End California Drought

California has a water problem driven by persisting drought. The reduced snowpack in the sierras and drought in the Colorado River basin are the leading causes of water shortages. With climate change causing droughts to become more frequent, California can no longer rely on the natural snowfall to maintain agricultural output. A new source is needed to supply the Channels on which farmers rely. Alternative sources for cities would further relieve pressure on the channel system.

Some argue that the solution to the water problems in California is the construction of more dams. But with the proposed dams being mostly upstream of already starved rivers and dams, this seems like a moot exercise. Many aggrieved framers invoke the chant "stop letting our water run into the ocean." The slogan is often posted on signs along highways in the state. Creating more storage and starving the natural waterways and estuaries would make an ecological disaster. There needs to be a new approach to solving the California water problem. Although I do not agree with the proposed dams or the suggested delta bypass project, I will look at these as a starting point. Another solution is to supply the coastal cities with desalinated seawater. Ultimately, I want to investigate if a mega engineering project involving desalination and tunnels spanning half the width of the state would solve California's water problems for good. The ultimate drawback of desalination and megaprojects is cost, but ultimately the price could be arguably offset by the aversion of economic loss in the agricultural sector.

Past suggested solutions

Delta Bypass

One of the longest-standing bills that try to remediate the California water problems is a bill to authorize the so-called "Delta Bypass project." In 2013 the bill failed under the leadership of Governor Brown. (Jim Carlton, 2013) The bill is all but dead and has been tabled in the State Senate as recently as 2021 under the new name the Delta Conveyance Project (DCP). (Contra Costa Herald, 2020) There are also groups still lobbying for the project and strong opposition from Delta area residents.

In essence, the bill failed because of cost and the fear that it would further drop the water levels of the Sacramento -San Joaquin Delta and increase salinity levels that already threaten the estuary. Additionally, the construction of tunnels would damage the sensitive ecology even further. Among those opposed to the project are waterfront properties owners; a law water level in the Delta would hurt their property values. Boaters and water skiers are equally upset.

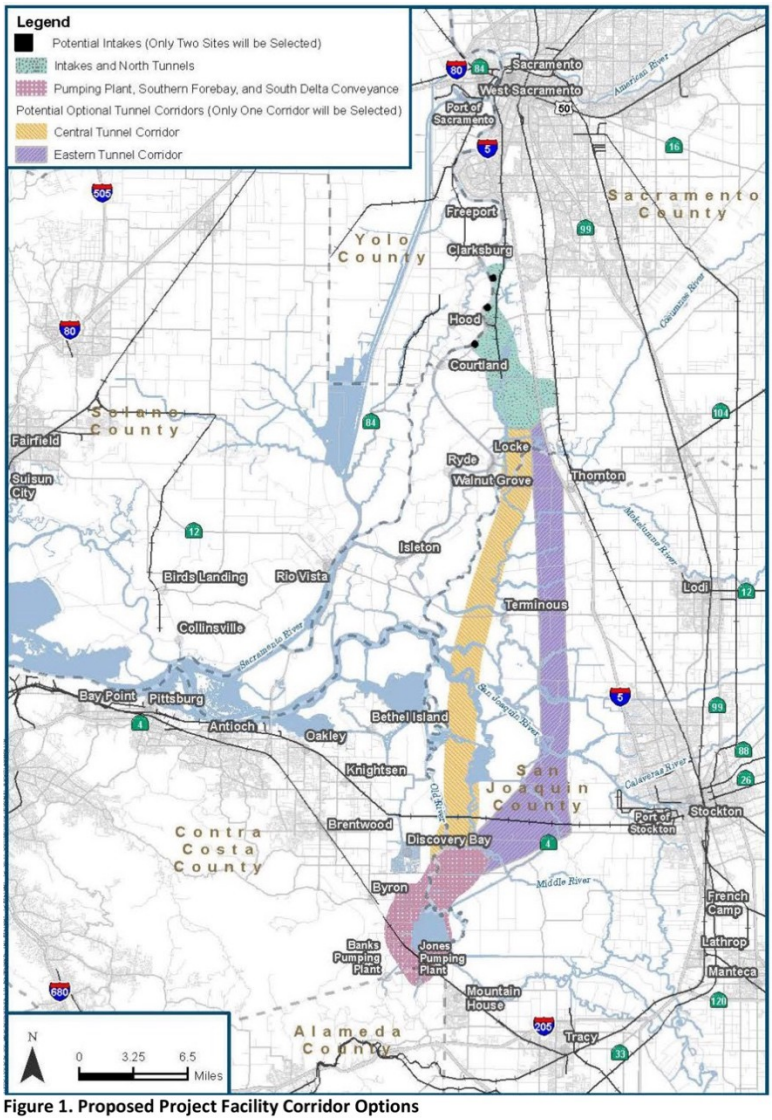


Figure 1. Proposed Project Facility Corridor Options

(Contra Costa Herald, 2020)

The project had an estimated sixteen billion dollars in 2015 and was subsequently shot down. One could only imagine what the cost would be now.

