

Review of the Pacheco Dam Feasibility Documentation: New Pacheco Dam Is Economically and Financially Infeasible

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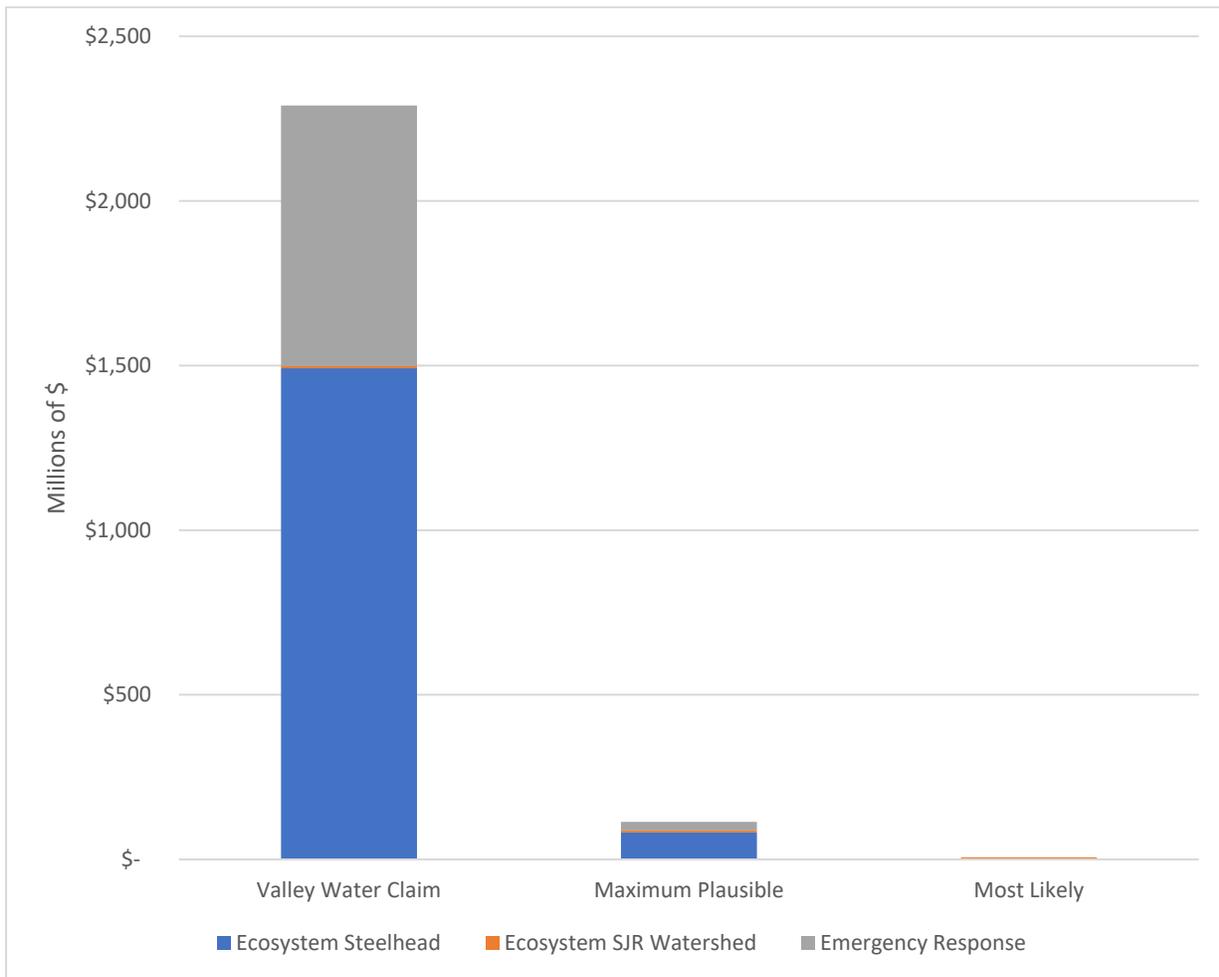
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Executive Summary

Santa Clara Valley Water District (Valley Water) recently released its Supplemental Feasibility Documentation Water Storage Investment Program: Pacheco Reservoir Expansion, Project dated November 2021 (Feasibility Documentation/Valley Water 2021). In the Feasibility Documentation, Valley Water presents a benefit-cost analysis to support its claim of feasibility, which includes an assessment of public benefits in support of its application for a grant from the California Water Commission’s (Commission) Water Storage Investment Program (WSIP).

The vast majority of monetized benefits are unsupported and severely overstated in the Feasibility Documentation. It is apparent that an accurate benefit-cost analysis is not even close to supporting the \$2.12 billion cost to Valley Water ratepayers and the State of California, and the public benefits are far too low to justify the nearly \$500 million award Valley Water seeks from the WSIP. As shown below in Figure 1, Valley Water’s claimed public benefits are more than twenty times the maximum plausible value of public benefits.

Figure 1. Net Present Value of Claimed Public Benefits from Pacheco Dam as Compared to Estimated Values Following WSIP Guidance



Note: Ecosystem SJ Watershed included for illustration only. These claimed values were not reviewed in this report.

Specifically, the Feasibility Documentation claims that the majority of benefits from Pacheco Dam are ecosystem benefits, namely additional water in Pacheco Creek for steelhead habitat, and emergency water supply benefits. The Feasibility Documentation grossly overstates these public benefits by using invalid valuation methods, misrepresenting no-project conditions, and not using the best available data. The benefit estimates are wildly out-of-scale with the reasonable maximum values. While most of this review is focused on public benefits, it is also important to note that Pacheco Dam also has low water supply benefits. The project is far less cost effective than other water supply and storage projects under consideration by Valley Water. Pacheco Dam only generates about 15 cents in benefits for every \$1 in costs, badly failing a benefit-cost test for a project whose cost to the public is now estimated to greatly exceed \$2 billion.

