

= Auburn Dam =

Auburn Dam was a proposed dam on the North Fork of the American River east of the town of Auburn, California in the United States, on the border of Placer and El Dorado Counties. Slated to be completed in the 1970s by the U.S. Bureau of Reclamation, at a height of 685 feet (209 m) the concrete arch @-@ gravity dam was to be the largest three @-@ centered thin arch dam in the world. Straddling a gorge downstream of the confluence of the North and Middle Forks of the American River and upstream of Folsom Lake, it would have regulated water flow and provided flood control in the American River basin as part of Reclamation's immense Central Valley Project.

Proposals and studies for the dam emerged in the late 1960s, and construction work commenced in 1968, involving the diversion of the North Fork American River through a tunnel and the construction of a massive earthen cofferdam. Following a nearby earthquake and the discovery of a seismic fault that underlay the dam site, work on the project was halted for fears that the dam's design would not allow it to survive a major quake on the same fault zone. Although the dam was redesigned and a new proposal submitted by 1980, spiraling costs and limited water storage offered by either design put an end to the project until heavy floods destroyed the cofferdam, sparking brief renewed interest in the dam. The California State Water Resources Control Board denied water rights for the dam project in 2008 due to lack of implementation.

Although new proposals surfaced from time to time after the 1980s, the dam was never built for a variety of reasons. Limited flood @-@ control capability, geologic instability, and potential harm on recreational and ecological values finally put an end to the Auburn Dam project. Many of the original groundworks and preliminary constructions at the Auburn Dam site still exist, and up to 2007, the North Fork American River still flowed through the diversion tunnel that had been constructed in preparation for the dam. Reclamation and Placer County Water Agency completed a pump station project that year which blocked the tunnel, returned the river to its original channel, and diverted water through another tunnel under Auburn to meet local needs. However, some groups continue to support construction of the dam, which they claim would provide important water regulation and flood protection.

= = Early history = =

In the 1850s, the city of Sacramento was rapidly growing around the confluence of the Sacramento River and its tributary the American River, near the middle of the Central Valley of California. The city's increasing population necessitated the construction of an extensive system of levees on the two rivers to prevent flooding, especially on the American. The flood control works were not enough to keep the rivers within their beds, however; in 1862, the city was inundated so completely that the state government was temporarily moved to San Francisco. In 1956, the U.S. Army Corps of Engineers built the Folsom Dam on the lower American, near the confluence of its North and South Forks, to provide flood control for the Sacramento metropolitan area. However, the Folsom Dam provided inadequate flood storage, and has overflowed on several occasions since its construction. In fact, a flood in 1955 filled the Folsom Reservoir to capacity, before the dam was even completed.

Water demand in the Central Valley in the Sacramento area was also growing, mainly for agricultural usage. In 1854, a diversion dam was constructed on the North Fork American River at the site of Auburn Dam, to divert water into a series of ditches that supplied irrigation water for downstream farms. Irrigation with dam and canal systems was favored because severe flow fluctuations in Central Valley rivers created floods in some years and droughts in others. It was in this light that the Auburn Dam was first contrived. As early as the 1950s, plans for a giant dam at the Auburn site were already being considered, in the name of flood control. Several designs, both earthfill and concrete, were considered. Before the dam could be built, however, the Auburn @-@ Foresthill Road, which crossed the river just upstream of the dam site, had to be relocated. Even before the project was authorized, several companies had already taken contracts for the construction of a high bridge to carry the road over the proposed reservoir and preliminary

excavations at the dam site .

Auburn Dam was to be a massive flood @-@ control and storage structure on the North Fork of the American River , just upstream from Folsom Reservoir . It would create a reservoir with more than twice the capacity of Folsom , which could help reduce floods on the American . With the introduction of the Central Valley Project in the mid @-@ 1930s , came the Auburn @-@ Folsom South Unit , with the purpose to " provide new and supplemental water for irrigation , municipal and industrial use , and to replenish severely depleted ground water in the Folsom South region " . In 1965 , Congress authorized the Auburn @-@ Folsom South Unit of the Central Valley Project , the primary feature of which was to be Auburn Dam . The targeted completion date was 1973 .

