KCET

5 Reasons Dam Removal Still Makes Sense Despite the Drought

Chris Clarke - March 22, 2016

Graffiti artists have editorialized on the obsolete Matilija Dam in Ventura County | Photo: Patrick Maloney, some rights reserved

When Interior Secretary Donald Hodel suggested in 1987 that California might tear down O'Shaughnessy Dam in Yosemite National Park, few took him seriously. The powers that be in San Fransisco were outraged: the Hetch Hetchy Reservoir supplies San Francisco with its drinking water. Even the radical environmentalists who sometimes talked about removing dams like Glen Canyon mistrusted Hodel, saying that he was likely trying to manipulate greens into supporting the controversial Auburn Dam as an alternative to Hetch Hetchy. The era of building big dams was just ending, and the thought of removing them was so far off the radar that Hodel just wasn't taken seriously.

Flash forward 30 years, and dams are starting to fall across the west. Two huge dams on the Elwha River in Washington State came down in 2011. The San Clemente Dam in Monterey County is coming down from the Carmel

River. Four dams on the Klamath River are so ripe for removal that their owner intends to take them out even if the state and federal governments aren't on board. In Southern California, the handwriting is on the wall for the Rindge Dam on Malibu Creek and the Matilija Dam on the Ventura River.

It may seem counterintuitive. California and the rest of the west are held in a crippling drought that this current El Niño season is doing little to alleviate. And from the 1850s through the 1980s, dams went up in California in part to ensure a secure supply of water for homes, farms, and factories. But dam removal is still often a good idea even as the state looks at yet another year of drought. Here are five reasons why.

1: Safety

Eighty-eight years ago this month, the poorly engineered St. Francis Dam failed just a few years after it was completed near Santa Clarita. It sent a wall of water down San Francisquito Canyon and the Santa Clara River to the sea, killing at least 431 people; perhaps more than 600 actually died in the flood, some swept all the way out to the ocean.

The St. Francis Dam failed mainly because its construction was unequal to California's geology. Unbeknownst to engineers of the day, the dam site sat on ancient, unstable landslides. We know a lot more about California's geology these days, and what we've learned about the locations of many existing dams is unsettling. One example of many: when the Anderson Dam was built near the Northern California city of Morgan Hill in 1950, geologists thought the nearby Calaveras Fault was inactive. We've since learned the Calaveras Fault is anything but. A sizable quake on the Calaveras could cause the 240-foot earthen dam to fail, devastating Morgan Hill and dumping eight feet of water into downtown San Jose. (The Santa Clara Valley Water District is in the process of retrofitting the dam to be more seismically sound.)

One of the state's most prominent dam removal projects stemmed in part from new awareness of earthquake risks. The San Clemente Dam, removed from the Carmel River in 2015, was identified as seismically unsafe as early as 1991. The 106-foot concrete arch dam, built in 1921, was also determined to be at risk of failure in a large flood, in part due to its reservoir having silted up almost entirely — more than 95 percent of the reservoir had been filled with sediment by the time it was removed. If the San Clemente Dam had failed, a wall of mud would have devastated communities downstream.

All dams fail eventually. Flowing water is one of the most inexorable forces on the planet. One of the biggest dams ever "built" in western North America, the 2,300-foot-tall lava flow in the Grand Canyon that geologists call Prospect Dam, was worn away to almost nothing over just a few millennia by nothing more than the flow of water and river-borne silt. Come back to visit planet Earth in 500 years, and it's unlikely any of our present-day dams will be both unmodified and in working order.

That's especially true in earthquake-prone California, where many of the best sites for dams — deep river canyons cut into rising mountain ranges — are found near earthquake faults. A 5.7 quake near Oroville Dam in 1975 surprised engineers, who reexamined the site of the then-proposed Auburn Dam on the North Fork of the American River and found a major fault system beneath the site capable of unleashing a 7.0-magnitude quake. That's much of the reason Auburn is yet unbuilt.

