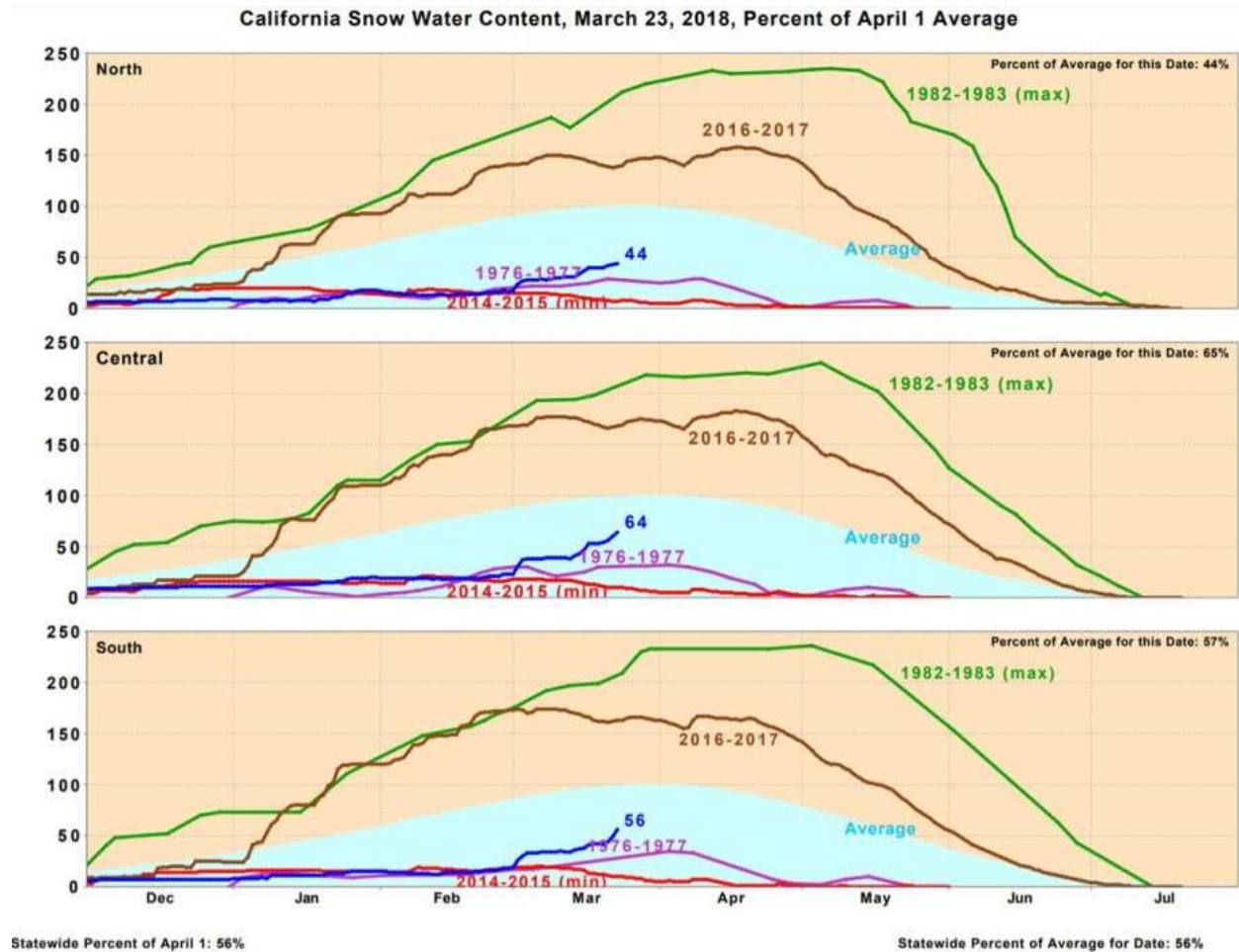
There still won't be enough water to go around once the storm passes and the snow melts, said Karla Nemeth, the director of the Department of Water Resources. The state water project is currently allocating 20 percent of the water farmers are entitled to in a good water year.

"We've got one word for Californians, and that's 'conserve,' " she said. "It is a new way of life."

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Sierra snowpack water content more than triples in a month

SF Gate | March 24, 2018 | Amy Graff



A series of supercharged storms that blasted the Sierra in March has bolstered the snowpack that was alarmingly low before the start of the month.

The National Weather Service (NWS) in Sacramento tweeted Saturday that the water content of the snowpack has more than tripled in the past month.

On Feb. 22, an average of 4.6 inches was measured and on March 23 an average of 15.5 inches was recorded, going from 16 percent to 56 percent of the April 1 average.

Daniel Swain, a meteorologist at UCLA, commented on the NWS's tweet, "California's snowpack has experienced a pretty amazing recovery in recent weeks, which is great news! And yet despite the feet of new powder, stored snow water still remains far below long-term average--a testament to just how bad things were in February."

On average, the Sierra snowpack supplies about 30 percent of the state's water needs, and its spring and summer runoff feeds rivers and reservoirs, watering crops, and filling bathtubs and water glasses.

The Sierra snowpack was low throughout most of winter, as December and February were dry with a high-pressure ridge parked along the West Coast, acting like an invisible wall and blocking moisture-rich storms in the Pacific Ocean from reaching land.

The storms that hit in November and January were weak and on Feb. 20 the snowpack was just 20 percent of average.

Finally, in March, California has seen a series of storms with strong moisture-taps that have piled up snow. This week, a system driven by an "atmospheric river" blasted the Sierra.

Squaw Valley reports it has seen 212 inches (17.5 feet) of snow between March 1 and March 23.

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After Heavy Snowfall, a Massive Rainstorm Hits California: What You Need to Know

California Magazine | March 20, 2018 | Glen Martin

Water managers and hydrologists are a mite worried. The good news is that the recent cold storms dumped a lot of new snow in the Sierra. That will help keep reservoirs charged and Californians adequately hydrated through the coming year. But there's a literal dark cloud counterbalancing that silver lining—a massive “atmospheric river,” aka the Pineapple Express, now poised to wallop California.

Billed as the largest storm of the season, it's expected to last through Thursday and drop up to five or six inches of water in the central and southern portions of the state. That could present significant public safety risks, particularly in those parts of SoCal that were ravaged by wildfires last year. Santa Barbara County and Ventura County officials, concerned about a reprise of the mudslides that killed 21 people in the Montecito area, have ordered mandatory evacuations of vulnerable areas.

“This [incoming storm] is aimed at the area between Monterey and Santa Barbara and there's a real possibility of localized flooding and more landslides,” says climate change and water resources authority Peter Gleick, (PhD, '86), the president emeritus of the Pacific Institute.

Moreover, as foreshadowed by the storm's tropical fruit-associated moniker, this precipitation will fall as rain, not snow, even at higher elevations—i.e., the Sierra Nevada. That has long-term implications that are even more worrisome than the immediate threat. These “rain-on-snowpack” events are typically responsible for the worst flooding in the state, says Gleick, especially in the Sacramento and San Joaquin Valleys.

Indeed, such occurrences figure prominently in the apocalyptic scenario that has long been feared: a huge snowpack suddenly melted by warm and torrential late winter or early spring storms, overwhelming already full reservoirs, ultimately breaching dams and levees from Lake Shasta at the north end of the Sacramento Valley to Friant Dam in the southern San Joaquin Valley, turning the interior of the state into a vast inland sea.

While not impossible, that's unlikely this year, says Gleick. Though reservoirs mostly were filled by last year's extremely wet winter, the most problematic reservoir, Lake Oroville, was drawn down to allow for repairs to its gigantic earthen dam, which was perilously close to failure following a series of big storms.

“Still, there has been a huge increase in the snowpack over the last couple of weeks,” says Gleick. “If it melts slowly, great—but if we get a lot of warm rain on it and rapid melting, we could have flooding. We always worry about these warm storms.”

Moreover, says Gleick, the current storm “needs to be superimposed on top of a very clear long-term trend in California hydrology that includes less snow and more rain. The data over the years have also shown a clear trend to more extreme weather, both in terms of dry spells and [the violence and duration] of storms.”

Such shifts were predicted in the mid-1980s, says Gleick, and “those changes are now happening.”

That's deeply problematic for California's water storage and distribution system because it was designed for a very different regime, one predicated on storing snowmelt. Under the original

plan, snow fell in the Sierra during the winter and melted slowly in the spring and early summer, yielding water at a steady and predictable rate to waiting reservoirs. Managers had little difficulty in controlling the level of the reservoirs for both flood control and water supply. But a warming planet has disrupted that strategy. Big, warm storm fronts can melt accumulated snowpack with great rapidity, swelling reservoirs and threatening to overtop dams. That means managers have to operate reservoirs as flood control structures first, releasing massive quantities of water to maintain dam integrity, sometimes at the expense of water supplies later in the year.

And even then that may not be enough: dams and reservoirs constructed in the 1950s may be inadequate for the geophysical realities of the 21st Century. Further, new dams won't solve the water supply problem. Most of the Sierra's rivers have one or more dams on them already and new dams would offer minimal additional storage. Two major coastal river systems, the Eel and the Klamath, could be dammed, but the environmental impacts would be profound and political opposition would be fierce. The projects also would be astronomically expensive, likely negating many of the benefits of additional storage.

"We'll never be able to replace lost snowpack with new surface storage," says Gleick. "We have to manage our existing reservoirs for a changing climate, and we need to pursue other options available to us. That includes groundwater storage, water recycling and increased efficiencies in use. Yesterday's climate is gone, and it's not coming back."

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DWR Finalizes \$85.8 Million in Grants for Local SGMA Implementation

The California Department of Water Resources on April 4 released the following statement regarding grant decisions for groundwater sustainability projects and the development of Groundwater Sustainability Plans by local agencies.

ACWA | April 4, 2018 | CA Department of Water Resources

SACRAMENTO – The California Department of Water Resources (DWR) today announced awarding \$85.8 million in grants for groundwater sustainability projects that directly benefit severely disadvantaged communities. The final grants also fund the development of Groundwater Sustainability Plans (GSPs) by local agencies. The list of awards and submitted applications can be found [here](#).

The funds support the goals of the landmark 2014 Sustainable Groundwater Management Act (SGMA), which requires local agencies to sustainably manage the state's groundwater basins.

“Sustainable management of our groundwater basins is a critical element of making our communities more resilient in the face of climate change and drought,” said DWR Director Karla Nemeth. “These funds direct critically needed resources to disadvantaged communities and newly formed groundwater sustainability agencies so that they may address regional water supply challenges now and in the future.”

DWR received 78 applications in response to the 2017 Sustainable Groundwater Planning (SGWP) grant solicitation with a total request of \$86.4 million. DWR is announcing full awards to 77 applicants and a partial award to one applicant. The final awards are consistent with the draft recommendations, announced on Feb. 6, 2018. The competitive grants are funded by Proposition 1 passed by California voters in 2014.

Of the \$85.8 million awarded:

- \$16.2 million will support groundwater sustainability planning and management benefitting severely disadvantaged communities.
- \$69.6 million will support GSP development by groundwater sustainability agencies. Of this amount, \$3.4 million is being tentatively awarded to three applicants that submitted an alternative plan to DWR in 2017. If the alternative plans are subsequently approved by DWR, the tentative awards would be withdrawn since applicants with approved alternative plans are ineligible for this funding.

The funding provides a means for local communities to create long-term sustainable groundwater management plans as required by law that help protect basins and their beneficial uses. Ultimately these plans are intended to facilitate basin-wide and regional sustainability. DWR will begin working with the grant applicants to develop and execute grant agreements.

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Desalinated Water in California Doesn't Have to Come From the Ocean

California has granted more than \$34 million to desalination projects, and much of that money is going toward brackish water projects. That approach isn't cheap or without environmental concerns, says Richard Mills of the Department of Water Resources.

Water Deeply | March 20, 2018 | Ian Evans

The California Department of Water Resources has awarded \$34 million in grants to eight desalination projects throughout the state. The money is part of a round of awards for desalination projects, as designated by Proposition 1.

While ocean desalination has often caught most of the public attention, two of those construction projects, in Antioch and Camarillo, focused specifically on inland brackish desalination, as did several of the other projects that received grant money. California has plenty of salty inland water, such as the water in the upstream Delta or in underground aquifers that have absorbed soil salts. As local agencies look for more potable water sources, desalinating that local water may become an important part of the equation, says Richard Mills, the Department of Water Resources' recycling and desalination chief.