As the proposals for the Auburn Dam evolved , the project saw a transformation from a purely flood @-@ control structure to a multipurpose high dam that would serve various purposes including storage , hydroelectricity generation , and recreational activities . One of the first ideas , publicized in the late 1950s , called for a 515 @-@ foot (157 m) embankment dam impounding 1 @,@ 000 @,@ 000 acre feet (1 @,@ 200 @,@ 000 dam³) of water . In 1963 , a 690 @-@ foot (210 m) earthfill dam holding back 2 @,@ 500 @,@ 000 acre feet (3 @,@ 100 @,@ 000 dam³) of water was proposed . The pre @-@ construction design was finalized in 1967 , for a concrete thin @-@ arch gravity structure over 680 feet (210 m) high . This dam would be 4 @,@ 200 feet (1 @,@ 300 m) long , 196 feet (60 m) thick at the base , and equipped with five 150MW generators at its base for a total generating capacity of 700 MW . Two concrete @-@ lined flip bucket spillways would abut both sides of the dam . Construction work for the dam started in late 1968 .

= = Construction = =

= = Site preparation = =

Official groundbreaking of the Auburn Dam started on October 19 , 1968 with preparatory excavations and test shafts drilled into the mountainsides of the North Fork American River gorge . The contract for the diversion tunnel through the mountainside on river left , 33 feet (10 m) in diameter , 2 @,@ 400 feet (730 m) long , and equipped to handle a flow of 74 @,@ 000 cubic feet per second (2 @,@ 100 m³ / s) (a roughly 35 @-@ year flood) was given to Walsh Western for about \$ 5 @. @ 1 million in 1968 . The actual construction of the tunnel itself did not begin until mid @-@ 1971 , and the tunnel was completed in late November 1972 . One construction worker was killed during the excavation of the tunnel . In 1975 , the earthen cofferdam for the Auburn project , 265 feet (81 m) high , was completed and water began to flow into the diversion tunnel later that year . The diversion tunnel bypassed a roughly 1 @-@ mile (1 @. @ 6 km) section of the riverbed for construction of the main dam .

Upstream of the dam site , Auburn @-@ Foresthill Road , one of the only all @-@ weather thoroughfares of the region , would have been inundated by the proposed reservoir . In preparation for the reservoir 's filling , the road was raised high above the canyon on a three @-@ spanned , 2 @,@ 428 @-@ foot (740 m) -long truss bridge rising 730 feet (220 m) above the river . Even though the Auburn Dam was never built , the bridge was still required because the pool behind the cofferdam would inundate the old Foresthill crossing anyway , especially during high water . It also improved safety and reduced travel time by eliminating a steep , narrow and winding grade into the canyon on either side of the river , as comparisons to maps showing the old road alignment will attest . The contracts for various projects pertaining to the relocation of the roadway were given to O.K. Mittry and Sons , Hensel Phelps Construction Company , and Willamette @-@ Western Corporation , the latter for the construction of the actual bridge . The Foresthill Bridge , which still stands today , was completed in 1973 .

= = Earthquake and redesigning = =

A magnitude 5 @. @ 7 earthquake shook the Sierra Nevada near Oroville Dam in 1975 , about 50

miles (80 km) north of the Auburn Dam construction site . This quake concerned geologists and engineers working on the project so much that the Auburn Dam construction was brought to a complete standstill while the site was resurveyed and investigations conducted into the origins of the earthquake . It was discovered that the quake might have been caused by reservoir @-@ induced seismicity , i.e. the weight of the water from Lake Oroville , whose dam had been completed in 1968 , was pressing down on the fault zone enough to cause geologic stress , upon which the fault might slip and cause an earthquake . As the concrete thin @-@ arch design of the Auburn Dam would be vulnerable to such a quake , the project had to be drastically redesigned .

Over the next few years , while all construction was halted , Reclamation conducted evaluations of the seismic potential of the dam site , even though these delays caused the cost of the project to rise with every passing year . Studies concluded that a major fault system underlay the vicinity of the Auburn Dam site , with many folds of metamorphic rock formed by the contact of the foothills rocks and the granite batholith of the Sierra Nevada . Reclamation predicted that the Auburn Reservoir could induce an earthquake of up to a 6 @. @ 5 , while the U.S. Geologic Survey came out with a higher magnitude of 7 @. @ 0 . Nevertheless , Reclamation redesigned the Auburn Dam based on their 6 @. @ 5 figure , even though a 7 @. @ 0 would be three times stronger . The design for the Auburn Dam was changed to a concrete thick @-@ arch gravity dam , to provide better protection against a possible earthquake induced by its own reservoir .

Through the rest of the 1970s , possible designs were looked at but never implemented , while preliminary work on the construction site was resumed . On April 29 , 1979 , the foundations for the Auburn Dam were completed . However , debates continued over whether to build an arched or straight @-@ axis dam , the latter of which was proposed because it might be less of an engineering challenge and withstand earthquakes better .