1. Required Feasibility Findings

The California Water Commission is required to make certain findings, including that a project is feasible, before non-early (non-study/non-permitting) funding can be released for projects that applied for Commission funding and were ranked in the one-time allocation decision. The Commission must make the feasibility and other findings by January 1, 2022.¹ The 2016 Water Storage Investment Program Technical Reference (WSIP TR) explains that documentation of feasibility includes:

Economic feasibility – the applicant must demonstrate that the expected benefits of the project equal or exceed the expected costs, considering all benefits and costs related to or caused by the project.

Financial feasibility – the applicant must demonstrate that sufficient funds will be available from public (including the funds requested in the application) and nonpublic sources to cover the construction and operation and maintenance of the project over the planning horizon. It must also show that beneficiaries of non-public benefits are allocated costs that are consistent with and do not exceed the benefits they receive.

(WSIP TR, pg. 3-6.)

This report explains how the Pacheco Dam project applicant has failed to properly substantiate the economic and financial feasibility claims in the Feasibility Documentation. Substantial modification and reanalysis would be required for this project to meet the minimum requirements for the Commission to make the necessary findings for WSIP funding.

¹ See Water Code, § 79757(a) and Cal. Code Regs., tit. 23, § 1603.

2. Valley Water Did Not Follow Established Standards for Valuing Public Benefits

The function of a benefit-cost analysis for a project, and the reason it is required in a feasibility analysis, is to ensure that the benefits to society are greater than the resources society would invest in the project costs. Unlike a simple financial accounting of the balance of revenues with expenditures, a public project like a dam produces social costs and benefits that must also be considered. To monetize a public or social benefit is to determine its intrinsic value in monetary terms so that these can be included in a benefit-cost assessment. The WSIP TR lays out a framework and guidelines for assessing public benefits that is consistent with well-established principles. According to the WSIP TR, there are three approaches to monetize these public benefits:

1. **Avoided cost:** reduction in a without-project cost that would occur as a result of a proposed project.
2. **Alternative cost:** the cost of the least-cost means of providing at least the same amount of physical benefit.
3. **Willingness-to-pay:** the dollar amount Californians would be willing to pay for the physical benefit, if it can be justified and documented.

These approaches follow established practices in economics and the federal regulations for policy decisions (Freeman 2014). OMB Circular A-4 states that cost benefit analysis provides decision makers with clarity on the “alternative” that provides the “largest” benefit to society.

The avoided cost approach is the basis for the emergency water supply benefit. It does not apply to the ecosystem benefits of Pacheco Dam Project because the project is not avoiding an ecological harm. Therefore, one would look to alternative costs or willingness-to-pay to assess ecological benefits. For both ecological benefits and emergency water supply benefits, Valley Water’s analysis clearly violates best practices as described in the WSIP TR.

3. Ecosystem Benefits Are Not Justified

In its Feasibility Documentation, Valley Water estimates a net present value of \$1.5 billion for the ecological benefits produced by the Pacheco Dam project. This benefit is based on additional water releases to Pacheco Creek, which Valley Water claims would increase the suitability of the Creek for steelhead. In addition, Valley Water claims that the least cost alternative for providing this ecological benefit is a slightly smaller version of Pacheco Dam in which all incremental water supplies are dedicated to steelhead benefits.

3.1. Valley Water’s invalid approach makes valuation of ecosystem benefits a function of the proposed project’s construction costs.

Valley Water uses the cost of building a single-use smaller version of the Pacheco Dam in the same location as the only alternative project in the least-cost analysis. The WSIP TR specifically states “an alternative must be substantially different from the proposed project, not a minor variation of the proposed project” (WSIP TR pg. 5-14). Using this approach, the cost and benefits of the project are linked. In other words, when the cost of building the dam goes up, the ecosystem benefits of its project go up proportionally, regardless of the physical benefits that are being produced. This clearly violates common sense professional standards in benefit-

cost analysis and appears to be a cynical attempt to rationalize the project's ever escalating costs.

The inappropriate linkage between costs and benefits can be clearly seen by examining the change in cost and benefits that occurred between the original WSIP application in 2017 and the current Feasibility Documentation. The physical benefit to steelhead was estimated as an improvement in habitat using a steelhead cohort score (Valley Water 2021). Since the time of the original WSIP application, the proposed dam was moved 1.8 miles upstream due to earthquake risks in the original location. The estimated cost of the constructing the dam nearly doubled. In both the original and the current analysis, Valley Water used a slightly smaller version of the proposed dam as its least cost alternative. As a result, the costs of the least cost alternative project double, and Valley Water's valuation of ecosystem benefits double, even though the physical environmental benefits produced by the project do not increase. In fact, the benefits would seem to be lower in the new location as the predicted habitat water storage capacity decreased from 55,000af to 35,000af (Valley Water 2021, pg. 114). However, Valley Water's claimed value of the ecosystem benefits has doubled in the new location, even though the physical benefits actually declined.

Physical benefits go down and the value of benefits go up using the absurd and erroneous logic of the Pacheco Dam Feasibility Documentation. This is because its invalid approach makes the value of ecosystem benefits a function of construction costs not a function of the physical ecological benefits. Clearly, this is an invalid approach to assessing ecological benefits, and this application is a perfect illustration of why the WSIP TR states that this approach should be avoided (WSIP TR pg. 5-14).

The economics reviewers of Valley Water's initial application for WSIP funding also noted that the Least Cost Alternative was not considered. "The applicant uses the alternative cost of a single-purpose alternative to develop the benefit estimate but has not demonstrated that it is the least-cost alternative, nor has it demonstrated that its cost is less than other monetization methods as required by sections 6004(a)(4)(F) and (G) of the regulations." (California Water Commission 2018, pg. 3). This fatal error is multiplied in the current Feasibility Documentation as the cost of Valley Water's invalid LCA soar.