But it's not cheap. Mills says that brackish desalination can run from about \$800 for an acre-foot of water to about \$3,000. While these projects are generally cheaper than ocean desalination, costs vary significantly by location. Still, the proposed projects show that, despite the cost, there is still a lot of interest in brackish desalination. "That may mean that we're running out of cheap water sources," he said.

Water Deeply spoke with Mills about the projects and the role of brackish desalination, especially groundwater desalination, throughout California.

Water Deeply: In these awards, why is there so much emphasis on brackish desalination, as opposed to ocean water desalination?

Richard Mills: I think that cost and the sustainability of implementation accounts for a lot of that. The cost of brackish water desalination is generally much less than seawater desalination, in part because the treatment itself – the cost is very much affected by the degree of salinity. The less salinity, the less cost. The environmental issues can [also] tend to be somewhat less, depending on the individual situation.

Water Deeply: What are the current environmental impacts of brackish desalination?

Mills: For open water intakes for brackish water – from San Francisco Bay or the upstream Delta – you have the effects on aquatic organisms in the water column. Brackish water [desalination] growth in California has been more focused on using groundwater, where the intake part isn't so much of an environmental impact, other than the effect on the groundwater itself and potentially overdrafting.

Brine is the other key environmental issue.

Water Deeply: Why is brackish groundwater desalination cheaper than seawater desalination?

Mills: I should say that, for either ocean water or brackish water projects, there is a very wide range of project costs. If you just look at the treatment itself, the desalination treatment technology is to take the salts out of the water, and the most common treatment technology that is being used currently is

reverse osmosis, which can be fairly energy-intensive and the amount of energy required is greatly affected by the concentration of the salts in the source water.

For the brackish water projects, we seem to be dealing in the range of 1,000–3,000 milligrams per liter of total dissolved solids, whereas when we're talking about ocean water, we're more in the range of 30,000–35,000 milligrams of total dissolved solids. So you're dealing with a concentration of salts that is about one-tenth that of ocean water, and therefore the cost itself is much less.

The brine is another significant cost, as well as an environmental issue. With ocean desalination, the quantities of brine are much greater, but one advantage is that you generally have the ability to discharge them into the ocean in an environmentally acceptable way. With inland projects, there's the issue of what to do with the salts. Putting them in a landfill – could there potentially be contamination issues as salts leech back into the groundwater?

So we can't say that in an individual situation, brackish groundwater desalination is going to be a cheaper alternative, but as you see from the eight awards there is still a lot of interest in it.

Water Deeply: How much do you think that brackish desalination will be a part of how California deals with water issues in the future?

Mills: In the California Water Plan 2013, we had kind of an inventory of projects that were in place at the time, and also what seemed to be in planning. In 2013, there were 23 brackish groundwater desalination plants, and three ocean desalination plants. The ocean plants, at that time, were very minuscule in size, so the annual production and capacity was only 560 acre-feet a year, whereas with the brackish groundwater, the annual capacity was 139,000 acre-feet a year.

Water Deeply: As brackish desalination becomes a bigger part of California communities meeting their water needs, how is the Department of Water Resources balancing brackish groundwater withdrawal with the Sustainable Groundwater Management Act?

Mills: Well, one thing is that when we give grants toward the planning or even for construction, we're expecting that there be an analysis of how the drawing of additional brackish water from the ground may impact the overall groundwater supply.

With the Groundwater Management Act, there's a mandate to analyze these issues. I think that even if there wasn't a prudent local effort to analyze the impacts on the part of the proponents of local brackish groundwater use, the groundwater management agencies that are trying to comply with the Groundwater Management Act are going to be a driving force to make sure that proper analysis is being done.

Water Deeply: Thank you for talking with us. Is there anything else that you would like to say?

Mills: I think in summary, it's not going to be on a statewide level a huge contribution to our state's water supply, but it is important for many local communities who need a more significant source of supply, and it is a way to take advantage of a source of water that is currently unusable and being able to use it.

Why New California Drought Regulations Have Caused an Uproar

Dozens of local water agencies are opposing state regulations to ban wasteful water practices, partly due to issues relating to the water board's authority.

Water Deeply | March 1, 2018 | Tara Lohan

On February 20, California's State Water Resources Control Board postponed a decision on the adoption of new statewide regulations meant to curb wasteful water practices. The regulations would make permanent some rules California enacted temporarily during the recent drought, which ended last year.

After several public comment periods this winter, water board staff tweaked the regulations to address concerns and recommendations from water users and other groups, but the postponement came after a large number of water agencies claimed the regulations are a violation of water rights.

"We believe using waste and unreasonable use as the tool to reach these conservation objectives is problematic and inconsistent with the law," read a comment letter to the board signed by dozens of water agencies. "The regulation is defective because it has the effect – if not the purpose – of diminishing water rights by legislative means, without any process whatsoever."

But the issue also appears to go beyond the fight over this set of regulations and centers on the water board's authority and a disagreement over state versus local control of water policy.

The Regulations

The proposed regulations prohibit such actions as hosing off driveways and sidewalks, watering that causes more than incidental runoff, operating decorative fountains that don't recirculate water and watering ornamental public medians. The regulations are part of a broader plan outlined in a May 9, 2016, Executive Order from Governor Jerry Brown titled Make Conservation a California Way of Life.

It is one small but important piece of the state's overall work at increasing resilience to climate change and its impact on California's water, according to Max Gomberg, climate and conservation manager at the State Water Resources Control Board.

Gomberg said that he doesn't expect major statewide impacts to water savings relative to other conservation measures, but "what it does is really help raise awareness of the need for conservation and efficiency at all times because of the way the state's hydrology is changing," he said. "I think it's about ensuring that there's basic uniform standards of water waste and the ability when needed to enforce those standards statewide."

Water Rights

At first glance, it would seem strange that so many water agencies are opposing the board's action because most agree that the prohibitions are common sense and good water policy. And in fact, many of the same regulations have been in place for years at the local level.

"This is not a wholesale new statewide set of prohibitions, it's taking a patchwork that was in place locally and making it uniform," said Gomberg.

Robert Donlan is an attorney with law firm Ellison Schneider Harris & Donlan who has spoken on behalf of a coalition of water agencies opposing the regulation. He said his clients are "concerned with this narrow issue of water rights and due process with the waste and unreasonable use approach to the regulation."

However, Donlan said that the groups that he has been working with support the concept of the regulation and the conservation measures that are in the regulation, but the concern is really around that narrow issue of the appropriate process to ground the regulation.

Jennifer Harder, an assistant professor at the McGeorge School of Law at the University of the Pacific and an expert in water law, thinks that in this particular situation the water board is operating within its rights and that "the water rights argument isn't very strong in this case."

She said, "Although there are circumstances where questions can be legitimately asked about actions that the water board is taking with respect to conservation, and there are some circumstances in which local action might be wisest, my opinion is that this particular resolution prohibiting wasteful uses is an easy case."

One of the main reasons, she explained, is that the regulation focuses on egregious waste and "a prohibition on waste is one of the fundamental principles of all water rights since the beginning of water rights," she said. "There is no question that water rights do not include the right to waste water, which is what we are talking about in this resolution. We're not talking about broader conservation measures."

Bigger Issues

What's at stake appears to be a much bigger fight, though. "The real problem here is that they have a fear that if the water board is going to take this action, that it may be an opening salvo to more actions," said Harder. "It's setting a precedent."

Donlan also acknowledged that larger issues are at play and concern with precedent is one of them.

"The higher-level concern is establishing a precedent that the board could, through quasi-legislative means, enact regulations declaring certain uses to be wasteful and unreasonable without affording due process on a case-by-case basis," said Donlan.

During a recent water board hearing, several commenters alluded to this issue of a "slippery slope" of regulations, which may be about urban water practices this year, but could take on agricultural or other water uses later.

Also at issue, believes Gomberg, is a state versus local power struggle. "There is a long-standing belief in some quarters that really the state shouldn't have anything to say about water use and this is just evidence of a balance of power and responsibility between locals and the state that is tilting toward the state and they don't like that," he said.

Harder concurs, but said there is an additional problem. “Good water policy is going to require statewide action that can only come from the state water board, but the legal rules that govern state water board authority are at best vague and at worst directly conflicting with each other.”

This has created a patchwork structure for state water board authority that results in unnecessary litigation and does not support good water policy, she said.

“If our goal is legal clarity, what we really need is a clear legislative delineation that gives the state water board clear authority where that is sensible and retains local authority where that is sensible,” said Harder.

It’s unclear if water agencies will pursue legal action if the board doesn’t amend its approach to the regulations, which Gomberg said may be taken up again as early as April.

While he said there is still time for discussion on the issue of water rights, he added, “It’s not as if we have changes under development at the moment.”

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Statewide Water Bond Measures Could Have Californians Doing a Double-Take in 2018

Two bond measures, worth \$13B, would aid flood preparation, subsidence, Salton Sea and other water needs.

Water Education Foundation | April 6, 2018 | Gary Pitzer

California voters may experience a sense of déjà vu this year when they are asked twice in the same year to consider water bonds — one in June, the other headed to the November ballot.

Both tackle a variety of water issues, from helping disadvantaged communities get clean drinking water to making flood management improvements. But they avoid more controversial proposals, such as new surface storage, and they propose to do some very different things to appeal to different constituencies.

Since 2002, California voters have approved more than \$15.5 billion in bonds – voter-approved debt reimbursed with general fund taxes – that have been largely focused on water.

This year California voters will consider whether to approve another \$13 billion in water bonds — the \$4.1 billion California Clean Water & Safe Parks Act (Proposition 68) in June and the \$8.9 billion Water Supply and Water Quality Act of 2018 in November.

Prop. 68, authored by Senate President Pro Tem Kevin de León as SB 5, includes \$1.5 billion for parks, \$1.5 billion for drought contingency/water supply and \$500 million for flood protection. It's the first parks and water bond since 2006, when the \$5.4 billion Prop. 84 was approved.

"It's a jam-packed bond," said Caitrin Chappelle, associate director at the Public Policy Institute of California's Water Policy Center. "It's not just a water bond. It's parks, coastal protection and outdoor access."

Gerald Meral, director of the Natural Heritage Institute's California Water Program, is the author of the November bond known as the Water Supply and Water Quality Act of 2018, which among other things dedicates \$640 million for assisting implementation of the Sustainable Groundwater Management Act (SGMA). He said his proposal, which is currently undergoing signature verification with the Secretary of State's office, is intended to complement Prop. 68, which is broader in scope. Californians, he said, are ready to embrace both measures.

"Typically, in polling usually what polls well is safe drinking water, clean water in rivers and streams and water supply that's resistant to drought," he said. This bond, he said, responds "to all those things in a really big way."

The two bond proposals reflect the disparity that sometimes exists among California stakeholders. Prop. 68, the result of the consensus-driven legislative process, includes funding for parks, coastal protection, outdoor access and natural resource management. Meral's measure is more geared toward the interests of urban and agricultural water suppliers.

"Given the need we have for water management, you couldn't have gotten it on one bond," said Tim Quinn, executive director of the Association of California Water Agencies, which represents both urban and agricultural water agencies. "The legislative bond reflects the constraints of doing something in the Legislature where the focus tends to be coastal, urban Democrat. The November bond shifts a lot of the investments inland [and] was developed through a different process reflecting a different political environment."

Water bonds regularly appear on the ballot (sometimes in June and November) because bond financing is seen as necessary to deal with water issues in a state as large as California. The recent spate of large water bonds can be traced to 1996's Prop. 204, which authorized \$995 million to help restore and improve the Sacramento-San Joaquin Delta and San Francisco Bay ecosystem, boost wastewater treatment, water supply and conservation and help with local flood control and prevention.

"Bonds are used in different ways," said Chappelle with PPIC. "Sometimes they are used to incentivize large infrastructure projects that wouldn't be able to get off the ground without state support and sometimes they are used to motivate new types of projects that local agencies haven't been investing in yet."

"Given the need we have for water management, you couldn't have gotten it on one bond."
~ Tim Quinn, executive director of the Association of California Water Agencies.

Voters last approved a water-related bond in 2014, when they passed Prop. 1, which included \$2.7 billion to fund the public benefits portion of new surface storage projects. Disbursement of the storage funds is subject to the California Water Commission's approval, and the agency has been criticized by some parties for its initial decision not to award funding for the proposed Sites Reservoir in Colusa County and Temperance Flat upstream of Friant Dam near Fresno.

Chappelle said the high bar set by the Water Commission was by design.