= = = Cofferdam failure = = =

In early 1986 a huge flood began pouring down from the Sierra Nevada mountains , as ten inches (254 mm) of rain fell on the Sacramento region in 11 days . Later to be considered one of the largest regional floods in recorded history , Placer County was quickly designated a Federal Disaster Area . Rampaging streams and rivers incurred some \$ 7 @. @ 5 million in damages within the county . Flooding was so catastrophic , that the rating for Sacramento 's levees , supposedly designed to prevent a 125 @-@ year flood , was dropped to a 78 @-@ year flood . The floods tore out long stretches of levees along the American , Sacramento and Feather Rivers through the Sacramento Valley , and the city of Sacramento was spared by a close margin . Folsom Lake again filled to capacity , and began spilling 134 @, @ 000 cubic feet per second (3 @, @ 800 m³ / s) by late February .

The flood rapidly filled the pool behind the Auburn cofferdam to capacity , as the diversion tunnel could not handle the extra water pouring into the reservoir . At about 9 : 00 A.M. on February 18 , the rising water overtopped the cofferdam near the right abutment , creating a waterfall that quickly eroded into the structure . Although the cofferdam was designed with a soft earthen plug to fail in a controlled manner if any such event were to occur , the outflow reached 100 @, @ 000 cubic feet per second (2 @, @ 800 m³ / s) by noon ; several hours later the maximum discharge was reached at 250 @, @ 000 cubic feet per second (7 @, @ 100 m³ / s) , completely inundating the construction site and destroying almost half of the cofferdam . When the 265 @-@ foot (81 m) high cofferdam collapsed , its backed @-@ up water surged downstream into already @-@ spilling Folsom Reservoir less than a mile downstream , deposited the dam debris and raised the lake level suddenly . Folsom Dam outflow exceeded the design capacity of levees downstream from re @-@ regulating Nimbus Dam downstream from Folsom , but the levees were not overtopped and severe flooding was avoided through Sacramento . The flood events spurred renewed interest in the Auburn Dam , since a permanent dam would have helped Folsom Dam store water without the flood from behind the cofferdam , but it became clear that the system of levees , dams and diversions on the American River needed to be re @-@ engineered .

= = Stopping the project = =

= = = Economic cost = = =

In the years following the 1980 @-@ era floods , some public opinion turned against the Auburn Dam because of its relatively small reservoir capacity related to its size , and the massive estimated cost to finish the project , which was then already rising into the billions of dollars . The best dam sites require a relatively small dam that can store massive amounts of water , and most of those sites in the U.S. have already been taken . A comparison with Hoover Dam , for example , reveals that the Auburn would store very little water compared to its structural size . Lake Mead , the reservoir behind Hoover , stores about 28 @, @ 500 @, @ 000 acre feet (35 @, @ 200 @, @ 000 dam³) . The proposed Auburn Reservoir , with a mere 8 % of that capacity , would require the construction of a dam not only as tall as Hoover but over three times as wide .

As early as 1980 , the cost of building the Auburn Dam was estimated at \$ 1 billion . As of 2007 , the cost to build the dam would be about \$ 10 billion . Other flood @-@ control works to raise the height and improve the spillway capacity of Folsom Dam , and to increase the capacity of levees in the Sacramento area , would cost significantly less while providing protection against the same floods . Also , the United States National Research Council believes that existing flood records , which have been in place less than 200 years , are insufficient to justify the construction of a dam as large as Auburn . Finally , water from Auburn Dam , if connected to the long @-@ unfinished Folsom South Canal as originally planned by Reclamation , would be costly and in unreliable supply as the annual inflows to the reservoir would be a relatively modest 1 @, @ 600 @, @ 000 acre feet (2 @, @ 000 @, @ 000 dam³) or 2 @, @ 209 cubic feet per second (62 @. @ 6 m³ / s) , even though the river poses a high flood threat .

= = = Failure risk = = =

Due to the seismically active nature of the area , the Auburn Dam would also be at risk for failure from an earthquake , even one that the weight of its reservoir might induce on one of the fault lines that crosses the area , known as the Bear Mountain fault zone . Surface displacement of the ground might range from a few inches / centimeters to 3 feet (0 @. @ 91 m) in each direction . Although a new concrete @-@ gravity design by Reclamation was tested to survive a magnitude 6 @. @ 5 earthquake , it performed poorly under the 7 @. @ 0 that the USGS had originally estimated .

