= New Don Pedro Dam =

New Don Pedro Dam , often known simply as Don Pedro Dam , is an earthen embankment dam across the Tuolumne River , about 2 miles ( 3 @.@ 2 km ) northeast of La Grange , in Tuolumne County , California . The dam was completed in 1971 , after four years of construction , to replace the 1924 concrete @-@ arch Don Pedro Dam .

The dam serves mainly for irrigation water storage , flood control and hydroelectricity production , and impounds Don Pedro Reservoir in the foothills of the Sierra Nevada .

The New Don Pedro Dam is owned and operated by the Modesto Irrigation District ( MID ) and Turlock Irrigation District ( TID ) . At 585 feet ( 178 m ) tall , the dam is the tenth highest in the U.S. and its reservoir is the sixth largest artificial lake in California .

The original dam was named for the old mining town of Don Pedros Bar on the Tuolumne River , which in turn takes its name from prospector Pierre " Don Pedro " Sainsevain .

= = Background = =

Shortly after their formation in 1887 , the MID and TID acquired water rights to the Tuolumne River to secure a water supply for their combined 1 @,@ 000 @-@ square @-@ mile ( 2 @,@ 600 km2 ) service area in the San Joaquin Valley . After selling revenue bonds totaling $ 4 @.@ 1 million , the two irrigation districts began construction of the Don Pedro Dam ( now known as Old Don Pedro Dam ) in 1921 , about one and a half miles ( 2 @.@ 4 km ) upriver of the present location of New Don Pedro Dam . Upon its completion in 1923 , this 284 @-@ foot ( 87 m ) concrete gravity arch dam was the highest dam in the world , forming a 289 @,@ 000 @-@ acre @-@ foot ( 0 @.@ 356 km3 ) reservoir with a surface area of 3 @,@ 086 acres ( 1 @,@ 249 ha ) . The dam 's 15 megawatt ( MW ) hydroelectric plant , later expanded to 37 @.@ 5 MW , delivered its first power in October 1923 .

Expanding Don Pedro or constructing a new dam altogether was first seriously considered in the 1940s because the existing dam could only store a year 's supply of water for valley farmers , with no guarantee that a multiyear drought could be weathered . An enlarged Don Pedro would provide a " bank " of water storage for prolonged droughts , capture more spring runoff , and provide increased flood control . Another proponent of a high dam was the city of San Francisco , which also sought a share of the Tuolumne 's water and decided to cooperate with the irrigation districts to construct the new dam . The U.S. Bureau of Reclamation made tentative studies for a high dam on the Tuolumne River as part of its Central Valley Project , though it later dropped the plans in favor of other sites .

= = Construction = =

In 1961 , an overwhelming majority of voters in the TID and MID service areas and San Francisco approved bond issues to finance the construction of a new dam . The irrigation districts hoped to complete the dam by 1966 , but concerns that the dam would further impact decreasing populations of king salmon in the Tuolumne put a temporary stop to the project . In fact , it was not until that year that the Federal Power Commission ( now Federal Energy Regulatory Commission ) licensed the irrigation districts to go ahead on New Don Pedro .

The $ 49 @.@ 7 million primary construction contract for the dam was awarded to Guy F. Atkinson Company on August 22 , 1967 . When he first saw the dam site , chief engineer John Goodier was reported to have said " [ it 'd be a ] tough nut to crack " . Clearing the dam site began immediately afterwards , in addition to the construction of access roads and a camp for construction workers . Construction of the dam 's service spillway began a week later on August 29 . On September 22 , 1967 , work began on the diversion tunnel that would allow the river to bypass the construction site . The 3 @,@ 415 @-@ foot ( 1 @,@ 041 m ) tunnel was fully excavated by March 13 of the following year and lined with reinforced concrete by August . On September 7 , a 40 @-@ foot ( 12 m ) cofferdam was constructed and the diversion tunnel began to carry the flow of the Tuolumne . As

the dam site dried out , the foundations were excavated down to bedrock ; cracks in the rock were injected with so @-@ called " dental concrete " to stabilize the foundation .

Construction of the embankment began on September 16 , 1968 using the hydraulic fill method . The dam 's massive concrete emergency spillway was completed on January 19 , 1969 . However , severe flooding on January 26 destroyed the cofferdam and all of the construction site 's bridges , putting work a month behind schedule . Cleanup proceeded at a rapid pace and placing of impervious material for the dam 's core commenced on February 27 . For the next fifteen months , a fleet of massive 125 @-@ ton ( 113 t ) dump trucks delivered an almost constant stream of dirt and rock to the site , and the dam wall rose at an average rate of one and a half feet ( 0 @.@ 5 m ) per day . The workforce peaked at 500 men in mid @-@ 1969 and on December 10 , the service spillway was completed . On May 28 , 1970 , the embankment was finally topped out with the last of over 250 @,@ 000 truckloads of material .

After the clearing of over 7 @,@ 000 acres ( 2 @,@ 800 ha ) of the future reservoir site and the relocation of several roads that ran through it , the diversion tunnel was closed and water began to rise behind New Don Pedro . The rising lake submerged Old Don Pedro Dam on April 12 , 1970 and inundated the Gold Rush town of Jacksonville by June . The powerhouse and penstocks were completed by August 1970 , after lengthy delays and setbacks due to the sheer scale of the generators , pipes and gates used in their construction . Some of the individual components were so heavy that a truck delivering one of the penstock sections sank up to its trailer bed in the road , and another was crushed when the driver braked , inadvertently snapping the chains that held the load in place .