But before the advent of modern seismology, we did build a whole lot of dams, large and small, in earthquake hazard zones. And even if a quake never damages those dams, watersheds in seismically active California carry a lot of eroded sediment. That sediment silts up reservoirs, reducing dam operators' ability to manage seasonal flood. Sediment can also speed erosion of dams, as we saw when the silty Colorado River nearly took out Glen Canyon Dam in 1983.

Sometimes, a dam just isn't a safe answer for water management in California's unstable watersheds. And dams built before we knew what we were doing, such as the completely silted-up Rindge Dam on Malibu Creek, just need to come out for public safety.


Shasta Dam being built, circa 1939 | Public domain photo via Library of Congress

2: Dams are bad for fish

It's no secret that dams hurt fish populations. Some of California's once-thriving salmon runs have been wiped out, or nearly so, by huge 20th Century dams. Take the Shasta Dam, for instance. When that 600-foot dam closed its gates in 1943, it closed off access to almost all of the Sacramento River winter-run chinook salmon's historic spawning habitat. Before 1943 there had been hundreds of miles of winter-run habitat on the Upper Sacramento, the Pit, and McCloud rivers, which flowed together to form the Sacramento River just above the site of Shasta Dam. After 1943, there was 16 miles of winter-run habitat left, and the winter run chinook found itself listed as an endangered species.

That's just one example, albeit a big one: few dams are as big as the Shasta, and few devastated an entire population of fish in the same way. But most California rivers held historic populations of anadromous fish such as salmon and steelhead, and all but two major California rivers — the Cosumnes and the Smith — now have dams on their main stems.

"Dams have blocked access to most historic spawning habitat in California," says John McManus, Executive Director of the Golden Gate Salmon Association.

It's not just that fish find their way upstream blocked by dams, points out McManus. Dams can drastically reshape rivers' downstream reaches as well. There's the above-mentioned issue of reservoirs trapping silt, for instance. It's not just silt that gets trapped: it's sand and gravel as well. "Salmon need gravel beds to spawn in," says McManus; "dams disrupt the natural flow of that gravel, meaning that they degrade spawning habitat downstream as well as upstream.

As if that wasn't enough of an injury to fish, dams also allow their operators to change the seasonal water flow patterns. Before the dams, California streams ran highest in late winter and early spring as cold snowmelt ran out of the mountains. California's fish evolved to expect that. Now, flows below the dams are pretty much as dam operators make them — and unless dam operators keep fish in mind, those flows can become too weak, and their water too warm, to benefit the fish.

"Baby salmon rely on that runoff to hitch a ride down to the estuary," says McManus. "Cutting off that runoff is like cutting a conveyor belt that carries our future salmon."

It's no wonder that the health of fish is a key reason offered for taking out aging dams, in California and elsewhere. Of 67 California dams removed from the late 1940s through 2009, improving passage for fish was cited as a reason for the removal of 19, and habitat restoration other than restoring access to upstream habitat for another four.

The most recent big dam removal in California, of the San Clemente Dam above Carmel, opens up about two dozen miles of spawning habitat for steelhead. The October 2015 removal of San Mateo County's Memorial Park Dam on Pescadero Creek has freed up 62 miles of coho salmon habitat. And an agreement reached in February that will remove four large Klamath River dams by 2020 — the largest dam removal project in U.S, history, if it's carried out — is being undertaken primarily to boost the health of the Klamath's salmon runs.

Like the sand on your beach? Thank your local river. | Photo: Wendell, some rights reserved

3: Dams can make us more vulnerable to sea level rise.

You might be asking yourself where all the silt, sand and gravel trapped by dams would have ended up if those dams hadn't been built. The answer: your local beach.

At least some of the sediment now cooling its heels at the bottom of California's reservoirs, especially soil particles of that particular size we know as sand, gets washed down free-flowing rivers to the sea. There it gets dropped on the seabed to join the great sand conveyor belts that — left to their own devices — replenish and rebuild beaches. The vast majority of sand on California beaches flowed down a river, much of it in times of flood when the energetic rivers could carry more sediment.