"Anyone who read or understood the original language of Prop. 1 probably is not that surprised because they set a pretty rigorous process by which money was going to be passed out," she said. "The fact that it's taking a while is because they are following the letter of the original bond language."

The two bonds of 2018 do not include any money for new surface storage. Among Prop. 68's supporters is the San Diego County Water Authority, which is keenly interested in seeing the state follow through on its commitment to restore the Salton Sea.

"Robust Salton Sea funding in this bond measure is significant for San Diego County because it supports agreements that generate substantial water supplies for our region," Mark Muir, chair of the Water Authority's board of directors, said in a March 22 statement. "The bond would help the state meet its obligations for Salton Sea restoration and allow our region to compete for other funds to further enhance water supply reliability and local watersheds."

The \$750 million allocated in the November bond to deal with subsidence issues in the San Joaquin Valley is crucial because of the need to move water for groundwater replenishment as part of SGMA, Quinn said. Beginning at Millerton Lake east of Fresno, the 36-mile Madera Canal moves water north to augment irrigation capacity in Madera County while the 152-mile Friant-Kern Canal moves water south to Fresno, Tulare and Kern counties.

"Both of these canals have been seriously impacted by subsidence," Quinn said. "The Friant-Kern Canal has lost an amazing 60 percent of its capacity to deliver water. These funds will help raise the canals and restore the ability to deliver replenishment water."

The two bonds together designate more than \$1 billion for the clean drinking water needs of disadvantaged communities, something ACWA endorses. The group would rather see the bonds fund this issue instead of a plan by the Brown administration to establish a tax on

drinking water of 95 cents per month to help repair the hundreds of mostly small public water systems with unsafe tap water.

“We want to solve the problem and we want to minimize the desire people have for a tax on drinking water,” Quinn said.

Unknown is whether voters will experience bond fatigue with two multibillion-dollar measures facing them in June and November. SB 5 was opposed by the Howard Jarvis Taxpayers Association, which generally opposes the use of large state bonds to finance projects. While not formally opposing SB 5, the Coalition for a Sustainable Delta, a group of south-of-Delta water contractors, last year issued a release saying that SB 5’s funding allocation of \$1.5 billion for water “is woefully inadequate.”

While voters have a history of supporting water bonds, Chapelle noted that Prop. 1 passed during a protracted drought when water was viewed as one of the most important issues in California. “That is not currently the case anymore,” she said. A drought-busting winter in 2017 refilled many of the state’s depleted reservoirs and late season snow and rain in 2018 likely prevented the return of an official drought.

Meral said voters have a history of passing two bonds in the same year and that the issue with the Water Commission and storage funding will soon be resolved.

“I think by July they [the Water Commission] will make some awards,” he said. “I would be clearly surprised if they didn’t.”

Quinn, a veteran of California water policy, said times have significantly changed since the days when the primary focus in the state was completion of a major infrastructure project like the State Water Project. The emphasis now is developing sustainable water supplies at the regional level with financial help from the state.

“It turns out that about every four years we pass a new bond that infuses some public dollars, which always leverages a lot more local money and the voters have overwhelmingly supported them,” he said. “This is what has kept the wolves away from California’s door for 25 years – public investment stimulating local investment in a different direction of water management and I believe it is now time for another infusion of that public investment.”

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Is Ecosystem-Based Management Legal for the Sacramento-San Joaquin Delta?

California Water Blog | March 8, 2018 | UC Davis Center for Watershed Sciences and Brian Gray (PPIC Water Policy Center), William Stelle (former NOAA Fisheries West Coast Administrator), and Leon Szeptycki (Stanford University, Water in the West)*



The Sacramento-San Joaquin Delta. (Photo credit: Carson Jeffres)

Introduction

In a recent three-part series posted on this website, a group of independent experts (including one of the authors here) proposed new ways to manage the Sacramento-San Joaquin Delta ecosystem. The purpose of the recommendations is to inform negotiations on the revised Bay-Delta Water Quality Control Plan, which will set new water quality and flow requirements for the Delta and its tributaries.

These experts urged the State Water Board and negotiating parties to: (1) take an integrated approach to the Delta to improve food web productivity and habitat, while reducing harmful algal blooms; (2) coordinate management of freshwater flows, tidal energy, and landscape changes in the North Delta and Suisun Marsh to improve ecosystem function; and (3) develop a robust, well-funded independent science program to guide implementation and assessment of the water quality plan.

The experts note that populations of native fish species listed under the state and federal endangered species acts are so low that they are no longer reliable indicators of Delta

conditions. They recommend shifting away from an emphasis on managing the Delta for these listed species. And they outline an ecosystem-based approach that would improve conditions for a wide range of terrestrial, wetland, and aquatic plants and animals—including listed fish species—as well as for human uses of the Delta’s water and lands.

These recommendations are intriguing, especially in light of growing consensus that the current approach to water quality and species protection in the Delta is failing to meet legal and policy objectives. But would management based on the proposed policies be legal?

Ecosystem-Based Management

An ecosystem-based approach to the Delta would differ in several important respects from the existing regulatory regime. Current regulations rely heavily on minimum flow and water quality standards, which are often met by releases from upstream reservoirs. These regulations also impose a variety of constraints on Central Valley Project (CVP) and State Water Project (SWP) operations—including seasonal restrictions on water exports from the south Delta—to minimize reverse flows and prevent dislocation and entrainment of fish.

The proposed approach calls for more flexible deployment of releases from upstream reservoirs to improve aquatic habitat, along with landscape changes to enhance habitat benefits from managed freshwater and tidal flows. The proposal also advocates focusing conservation and recovery actions on an arc of habitat from the Yolo Bypass through the North Delta and into Suisun Marsh (the “North Delta Arc”), which has been less altered by human interventions and is linked by the Sacramento River. This area has a greater likelihood of producing significant, near-term ecological improvements compared with conservation actions elsewhere in the Delta. The proposal also would alter the current strategy of using large volumes of freshwater outflow to manage salinity in the Delta and Suisun Bay, choosing instead a geographically targeted approach to the application of freshwater flows.

Although it would represent a marked change from existing regulatory policy, an ecosystem-based strategy would be consistent with the water quality laws and the endangered species acts.

The Water Quality Laws

California’s Porter-Cologne Act implements the federal Clean Water Act and establishes independent state standards for water quality. It requires the State Water Board to set water quality standards that provide “reasonable protection” for an array of beneficial uses of the waters of the Delta ecosystem, including fish and wildlife and water supply. The courts have held that the Board has broad authority to determine what water quality criteria are reasonable and appropriate in light of competing demands on the resource, as long as its decision is supported by substantial evidence in the administrative record.

The Porter-Cologne Act thus grants the Board significant discretion to choose how best to deploy the freshwater available in the Delta. For example, if the Board concludes that the North Delta Arc is the most productive habitat for conserving and recovering protected species, then it would have authority to set water quality standards (including targeted flow requirements) that make this a priority region. If the Board is also persuaded that the central and south Delta are

now unproductive and inhospitable habitat for native fish species, it could adjust salinity and flow standards accordingly.

In short, because of the multifaceted and flexible authority vested in it by the water quality laws, there is no significant legal impediment for the State Water Board to follow an ecosystem-based approach in revising its water quality standards for today's Delta.

The Endangered Species Acts

The federal and state endangered species acts pose more difficult questions because they contain more rigid directives than do the water quality laws. Rather than setting standards to accommodate a variety of beneficial uses, these laws categorically prohibit the unauthorized "taking" of any protected fish. The federal statute also requires all federal agencies to ensure that their actions are not likely to jeopardize the continued existence of any listed species or adversely modify their critical habitat. Takings that are "incidental" to otherwise lawful activities—including water diversions and other water project operations—may be authorized by incidental take statements in biological opinions or by incidental take permits for non-federal activities. Both laws require the impacts of authorized takings to be "minimized," and the state statute requires that they also be "fully mitigated."

These laws govern water management in the Delta ecosystem principally as applied to the coordinated operations of the CVP and SWP, which must comply with a series of conditions set forth in biological opinions issued by the U.S. Fish and Wildlife Service (USFWS) for Delta smelt and by the National Marine Fisheries Service (NMFS) for anadromous species (salmonids and green sturgeon). The California Department of Fish and Wildlife (CDFW) plays a complementary role. Its principal regulatory authority in the Delta is through the longfin smelt incidental take permit issued to the SWP.

Legal Questions

The proposed ecosystem management approach raises several key legal questions to which we provide brief answers:

- Is an ecosystem-based approach to water quality and species protection consistent with the federal and state endangered species acts?

Yes. Although the focus of the endangered species acts is on individual species and their critical habitat, there is nothing in the statutes that would preclude the fish agencies from adopting a more holistic and integrated approach—if the best scientific evidence supports the decision that the ecosystem objectives would be an effective means of fulfilling the no jeopardy/adverse habitat modification standards, as well as the mitigation requirements associated with the incidental take of each listed species.

Indeed, this legal question can be framed in a relatively simple way: What are good scientific metrics for predicting and assessing ecosystem functions (e.g., food web productivity) on which each species relies for its survival and recovery, and are these better expressed as ecological system metrics, rather than through the salinity, flow, and temperature metrics that are currently employed? If the ecosystem approach would be a better way to protect and enhance the

biological requirements of each listed species, the fish agencies could approve it under the conventional consultation and incidental take regulatory processes.

- Could the federal fish agencies revise the biological opinions for CVP/SWP operations to recognize the proposed focus on a North Delta Arc of critical habitat?

Yes. If the agencies conclude that creation of a North Delta Arc of habitat would promote the applicable conservation standards for each of the federally listed species, they would have authority to incorporate this strategy into the biological opinions. As noted above, these could include changes in upstream storage and release requirements to provide targeted flows into the Sutter and Yolo Bypasses, as well as other tidal sloughs and channels, to improve food webs and aquatic habitat.

- Could the federal agencies revise the biological opinions to recognize a geographically specialized Delta ecosystem that reduces the emphasis on the central and south Delta as critical habitat for some species?

Yes. The federal endangered species act does not require conservation and recovery of listed species throughout their entire range of existing or potential habitat. It also affords the fish agencies considerable flexibility in setting priorities for habitat types and locations—if these conservation strategies would satisfy the no jeopardy/critical habitat directives for each listed species.

Therefore, if the best scientific evidence supports the conclusion that the central and south portions of the Delta are irreparably degraded and that the North Delta Arc is now the most promising habitat for the Delta smelt, the USFWS could adopt geographic specialization as a conservation strategy. This would be accompanied by changes in the critical habitat designation for the smelt, as well as adjustments in the incidental take limitations for the CVP and SWP south Delta pumps to account for this change in focus.

Similarly, NMFS could conclude (also based on the best available science) that the most promising habitat for Sacramento River salmonids is the North Delta Arc. Based on this determination, it too could shift the focus of its conservation and recovery directives to that region. The salmonid biological opinion also would have to include measures to promote passage of salmon and steelhead in the central and south Delta and lower San Joaquin River. As there is no scientific consensus on this subject, we recommend that NMFS—in cooperation with CDFW and the State Water Board—convene a small independent panel of creative scientists and engineers to evaluate the options.

- Could the California Department of Fish and Wildlife revise the State Water Project's incidental take permit for longfin smelt to recognize a specialized Delta ecosystem?

Yes. Although the longfin smelt once inhabited much of the Delta, its current population exists primarily in San Francisco Bay. As with federal law, the California Endangered Species Act does not require conservation and recovery of listed species throughout the full extent of their habitat, and it grants CDFW discretion to create priority habitat characteristics and locations. The department therefore would have authority to make the North Delta Arc (which once was important spawning habitat for the smelt) the focus of its conservation and recovery efforts.

Longfin smelt are anadromous and depend on freshwater and tidal flows in the Delta and Carquinez Strait. CDFW would have to ensure that the North Delta Arc conservation and recovery strategy would provide conditions that enable the fish to migrate between their freshwater and more saline habitats.

In addition, in revising the SWP's incidental take permit, the department must determine that the North Delta habitat improvements would "fully mitigate" any adverse effects of the change in policy. Restoration and long-term enhancement of intertidal and sub-tidal wetlands in the North Delta is already part of the mitigation requirements of the SWP's incidental take permit. If necessary to offset any risks posed to the smelt from the new habitat strategy, CDFW could require the acquisition and management of additional mitigation acreage.