The total cost of the New Don Pedro Dam project , including site preparations , reservoir clearing and road relocations , was $ 115 @,@ 679 @,@ 000 . The dam was formally dedicated on May 22 , 1971 to a crowd of over 3 @,@ 000 people . Among the dedication ceremonies were a speech by San Francisco mayor Joseph Alioto and a beef barbecue hosted by TID .

= = Design and usage = =

Rising 585 feet ( 178 m ) above its foundations and 560 feet ( 170 m ) above the Tuolumne River , New Don Pedro is a massive earth and rock fill structure containing 16 @,@ 750 @,@ 000 cubic yards ( 12 @,@ 810 @,@ 000 m3 ) of material . The 1 @,@ 900 @-@ foot ( 580 m ) long dam is 40 feet ( 12 m ) wide at the crest and over 2 @,@ 800 feet ( 850 m ) wide at the base . High water releases are controlled by four sets of gates . A set of internal gates in the diversion tunnel can release up to 7 @,@ 370 cubic feet per second ( 209 m3 / s ) , while a hollow jet valve at the base of the dam can discharge 3 @,@ 100 cubic feet per second ( 88 m3 / s ) . The service spillway , controlled by three 45 @-@ by @-@ 30 @-@ foot ( 13 @.@ 7 m × 9 @.@ 1 m ) radial gates , has a capacity of 172 @,@ 000 cubic feet per second ( 4 @,@ 900 m3 / s ) , and finally the emergency spillway , a 995 @-@ foot ( 303 m ) long concrete overflow structure , can discharge more than 300 @,@ 000 cubic feet per second ( 8 @,@ 500 m3 / s ) .

The hydroelectric plant at the base of the dam has four generators capable of producing 203 MW combined . The TID 's share is 139 MW or 68 @.@ 47 % , while MID receives 64 MW or 31 @.@ 53 % . Three generators , each with a capacity of 55 MW , were included in the original design of the dam while an additional 38 MW generator was incorporated in 1989 . The plant generates an average of 618 @.@ 4 million kilowatt hours ( KWh ) of electricity each year , equal to an average output of 70 @.@ 6 MW . The cities of Modesto and Turlock receive a large share of their power supplies from New Don Pedro Dam .

Don Pedro Reservoir has a capacity of 2 @,@ 030 @,@ 000 acre feet ( 2 @.@ 50 km3 ) , of which 340 @,@ 000 acre feet ( 0 @.@ 42 km3 ) is reserved for flood control and 1 @,@ 381 @,@ 000 acre feet ( 1 @.@ 703 km3 ) is available for irrigation , municipal water supply , and hydroelectric generation . The flood control reservation is one of the smallest among major California reservoirs because it allows for more water to be stored for power generation , but this has often resulted in inadequate flood protection such as in 1997 when the dam released more than 50 @,@ 000 cubic feet per second ( 1 @,@ 400 m3 / s ) ? almost six times the capacity of downstream levees . The

bottom 309 @,@ 000 acre feet ( 0 @.@ 381 km3 ) is considered dead storage , or the lowest point at which water can be released to generate power . At an elevation of 804 feet ( 245 m ) ( service spillway crest ) , the reservoir is 25 miles ( 40 km ) long , and has an area of 12 @,@ 960 acres ( 5 @,@ 240 ha ) with 160 miles ( 260 km ) of shoreline . The maximum elevation of the reservoir at the crest of the emergency spillway is 830 feet ( 250 m ) above sea level .

During construction of the dam , it was anticipated that the large size and scenic location of the reservoir , coupled with its proximity to urban centers , would make it a large tourist draw . A $ 40 @,@ 000 plan was put forth to develop the reservoir for recreational activities . This entailed the construction of campsites , picnic areas , boat ramps , a landing strip , and hiking trails , including on 14 of the 33 islands in the lake . Don Pedro has become a popular summer destination in Central California , attracting 360 @,@ 000 ? 400 @,@ 000 visitors each year .

= = Future development = =

In 1923 , the same year that Old Don Pedro was completed , the City of San Francisco finished construction of O 'Shaughnessy Dam , which forms a reservoir in the upper Tuolumne River 's Hetch Hetchy Valley and is the focus of one of the most longstanding environmental controversies in United States history . Proponents of the dam 's removal , including former Sierra Club president David Brower , suggest raising New Don Pedro Dam to replace the storage that would be lost with the draining of Hetch Hetchy . Increasing the height of New Don Pedro by just 20 feet ( 6 @.@ 1 m ) would add about 360 @,@ 000 acre feet ( 0 @.@ 44 km3 ) to the reservoir 's storage capacity , replacing most of the storage in Hetch Hetchy , though new tunnels would have to be built to deliver water from Don Pedro Reservoir to the Hetch Hetchy Aqueduct and there would be a net loss of hydroelectric generation from O 'Shaughnessy . Of note is that San Francisco is already entitled to 453 @,@ 000 acre feet ( 0 @.@ 559 km3 ) of the water stored in Don Pedro , although this allocation is overruled by the senior water rights of the irrigation districts during dry years .

TID is currently investigating the feasibility of constructing a large pumped @-@ storage hydroelectric plant on Lake Don Pedro in order to better meet peaking power demands without releasing extra water at New Don Pedro Dam . The proposed Red Mountain Bar Project would involve building a 465 @-@ foot ( 142 m ) high dam across a canyon adjacent to Lake Don Pedro , creating a reservoir with a capacity of 25 @,@ 000 to 42 @,@ 000 acre feet ( 0 @.@ 031 to 0 @.@ 052 km3 ) . Water would be pumped into this new reservoir using power generated at New Don Pedro Dam during periods of low electricity demand , while during high demand water would be released through a penstock to an 880 MW generating facility . As of September 2011 , poor economic conditions had put the project " on hold indefinitely " .