A Bureau of Reclamation study released in 1980 proved that a failure of Auburn Dam would result in a giant wave reaching Folsom Lake within five minutes , and most likely would cause a cascading failure of Folsom and Nimbus Dams downstream as well within an hour , unleashing millions of acre @-@ feet of water which would cause far greater damage downstream than any possible natural flood . Folsom would collapse or at least get severely overtopped ; Nimbus Dam would be overtopped by 70 feet (21 m) of water ; and the California State Capitol would be under 40 feet (12 m) of water , as would be much of the rest of the Sacramento metropolitan area . In 1975 , a study predicted that a failure of Folsom Dam alone would result in over 250 @, @ 000 fatalities . With Auburn Dam 's capacity added in , the resulting flood would be over three times larger , and cause even greater damage , inundating land for miles on either side of the American and Sacramento rivers .

= = = Fate = = =

Filling of the Auburn Reservoir would result in a two @-@ pronged , 40 @-@ mile (64 km) lake which would inundate numerous canyons and rapids of the North Fork and Middle Fork of the American River . In 1981 , the American River was acknowledged as the most popular recreational river in California . Over one million people visit the canyons of the North and Middle Forks of the American River each year to engage in various recreational activities not least of which include

kayaking , rafting , hiking , hunting , biking , horseback riding , gold mining , off @-@ roading , and climbing . 900 @, @ 000 of these visitors go to the Auburn State Recreation Area , which surrounds the former dam site . The reservoir would inundate this popular recreational haven , and cause the silting and destruction of riverbeds and rapids in the canyons . Trails , including those for the Tevis Cup and Western States Endurance Run , would be among the ones submerged . The Auburn Reservoir would also result in the destruction of thousands of acres of riverine habitat , and the inundation of historic and archaeological sites .

In the end , the Auburn Dam project , once referred to as " the dam that wouldn 't die " and " with more lives than an alley cat " , was defeated by the intervention of environmentalists , conservationists , and cost @-@ conscious economists . Although four bills to revive the dam project were introduced in Congress over the next twenty years , all were turned down . Representative Norman D. Shumway introduced the Auburn Dam Revival Act of 1987 , which was rejected because of the phenomenally high costs . A flood control bill in 1988 involving the Auburn Dam was also defeated . In 1992 and 1996 , plans for restarting the Auburn project appeared in various water projects bills . However , even though the project was now leaning towards purely flood control instead of the original expensive multipurpose that environmental groups had opposed , both were denied . As the years dragged on , the cost of the project grew , and it officially ended with the revoking of USBR water rights to the site by the state on November 11 , 2008 .

= = Proposals for resurrecting the Auburn Dam = =

" Auburn Dam is the public works equivalent of a Hollywood zombie , rivaling any Tinseltown creation in its ability to withstand repeated attempts to kill it . First proposed nearly a half @-@ century ago for a site in the American River canyon near the Gold Rush town of Auburn , the dam has withstood attacks by U.S. presidents , member of Congress , state and federal agencies , environmentalists , tax watchdogs , scientists , engineers and even nature itself ? the political equivalent of being shot , stabbed , drowned , poisoned , electrocuted and set on fire . " --Renewed Flood Sensitivity Reactivates Auburn Dam ? California Planning and Development Report , August 8 , 2006

Although the Auburn Dam is now mostly considered history , there are still proponents and groups devoted to restarting the long @-@ inactive project . Advocates argue that the construction of Auburn would be the only solution for providing much @-@ needed flood protection to the Sacramento area ; that millions of dollars have already been spent making preparations ; that it would provide an abundant supply of reliable water and hydroelectricity ; and also that the recreational areas lost under the reservoir could be rebuilt around it . A major supporter of the revival of the dam is the Sacramento County Taxpayer 's League ; a recent survey revealed that up to two @-@ thirds of Sacramento citizens support construction of the Auburn . They also argue that the dam would only cost \$ 2 @. @ 6 billion instead of \$ 6 ? 10 billion , and that it is the cheapest alternative to provide flood control for the American River .

Area Congressman John Doolittle was one of the largest proponents of the Auburn Dam , and he appropriated several million dollars for funds to conduct feasibility studies for the dam . About \$ 3 million went into the main feasibility report , and the remaining \$ 1 million was used for a study concerning the relocation of California State Route 49 , which runs through the site . After the Hurricane Katrina disaster in 2005 , Doolittle drew public attention to the flood vulnerability of the Sacramento region . He also used the flood @-@ protection " incompetence " of the Folsom Dam to his advantage , saying that " without an Auburn Dam we could soon be in the unenviable position of suffering from both severe drought and severe flooding in the very same year . " He led all 18 Republican members of the United States House of Representatives from California in a protest in 2008 , trying to convince Governor Arnold Schwarzenegger to revoke the water @-@ rights decision that California had made against Reclamation . Doolittle is sometimes known as the Auburn Dam 's " chief sponsor " .