3.2. No evidence that steelhead will ever inhabit Pacheco Creek

The Feasibility Documentation provides no evidence that habitat improvements will create a steelhead population in Pacheco Creek. Instead, the study uses a proprietary model that suggests only a marginal steelhead habitat improvement, using a habitat suitability index that ranges from 0 to 100. The Feasibility Documentation finds that the project increases habitat suitability from extremely low (5.9) to very low (14.5 on a 100 point scale). This measurement of habitat suitability is not translated into any expected increase in the threatened species population itself, which currently does not exist year to year in Pacheco Creek. Thus, the Feasibility Documentation does not support any increase in the physical abundance of threatened steelhead, the resource for which a public benefit is claimed.

The use of this proprietary model and undefined index provides no transparency in the physical benefits expected with the Pacheco Dam project, and therefore, no support for the claim of any ecological benefits. The WSIP TR suggests the use of a willingness to pay value of \$100,000 per returning central valley adult steelhead as an option for monetizing potential steelhead benefits (California Water Commission 2016, pg. 5-32). Because the Feasibility Documentation

provides no estimate of physical improvements in the steelhead population, the willingness-to-pay benefit estimate would be zero.

3.3. Invalid application of “least-cost alternative method” to monetize ecosystem benefits.

The WSIP TR specifies that “applicants shall estimate the cost of the least-cost alternative means of providing the net physical benefit amount” (pg. 5-13). “Alternative costs represent options that could be implemented to provide the same physical benefit as the project” (pg. 5-13). For the Pacheco Dam project, the physical benefit being measured is the increase in population of threatened steelhead.

For a public benefit that is a non-use value² like increased abundance of endangered and threatened species, it is not necessary to restrict the alternatives to projects in a specific location. Furthermore, the WSIP TR is clear that alternative projects that are just a variation of the project being evaluated should not be used. Valley Water violates both of these key principles in its analysis by insisting that the least cost alternative is a slightly smaller Pacheco Dam in which all the incremental water supply is dedicated to environmental flows in Pacheco Creek.

3.4. Valley Water’s LCA adds water to Pacheco Creek for \$9,442 per acre foot, 10 times the cost of the most expensive alternative supplies

The Feasibility Documentation shows an annualized cost of \$40.6 million for its LCA (smaller Pacheco dam) to assess ecosystem benefits (Table 4-3). Table 5-5 shows the water that will provide the ecosystem benefit is an increase from 3,700 to 8,000 AF, or an additional 4,300 AF, of controlled releases to Pacheco Creek. The cost per AF for this habitat benefit can be calculated from the total ecosystem benefit estimate of \$40.6 million divided by the AF of water released resulting in a cost per AF of \$9,442.

Valley Water’s least cost alternative puts water in the Creek at a cost of \$9,442 per AF which is 10 times Valley Water’s estimated value for its M&I water in the Feasibility Documentation. Thus, Valley Water could take water from its own M&I supplies to release to Pacheco Creek and replace the M&I water supplies for one tenth the cost. And of course, Valley Water could acquire substitute water from agricultural sources for even less.

Given the extreme cost difference of water from Pacheco Dam compared to alternative sources of water supplies, it is invalid for Valley Water to dismiss the option of using the cost of alternative water supplies to measure the benefits of increased water releases to Pacheco Creek. Much of Valley Water’s justification for ruling out these actions are that they could potentially conflict with the Sustainable Groundwater Management Act (SGMA) in the future. However, effects of implementing SGMA effects can be, and are, accounted for by using an increasing value of agricultural water over time as suggested in the WSIP TR. Even under tighter groundwater restrictions in the future, agricultural water supplies can be obtained in compliance with SGMA for a small fraction of \$9,442 AF cost of Valley Water’s invalid LCA.

² Examples of a use value would be recreation, where the location would be fixed.

3.5. Alternative projects outside Pacheco Creek are erroneously dismissed

Valley Water uses only one alternative project estimate to assess the ecosystem benefits of the Pacheco Dam. The Feasibility Documentation provides a short-list of potential substitute projects, but rejects them all and does not consider projects that could be conducted away from Pacheco Creek. The WSIP TR recommends that “alternatives that could provide the same benefits in the same place are preferred, but alternatives that provide similar benefits close to the project can be considered” (pg. 5-14).³ It is not necessary to use releases to Pacheco Creek to measure the ecological benefits. Non-use values for threatened species are not typically location specific unless the location is unique (Freeman 2014). There are numerous steelhead restoration projects that could be implemented within the region and state that would provide the benefit of steelhead population protection. The cost of these projects should be the basis of any application of the least-cost alternative method.

3.6. Steelhead projects regionally and across the State demonstrate that the Pacheco Dam ecological benefits are grossly inflated

3.6.1. South Central California

The West Coast Region of the National Marine Fisheries Service (NMFS) has a recovery plan for South-Central California steelhead (SCCCS) which are a threatened species. The SCCC population is located in watersheds from the Pajaro River (boundary between Sant Cruz and Monterey Counties) south to Arroyo Grande Creek (San Luis Obispo County). NMFS estimates the recovery cost for the SCCC population will be \$560 million borne over the next 80 to 100 years (NOAA 2013, pg. xvii). The benefits of the myriad of projects proposed in this recovery plan, with the intent of removing the species from the endangered species list, far outweigh the benefits of the improvement in habitat on Pacheco Creek alone. Nevertheless, the benefit estimate Valley Water has placed on this habitat improvement is nearly three times the estimated cost for substantially improving steelhead habitat throughout the entire range of the species.

