

WESTERN WATER LAW

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FEATURE ARTICLE**MEETING CALIFORNIA'S WATER SUPPLY NEEDS:
WHATEVER HAPPENED TO STORAGE?**

By Nicholas A. Jacobs

In 2003, California is home to over 30 million people and boasts the world's fifth largest economy. California's population is expected to grow to nearly 50 million people by 2020. Like many regions of the West, California is already facing water supply shortages in many areas, and without significant new sources of supply the state will soon have annual shortfalls in the millions of acre-feet.

The rise of California's population and economy are most often traced to the goldrush of the 1840s. The fortune-seeking phenomenon brought settlers from all across the country and, indeed, the world to California. These miners are first credited with harnessing the state's northern rivers on a large scale. A century later, the federal government and the State of California collaborated to build massive storage and conveyance systems. These projects, combined with other local systems and flows from the Colorado River, created the most productive agricultural economy in North America and allowed southern California's urban population to boom. In addition to storing rain from the wet season to create a year-round steady source of supply, these reservoir projects help control flooding and generate significant amounts of "clean" hydropower energy. And then, for the most part, development of storage and conveyance systems halted.

Since the late 1960s "storage" has been considered a dirty word in some circles, principally for the

impact to fisheries from damming a river. Certain small but vocal environmental proponents have focused intense political pressure against new storage projects. In addition, the web of state and federal regulations governing any new development have become increasingly more strict. With a handful of notable exceptions, these factors have combined to hinder the development of new storage projects.

In lieu of new storage projects, Californians have tried to keep pace with demand by implementing a number of other means to either create new supply or reduce consumption. Conservation and reuse programs are now popular throughout the state. Most notably, Californians have turned to pumping groundwater to meet demand.

This article asks the question: Whatever happened to storage? Until very recently, the debate over how to meet California's imminent future demand—and seemingly imminent shortages—shied away from serious discussions on new, large-scale storage projects. Why? Admittedly, storage and conveyance projects have environmental impacts, in addition to high costs and other externalities. But storage projects also offer significant environmental benefits, in addition to their contribution to flood control, energy generation and water supply. Recently, more pragmatic minds have prevailed and California is again looking to new storage projects as part of the solution to a complicated suite of interrelated issues

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facing the state. This article explores the rise and fall of storage projects, and suggests that California must include significant new storage projects as part of the overall plan to meeting the state's future water demand, flood control, energy and environmental needs.

Background

In California, over 75 percent of the total precipitation falls north of the City of Sacramento, yet over 75 percent of the state's water use is in the south. California's climate is characterized by wet winters and mild summers. Perhaps the most significant aspect of California's hydrologic cycle is that a large percentage of the precipitation falling in the north comes in the form of snow. Under typical conditions, snow remains in its solid state during the winter and then slowly releases during the spring melt. At least that is how things are supposed to happen.

The story of California's development of its massive surface storage reservoirs and conveyance systems begins with the state's modern population boom associated with the Gold Rush of the 1840s. Water was essential to the mining practices of the era, and the gold miners were the first group credited with building large-scale diversion and storage works. Their hydraulic mining techniques used high-pressure water streams to dislodge gold from the hills of northern California. The miners used reservoirs and the force of gravity to create their pressurized water streams.

After the Gold Rush slowed down, many of the miners took up farming in the Central Valley and the Sacramento-San Joaquin Delta (Delta). These early farmers worked together to build private storage, conveyance and flood control systems. In 1887, the Wright Irrigation District Act passed allowing the formation of public irrigation districts. Soon, irrigation districts formed throughout the state and the pace of constructing small-scale storage and conveyance systems accelerated with the support of public funding.

The first major California storage projects were the Owens Valley project in southern California and the Hetch Hetchy project in northern California, designed to supply Los Angeles and San Francisco, respectively. Then, as now, these projects were controversial for their local environmental impacts.

In the Owens Valley, farmers dynamited the Los Angeles Aqueduct in an effort to disrupt the flow of water to Los Angeles. Up north, John Muir led the fight against damming the Tuolumne River and flooding the Hetch Hetchy Valley. Ultimately, both opposition efforts were unsuccessful, and the projects were constructed. These projects continue to operate today, and remain valued sources of water supply.