Concluding Thoughts

Ecosystem-based management in the Delta may be a more efficient and effective means of implementing the water quality laws and endangered species acts than the current regulatory regime. Whether this is true will depend on the responses of the ecosystem and the fishes that inhabit it to the combination of targeted freshwater flows, tidal energy management, and landscape changes that would be concentrated along the North Delta Arc.

To test this new strategy, regulators, water managers, and environmental advocates must be willing to assume the risk of moving away from entrenched policies that have largely failed to achieve their objectives. The judgment whether the new approach is the "best available science"—and therefore may serve as the foundation for a revised water quality control plan and new biological opinions—rests with the regulators. We can simply say that there is nothing in state or federal law that would preclude such a decision.

More importantly, the strategy proposed in the earlier blog posts illustrates a foundational—but often neglected—principle of aquatic ecosystem management: Protection of water quality and conservation of species are one in the same, and neither can be achieved without the other. Perhaps the greatest contribution of the new Delta science will be to encourage the State Water Board and the fish agencies to work together to devise truly integrated standards for today's novel Delta ecosystem.

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* With contributions and insights on the intersections between law and science from Peter Moyle and Jay Lund (UC Davis) and Jeff Mount and Ellen Hanak (PPIC Water Policy Center).

Further Reading

Gartrell, Greg, and Brian Gray. 2017. *A Brief Review of Regulatory Assignment of Water in the Sacramento–San Joaquin Delta*. Public Policy Institute of California.

Gore, James, Brian Kennedy, Ronald Kneib, Nancy Monsen, John Van Sickle, Desiree Tullos. 2018. *Independent Review Panel (IRP) Report for the 2017 Long-term Operations Biological Opinions (LOBO) Biennial Science Review: Report to the Delta Science Program*. Delta Stewardship Council and Delta Independent Science Program.

Mount, Jeffrey. 2018a. "Advice on Voluntary Settlements for California's Bay-Delta Water Quality Control Plan Part 1: Addressing a Manageable Suite of Ecosystem Problems." *California WaterBlog*, Feb. 13.

Mount, Jeffrey. 2018b. "Advice on Voluntary Settlements for California's Bay-Delta Water Quality Control Plan Part 2: Recommended Actions to Improve Ecological Function in the Delta." *California WaterBlog*, Feb. 21.

Mount, Jeffrey. 2018c. "Advice on Voluntary Settlements for California's Bay-Delta Water Quality Control Plan Part 3: Science for Ecosystem Management." *California WaterBlog*, Feb. 27.

Moyle, Peter, William Bennett, John Durand, William Fleenor, Brian Gray, Ellen Hanak, Jay Lund, and Jeffrey Mount. 2012. *Where the Wild Things Aren't: Making the Delta a Better Place for Native Species*. Public Policy Institute of California.

Wondolleck, Julia, and Steven Yaffe. 2017. *Marine Ecosystem-Based Management in Practice: Different Pathways, Common Lessons*. Island Press.

Advice on Voluntary Settlements for California's Bay-Delta Water Quality Control Plan Part 3: Science for Ecosystem Management

California Water Blog | February 27, 2018 | UC Davis Center for Watershed Sciences and Jeffrey Mount, PPIC Water Policy Center*



The Delta.

Recommendation

Improving Delta ecosystem functions under the State Water Board's proposed Bay-Delta Water Quality Control Plan will require a complex series of changes to water and land management—and a strong science program to guide actions. This science effort will need to go well beyond current Delta science programs in scope, authorities, and funding. The most promising approach is to expand the existing Delta Science Program and grant it the authority and responsibility to support the plan. As part of this effort, parties engaged in the Delta should create a Delta Science Joint Powers Authority (JPA) to better pool and administer science resources to be used by the Delta Science Program. The JPA also would be a forum for agencies, water users, and other stakeholders to develop consensus and collaborations on science-based management.

Introduction

The State Water Board is updating its Water Quality Control Plan for the Sacramento-San Joaquin Delta. Multiple parties that would be affected by this plan are seeking to negotiate voluntary settlement agreements for the Board to consider. In two previous posts, a group of us* have suggested that the Board and negotiating parties take a new approach to resolving some of the Delta's ecological and water supply problems. The first post calls for integration of freshwater flows with tide and landscape management to improve food web productivity, maximize habitat for desirable plants and animals, and reduce the impacts of harmful algal blooms. The second post describes a suite of actions to meet these objectives.

This approach cannot succeed without a strong science program that is well-funded, authoritative, and useful. Most important, this science program must go beyond meeting the traditional interests of specific state and federal agencies and integrate science to meet broader objectives. It must also be an integral part of any adaptive management program. In this blog post we propose a science effort to inform and assess the implementation of the Water Quality Control Plan.

Science in the Delta Today

The San Francisco Estuary, including the Delta, is one of the most studied in the world (Cloern and Jassby 2012, Healey et al. 2016). Science and monitoring is done by many state and federal agencies, water utilities, water user organizations, universities, stakeholder groups, and a large network of consultants (summarized in Hanak et al. 2013 and Gray et al. 2013). Many reviews of the science enterprise in the Delta have recommended reforms. Two particularly useful reviews are by the National Research Council (2012) and the Delta Independent Science Board (DISB 2016, Weins et al. 2017). Several persistent themes from these reviews inform the proposals made here. These include:

- Conflicting agency goals lead to fragmentation of scientific efforts (Lund and Moyle 2013);
- Divergence among preferred actions of different organizations — combined with fragmented science administration — leads to advocacy-based or “combat” science, pitting different organizations against each other in their scientific efforts;
- The lack of reliable funding — and the inability to deploy it quickly — hampers the ability to conduct innovative science and monitoring, respond to new opportunities and information, and sustain vital long-term investigations.

Since the publication of the 2012 National Research Council report, there have been efforts to improve Delta science, principally through cooperation and collaboration among the many current efforts. But as the NRC report pointed out, “collaboration does not equal integration.” While these efforts have improved the quality of the science, they are not sufficient to support the integrated, ecosystem-based management program recommended in our previous posts.

Matching Science with Management Goals and Objectives

In our view, no single state agency has the capacity or authority to guide the implementation of the ecosystem management actions needed over the next 15 years. In addition, science funding has been unreliably based on a boom-bust cycle of state bonds and other sources; it has been unable to support the sustained research needed to inform and improve management. However, we believe the building blocks for an effective science program exist. The core of our proposal is to elevate the existing Delta Science Program (DSP) by granting it responsibility and resources to guide the science needed to implement the Water Quality Control Plan.

The Delta Science Program was established by the 2009 Delta Reform Act. Its mission is to provide the best available science for decision making in the estuary and watershed. The DSP answers to the Delta Stewardship Council, which appoints its lead scientist and approves the program’s budget. The program also houses the Delta Independent Science Board—a group of distinguished scientists and engineers who advise on scientific issues. At present, the DSP

primarily tries to coordinate the many disparate science activities in the Delta, develop syntheses on important topics, and run modest grant and fellowship programs.

Although the DSP is structured to do just the kind of integrated science needed to meet the needs of the Water Quality Control Plan, it lacks the necessary budget and authority over the science agenda. We propose expanding its mission and finding creative ways to grant it the financial and institutional capacity to succeed.

The New Delta Science Program and Delta Science Joint Powers Authority

The Delta Science Program should be given resources and decision-making authority to:

Work with agencies, water users, and other stakeholders to develop a science action plan to meet the Water Quality Control Plan's ecosystem-based objectives and, where possible, the broader science needs of state and federal agencies and stakeholders;

Build capacity to project outcomes of flow-tide-landscape investments with integrated hydrodynamic, ecologic, and economic models supported by data collection networks;

Coordinate protocols and data for monitoring in the estuary and the watershed to inform the Water Quality Control Plan;

Implement and oversee a science program that can guide management actions as experiments and assess outcomes and performance measures;

Build trust and promote consensus on the science used to inform decision making (recognizing that there will never be consensus on the decisions themselves).

The DSP has a good foundation to take on this task. Its 2016 Delta Science Plan and 2017-21 Delta Science Action Agenda cover many of the proposals in our earlier posts, and could readily be adapted to organize the science needed to guide implementation of the Water Quality Control Plan. In addition, the DSP already has a governance structure that provides both administrative oversight (by the Delta Stewardship Council) and scientific oversight (by the Delta Independent Science Board and review panels).

Placing the DSP in charge of science for the Water Quality Control Plan is insufficient, however, given both funding and institutional constraints. To overcome these hurdles, we suggest that the DSP be the core of a new Delta Science Joint Powers Authority (JPA). This JPA would be modeled, in part, after a successful water quality research effort in Southern California. The Southern California Coastal Water Research Program (SCCWRP) is a JPA that unites sanitation and stormwater agencies with water-quality regulating agencies. Together, these parties develop and fund a common scientific effort to support management and monitoring decisions on stormwater and wastewater. This program—which has also benefitted from excellent leadership—shows how to develop high quality, useful, and consensual science support for policy and management decisions.

Like SCCWRP, the Delta Science JPA would be funded and overseen by a group of regulated and regulatory entities and other parties. It would be chaired by the DSC, with a science program led by the DSP's lead scientist. State and local public agencies would be signatories to

this effort and contribute financial support or personnel. Federal agencies cannot sign JPA agreements, but they can contribute resources and serve on the JPA board. The JPA board can also include non-governmental stakeholder representatives, such as environmental non-profits. In this way, the parties affected by and overseeing the Water Quality Control Plan would have an opportunity to pool resources and build consensus on a science agenda and integrate scientific findings and actions.

The JPA structure provides a better way to fund scientific research and experimentation than is currently available to the DSP or other state agencies. JPAs can exercise authorities granted to any signatory agency. Because local agencies generally have more flexibility to administer funds than state agencies, the JPA will be able to write contracts to support research and monitoring activities more quickly (days instead of many months), and with less overhead. At present, difficulties in securing timely contracts from state and federal funders present a hurdle to science in the Delta and lead to missed opportunities for research by agencies, universities, non-profits, and private consultants.

We estimate that \$20 to \$30 million annually is needed to fund this science program. (This is in addition to the current DSP budget of approximately \$10 million, and does not count planned restoration efforts or monitoring activities currently being conducted by agencies.) Without a budget of this scale, there is little hope for a successful, collaborative, science-based ecological management program in the Delta. Funding sources could include pooled contributions from JPA members, contracts for research, appropriations from the state General Fund, and small fees on the use of water originating in the watershed and the discharge of pollutants into waterways both upstream of and within the estuary. For example, a \$1/acre-foot fee on water use would generate more than \$20 million annually.

In conclusion, we believe this proposed approach—elevating the Delta Science Program and anchoring it within a new Joint Powers Authority—is a practical and effective way to develop the scientific support needed to guide, evaluate, and adapt implementation of the Water Quality Control Plan. It builds on existing institutions while establishing a way to build consensus around a science agenda, pool and use resources more efficiently, and tailor a science program to meet the needs of an integrated, ecosystem-based approach to improving ecosystem conditions in the Delta.

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*This blog post summarizes some of the ideas generated by an informal group of experts who have met several times to explore concepts for better management of the Delta. Group members include (in alphabetical order): Jon Burau (US Geological Survey [USGS]), Jim Cloern (USGS), John Durand (UC Davis), Greg Gartrell (consulting engineer), Brian Gray (PPIC), Ellen Hanak (PPIC), Carson Jeffres (UC Davis), Wim Kimmerer (San Francisco State University), Jay Lund (UC Davis), Jeffrey Mount (PPIC), and Peter Moyle (UC Davis).

Further Reading

Cloern, J., and A. Jassby. 2012. "Drivers of Change in Estuarine-Coastal Ecosystems: Discoveries from Four Decades of Study in San Francisco Bay," Reviews in Geophysics. 50.

Delta ISB (Delta Independent Science Board). 2017. Improving Adaptive Management in the Sacramento-San Joaquin Delta. Delta Stewardship Council.

Delta Science Program. 2016. Delta Science Plan: One Delta, One Science. Delta Stewardship Council.

Delta Science Program. 2017. Science Action Agenda: A Collaborative Road Map for Delta Science. Delta Stewardship Council.

Gray, B., B. Thompson, E. Hanak, J. Lund, J. Mount. 2013. Integrated Management of Delta Stressors: Institutional and Legal Options. Public Policy Institute of California.

Hanak, E., J. Lund, J. Durand, W. Fleenor, B. Gray, J. Medellin-Azuara, J. Mount, P. Moyle, C. Phillips, B. Thompson. 2013. Stress Relief: Prescriptions for a Healthier Delta Ecosystem. Public Policy Institute of California.