3.6.2. Western United States

Even more extraordinary is the comparison of the estimate of benefits of habitat improvements in Pacheco Creek to the money spent from the Pacific Coastal Salmon Recovery Fund to reverse declines in Pacific salmon and steelhead. The program was established by Congress in 2000 and as of October 2019 has awarded \$1.4 billion in funds for salmon and steelhead restoration in five western states; Alaska, Washington, Oregon, California, and Idaho.⁴ The funds have allowed states and tribes to undertake 13,700 projects, restoring 1.1 million acres of spawning and rearing habitat. Valley Water claims the benefits of Pacheco Dam to steelhead are \$1.5 billion, roughly equivalent to the total amount invested in salmon and steelhead recovery by the federal government over the last 20 years.

³ The WSIP TR also notes, “this approach is similar to the NMFS’ 2009 Biological Opinion on Chinook Salmon and Sturgeon, which suggests that alternatives be evaluated and agencies may select an option that is most practical. “NMFS cares only that the stressor be sufficiently reduced” and less about the option selected.”(WSIP TR, pg. 5-14, fn. 1).

⁴ <https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/pacific-coastal-salmon-recovery-fund>

3.6.3. Individual Projects

Individual projects demonstrate much lower costs for very high value steelhead benefits. For example, at the Nimbus Hatchery in Folsom a two-year project is underway to construct a 1,900 foot fishway that adds additional natural spawning habitat and allows more fish to reach the hatchery area before they die. In addition, the project is providing enhancements for public viewing of the spawning salmon and steelhead by constructing an underwater viewing area. The cost of this project is \$9.7 million.⁵ It is clear that this project provides a high level of both use and nonuse benefits for salmon and steelhead at a fraction of the cost of the Pacheco Dam project.

The Battle Creek Salmon and Steelhead Restoration Project is a twenty-year project located in Shasta and Tehama Counties. The project restored 42 miles of habitat on Battle Creek and an additional 6 miles on tributaries. In addition, the Project reduced migration barriers at hydroelectric facilities including multiple dam removals, a mile long bypass canal, and fish ladders.⁶ This is probably the largest salmon and steelhead project in California, and its ecological benefits are clearly larger than the proposed Pacheco Dam. For reference, this project costs \$162 million (\$2021), one tenth the cost of the “alternative project” used as the basis of the benefits estimate for the Pacheco Dam.

3.7. Reasonable Range of Benefits

Because Valley Water provides little evidence that increased dam releases will improve the steelhead population in Pacheco Creek, these ecosystem benefits are likely zero. Furthermore, the comparison of costs for other steelhead habitat improvement projects and increased water flow, to the benefits estimate in the Feasibility Documentation, show there are alternatives with significantly lower costs. The examples in Table 1 demonstrate the outrageous magnitude of the estimated ecosystem benefits compared to real world benefits estimates.

⁵ <https://www.usbr.gov/mp/cao/hatchery/>; <http://carmichaeltimes.com/articles/2020/0827-Freeway-for-Fish-Heads/index.php?ID=8810>

⁶ Battle Creek Salmon and Steelhead Restoration Project, September 2017. <https://www.battle-creek.net/restoration.html>

Table 1. Potential Alternatives Projects to Value Ecosystem Benefits to Pacheco Creek (Net Present Value in \$2021)

Physical Benefit	Total Cost
Valley Water Claim – Cost of Smaller Pacheco Dam that Dedicates All Water Supply to Steelhead Benefits⁷	\$1,491.5 million
Large projects with more benefits than Pacheco Dam	
Restore salmon and steelhead habitat in Battle Creek – 48 miles of riparian and stream restoration, multiple dam removals, canal	\$162 million
Steelhead Recovery Plan for Pajaro River and Salinas River Core 1 Population (Pacheco Creek is part of the Pajaro River complex) ⁸	\$117 million (NPV)
Potential alternative benefit estimates (\$2021)	
Purchase 4,300 AF/yr of Agricultural water at \$316-\$749/AF over time ⁹	\$81.5 million (NPV)
Purchase 4,300 AF/yr of M&I water at \$761-929/AF over time ¹⁰	\$105.8 million (NPV)

Because the Feasibility Documentation does not predict a population improvement, the maximum benefit estimate would likely be equivalent to the value of the additional agricultural water. The cost of purchasing agricultural water is used as the basis for a maximum plausible value for the ecosystem benefits for steelhead. The total net present value of 4,300 AF per year is \$81.5 million (Table 2).

Table 2. Alternative Estimate of Ecosystem Benefits for the Pacheco Dam Project

	Valley Water Claim	Maximum Plausible Value	Most Likely Value
Estimated Benefits (\$M)	\$1,491.5	\$81.5	\$0

⁷ From Table 4-17, Valley Water 2021.

⁸ From Table 20, Page E-9 NOAA 2013 expressed in 2021 dollars.

⁹ From Table 5-5 Delta Export \$/AF in below normal water year converted to 2021 dollars (California Water Commission 2016, pgs. 5-16&17). Net present value calculation assumes a linear increase in cost between 2030 and 2045.

¹⁰ From Table 4-9 Cost of M&I water during below normal year (Valley Water 2021, pg. 4-12). Net present value calculation assumes a linear increase in cost between 2030, 2040, 2050 and 2060.

4. Other Ecosystem Benefit Considerations

The Feasibility Documentation includes construction mitigation costs of \$59.7 million and claims that this will fully mitigate project impacts as required in the WSIP TR.¹¹ This figure does not appear to be justified and may be inadequate to fully mitigate the impacts of the new dam. The Feasibility Documentation Appendix (October 2021) does not discuss this issue. Any unmitigated environmental impacts that would occur during and after the construction period should be monetized and subtracted from Valley Water's claimed ecosystem benefit. This is yet another way in which Valley Water appears to have vastly overstated ecosystem benefits from the project.