In the early years of the 20th century, several factors combined to demonstrate the need for additional water supply in northern and central California. Delta farmers were hit with the double whammy of winter flooding and summer salinity intrusion. Farms in the Central Valley were without surface water flows in the summer months. To irrigate their crops, the farmers turned to extensive groundwater pumping, which caused a severe drop in groundwater levels. Wells dried up, and thousands of acres of Central Valley farms went out of production. A protracted drought between the years 1928 and 1934 finally brought enough political pressure on the California Legislature to address the situation, and in 1933 the California Central Valley Act passed. The legislation authorized the sale of revenue bonds to fund the project, but due to the Great Depression, the bonds did not sell. Without the ability to construct a project at the state level, California turned to the federal government for financing assistance. In 1935, the federal government assumed control of the project and in 1937 work began on the most ambitious system of dams, reservoirs, power facilities and canals known as the Central Valley Project (CVP).

Estimated to cost \$170 million in 1933, the CVP's capital construction costs exceeded \$3.2 billion in 1992. The CVP currently operates approximately 20 reservoirs in northern and central California. Total storage capacity is 11 million acre-feet of water, with average deliveries to CVP water users of around 7 million acre-feet. Ninety percent of CVP water goes to irrigation uses and ten percent goes for municipal and industrial uses. In addition to its storage and conveyance systems, the CVP operates 11 power plants and three fish hatcheries. Its power facilities generate an annual average of approximately 5 billion kilowatt hours of electricity.

At about the same time the CVP was being built, the federal government was creating the massive storage and conveyance facilities on the Colorado River. Under the act authorizing construction of

Hoover and Imperial dams, and the All-American Canal, California agreed to limit its annual diversions from the Colorado River to 4.4 million acre-feet. For years California was allowed to take more than 4.4 million acre-feet on an annual basis under the “surplus” provisions of the allocation agreement. This extra water was cut-off by the federal government in January 2003, when the Imperial Irrigation District and San Diego County Water Authority failed to broker a long-term water transfer to meet the municipal demand of San Diego County. (See related article, p. 153.)

The last major storage and conveyance system built in California was the State Water Project (SWP). The SWP was authorized in 1960 to meet the demand created by California’s exploding population. It stores and conveys approximately 3.1 million acre-feet annually of Feather River flows. The SWP’s facilities include Oroville Dam and Lake Oroville, a massive pumping plant in the Delta, the joint-use (both CVP and SWP) San Luis reservoir and the Kern Water Bank—a groundwater storage and recover project. Approximately 70 percent of SWP water deliveries go to municipal and industrial users, the remaining 30 percent go to agricultural irrigation. Construction of the SWP was never completed, and there remain more than one million acre-feet of storage and conveyance capacity in the project.

Present and Future Water Supply Needs

Current California water demands are not being met. On an annual basis, there are shortages in surface water deliveries to CVP and SWP users due to a number of factors. The burden of these shortages falls first on agricultural users, before urban uses are cut back. In order to make up for shortfalls in surface water deliveries, many agricultural users pump groundwater. It is estimated that California groundwater pumpers are producing 1.5 million acre-feet of water annually *more* than is being naturally replenished. Over time, this overdraft condition has resulted in lowered groundwater levels and reduced quality of groundwater produced in some areas. Lower groundwater levels typically result in higher pumping costs.

Every five years, California’s Department of Water Resources (DWR) publishes a report, dubbed “Bulletin 160,” on the overall state of California’s water supply and how the demand for water is being met.

DWR published the most recent version of Bulletin 160 in 1998, and an updated version is due out this summer. Bulletin 160-98 projected that under the current supply conditions, by the year 2020 California would experience a shortfall of 2.4 million acre-feet of water annually in average precipitation years. In drought years, the shortfall will balloon to 6.2 million acre-feet.

To address the projected supply shortfall, Bulletin 160-98 recommends a multi-pronged approach to meeting the supply deficit—including new storage facilities. In fact, the report states that building new storage facilities is crucial to this effort. “Clearly, conservation and recycling alone are not sufficient to meet California’s future needs....New storage facilities are an important part of the mix of options needed to meet California’s future needs,” concludes Bulletin 160-98. In support of that effort, the report suggests that DWR take a lead role in performing feasibility studies of potential storage projects.