Current thinking is that California's coastline is made up of a number of so-called "littoral cells" — segments of coastline where local rivers and streams deposit sand that is then distributed along beaches by wave action. Sand eventually flows out of each littoral cell; some of it may be washed into adjoining littoral cells, but a lot of it ends up on the deep ocean floor. Damming the waterways that feed into those littoral cells, whether with gigantic mega-dams of with six-foot debris dams, cuts down the amount of sand flowing into the system, which means narrower beaches.

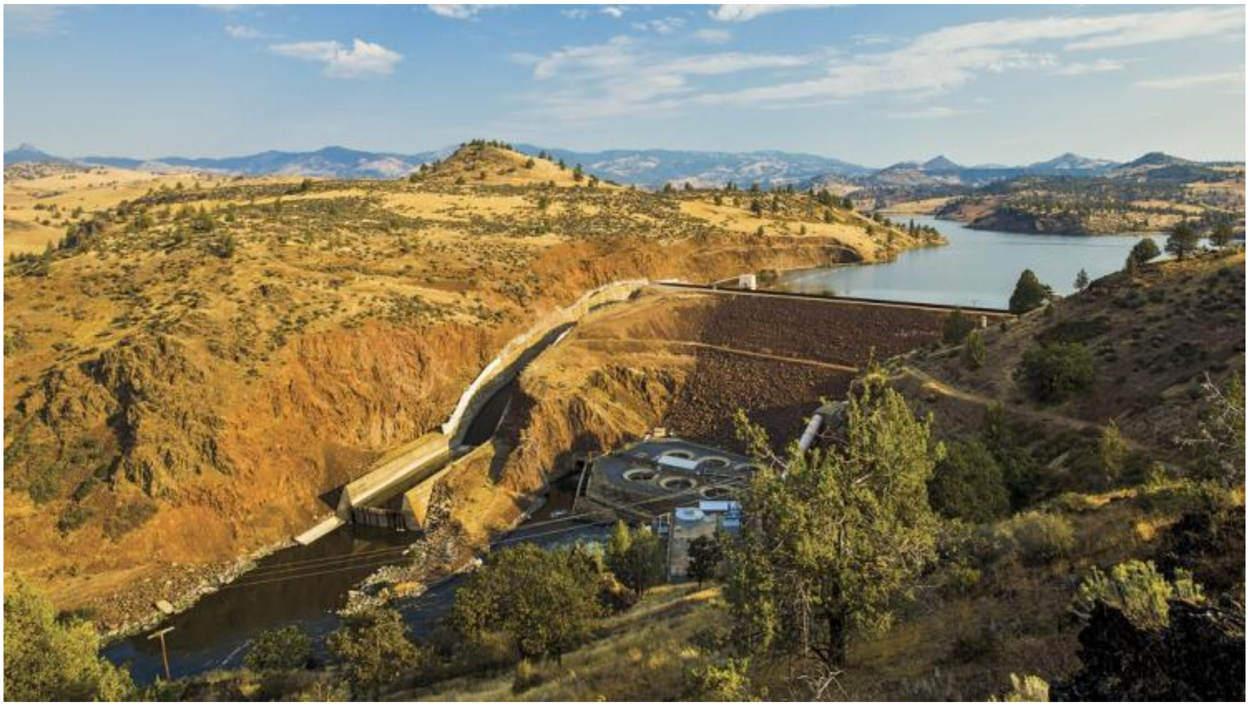
It's thought that the many dams on California rivers and streams has cut the amount of sand reaching California beaches by about one-quarter. That's a problem. Sandy beaches provide a natural buffer between the ocean's pounding surf and the terra firma where we live. A long, gently sloping, sandy beach allows waves to discharge their energy relatively harmlessly. Where waves are able to pound against the land behind the beach, catastrophic erosion can result, as recently documented in this bit of drone footage of crumbling cliffs beneath apartment houses in Pacifica.