In response to public outcry , most pro @-@ Auburn Dam groups now recommend the construction of a " dry dam " , or one that purely supports the purpose of flood control . Such a dam would stand

empty most of the year , but during a flood the excess flow would pool temporarily behind the dam instead of flowing straight through , and therefore the dam could still provide flood control while leaving the American River canyons dry for most of the year (hence " dry ") . Water would be impounded for only a few days or weeks each year instead of all year long , minimizing damage on the local environment . The dam would be built to protect against a 500 @-@ year flood . Also , with the construction of a " dry " Auburn Dam , Folsom Lake could be kept at a higher level throughout the year because of reduced flood @-@ control pressure , therefore facilitating recreational access to the reservoir . Finally , regulations in flow could help groundwater recharge efforts ; the lower Sacramento Valley aquifer is acknowledged as severely depleted .

= = Legacy = =

Since its inception , hundreds of millions of dollars have been poured into the Auburn Dam project , but no further work has been done since the 1980s . However , the Bureau of Reclamation continues to list the Auburn as a considered alternative for the future of its Auburn @-@ Folsom South Unit project . As of now , massive evidence of the dam 's construction still remain in the North Fork American River canyon , specifically the excavations for the abutments and spillway , with the consequences of increased erosion .

In recent decades , California has been struck with a series of severe droughts . In order to facilitate continued deliveries of water to the thirsty southern half of the state , the Central Valley and State Water Projects have been forced to cut water supplies for agriculture in much of the San Joaquin Valley . Annual deficits of water in the state are projected to rise from 1 @,@ 600 @,@ 000 acre feet (2 @,@ 000 @,@ 000 dam3) in 1998 to an estimated 2 @,@ 900 @,@ 000 acre feet (3 @,@ 600 @,@ 000 dam3) by 2025 . The state has proposed three or four solutions to the shortfall . One , the Peripheral Canal , would facilitate water flow from the water @-@ rich north to the dry south , but has never been built due to environmental concerns . The raising of Shasta Dam on the Sacramento or New Melones Dam on the Stanislaus , or the building of Sites Reservoir , has also been proposed . Lastly , the Auburn Dam has also been revived in light of this . According to supporters , it would cause the least environmental destruction of the multitude of choices , and would give the most reliable water yield , regardless of its skyrocketing costs .

In part as an alternative to Auburn Dam project , flood control for the lower American River is being improved through the USD \$ 1 billion Joint Federal Project (a collaboration of the US Bureau of Reclamation and the US Army Corps of Engineers) at Folsom Dam which adds a new lower spillway and strengthens the eight dikes that serve as part of the dam . Additional work proposed includes a possible raise of Folsom Dam several feet to improve its flood control and storage capacity . Key levees downstream have also been improved for flood control in the Sacramento area by the US Army Corps of Engineers and the Sacramento Area Flood Control Agency . Sugar Pine Reservoir , an auxiliary component of the Auburn @-@ Folsom South Project upstream in the watershed , was transferred in title by the Bureau of Reclamation to Foresthill Public Utility District in 2003 . As a result of a court decision in 1990 (Hodge Decision) , the uses of Reclamation 's Folsom South Canal changed further when the Freeport Project came online in 2011 to redirect water supplies for East Bay Municipal Utility District and Sacramento County Water Agency from the Sacramento River instead of from the canal via the lower American River , thereby reducing the need for additional supplies from Auburn Dam to the American River . Anticipated diversions from the Folsom South Canal had previously been reduced when the Sacramento Municipal Utility District decommissioned its Rancho Seco nuclear facility in 1989 and no longer required large quantities of cooling water from the canal .

A pumping station to supply water to the Placer County Water Agency was built in 2006 on the Middle Fork American River , supplying 100 cubic feet per second (2 @.@ 8 m³ / s) to a northwest @-@ running pipeline , eliminating the need for Auburn Dam for this supply . The capacity of the station is eventually expected to be upgraded to 225 cubic feet per second (6 @.@ 4 m³ / s) . By 2006 , the Bureau of Reclamation itself began to restore the dam site , which then had been untouched for more than a decade . The river diversion tunnel was sealed but not filled in , and the

remnants of the construction site in the riverbed as well as the remains of the cofferdam excavated out of the canyon . After the riverbed was leveled and graded , an artificial riverbed with manmade Class III rapids was constructed to channel the river through the site . The restoration project also included the construction of other recreational amenities in the Auburn site . This act was seen as the final step of decommissioning the Auburn project and shelving it forever .