5. Emergency Water Supply Benefits Are Extremely Overstated

The Feasibility Documentation claims emergency water supply benefits with a cumulative present value of \$792.2 million, or \$21.5 million annually. The emergency water supply benefits are based on the risk of a simultaneous flood of twenty or more islands in the Delta that disrupts water supplies from the State Water Project and Central Valley Project for an extended time. The Feasibility Documentation grossly overstates these benefits by misusing outdated and invalid risk estimates, and assuming an implausible no-project scenario. In addition, the report completely ignores more recent analysis of this risk from the Department of Water Resources (DWR) and Valley Water's own water management plan. Under more realistic scenarios, the emergency water supply benefits of Pacheco dam are at or near zero. The maximum plausible emergency water supply benefit from Pacheco dam is just over \$1 million annually, meaning that the Feasibility Documentation overestimates water supply benefits by at least a factor of 20.

The Feasibility Documentation's estimate of emergency water supply benefits is based on a misuse of the Delta Risk Management Study (DRMS) (DWR et al. 2009). Specifically, it errs in three significant ways: 1) overestimates Delta levee failure probabilities, 2) overestimates the duration of an interruption in Delta water supply, and 3) overestimates the economic loss from interruptions. A frequently occurring mistake in the analysis is that it assumes that no other actions have been taken or will be taken to reduce these risks, whether in the Delta itself, or through local actions that are specified in Valley Water's own Water Supply Master Plan (Valley Water 2019).

5.1. Risk of Delta failures is grossly inflated using an outdated and invalid study

The Feasibility Documentation assumes a grossly inflated probability of a catastrophic 20-30 delta island failure event taken directly from the outdated Delta Risk Management Study (DRMS) against clear warnings against such action in the study itself and ignoring more recent assessments. The first page of the report of the Independent Review Panel of the DRMS study states, "the IRP cautions users of this revised DRMS Phase 1 report that **future estimates of consequences must be viewed as projections that can provide relative indicators of directions of effects, not predictions to be interpreted literally**" (CALFED Science Program Independent Review Panel 2008, pg. 3)." The Feasibility Documentation ignores this warning

¹¹ Valley Water 2021, pg. 6-5.

and more recent studies of Delta levees, and directly uses the outdated and inaccurate failure probabilities – assuming a 4.2% annual probability of a catastrophic 20-30 delta island failure event.

5.2. Recent data and reports on risk are ignored

The Feasibility Documentation also ignores recent history, failing to use the 15 years of observation since the DRMS levee failure estimates were released in 2006 to evaluate its reasonableness. According to DRMS, the expected number of Delta island breaches between 2006 and 2021 is around 40, in reality there have been no breaches of this type. The Feasibility Documentation cites a DRMS estimate of a 42% probability of at least one delta island levee breach annually which equates to a 1 in 3,500 chance that the levees would perform as well as they actually have over the past 15 years. Clearly, the Feasibility Documentation fails to apply even the most basic reasonable test of direct observation to its assumptions.

DWR does not assume failure probabilities of this magnitude. In 2013, DWR's Bay Delta Conservation Plan (BDCP) Economic Benefits Analysis used a 2% failure probability based on the DRMS analysis, less than half the 4.2% probability assumed in the Pacheco Feasibility Documentation. This 2% probability in the 2013 report is actually cited in the Feasibility Documentation, yet no explanation is given for why they did not use this more recent assessment.

The Pacheco Dam Feasibility Documentation also ignores other reports of Delta levees that show Delta levees to be in far better condition than estimated in DRMS such as Chapter 5 of the 2012 Economic Sustainability Plan, and more recently, the Delta Stewardship Council's Delta Levee Investment Strategy (Delta Protection Commission 2012; <https://deltacouncil.ca.gov/dlis/>). With an average \$22 million per year investment since the 1980's, there has been about a 50 percent reduction in levee failures in the Delta, according to DWR (Department of Water Resources 2019).

5.3. The duration of water supply interruptions is overstated

The Feasibility Documentation greatly overstates the likely duration of water supply interruptions from a delta levee failure scenario. Specifically, it assumes a 12-month outage, which is more than double current estimates and is double the state's current 6-month planning guidelines for the same scenario. In fact, DWR has revised its estimate of likely water supply outage from such an event to weeks and months, not years. In 2015, the Director of DWR changed the description of seismic induced outages from years to weeks and months. "The shutdown could last for weeks or months depending upon how much fresh water was available to flush salt water out of the Delta"¹²

By 2018, DWR's official guidance was to plan for a 6-month outage. "In consideration of this fact, DWR has asked urban water agencies to assume a 6-month Delta outage when preparing water supply reliability analyses as part of their Urban Water Management Plans" (Sunding 2018, pg. 28). Valley Water's 2020 Water Shortage Contingency Plan states "multiple earthquake-generated levee breaches and levee slumping along the freshwater pathway can be repaired in less than six months. Significant improvements to the central and south Delta levee

¹² <https://mavensnotebook.com/2015/07/13/media-call-director-mark-cowin-on-the-revised-environmental-documents-for-california-water-fix/>

systems along the emergency freshwater pathway began in 2010 and are continuing.” Thus, the expected duration of a water supply interruption from a catastrophic levee breach scenario is less than 6 months according to Valley Water’s own planning documents.