Healey, M., P. Goodwin, P., M. Dettinger, and R. Norgaard. 2016. The State of Bay-Delta Science 2016: An Introduction. San Francisco Estuary and Watershed Sci. 14

Lund, J. and Moyle, P. 2013. "Adaptive Management and Science for the Delta Ecosystem." San Francisco Estuary and Watershed Sci. 11.

NRC (National Research Council). 2012. Sustainable Water and Environmental Management in the California Bay-Delta. National Academies Press.

Weins, J., et al. 2017. "Facilitating Adaptive Management in California's Sacramento-San Joaquin Delta." San Francisco Estuary and Watershed Sci. 15.

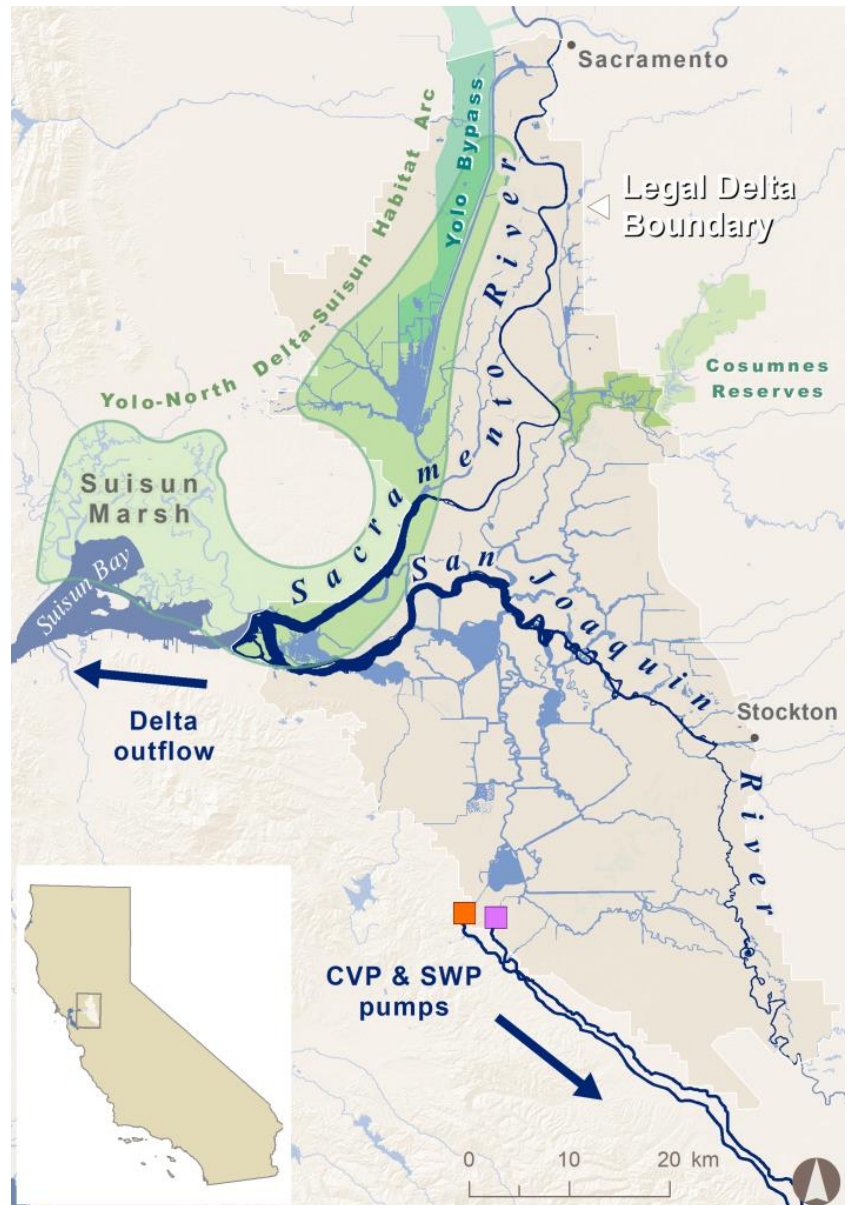
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Advice on Voluntary Settlements for California's Bay-Delta Water Quality Control Plan Part 2: Recommended Actions to Improve Ecological Function in the Delta

California Water Blog | February 21, 2018 | UC Davis Center for Watershed Sciences and Jeffrey Mount, PPIC Water Policy Center*

Recommendation

By strategically linking freshwater flow releases with the management of tidal energy and investments in landscape changes in the Delta, it is possible to improve ecological food webs and habitat for native species and reduce the effects of pollutants. Projects to address these problems should be concentrated in the North Delta and Suisun Marsh, and can be completed within 15 years. These include habitat improvements on flood bypasses, terminal channels, shallow open-water habitat, river-tide transition zones, and tidal marshlands, along with strategies for reducing harmful algal blooms. This integrated, ecosystem-based approach—in which freshwater flows, tides, and landscapes are managed together—is preferable to current approaches that manage them mostly in isolation from one another, and for a few species of fish.



The Sacramento-San Joaquin Delta.

Introduction

The State Water Board is preparing a new Bay-Delta Water Quality Control Plan. Parties affected by this plan are attempting to negotiate voluntary settlement agreements for the Board to consider. A group of us—experts on the Delta and not part of any negotiations or representing any interested parties*—have come up with a series of recommendations to help inform these negotiations. This is the second in a series of three blog posts that reflect our

discussions and conclusions. In our previous post, we recommended that negotiating parties and the Board identify and focus on a set of ecological goals for the Sacramento-San Joaquin Delta that could be achieved over the next 15 years. That post also lays out our view of the problems facing the Delta and the tools that can be used to better manage it. Here we recommend near-term actions with the greatest likelihood of achieving significant and measurable progress in improving ecosystem conditions.

These recommendations are based principally on the professional judgment of the group, guided by a set of constraints on Delta management that will need to be taken into account (see text box). Many of the actions will be familiar to those working on ecosystem issues in the Delta.

Management Options to Improve Delta Ecosystem Conditions

The Delta and its watershed face many different environmental problems, and multiple tools are available to address them. There are three general management options (all include a commitment to improve water quality through management of pollutants):

Focus on flow volumes: Emphasize allocation of freshwater flows to the ecosystem, with significant increases in outflow from the Delta into San Francisco Bay and the ocean.

Focus on landscape management: Improve habitat through landscape management with no major changes in the current allocation of freshwater flows.

Use a portfolio of actions: Increase flexibility in the timing and magnitude of freshwater flows and link these to landscape modifications that increase habitat benefits and take advantage of tidal energy (described below).

All three approaches have scientific merits and uncertainties; they also present different social and economic trade-offs. The first—significant increases in Delta outflows—is based on the historical connection between cool, wet years and improved population counts of some species, including pelagic fishes. This relationship is no longer as clear, however, particularly for Delta smelt (see the text box). To fully test this approach the Board would have to re-allocate very large amounts of water to outflow, because modest, incremental changes in outflow are unlikely to result in substantial changes in Delta conditions. This would have large impacts on available water supplies.

The second approach—relying principally on landscape changes to improve conditions—seeks to reverse some of the extensive losses in habitat caused by land reclamation, channelization, and flood control projects. Like the high outflow approach, this too has merit. But it ignores the importance of flow timing and magnitude to ecosystem functions and the life-history requirements of desirable plants and animals.

In our view, the third option—a portfolio that includes increased flexibility in how flows are managed, improvements in landscapes, and management of tides—has the highest likelihood of substantially improving ecosystem conditions. This approach also has the best chance of improving our understanding of how to manage the Delta in the future. To be effective, this

option will involve reconnecting significant, contiguous areas of land—some currently held in private ownership—to freshwater flows and tides. This will require both the cooperation of Delta landowners and funding to acquire and manage these lands. Changes in flow management could also introduce some new constraints on water availability for human uses. However, by targeting flow releases we expect that this portfolio approach has the potential to use water, land, and financial resources most efficiently to improve ecosystem conditions in the Delta.

We next briefly describe what we mean by management of freshwater flows and tides. We then outline six project areas for the recommended portfolio approach.

Managing Freshwater Flows

Managing fresh water in conjunction with the landscape and tides will require water users and regulators to shift away from the current approach—which focuses on adhering to minimum instream flow and water quality regulations—toward more flexible management. Flexibility includes allowing for real-time adjustments to hydrologic conditions (for example, to take advantage of pulse flows from storms), experimental flows to test ecological responses to landscape changes, and strategic use of flows to improve water quality. This also involves narrowly targeting flows to improve ecological conditions in specific areas, which increases the efficiency of the use of this water.

Some of us have presented ideas on how to accomplish this using ecosystem water budgets coordinated by designated “ecosystem trustees” (Mount et al. 2017). Regardless of the approach, there is one basic requirement: the ecosystem must have assets to enable managers to adjust the timing of flow releases and diversions. These assets can include a portion of annual flow that can be flexibly used, stored, or traded; water stored in reservoirs or groundwater basins; shares in storage and conveyance capacity; and financial resources to purchase water.

Managing Tides

Tides drive most water movement and mixing in the Delta and the San Francisco estuary. They are vital for connecting nutrients and supporting food webs across tidal marshes and channels, helping to address food limitations within the Delta. The concept of managing tides may be novel to policymakers, but their ecological relevance is grounded in studies showing that ecosystem productivity increases when different habitat types are connected by tidal flows (Cloern 2007).

Tools for managing tides include changing the Delta’s landscape and channels, as well as using gates and barriers. For example, restoring large tracts of tidal marsh will expand the area inundated by tides and dissipate tidal energy, reducing tidal influence elsewhere in the Delta. Gates and barriers can be used to direct tidal flows at the local scale, helping to move food resources (and fish) into or out of specific areas. Landscape changes that do not consider tidal effects can lead to unanticipated or unwanted consequences.

Six Recommended Flow-Tide-Landscape Projects

To improve food webs, maximize habitat for desirable plants and animals, reduce impacts of algal blooms, and increase understanding of the Delta, we recommend a 15-year commitment to a suite of six linked projects. Five of these projects focus on managing landscapes, tides, and freshwater flows—principally within the North Delta, Suisun Marsh, and the Sacramento River floodplains. The sixth project focuses on building and applying knowledge to reduce the human and environmental health risks of algal blooms.

Flood bypasses: Yolo and Sutter Bypasses—the two large flood bypasses on the Sacramento River—have the greatest potential for reestablishing floodplain function in the Central Valley and enriching downstream food webs. Water can be directed through weirs onto floodplains to maximize habitat for migratory fishes (e.g., splittail and juvenile salmon), waterfowl, and wading birds. This requires operable weirs to test and refine management actions, improve ecological outcomes, and allow summer agriculture. This approach also may require pulse flow releases to augment natural flows.

Terminal channel systems: The North Delta and Suisun Marsh both have networks of dead-end channels that commonly host abundant native fishes (Moyle et al. 2012, 2014). Tidal mixing within these channels is associated with turbid water—which fish may use to avoid predators—and high food web productivity. In the mixing zone of the Deep Water Ship Channel, for example, Delta smelt and other native fish densities are as high as anywhere in the Delta (Feyrer et al. 2017). Landscape changes and freshwater flow pulses can be used to manage these mixing zones in the North Delta to increase productivity. In Suisun Marsh, the salinity control gates could be used to help meet this objective.

Shallow open-water habitat: The Delta has approximately 20 square miles of shallow freshwater habitat, mostly in areas where levee breaches have flooded agricultural lands. Landscape changes may be able to enhance food production in these lake-like areas and transfer it to less productive adjacent channels (Lopez et al 2006). Experiments are needed to test this potential source of productivity.

Tidal transition zones: Zones where rivers meet the tides account for a large fraction of juvenile salmon mortality within the Delta (Perry et al. 2018). Seaward of these zones, river flows have little influence on the tides, and correspondingly little impact on mortality. Ongoing research shows that it may be possible to increase juvenile salmon survival in tidal transition zones by restoring marshland and making other landscape changes that reduce the influence of the tides in the North Delta. Strategic, short-duration freshwater flow pulses—coupled with improved channel margin habitat—may also help.

Tidal marsh habitat: Marshes, including their networks of branching (“dendritic”) channels, are some of the most productive, high-quality habitats within the Delta and estuary (Moyle et al. 2014). They also form an important link with upland and wetland areas, promoting the exchange of nutrients and animals essential for this productivity. Creation of new marsh-channel systems is essential and will be most effective in large (1,000+ acre) interconnected areas where they were historically abundant (e.g., in the Cache-Lindsay Slough region and Suisun

Marsh; see Robinson et al. 2016). Ongoing research shows that pulses of freshwater flow into Cache Slough have promise for improving habitat and food productivity.