The promise of directing water straight from the Sacramento River and Orville dam to the California aqueduct may have benefits if the Delta is managed carefully. Lawmakers still fear that there is not enough environmental protection in the project even in current iterations. Modern boring and tunneling technologies might mitigate some construction damage by not disturbing the surface.

Not enough has been done to ensure the environmental and recreational preservation of the Delta estuary. Much more needs to be done to win the confidence of environmentalists and residents. Many argue that simple rehabilitation of levies, some 100 years old, and upgrading existing pumping should already provide marked throughput to the aqueduct.

More Dams

The Auburn Dam on the American River is a prime example of a suggested dam project that reached advanced stages of development only to be thwarted by environmental concerns. (Mardon, 1990) These are the kinds of projects that some are calling to be reconsidered in light of the enduring drought conditions. But skepticism remains that more dams would result in more water retention without damaging the ecology of natural river systems.



(Auburn Dam 2022)

The biggest objection to the Auburn dam is that it would dam back the wild river up to 48 miles. That would flood a great area currently used for recreation like trail running, fishing, rafting, and gold panning. Further, the project's history is riddled with interruptions, including geological studies after significant earthquakes in the area. A dam was initially suggested in the area to prevent flooding as Folsom Dam nearly failed to tame the water in the past. But a dam breach in an earthquake would be much worse than natural flooding.

Below is a list of similar proposed projects:

Sites Reservoir (Rodriguez, 2021)

Pacheco Pass Dam (Rogers, 2021)

Del Puerto Canyon Reservoir (*Del Puerto Canyon Reservoir*, 2022)

New Solutions

Mega Desalination Project, The Best Solution

Desalination removes salt and other harmful substances from seawater to make it potable. If the coastal cities of San Francisco, Los Angeles, and San Diego built local desalination plants, it would free up water for agricultural use.

I would argue that the best solution would be a hybrid of using desalinated water for coastal cities and building massive geothermal desalination plants and tunnels to supply farms. It would offer a long terms solution in the face of global warming and decreasing rainfall. Tunnels could be dug from the coast to a central supply point for the California aqueduct like San Luis reservoir, Milnerton lake, or Clifton Court Forebay.



(Walton & agriculture, 2016)

The largest desalination plant globally is found in Al Jubail, Saudi Arabia. The plant produces 4200 gallons per minute (*Inside the world's biggest water desalination plants* 2020), more than half of the 7000 gallons per minute that run in the California Aqueduct. (The Editors Encyclopedia Britannica, 2022) A similar plant is constructed in California should make up for the water shortages in dry years. Such plats cost Billions of dollars.

Geothermal desalination uses the heat of the earth's core to boil seawater, thus removing all salt and heavy metals. Small-scale geothermal projects use wells and, in some cases, even natural guizers. On a large commercial scale, it would involve digging deep mine shafts and providing systems to remove sediment from underground. Steam would have to be captured and condensed to potable water at the surface. IT is hard to estimate the cost of such a relatively new technology. It would stand to argue that it is a greener option, but even conventional desalination can be green using renewable electricity.



(The boring company, 2022)

The North American leader in tunnel construction is arguably Elon Musk's aptly named Boring Company. They estimate that they can dig a tunnel large enough for an electric car to drive in for less than ten million dollars a mile. Looking at their recently completed Las Vegas project, they averaged closer to 28 million. (Reuter, 2021) Using those estimates as low and high limits, it would cost 410 million to 1.1 billion to construct a tunnel from the closest shore to San Luis Reservoir (41 miles), or 340 million to 952 million to build a tunnel from the San Francisco Bay to Clifton Forebay (34 miles). It would cost an additional 740 million to 2 billion to build a tunnel from the San Luis Reservoir to Milnerton Lake (74 miles). A tunnel that size should be more than adequate for the volume of water.

A powerful counterargument would be cost. Using the above numbers, it would cost 5-7 billion to construct a single plant and tunnel to the San Luis Reservoir. All projects cost money; it is just a question of whether it is justified. Other arguments against the project could be based on an anti-environmental logic where there needs to be education on the effects of starving natural water systems. Climate change denial would also argue that it is just a temporary problem. Whether it is or not, a permanent solution to droughts would still be a highly beneficial event if the current drought is just an effect of cyclic weather.

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