5.4. The costs of water supply interruptions are grossly overstated

The Feasibility Documentation overstates the cost of water supply interruptions by overestimating the amount of water supply shortages and underestimating the ability of the agency to manage shortages. Valley Water’s 2020 Water Shortage Contingency Plan states the following about a six-month outage to Delta water supplies, “The impacts of such an outage are largely operational as retailers would be required to use groundwater instead of their usual treated water supplies and Valley Water would actively manage the groundwater recharge program to meet countywide needs. Even with increased pumping, groundwater storage is estimated to remain in the normal (Stage 1) range. Thus, the impacts of a six-month Delta outage are manageable assuming a normal starting position (Valley Water 2020, pg. 11).” In addition, the Feasibility Documentation overestimates future shortages from these outages by ignoring planned water supply and storage investments. For example, it assumes water recycling capacity remains below 27,000 AF, whereas Valley Water’s 2020 Water Supply Master Plan forecasts 48,000 AF of recycled water supply will be available by 2040.

5.5. The plausible range of emergency water supply benefits is between zero and \$1.2 million annually

Zero emergency water supply benefits are likely for several reasons. As stated above, Valley Water’s own planning documents describe the impacts of a 6-month delta supply outage as operational and manageable, and not requiring conservation efforts unless it occurred during a severe drought. In addition, DWR, with the support of Valley Water, proposes to build a Delta water conveyance tunnel largely for the purpose of eliminating this risk. If this project went forward, the emergency water supply benefits claimed by Pacheco dam would no longer exist.

In addition, Delta levees are likely to continue improving with additional public and local investment. The water supply disruption described in the Feasibility Documentation is only one part of the massive consequences of large-scale Delta levee breaches, should they occur. Such an event would likely create mass fatalities and devastating property damage.¹³ The people of California would enjoy a much broader range of benefits, including saving lives, communities, other infrastructure, and water supplies from an increased levee investment strategy. The Feasibility Documentation’s claim of emergency water supply benefits is based on a very tenuous assumption that significant actions will not continue to be taken to bolster Delta levees against this broad array of consequences, in the absence of the Pacheco Dam project. Thus, there are three reasons to believe that Pacheco dam would actually provide little to no emergency water supply benefits.

The maximum plausible emergency water supply benefit is about \$1.175 million per year (Table 3). This value can be derived by calculating Valley Water’s share of statewide benefits assessed in two studies by DWR. Valley Water receives about 3.6% of water exported from the

¹³ DRMS estimated 700 fatalities from a 20-30 island breach scenario, which would make it the deadliest disaster in California since the 1906 San Francisco earthquake. It also estimated local property and infrastructure damage comparable to the Camp Fire that destroyed the town of Paradise in 2018.

Delta.¹⁴ The first report is the 2013 BDCP Economic Benefits analysis. In this analysis, the expected annual benefit for safeguarding the state from an earthquake induced Delta levee failure was estimated at \$32.64 million (2021\$). Applying this benefit estimate to Valley Water’s share (3.6%) produces a \$1.175 million annual benefit.¹⁵ In a more recent 2018 economic analysis, DWR estimated the statewide cost of a 7.5 month outage to Delta water exports at \$499 million. If we assume a 1% annual probability of a catastrophic Delta levee failure and Valley Water’s share (3.6%), the annual benefit of emergency protection is \$0.18 million annually (Sunding 2018). It should be noted that this 7.5-month outage is longer than expected and thus the estimated annualized value of emergency protection benefit is likely overstated. While we believe the lower values in more recent estimates are more likely, we use this \$1.175 million as the maximum plausible value of annual expected emergency water supply benefits.

Table 3. Value of Emergency Water Supply (Net Present Value \$2021)

	Valley Water Claim	Maximum Plausible Value	Most Likely Value
Estimated Benefits (\$M)	\$792.2	\$26	\$0

6. The Feasibility Documentation’s Estimated Benefits from M&I Water Supply and M&I Water Quality are Underwhelming

Valley Water used its WEAP model to value an estimated 3,595 AF increase in average M&I water supplies that would result from the construction of Pacheco Dam. The increase in water supply varies across water year types from wet to critically dry, with the largest increase in water supplies occurring in critically dry years. Using the WEAP model, the weighted average value of M&I water supplies across all water year types is estimated to be \$903 AF in 2030 and rises to \$1,115 AF by 2060. While I did not specifically review Valley Water’s WEAP model, it is worth noting that the unit values for M&I water are somewhat higher than other similar estimates. Most notably the Los Vaqueros feasibility documentation estimates the value of M&I water delivered to the South Bay in a critically dry year at \$1,094 in 2030, compared to \$1,222 value used by Valley Water in the Pacheco Feasibility Documentation.

Because I have not reviewed the WEAP model in depth and the physical water supply benefits of Pacheco Dam are low, this analysis accepts Valley Water’s M&I values for Pacheco Dam even though its unit values for M&I water appear to be high. Similarly, I did not specifically review the claimed water quality benefits. Because I did not review the water quality benefits and this value is relatively low compared to the project costs, this analysis uses Valley Water’s estimate of water quality benefits. My use of these values in the present analysis should not be considered an endorsement.

¹⁴ Valley Water’s Water Supply Master Plan states they receive an average of 162,000 AF annually in Delta exported water through the State Water Project and Central Valley Project. The Delta Stewardship

¹⁵ Council reports average Delta water exports of 4.5 million acre feet over the past 15 years. Thus, Valley Water represents about 3.6% of the total water supply exported from the Delta.

The Pacheco Dam Project would produce a very modest increase in the M&I water supply and do so at much higher costs than other projects in Valley Water's master plan.¹⁶ The M&I water supply benefits and costs also look poor compared to other surface storage proposals under consideration by the WSIP. For example, the Los Vaqueros Reservoir Expansion project increases the M&I water supplies to the Bay Area by 32,400 AF/year at a projected construction cost of \$894.8M. Comparing Los Vaqueros numbers to the 3,595 AF/year M&I water supply yield for the Pacheco Dam at a construction cost of \$2.1 B shows the Pacheco Dam would provide one tenth the water supply for three times the cost.