Algal blooms: A two-pronged approach is needed to address the problem of harmful algal blooms in the Delta: 1) investigating relationships among flows, water quality, and cyanobacteria blooms; and 2) managing freshwater flows, tides, nutrients, and landscapes to reduce these blooms while promoting productivity for Delta food webs.

Except for the management of harmful algal blooms, all of the projects described above are detailed in some form in numerous state planning and regulatory documents (e.g., Bay-Delta Conservation Plan, Delta Plan, California EcoRestore). The San Francisco Estuary Institute has also produced an excellent summary of opportunities for habitat improvement (Robinson et al. 2016). Our proposed approach emphasizes two overarching recommendations: that priorities be based on geography, and that actions combine—wherever appropriate—the flexible allocation of freshwater flows with the management of tides and landscapes.

Why This Approach Is Better than the Current Path

Federal and state efforts to manage the Delta for ecosystem objectives have been unsuccessful, as indicated by declines in native biodiversity and water quality (Gore et al. 2018). The approach outlined here departs from historical efforts in two ways. First, we propose an integrated approach that considers the complex interaction among tidal and river flows, landscapes, and water quality. Past approaches have failed to consider that the benefits of environmental flows depend on their landscape setting, and that the benefits of landscape changes depend on their hydrologic setting.

Second, we take an ecosystem-based view that includes, but extends beyond, population declines of some native fishes listed under federal and state endangered species laws. The integrated approach seeks to improve Delta ecosystem conditions for a broad range of benefits, including fish and wildlife habitat as well as human uses of the Delta's lands and water.

In our view, this integrated approach is more likely to achieve positive results and efficient use of resources than the current path. And by focusing on the North Delta and Suisun Marsh, measurable benefits can be achieved within a 15-year time frame. To be successful, however, this approach must be supported by a robust, well-funded, and trusted science program—a subject that will be explored in our next blog post.

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Further Reading:

Cloern, J.E. 2007. "Habitat Connectivity and Ecosystem Productivity: Implications from a Simple Model." *The American Naturalist* 169:E21-E33

Gore, J., B. Kennedy, R. Kneib, N. Monsen, J. Van Sickle, D. Tuilos. 2018. *Independent Review Panel (IRP) Report for the 2017 Long-term Operations Biological Opinions (LOBO) Biennial Science Review: Report to the Delta Science Program. Delta Stewardship Council and Delta Independent Science Program.*

Gray, B., B. Thompson, E. Hanak, J. Lund, and J. Mount. 2013. *Integrated Management of Delta Stressors: Institutional and Legal Options, Public Policy Institute of California.*

Hanak, E., J. Lund, J. Durand, W. Fleenor, B. Gray, J. Medellín-Azuara, J. Mount, P. Moyle, C. Phillips, and B. Thompson. 2013. *Stress Relief: Prescriptions for a Healthier Delta Ecosystem, Public Policy Institute of California.*

Lopez, C. B., J. E. Cloern, T. S. Schraga, A. J. Little, L. V. Lucas, J. K. Thompson, and J. R. Burau. 2006. "Ecological Values of Shallow-Water Habitats: Implications for the Restoration of Disturbed ecosystems." *Ecosystems* 9:422-440.

Lund, J. and P. Moyle. 2018. *Ecological Incentives for Delta Water Exports, CaliforniaWaterBlog.com. January 24.*

Mount, J., Gray, B., Chappelle, C., Gartrell, G., Grantham, T., Moyle, P., Seavy, N., Szeptycki, L., Thompson, B. 2017. *Managing Freshwater Ecosystems: Lessons from California's 2012-16 Drought. Public Policy Institute of California.*

Moyle, P., W. Bennett, J. Durand, W. Fleenor, B. Gray, E. Hanak, J. Lund, and J. Mount. 2012 *Where the Wild Things Aren't: Making the Delta a Better Place for Native Species, Public Policy Institute of California.*

Moyle, P.B., A. D. Manfree, and P. L. Fiedler. 2014. *Suisun Marsh: Ecological History and Possible Futures. Berkeley: University of California Press.*

Perry, R.W., A.C. Pope, J.G. Romine, P.L. Brandes, J.R. Burau, A.R. Blake, A.J. Ammann and C.J. Michel, *Flow-Mediated Effects on Travel Time, Routing, and Survival of Juvenile Chinook Salmon in a Spatially Complex, Tidally Forced River Delta. Canadian Journal of Fisheries and Aquatic Sciences.*

Robinson, A., Safran, S., Beagle, J., Grenier, L., Grossinger, R., Spotswood, E., Dusterhoff, S., Richey, A. 2016. *A Delta Renewed: A Guide to Science-Based Ecological Restoration in the Sacramento-San Joaquin Delta. Delta Landscapes Project. Prepared for the California Department of Fish and Wildlife and Ecosystem Restoration Program. A Report of SFEI-ASC's Resilient Landscapes Program. SFEI Contribution No. 799. San Francisco Estuary Institute – Aquatic Science Center.*

Weins, J., et al. 2017. "Facilitating Adaptive Management in California's Sacramento–San Joaquin Delta." *San Francisco Estuary and Watershed Sci.* 15.

Advice on Voluntary Settlements for California's Bay-Delta Water Quality Control Plan Part 1: Addressing a Manageable Suite of Ecosystem Problems

California Water Blog | February 13, 2018 | UC Davis Center for Watershed Sciences and Jeffrey Mount, PPIC Water Policy Center*

Recommendation

The State Water Resources Control Board and the parties seeking to incorporate voluntary settlement agreements in the Bay-Delta Water Quality Control Plan should identify a specific, tractable set of problems that can be addressed over the next 15 years through this plan. We urge the participants to focus a near-term Delta plan on:

- 1) increasing food-web productivity in the Delta,
- 2) maximizing high-quality habitat that favors native plants and animals, and
- 3) improving water quality through nutrient management.

These efforts should recognize the inadequacies of actions focused on single species recovery, and instead focus on the simultaneous and integrated management of flows, tides, and landscapes to improve overall ecosystem function and condition.



Introduction

The State Water Resources Control Board is revising its Bay-Delta Water Quality Control Plan. The plan is critical for water management because it prescribes water quality and flow requirements in the Sacramento-San Joaquin River and Delta. The Board is considering incorporating Voluntary Settlement Agreements between affected parties to guide development of its water quality plan.

Members of the Brown administration asked a small group of us to offer views on elements that should be considered in such settlements. Each of us met the following criteria: 1) are not part of the settlement negotiations, 2) do not represent any interested stakeholder, and 3) have expertise in water and ecosystem management in the Delta watershed and the San Francisco

Estuary. We have prepared three blog posts that reflect our discussions and conclusions. This is the first in the series.

The Delta Challenge

Balancing the competing interests for water in the Delta and its watershed is one of California's most vexing water policy challenges. This challenge stems from the high economic value of this water throughout the watershed and to export areas, and the highly disrupted ecological conditions of the rivers, the Delta, and the greater San Francisco Estuary. Management for "co-equal" goals, as required by the Delta Reform Act, involves difficult trade-offs that can never fully satisfy all interests.

While there can be value in seeking to simultaneously address all of the many Delta challenges, we think it is more realistic to identify a smaller, well-defined set of problems that can be addressed in the near term (15 years for purposes of this discussion). This requires identifying a set of linked priority actions that might help address ecosystem problems while providing information about how to better manage the Delta in the future. And because we are uncertain about their effectiveness, any suite of actions must include adequate funding and suitable governance for the science needed to test and refine these actions.

Here we recommend three problem areas to address over the next 15 years, as well as three management tools to use in addressing these problems. Two subsequent posts will recommend priority actions and explore possible funding and governance structures.

Toward a Manageable Set of Delta Problems

The Delta and its watershed have many problems. Some will require decades to address (e.g., adaptation to sea level rise and climate change, and improving storage and conveyance). We recommend that the settlement agreements emphasize problems that can be addressed in the near term and help build foundations for long-term solutions. We focused on three fundamental ecological problems:

The Delta has become a low-productivity estuary. Reclamation of the Delta landscape eliminated 98% of its high-productivity wetland habitats, leaving an estuary where growth of fish and invertebrates is limited by a small food supply. Low productivity at the base of food webs constrains our ability to meet biological goals for the Delta (Cloern et al. 2016).

Ecosystem conditions favor non-native plants and animals over many native species. Current conditions support novel assemblages of organisms that have no historic analog and are difficult to manage. Many non-native species prey on or compete with desirable native fishes. Invasive clams deplete food web productivity. And non-native aquatic vegetation reduces habitat quality for native species and promotes non-native predatory fish (Brown et al. 2016).

Water quality is declining. Degradation of water quality by nutrients, pesticides, and other contaminants is affecting human uses of Delta water for recreation and water supply and likely causing harm to native species. An example is the increasing occurrence of blooms of the toxic cyanobacteria *Microcystis* (Lehman et al. 2010, Brooks et al. 2012).

For several decades, Delta water management has been driven by efforts to recover several fish species listed under the federal and state Endangered Species Acts. These fishes are no

longer reliable indicators of changing ecosystem condition, due to their small population sizes. We recommend that the settlement agreements and the Water Quality Control Plan take an ecosystem-based approach that explicitly recognizes that addressing these three fundamental problems will improve conditions for a wide range of terrestrial, wetland, and aquatic plants and animals—including listed fish species—as well as human uses of Delta water.

Three Tools to Address These Delta Problems

To improve productivity, habitat, and water quality, the Water Quality Control Plan will need to employ a range of tools. These include:

Managing freshwater flows. Regulating flows into and out of the Delta has been the primary emphasis of past water management actions, and will continue to be important. The focus has been on setting minimum flow and water quality requirements that result in outflow from the Delta into San Francisco Bay, and on regulating export flows when fishes of concern are likely to be harmed by export pumping (Gartrell et al. 2017). A range of flow attributes will need to be managed to address the three near-term ecological problems discussed above. These include: flow regime (frequency, magnitude, duration, timing), quality (including salinity, nutrients, and toxins), and the geographic application of freshwater flows. Flow management will be more effective in confined regions where existing flows are small, rather than broadly across the entire Delta (Brown et al. 2008). More ecologically-effective flow management will require flexibility to respond to new information and changing climatic and hydrologic conditions (Mount et al. 2017).

Managing tides. Water quality and circulation in the estuary is largely driven by tides. For most of the Delta, tidal flows dwarf freshwater inflows, particularly in dry times. Historic management of the Delta has viewed tides as a constraint, rather than an opportunity to improve ecosystem conditions. New approaches must accommodate or harness tidal energy to meet flow, habitat, and water quality objectives. This includes considering how changes in inflows and landscapes in one area may affect tidal energy elsewhere (Enright 2014).

Managing landscapes. Although most of the focus on Delta management has been on flows, the historic transformation of the Delta through channelization and reclamation of wetlands has arguably had a greater impact on ecosystems. To use freshwater inflows and manage tidal energy more effectively, alterations of flow must be paired with strategic changes to the landscape. These changes may include reconnecting landscapes to tidal action and flood flows and altering existing channels in ways that improve ecological conditions and water quality (Robinson et al. 2016, Durand 2017).

These three tools—managing freshwater flows, tides, and landscapes—must be applied in concert to address the three near-term problems identified here. Applying any one of these tools without the others substantially reduces the likelihood of success.

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Hanak (PPIC), Carson Jeffres (UC Davis), Wim Kimmerer (SFSU), Jay Lund (UC Davis), Jeffrey Mount (PPIC), and Peter Moyle (UC Davis).

Further Reading:

Brooks, M. L. et al. 2012. *Life Histories, Salinity Zones, and Sublethal Contributions of Contaminants to Pelagic Fish Declines Illustrated with a Case Study of San Francisco Estuary, California, USA*. *Estuaries Coasts* 35: 603-621.

Brown, L. R., W. Kimmerer, and R. Brown. 2008. *Managing Water to Protect Fish: A Review of California's Environmental Water Account*. *Environ. Manage.* 43: 357-368.

Brown, L. R., W. Kimmerer, J. L. Conrad, S. Lesmeister, and A. Mueller-Solger. 2016. *Food Webs of the Delta, Suisun Bay, and Suisun Marsh: An Update on Current Understanding and Possibilities for Management*. *San Francisco Estuary Watershed Sci.* 14.