Since the completion of the SWP, California has not constructed another major surface water storage project, and only constructed a handful of small to medium sized projects. During this same period of time, millions of people have joined the state’s population. These incongruous facts have led to the inevitable shortfall in water supply now faced by the state. Despite significant conservation and recycling efforts, the water supply deficit continues to expand.

Storage Benefits

Surface water storage projects offer significant and diverse benefits. Of course, the primary role of a storage facility is to impound water from runoff during the wet season and release the water for year-round needs. In this respect, the state’s network of surface water storage facilities are able to operate in a coordinated (somewhat) pattern of water releases that is intended to maintain steady water deliveries and avoid the “torrent to trickle” pattern that naturally occurs in California’s seasonal cycle. The steady, relatively predictable water supplies from California’s storage network have played a vital role in the state’s agricultural and urban boom.

California’s large storage projects include significant hydropower generation facilities. The second important benefit of surface water storage facilities is the ability to generate power when water is released. The same principles of gravity employed by the early

gold miners to create pressurized blasting streams from storage impoundments are exploited to turn powerful turbine generators with pressurized water released from the bottom of reservoirs. Combined, the CVP and SWP generate billions of kilowatt-hours of electricity on an annual basis. The electricity is generated in a manner that does not create the pollution by-products of other power generation techniques, such as coal and gas-fired plants, or nuclear plants. Moreover, the source of the energy, essentially falling water, is a renewable resource. In the often vitriolic debate over new storage projects, the benefits of creating “clean” hydropower energy are often downplayed or overlooked by project opponents.

Surface water storage projects also offer significant flood control protections. In northern California, the Sacramento and San Joaquin valleys and the Delta areas were inundated with seasonal flooding prior to development of the CVP and local levee networks. The Gold Rush-era mining practices left streams and rivers clogged with sediment, which raised river beds and exacerbated the flooding problem. Today, the state’s northern reservoirs operate to hold-back as much water as possible during periods of excessive precipitation. Although flash-flooding in local streams remains a concern, the region no longer experiences the annual winter inundation.

Beginning in 1915, southern California began building a systems of levees and dams to protect against flooding. Today, it includes 15 dams, 450 miles of flood control channels, and 2,500 miles of underground storm drains. Surface water dams and reservoirs, therefore, are a crucial component of both northern and southern California’s approach to flood control.

Another benefit from California’s surface water storage facilities is the role played in enhancing the environment. There is much discussion in the environmental community about the impacts to fisheries from dams, but not as much discussion regarding the beneficial effects of storage releases for instream flow augmentation. Storage releases from the CVP and SWP play a crucial role in the current effort to meet state mandated water quality objectives in the Delta. Water released from Lake Shasta and Lake Oroville in northern California travels hundreds of miles—benefiting the aquatic habitat as it moves—until reaching the Delta. Likewise, water

from New Melones and other projects south of the Delta provides dilution for Delta waters.

Surface storage also creates recreational opportunities benefiting all Californians, including the local communities that reap the tourism benefits from these activities. Boating, fishing, swimming, camping and other outdoor activities are a natural fit with these facilities. Tours of California’s dams and power generation facilities are a popular vacation activity.

Finally, both on-stream and off-stream reservoirs may be crucial for adopting to a climate change associated with global warming. A recent report issued jointly by NASA and the University of California, Los Angeles, predicts severe flooding and water supply disruptions in California’s future associated with rising global temperatures. The study modeled conditions predicted to occur in 2050, and found that if current trends continue, California may see an increase of one-third more winter rainstorms. The impact of the increase in rainstorms associated with global warming would be severe, warns the report. In particular, the increase in winter rain storms would cause massive flooding and/or a decrease in stored water due to the need to draw down reservoirs in order to allow room for flood control purposes. While the state would receive more precipitation, the timing and form (rain versus slow-melting snow) in which it is delivered would actually reduce water supplies. In this context, having adequate storage facilities available to collect the winter storm water and store it for summer use will be critical.