With less sand on our beaches, our coasts are more vulnerable to damage from rising seas. But dams don't just interfere with our ability to withstand rising seas by hurting our beaches. Sand grains are relatively big, and it takes energy for a river to carry them. When river water slows when it meets the ocean, it loses energy and can no longer carry sand. That sand falls out of suspension and onto the beach. Smaller soil particles such as silt and clay, which take a lot less energy to keep in suspension, are usually flushed out past the beaches into the open ocean, where they fall to the seafloor.

But there are places where even those lighter soil particles settle out on land, or close to it, and end up helping provide a buffer for floods and rising oceans. Tidal estuaries, where the advancing ocean slows rivers to a halt twice a day, are places where those smaller grains of soil can build up, providing a substrate for marshes and other wetlands. Farther upstream, occasional floods dump silt and clay onto floodplains, lowlands that provide an ecologically rich buffer zone between rivers prone to flood and the uplands where we tend to live.

By sticking a cork in the source of all that helpful sediment, dams interfere with the natural processes that help protect us against flooding from sea level rise and extreme weather.

And when we remove those dams, that stored-up sediment comes out of storage. On the Elwha River in Washington State, where the Glines Canyon and Elwha Dams came down a few years ago, that withheld sediment is rebuilding an estuary along the south shore of the Strait of Juan de Fuca. Releasing sediment from removed dams has to be done carefully, as too much sand and silt and clay can obliterate what's left of the habitat downstream. But with some care, dam removals can put those sediment transport processes back the way they were supposed to be in the first place, to our benefit.


The Iron Gate Dam on the Klamath River | Photo: Matt Stoecker, DamNation collection

4: Removing dams makes solid financial sense

In February, when a pact among agencies, tribes, and the utility Pacificorp to remove four dams on the Klamath River seemed like it had fallen apart, Pacificorp stunned some observers by saying it wanted to remove the dams anyway. The Iron Gate and Copco 1 and Copco 2 dams near Horngate, CA, along with the John C. Boyle Dam upriver in Oregon, had been the subjects of decades of controversy. Downstream tribes and environmental groups pinned a decline in the Klamath's legendary salmon runs on the four dams. Upstream farmers said that if the dams were removed, the resulting renegotiations of river management might mean their water allocations would be cut.

It was diversions from these same dams' reservoirs that caused the catastrophic salmon die-off in the lower Klamath in 2001, amid allegations that the Bush administration had interfered with agency scientists and ordered water deliveries to continue to farms. Too-warm water in the reservoirs bred toxic algal blooms that killed more fish, with an especially bad year in 2006.

So it was a little bit of a surprise to some when Pacificorp suggested, after talks fell apart, that it wanted to scrap the dams. And part of the reason: the dams required extensive — and expensive — upgrades. Removing the dams would cost several million dollars more, but it would also allow Pacificorp to avoid paying ongoing maintenance costs for the dams. No dams? No maintenance.

All four dams were mainly designed as sources of hydroelectric power, and no fish passage was designed into them when they were built in the late 195-0s and early 1960s. Laws have changed since then, and if Pacificorp intended to keep the dams operating the Federal energy Regulatory Commission would have required the utility add fish ladders to the dams. It became easier to take the dams out, which is slated to happen by 2020. The four dams will collectively become the largest dam removal project in history. As Pacificorp's Bob Gravely told the North Coast Journal in January, the removal just makes good business sense:

> *Dam removal for a lot of people means a lot of things, and for us, we just need an outcome for an expired federal license that's a good outcome for our customers in the eyes of our regulators. With the protections provided by the Klamath Hydroelectric Settlement Agreement, removing the dams and replacing the power was going to be a better way forward for our customers than re-licensing with the new requirements that it would [include].*