Cloern, J. E., A. Robinson, A. Richey, L. Grenier, R. Grossinger, K. E. Boyer, J. Burau, E. A. Canuel, J. F. DeGeorge, J. Z. Drexler, C. Enright, E. R. Howe, R. Kneib, A. Mueller-Solger, R. J. Naiman, J. L. Pinckney, S. M. Safran, D. Schoellhamer, and C. Simenstad. 2016. *Primary Production in the Delta: Then and Now*. *San Francisco Estuary and Watershed Science* 14.

Durand, J. 2017. *Evaluating the Aquatic Habitat Potential of Flooded Polders in the Sacramento-San Joaquin Delta*. *San Francisco Estuary and Watershed Sci.* 15.

Enright, C. 2014. *Physical processes and geomorphic features*. Pages 45-64. In Moyle, P.B., A. D. Manfree, and P. L. Fiedler. 2014. *Suisun Marsh: Ecological History and Possible Futures*. Berkeley: University of California Press.

Gartrell, G., Mount, J., Hanak, E., Gray, B. 2017. *A New Approach to Accounting For Environmental Water: Insights from the Sacramento-San Joaquin Delta*. Public Policy Institute of California.

Lehman, P. W., S. J. Teh, G. L. Boyer, M. L. Nobriga, E. Bass, and C. Hogle. 2010. *Initial Impacts of Microcystis aeruginosa Blooms on the Aquatic Food Web in the San Francisco Estuary*. *Hydrobiologia* 637: 229-248.

Mount, J., Gray, B., Chappelle, C., Gartrell, G., Grantham, T., Moyle, P., Seavy, N., Szeptycki, L., Thompson, B. 2017. *Managing Freshwater Ecosystems: Lessons from California's 2012-16 Drought*. Public Policy Institute of California.

Robinson, A., Safran, S., Beagle, J., Grenier, L., Grossinger, R., Spotswood, E., Dusterhoff, S., Richey, A. 2016. *A Delta Renewed: A Guide to Science-Based Ecological Restoration in the Sacramento-San Joaquin Delta*. Delta Landscapes Project. Prepared for the California Department of Fish and Wildlife and Ecosystem Restoration Program. A Report of SFEI-ASC's Resilient Landscapes Program. SFEI Contribution No. 799. San Francisco Estuary Institute – Aquatic Science Center: Richmond, CA.

Weins, J., et al. 2017. *Facilitating Adaptive Management in California's Sacramento–San Joaquin Delta*. *San Francisco Estuary and Watershed Sci.* 15.

Weston, D. P., D. Chen, and M. J. Lydy. 2015. *Stormwater-Related Transport of the Insecticides Bifenthrin, Fipronil, Imidacloprid, and Chlorpyrifos Into a Tidal Wetland, San Francisco Bay, California*. *Sci. Total Environ.* 527: 18-25.

Stronger together: The Bay Area's newly linked water lifelines

Bay Area News Group | April 4, 2018 | Lisa M. Krieger

The Bay Area's deeply unequal cities, home to mansions and shacks alike, are linked by one thing: thirst.

Banding together, the region's water agencies on Tuesday unveiled the latest upgrades to a vast network that connects six million people and provides mutual aid in a crisis, such as an earthquake or severe drought.

"Interconnection makes all of us more reliable," said Steve Ritchie, assistant general manager of the Hetch Hetchy Regional Water System, operated by the San Francisco Public Utilities Commission.

If an earthquake fractures one system, an adjacent system kicks in to keep the faucets running. In a pinch, water could flow from one end to the other of our nine county region — all the way from South San Jose to Oakland, for instance.

Meanwhile, upgrades completed by each agency is building a system that is far more resilient than before. Pipes are designed to bend or twist, not break. Water tanks are sturdy. So are treatment plants. Special hoses could deliver water over a fractured landscape.

Water systems such as Hetch Hetchy have been operating for more than 80 years and were in need of a makeover.

According to the U.S. Geological Survey, there is a greater than 60 percent chance of a major earthquake occurring in the Bay Area in the next 30 years. It may not rupture in the remote Santa Cruz Mountains, like the Loma Prieta earthquake of 1989, but underneath our feet.

A century ago, American individualism created a system in which each municipality had a great deal of autonomy, making regional cooperation challenging. There's still a great deal of independence, with different water agencies getting their water from different sources.

But isolation is no longer good enough for the Bay Area's \$535 billion a year economic engine. The region is among the world's highest concentrations of wealth and a center of innovation, with top universities and home to companies such as Apple, Google Tesla and Facebook.

"Water is the lifeblood of the Bay Area's economy," said Ritchie. "We happen to have all these different water systems that date back decades, even a century. It is one Bay Area now and we have to think regionally to make sure we are all able to serve all of our customers."

At Tuesday's behind-the-scenes tour, the agencies showed how they are combining forces to face the realities of delivering water in an earthquake and drought-prone area:

- In Castro Valley, East Bay MUD's South Reservoir tank is replacing an open reservoir protected with a fragile wood roof. About two-thirds complete, the \$15 million tank will hold 9 million gallons of water. It is a temple of seismic safety, with 18-inch thick concrete walls strengthened by bundles of rebar, to withstand sloshing. A band of steel surrounds the tank, like a belt. Completion is scheduled for December.

- In Hayward, an \$18 million “intertie” of pipes, running through the city of Hayward, connects two East Bay water systems serving a combined 5.1 million people with the Hetch Hetchy system serving 2.6 million people.
- In Fremont, a large bright green above-ground pipeline, managed by the Alameda County Water District, crosses the Hayward Fault. It supplies water to 350,000 Fremont, Newark and Union City residents. There are \$40,000 ball joints on both ends. The pipe, made of ductile iron, sits on special pads that allow it to slide. If the ground breaks, it can extend several feet.
- Also in Fremont, a massive new 60-inch pipeline constructed by the San Francisco Public Utilities Commission connects the seismically-safe new Irvington Tunnel to the new Bay Tunnel. The 3.5-mile Irvington Tunnel is built to withstand a 7.1 earthquake on the Calaveras Fault and a 7.25 earthquake on the Hayward Fault. Inside the tunnel are welded steel pipes, nine feet in diameter. The Bay Tunnel, 100 feet underground and running from Redwood City to Newark, is also built to be extra sturdy.
- In Milpitas, cobalt blue pipes connect the Santa Clara Valley Water District with the Hetch Hetchy Water System. This “intertie” has been in use in recent weeks, because San Francisco stopped water flow from Yosemite due to construction, and relied on South Bay water, along with water from its local reservoirs.

Through these pipes, water would be sent from the Santa Clara Valley Water District through San Francisco’s Hetch Hetchy System, to Alameda County Water District — and delivered to East Bay Municipal Utility District.

Even the largest earthquake would never swallow whole an entire water system as colossal and dispersed as ours, the water experts said. But despite the interconnections, those first hours or days after a giant rupture could be traumatic, and there might be sputters and interrupted local flows.

To be truly safe, their advice: store bottled water.

There is only so much we can do with an earthquake that size,” said Bob Shaver, general manager of Alameda County Water District.

“At home, keep two gallons of water per person, per day.”

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Case Study: Oroville Spillway Response Update

Safety Management Systems has operated in California for five years, providing safety specialists, consulting, auditing and industrial hygiene (IH) services. In early 2017, our crews were called to the Oroville Dam, located north of Sacramento, to assist in damage response, repair work and release of the dam's emergency spillway.

Safety Management Systems | April 3, 2018 | Staff

The Backstory

After record rainfall occurred in the region during February 2017, Lake Oroville, which feeds into the dam, rose from receiving 30,000 cubic feet of water per second to more than 130,000 cubic feet per second in the span of one day. At that time, a crater in the dam's spillway was discovered. Due to the significant damage of the crater, spillway flow was reduced to minimize additional damage. As a result, water levels in Lake Oroville rose to full capacity, prompting the state to utilize an emergency spillway. A few days after the spillway crater was discovered, erosion was found beneath the emergency spillway. Authorities feared that a failure of the emergency spillway could result in the release of a 30-foot wall of water into the towns below the dam, prompting the emergency evacuation of nearly 200,000 residents in the immediate area. A break in the weather allowed the California Department of Water Resources (DWR) time to reopen the spillway long enough to lower the lake's water to a safe level.

Safety Management Systems' Involvement

Upon discovery of the damage, SMS safety team members immediately deployed to the Oroville Dam spillway incident site to assist in the efforts to mitigate and repair spillway damage. They worked alongside DWR's safety engineers and CAL FIRE's incident management teams to aid in the development of pre-work safety plans for all work activities and to provide line safety oversight to ensure the safety of all workers at the incident.

In early March 2017, an investigation found the presence of naturally occurring asbestos at the work site. SMS' Industrial Hygiene (IH) technicians stepped in to recognize, evaluate and control dust and potential exposure to airborne asbestos fibers. In addition, they are providing a range of other IH services including recognizing, evaluating and controlling dust and potential exposure to airborne asbestos fibers, air sampling, rock crusher aggregate testing, employee exposure testing and dust station telemetry.

Since this story was originally published, the project has evolved as Safety Management Systems progresses. "We currently have 13 employees directly supporting this effort, which include 12 industrial hygiene technicians and one certified industrial hygienist," says West Coast Regional Manager Ryan Hester, CSP, CAC. This number has decreased since the response began, but Hester says they plan to add two more industrial hygiene technicians in the coming months. Since the incident, SMS has dedicated up to 15 employees directly supporting this effort, including industrial hygiene technicians, a certified industrial hygienist, three safety specialists and one safety consultant.

Ryan adds, "At this time, the project is anticipated to run through December 2018 in order to ensure that the dam and surrounding areas are safe for area residents."

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Southern California water agency backs off plan to finance both Delta tunnels

Sacramento Bee | April 2, 2018 | Ryan Sabalow and Dale Kasler

It was one of the most ambitious and controversial plans floated in California water politics in decades.

Southern California's behemoth water agency was going to bankroll most of Gov. Jerry Brown's \$16.7 billion Delta tunnels project, ensuring both giant pipes get built but raising the specter of a "water grab."

That plan died suddenly on Monday, less than a week after staffers from the Metropolitan Water District of Southern California presented the proposal to the agency's board of directors. The district ultimately decided the financing plan contained too many risks.

Metropolitan officials said they now support the "staged approach" reluctantly championed by Gov. Jerry Brown's administration. Under that plan, the tunnels would get built one after another, as funding becomes available. State officials say there's enough support from south-of-the-Delta water districts to build the first tunnel, at a cost of about \$11 billion.

The Brown administration, in a prepared statement, said "the state will continue pursuing final permitting to allow construction of the project — whether full or built in stages."

Metropolitan General Manager Jeff Kightlinger said Monday he wanted to build both tunnels at once, but his agency couldn't secure commitments from cost-wary San Joaquin Valley farmers to repay Metropolitan in the coming years.

So for now, he said, one tunnel will have to do.

"We can't just keep debating the nuances of the project," Kightlinger said. "We have to settle on something. I would have preferred the larger one ... but I think it's important we decide to move forward."

The project, known officially as California WaterFix, has been on the drawing board for a decade, and long has had issues with its costs and financing.

The sticking point for Metropolitan's funding plan stemmed from the San Joaquin Valley agricultural districts that belong to the federal Central Valley Project, a network of reservoirs and canals that supply water to different parts of the state. So far, key agricultural districts have refused to participate in WaterFix. They say the project's costs are too high, in large part because of a funding formula developed by the CVP's operator, the U.S. Bureau of Reclamation.

Metropolitan already has committed more than \$4 billion to the tunnels but offered in February to contribute another \$6 billion or so to cover the agricultural districts' share. That would have allowed both tunnels to be built simultaneously. Metropolitan would have acted as the banker, financing the lion's share of the project up front and then selling tunnel capacity to the farmers "to make sure Metropolitan's investment was protected and would be paid back," Kightlinger said.

The plan ran into internal resistance. Some members of Metropolitan's board were wary about using urban residents' water bills to finance a project that would require eventual reimbursement from agricultural agencies.

"It would have been a huge risk for ratepayers," said Mark Gold, one of the city of Los Angeles' representatives on the Metropolitan board. Gold had voted against Metropolitan's initial decision to spend \$4 billion on the tunnels.

Kightlinger said the biggest hangup was that most Central Valley Project contractors remained leery of the costs, even if Metropolitan was willing to pay them upfront.