Storage Impacts

Without a doubt, storage projects have some negative impacts on the environment. First, on-stream reservoirs necessarily entail damming a river. Placing a barrier in the river impedes the spawning activities of anadromous fish, such as salmon. California’s native salmon populations have dramatically decreased in number since the CVP and SWP were built. Salmon and steelhead populations have been notably impacted by the dams.

Second, the large CVP and SWP reservoirs are supplied water from several smaller rivers. In some situations the flows in these smaller rivers have been significantly decreased because the diverted water is sent to the main reservoir, instead of being released immediately downstream of the diversion dam. In

these situations, there has been a permanent flow reduction in once wild rivers.

Third, storage opponents often focus on project costs. They claim that public monies are unfairly subsidizing the cost of water to farmers and urban users. Any new storage projects should be paid for by the parties that receive the water or benefits, not the general taxpayer.

Finally, water quality in the Delta has been degraded due in large part to the state and federal water pumps that send huge volumes of water through the Central Valley and down to Southern California. These pumps, which combined pump several thousand cubic feet per second of water, are part of the surface storage and conveyance systems. California and the federal government are now engaged in a complex joint effort to address the water quality issues in the Delta (commonly referred to as CalFed). A complicated solution is being proposed that involves reallocating water to in-Delta use, studying new storage options, and implementing programs to restore local habitat and purchase water for environmental uses.

The Benefits to Constructing New Surface Storage Outweighs the Burdens

Despite the environmental impacts associated with constructing and operating a large-scale storage project, California must move forward with this effort. The positive benefits far outweigh the burdens. With proper planning, many of the impacts from storage projects can be mitigated.

For example, the use of fish ladders and hatcheries aid the natural spawning migration and boost species populations. As discussed above, global warming may dictate a more flexible storage system whereby a greater number of reservoirs are maintained at lower levels for flood control purposes. This approach might allow more water to pass-through diversion dams and bolster anemic flows of "feeder streams." Of course, this assumes that more reservoirs are constructed to capture an overall greater amount of water, while not relying as heavily on each stream.

The cost of the projects has been hotly debated for decades. Although on their face, the costs of the SWP and CVP are daunting, there exists a strong argument why these projects have actually brought in more tax revenue than was spent on construction. The projects allowed the Central Valley to become

the most productive agricultural area in North America. Jobs were created, products sold, and taxes paid. In addition, property values in the Central Valley and other agricultural areas supported by CVP or SWP water are greatly enhanced by the ability to farm. The increase in property taxes from these lands must also be considered. Costs associated with annual flooding have also been greatly reduced.

Opponents of new storage projects argue that any positive benefits from storage are not offset by the detrimental environmental impacts caused by damming California's rivers and continuous pumping in the Delta. This argument misses the point, however, for it assumes that our state can sustain its operations in even a *remotely similar manner* without new storage projects. Such is not the case, as described in the above-quoted language from Bulletin 160-98.

Proposed New Projects

The most focused effort at creating new storage is occurring in the CalFed process to address water quality issues in the Delta. A component of CalFed involves the study and possible funding of several new surface storage projects. North of the Delta, CalFed is investigating expanding several existing reservoirs, including Lake Shasta and Lake Berryessa. These projects would create up to ten million acre-feet each of additional storage capacity. Other proposals involve flooding the Sites Valley near the town of Maxwell by constructing dams on Stone Corral and Funks Creek. Excess Sacramento River water would be stored at the Sites Reservoir via the Tehama-Colusa Canal. This project would create a maximum additional storage capacity of 1.8 million acre-feet. A larger version of this project would extend north into the Hunters and Logan Creek drainages for a total capacity of 3 million acre-feet.

South of the Delta, the California Aqueduct transports water from the CVP and SWP to southern California. Several projects have been proposed for diverting water from the California Aqueduct into off-aqueduct storage. These projects are generally smaller in size, and offer considerable flexibility in operating the SWP and CVP projects.

Conclusion

Over the past 30 years, there has been a general paralysis associated with building new surface storage in California. During this period when California's

taxpayers supported billions of dollars in grants and loans for local conservation projects and ecosystem restoration, the state's storage needs were neglected. Moreover, the debate over current and new storage projects took on a pitted adversarial tone. If Califor-

nia hopes to meet its future water demand, flood control and energy production needs, then things must change. The debate must move forward and cooperation on new storage projects must begin.

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