To be sure, there were other factors behind Pacificorp's decision, including a decades-long campaign by North Coast Native people and their allies that affected the company's stock price. But the bottom line is the bottom line. Pacificorp won't actually be going it alone in removing the dams: the above-mentioned Klamath Hydroelectric Settlement Agreement, crafted in 2010 but seemingly moribund as Congress refused to provide funding for the removal, got a new lease on life in February with an agreement under which Pacificorp ratepayers and the State of California would split the $450 million tab for removing the dams. It's a lot of money, but those ratepayers and the state would have been on the hook for the retrofitting and maintenance costs, which could easily have outstripped removal costs not long after 2020.

The Klamath dams are a huge example, but there are plenty of cases where it was cheaper to remove dams than to bring them into compliance with existing laws. Removal of the Waterworks Dam on Wisconsin's Baraboo River cost $213,770, while retrofitting would have cost between $694,600 and $1,091,500. The Edwards Dam on the Kennebec River in Maine would have cost so much to bring into compliance with environmental laws that FERC gave the dam's owner only a *pro forma* choice whether to retrofitting it: that dam came down in 1999.

Reservoirs in California lose between one and two meters of water each year to evaporation. | Photo: Ken Schneider, some rights reserved

5: There Are Better Ways to Supply Water

We build dams for several reasons — flood control, power generation, even to create recreational lakes — but in California, the main purpose of dams that comes up when the topic of dam removal is being discussed is water storage.

And indeed, on the face of it, dam removal in dry years seems counterintuitive. Why take down dams — and by extension, the reservoirs behind them — when California's going thirstier than ever?

But there's such a thing as too much storage capacity. In some California watersheds there's more storage capacity than there is water in the river in an average year. reservoirs in the San Joaquin River watershed can hold 8.7 million acre-feet. The San Joaquin, in an average year, delivers only 6 million acre-feet of water.

In a watershed with surplus storage capacity, you can find yourself actually losing more water to evaporation from the surfaces of reservoirs than you would if you decommissioned a dam or two, and concentrated the storage in fewer reservoirs — thus making less surface area for the water to evaporate from.

California has enough large reservoirs, Lake Shasta and Lake Oroville at the top of the list, that some studies have shown smaller dams with smaller reservoirs could be decommissioned without substantially affecting the state's water supply. A 2014 study, for instance, indicated that a number of large California dams — the Whiskeytown, Pine Flat, Pardee, Camanche, and Englebright dams — could conceivably come down without mattering to California's water consumption. The study showed that even if the dams stayed up, climate change is likely to reduce Californians' water supply by more than we'd lose taking them down.

As the drought continues, Californians are looking toward finding other sources of water to supplement reservoirs, nd those sources of watwr could replace some reservoirs. Some of those new water sources are cost-competitive with storage provided by new dams, and they might well be cost-competitive as an alternative to maintaining existing dams. Two new controversial dam projects, the proposed Sites Reservoir near Colusa and the proposed Temperance Flat Dam on the San Joaquin River, would cost $340 to more than $1,000 per acre-foot of storage, respectively. According to the California Department of Water Resources, recycling urban wastewater would cost about the same amount, while other measures such as groundwater storage and increasing water efficiency are far more economical than building the new dams would be.

And that alternative — just plain using less water — is the real issue. At its root, the dam removal question forces a value judgment. What do we value more? Wild, free-flowing rivers with healthy fish populations, thriving estuaries and beaches, and opportunity for recreation and enjoyment? Or watered lawns in highway medians that never feel the touch of an unshod human foot?

For the record: This article has been edited. A previous version suggested that Klamath Basin farmers would suffer direct water cuts if the four dams on the Klamath River were removed. Those dams are hydroelectric dams only, and thus supply no water to irrigators. Farmers had feared cuts in their water supply as a result in larger river management discussions of which the dam removals are part, but none of that water is being delivered by the four dams at issue. We regret the error.