Unlike Metropolitan, which can spread its costs over 19 million ratepayers whose monthly bills would rise by just a few dollars, the farmers' costs would be shared by a few thousand growers.

Another crucial problem: Because of historic water rights that predate the construction of the Central Valley Project in the 1930s, some farmers are exempt from paying for water they get from the Delta. As a result, the U.S. Bureau of Reclamation decided they shouldn't have to pay for the tunnels either, putting more of the burden on the remaining growers.

That issue became apparent last week at a summit meeting of all the parties interested in the tunnels.

In a memo sent Monday to their board of directors, Metropolitan staff said there were "a number of internal institutional issues that first needed to be resolved" among the farmers on the Central Valley Project before Metropolitan could commit to the financing.

The federal government isn't contributing funding for the tunnels, but it has the authority to establish how its agencies in the Central Valley Project would pay for building WaterFix.

The largest Central Valley Project contractor, the sprawling Westlands Water District in Fresno and Kings counties, would see water costs triple or quadruple to as much as \$800 an acre-foot, making the project too expensive, Westlands general manager Tom Birmingham said in an interview Monday.

Birmingham said the Bureau of Reclamation still is studying the funding and might develop a formula that he would consider more reasonable.

"I don't know what ultimately that will look like, if anything," Birmingham said. "But I think it would be premature to say that the federal participation is not going to occur. Somebody may pull a rabbit out of their hat at the last moment."

Kightlinger said the project can't afford to wait around for the Trump administration to change its funding formulas, a process that could take years.

WaterFix is designed to overhaul the way Northern California's river water reaches the massive federal and state-owned pumping stations at the south end of the Sacramento-San Joaquin Delta.

The pumps deliver billions of gallons of water to urban Southern California and to San Joaquin Valley farms, but the machinery has degraded the Delta's eco-system and has helped drive some endangered fish species to the brink of extinction.

Pumping sometimes has to be halted or scaled back to comply with the Endangered Species Act, meaning less water gets delivered to the south state.

The tunnels, by altering water flows, are supposed to enable the pumps to operate more reliably without harming the fish. However, some environmentalists and Delta landowners say the tunnels actually would worsen the estuary's eco-system and harm local water users.

They're fighting the tunnel plan in the courts and in marathon water-rights hearings underway before the State Water Resources Control Board.

Even with just one tunnel, some environmentalists remain skeptical about WaterFix. The Brown administration's plan still would take too much water out of the Delta, said attorney Doug Obegi of the Natural Resources Defense Council in San Francisco

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LA is deceiving itself if it thinks it doesn't need delta tunnels

San Francisco Chronicle | March 29, 2018 | Joe Mathews

“Chinatown” is fooling itself.

Los Angeles has a long history of water deceptions, a point made famously by Roman Polanski's 1974 film. But the huge self-sabotage of the city's latest scheme is a real doozy. L.A. has convinced itself of the hokum that it has all the water it needs.

Let me be clear: L.A. must produce more of its own water for its long-term security. And leading Angelenos are right to ramp up storm water capture, groundwater cleanup, recycling and conservation so that more Los Angeles water is local.

But the idea now being sold by elites — that Los Angeles can become completely self-sufficient on water — is a fantasy. Producing more local water is so costly that L.A. would be fortunate to get half of its water from local sources.

Which makes L.A.'s current deluge of self-deception dangerous. Leading Angelenos are broadcasting their self-sufficiency message at a moment when the state is debating a vital plan to shore up a crucial piece of the region's water supply: the Sacramento-San Joaquin River Delta.

That proposal, estimated to cost anywhere from \$10 billion to \$30 billion, would construct one or two tunnels to carry Sacramento River water south, thus providing more certainty about the 30 percent of L.A. water that now runs through the delta.

The project should be a no-brainer for L.A. But L.A. isn't thinking clearly on water. Instead, the city, under Mayor Eric Garcetti — a smooth-talking optimist full of plans and presidential ambition — believes it can make transformational changes without much trouble.

Such triumphalism is rooted in the city's winning streak: securing the 2028 Olympic Games, rebuilding its schools, reviving South L.A., transforming downtown into a true center, and expanding transit.

Water is different. But in a triumphalist Los Angeles Daily News opinion piece, Garcetti framed his drive for water self-sufficiency as a “Mulholland moment,” a strange choice given that William Mulholland ushered in water imports that Garcetti now rejects.

From there, the mayor went off the deep end, blasting the delta tunnels as somehow detrimental to the dream of L.A. self-sufficiency, writing: “We will never be able to solve our water needs if we have tunnel vision.” Finally, he wrote of a city that gets 70 percent-plus of its water from elsewhere: “I'm often asked if we have enough water in Los Angeles for our future. And I always answer that we have plenty of water.”

Garcetti isn't alone in his hubris. The Los Angeles City Council just voted to oppose the tunnels if they don't meet certain conditions. That vote reflects fears of local environmental and consumer groups that use the myth of self-sufficiency to oppose the tunnels. They have demanded the firing of the L.A. Department of Water and Power's ratepayer advocate for the crime of saying that L.A. could afford the water that the delta tunnels would bring.

Of course, interest groups and politicians aren't the only Angelenos selling fantasies of self-sufficiency. UCLA has issued a Grand Challenge that includes many smart ideas for creating

more local water, but also promotes the self-sufficiency myth, setting the goal of transitioning Los Angeles County to “100 percent local water” by 2050. The challenge’s leader, the environmentalist Mark Gold, embraced the madness with a Los Angeles Times piece, titled “Let’s Go Local on Water,” and touting “complete water self-sufficiency.”

Gold, at least, acknowledged that such a transition would be extremely costly. Those who oppose the delta tunnels love to talk about the project’s high sticker price and how it would get passed on to ratepayers. But the truth is that delta water via the tunnels would be far cheaper than all the expensive new infrastructure needed to make L.A.’s water more local.

And the tunnels are a real project. L.A.’s various sustainability plans don’t explain how to pay the costs of producing more local water. They also ignore the reality that L.A.’s water is becoming less local. The 2012-16 drought increased L.A.’s reliance on water imports, particularly from the delta and the Colorado River. The combination of that greater dependence on imports — and L.A.’s statements of self-sufficiency — is dangerous. Why should other parts of the state send water to us, if our leaders say we don’t need it?

So, my fellow Californians, I hereby apologize for Angelenos’ ingratitude for the water that comes from your communities to ours. I wish I could promise you that we Angelenos will cool the self-sufficiency rhetoric while the state is debating the tunnels.

But c’mon, Jake, you know what town this is.

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Californians Are Struggling to Pay for Rising Water Rates

Water rates are rising in many California communities faster than some residents can keep up. While the state works to come up with a plan to tackle affordability issues, one bill seeks to protect against water shutoffs.

Water Deeply | February 27, 2018 | Alastair Bland

The Owens River Aqueduct system near Los Angeles. The series of pipelines and constructed rivers divert and transport water via gravity into the city of Los Angeles from more than 230 miles away. Upgrades to infrastructure projects are driving up water rates in many California cities, including Los Angeles. Ted Soqui/Corbis via Getty Images

California has been blessed with the distinction of being home to some of the richest and the poorest income-earning Americans, according to a 2015 report by the Social Science Research Council. This stark division of wealth between the extravagantly rich and the destitute is displayed vividly in how the state's residents consume water. On the one hand, some estate owners have been publicly shamed for watering their lawns during extreme drought with thousands of gallons per day – sometimes five or 10 times the average household rate. While other Californians live in communities where there isn't enough water or the water isn't safe to drink.

But it's not just access to water that's a problem, it's also the cost. Many California residents, in both small towns and big cities, are struggling to keep up with the rising price of water. The State Water Resources Control Board has been tasked with coming up with a plan to tackle affordability, but it's been slow going.

Max Gomberg, the State Water Resources Control Board's climate and conservation manager, says the price of water has increased at six times the rate of inflation across the state. Gomberg's agency is currently drafting a set of recommendations that will help the state legislature develop a financial assistance program for residents with soaring water rates. The water board, which already missed a February 1 deadline on the task, aims to submit the guidelines this year, though Gomberg says the legislature is not required to follow them.

Water prices are rising in California for a variety of reasons. For one thing, much of the state is either a desert or is dominated by an arid Mediterranean climate, so water is naturally scarce. Because water must often be obtained from distant sources, large infrastructure projects are necessary – and much of this infrastructure is aging. Gomberg says many water agencies are catching up on deferred maintenance of pipes, pumps and wells and passing associated costs on to their customers. In some districts, water has become contaminated and must be treated – another cost that gets distributed through residential water bills.

“But one of the big drivers is climate change,” Gomberg says. “Climate change is making hydrology more variable. We're having longer droughts and warmer hot spells. Water districts that could once rely on rain and reliable groundwater reserves no longer can.”

In the small San Joaquin Valley communities of Cantua Creek and El Porvenir, hundreds of residents are paying above-average rates for water that they cannot even safely drink. It's a situation that Erica Fernandez Zamora, a policy advocate with the Leadership Counsel for

Justice and Accountability, says violates the California Human Right to Water law of 2012, which states that, “every human being has the right to safe, clean, affordable and accessible water.”

Cantua Creek and El Porvenir both receive water from Fresno County via Westlands Water District, a wealthy agricultural region that obtains water from the federal Central Valley Project run by the U.S. Bureau of Reclamation. The 2012–16 drought affected supplies, forcing Westlands to pay more. In turn, the 600 residents of Cantua Creek and El Porvenir were faced with rate increases, which the communities of mostly low-income farm workers didn’t believe they could pay. Rates were \$110 a month in El Porvenir and \$72 a month in Cantua Creek for water that the state deemed unsafe. Facing water shutoffs, the state stepped in with emergency funds to reduce costs and provide bottled water, but the grants expire this spring.

“We’re trying to find permanent solutions for these people,” Zamora says.

But the San Joaquin Valley isn’t the only area where water affordability is a problem.

According to the water news agency Circle of Blue, between 2010 and 2017 water rates in Los Angeles jumped 71 percent. The biggest increase was for households of four that used 100 gallons per capita a day, which saw monthly water bills increase from \$58.49 to \$100.14. In San Francisco water rates increased 119–127 percent (depending on usage) during the same period. Bills increased from \$86.31 to \$195.86 a month for a household of four using 150 gallons per person a day. For those using only 50 gallons per person a day, rates jumped \$30.63 to \$67.07. Both cities have undertaken costly infrastructure upgrades.

Even in relatively affluent smaller communities, the cost of water has escalated, too. The wine country town of St. Helena in the Napa Valley, which is grappling with infrastructure upgrades, is one example.

“Our rates are now two-and-a-half times those in the city of Napa,” says Geoff Ellsworth, a member of the St. Helena City Council.

State senator Bill Dodd, a Democrat from Napa, recently introduced legislation that would make it more difficult for utilities to abruptly discontinue service for customers unable to pay their water bills. Currently, he says, cell-phone companies face tighter restrictions in cutting off services than do water agencies.

The water board reports that the state spends more than \$2.5 billion per year to aid low-income residents with gas, electric and telecommunication services, but more than half the state’s residents have a water provider that doesn’t offer rate assistance for low-income customers.

Dodd’s proposed law, Senate Bill 998, seeks to model California’s water deliveries more like electricity and phone services, where failure to pay bills may result in soft enforcement – first warnings, followed by opportunities to appeal and probably fines. Only as a last resort, he explains, do phone and electricity providers terminate service.

But Dodd says that with water service, missing a due date on a payment can mean dry taps in just days. His proposed law would prohibit service cuts for at least 60 days if a customer fails to

pay a bill. It would require advanced written warning that service might be discontinued and would prohibit cutting of water supplies for the ill or elderly if a local health agency determines doing so would seriously threaten their health.

The bill, which is currently pending in the Senate, would also provide clear instructions to help people in restoring discontinued service and would waive reconnection fees for low-income households.

Dodd says many of the poorest Californians are paying as much as a fifth of their incomes for water. In the East Bay Municipal Utility District alone, which provides drinking water for 1.4 million people, household water deliveries were interrupted for more than 8,000 residences in 2015 due to unpaid bills, according to a press release from his office. In July 2017, the utility's board voted to increase rates 19 percent over two years.

California is served by more than 400 large public water agencies. Additionally, many people receive water from private wells or small water systems. This decentralized system makes providing water for all in an equitable way a difficult task.

When it comes to the state's Right to Water law, "It's great to have this right written on paper, but it's more important to have that right realized," says Dodd.

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