7. Ability-To-Pay Analysis Ignores State Standards for Affordability, the Local Cost-of-Living Crisis, and Recent State Analysis Showing Santa Clara Water Bills Are Unaffordable for Disadvantaged Communities

Valley Water's assessment of ability-to-pay (Feasibility Documentation, section 5.5.2) relies on a single, outdated federal standard from over 40 years ago. The 1980 EPA affordability threshold of 2.5% of median household income has not been utilized by the State of California for many years, because it is obviously irrelevant to the current, economic reality of California households. Since 1980, it is well-known that income inequality and the general cost-of-living have soared across California, especially in Santa Clara County. Valley Water's use of this obsolete federal standard while ignoring recent State assessments is methodologically invalid and stunningly insensitive to the extreme cost pressures and economic hardships faced by many Santa Clara County households.

7.1. Valley Water ignores the State's 1.5% Affordability Threshold and the State Water Boards's Drinking Water Needs Assessment

As recently highlighted by the Public Policy Institute of California,¹⁷ the State of California has used a 1.5% of median household income as a water affordability threshold for many years, not the outdated 2.5% of median household income used by Valley Water. Furthermore, recent analysis by the State Water Board has used two additional affordability thresholds; extreme water bill and the prevalence of water shut-offs.¹⁸ As shown in Figure 2, most of the local water agencies served by Valley Water exceed at least one or more of these affordability thresholds and the region stands from the rest of the State for having acute affordability challenges.

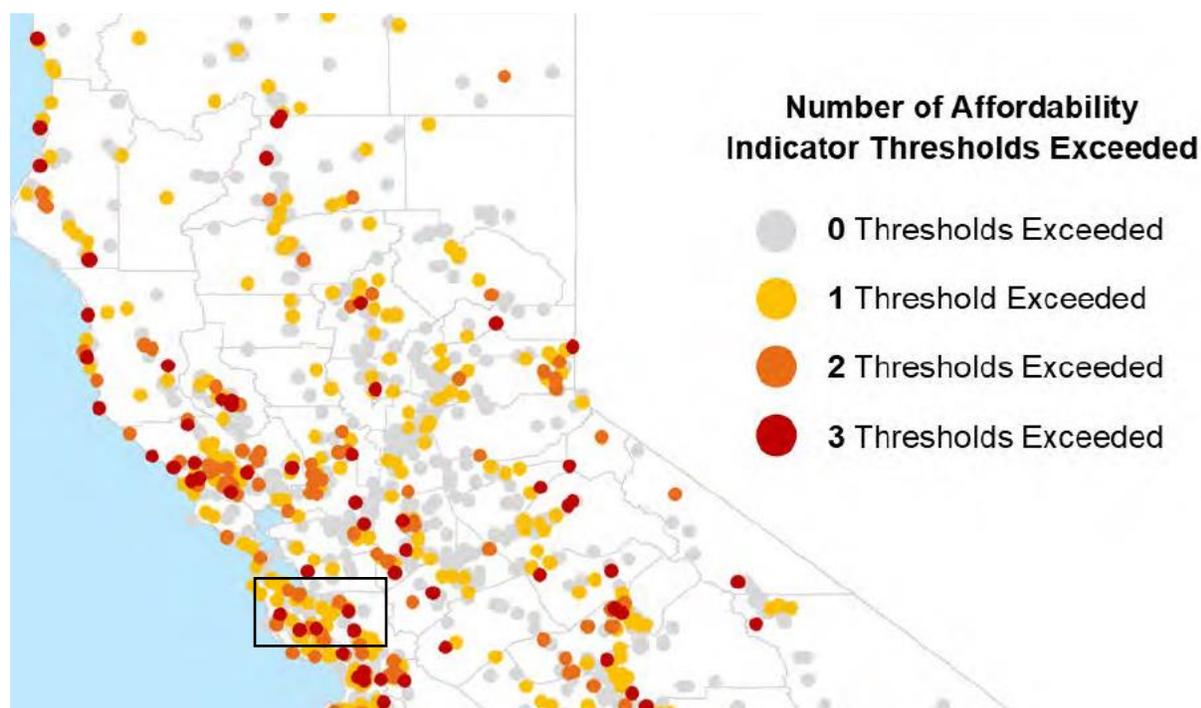
¹⁶ Santa Clara Valley Water District October 22, 2021 Special Meeting, Agenda item 4.

¹⁷ <https://www.ppic.org/publication/water-affordability/>

¹⁸

https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2021_needs_assessment.pdf

Figure 2. State Water Resource Control Board Assessment Shows Almost All Santa Clara County Water Districts Exceed Affordability Thresholds. (From Figure 49, page 122 of State Water Board’s 2021 Drinking Water Needs Assessment.)



7.2. Valley Water ignores the cost-of-living crisis in Santa Clara County

It is stunning that Valley Water’s Feasibility Documentation ignores the well-known cost-of-living challenges facing Santa Clara County households when considering their ability-to-pay higher water bills. Experts in water policy agree that this broader affordability context is important. For example, the Public Policy Institute of California states, “More precise local measures of affordability—for instance, [including housing costs in calculations](#)—could better inform affordability programs.”

The following are just a few facts describing the burden and impact of the region’s cost-of-living on Santa Clara County households.

- Total monthly bills for Santa Clara County residents are the highest in the United States (Doxinsights 2021).
- Overall cost of living in San Jose is estimated to be 215% above the U.S. average (bestplaces.net 2021).ⁱ
- A record 56% of Silicon Valley residents say they plan to leave in the next few years with 84% citing the cost of living as the main reason they plan to move (Joint Venture Silicon Valley 2021).

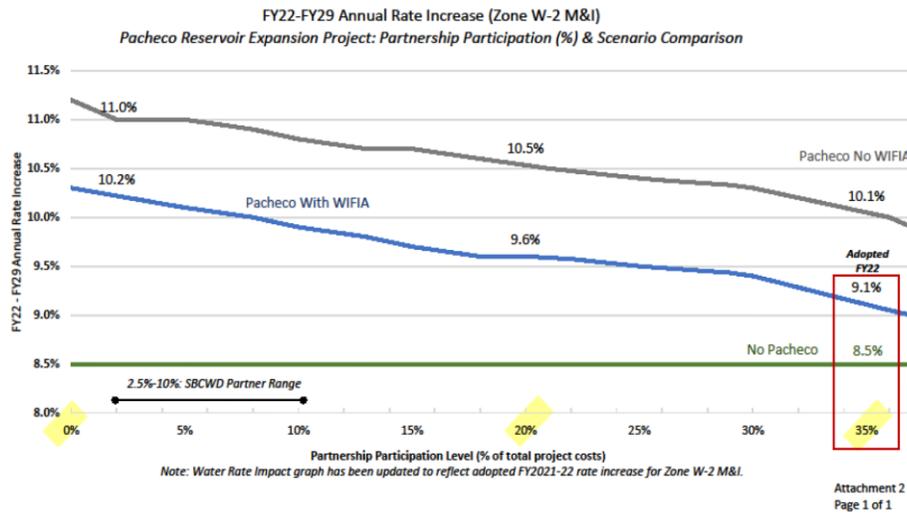
Clearly, the capacity of Santa Clara households to bear any increase to their monthly bills, whether water or otherwise, is zero.

7.3. Valley Water’s representations of rate increases from the new Dam are misleading.

Valley Water has provided the required commitment letter to CWC for not less than 75% of the non-public benefit costs share of the Pacheco. But in materials presented to its Board of Directors to justify this commitment, Valley Water used just one very misleading rate impact graph to support a massive financing commitment to the Pacheco Dam.¹⁹

Figure 3. Sole exhibit presented to Valley Water board prior to finance commitment vote (SCVD November 9, 2021 board meeting, Agenda item 7.1, attachment 2).

Water Rate Impact



The figure above shows the estimated impact on average rate increases from FY 2022 to 2029, but Pacheco Dam construction is expected to run from 2025 to 2032. Thus, this average calculation includes many pre-construction years with near zero costs, and only extends through half of the construction period.

The rate increase graphic suggests a 0.6% annual rate increase over 7 years (4.2% cumulative) assuming high partnership participation and low-cost WIFIA financing and a worst-case scenario of 2.5% annual rate increases (19% over 7 years) results from constructing Pacheco reservoir. These small rate increases are clearly insufficient to support this financing commitment.

Valley Water District’s most recent Comprehensive Annual Financial Report shows the district had \$500 million in long-term debt, and water rate revenue of \$267 million in 2020.²⁰ Financing an estimated 75% of Pacheco’s \$2.2 billion cost would more than triple the long-term debt and require rate increases several times larger than Valley Water claims in the rate increase graphic.

Taken together, these findings show that Valley Water has not adequately assessed the capacity of its ratepayers to handle the massive costs allocated to them for the Pacheco project

¹⁹ SCVWD November 9, 2021 meeting, Agenda item 7.1, attachment 2.

²⁰ https://www.valleywater.org/sites/default/files/2021-02/FY2020-CAFR_0.pdf

and the large rate increases that will result. Valley Water ignored state standards for water bill affordability, as well as recent state findings that water bills are not affordable in their service area. To add insult to injury, Valley Water used a clearly misleading and incomplete estimate of water rate impacts to support its financial commitment letter to WSIP.

8. Alternative Estimate of Benefits and Conclusion

Valley Water's Feasibility Documentation does not follow well established economic analysis practices, as documented in the WSIP Technical Reference. As a result, its benefit cost analysis includes grossly inflated benefits to justify its enormously expensive dam project (California Water Commission 2016). Most importantly, the Feasibility Documentation used a smaller version of the Pacheco Dam Project itself, and clearly invalid approach that gives the absurd result that the value of ecosystem benefits soars in response to rising project costs, not physical improvements in ecosystem benefits. Valley Water ignores the WSIP Technical Reference's specific warning against this approach, and it is clearly not the least cost method of providing steelhead benefits. Second, the Feasibility Documentation uses an outdated study to value emergency water benefits, and ignores real world recent data to develop risks for a Delta levee failure. Again, Valley Water is grossly inflating the benefits to justify its costly project.

Table 4 compares Valley Water's claimed benefits to more accurate values. Using the discount rate and duration assumptions of the feasibility study (2.5% discount rate and 100-year lifespan, 2021 dollars as illustrated in Tables 4-18 and 4-19 of the Feasibility Document), a more accurate net present value of benefits ranges from \$274.3 million to \$381.8 million. This compares to the Feasibility Documentation's present value benefit estimate of \$2,558 million, the vast majority of which are invalid ecosystem benefits. **Thus, the Feasibility Documentation (and the information upon which Proposition 1 funding is based) overestimates the project benefits by a factor of 7 or more.** Even with these wildly inflated benefits, the Feasibility Documentation analysis only found that benefits slightly exceeded costs for a benefit-cost ratio of 1.18. Using more appropriate benefit values shows that Pacheco Dam badly fails a benefit-cost test. The maximum plausible benefit-cost ratio is 0.18 and the most likely benefit-cost ratio is 0.13. **With costs approximately six times larger than the maximum plausible value of benefits, Pacheco Dam is clearly not economically feasible as required by WSIP.**

Table 4. Alternative Estimate of the Net Present Value of Benefits of the Pacheco Dam Project

Category	Valley Water Claim (\$M)	Maximum Plausible (\$M)	Most Likely Benefits (\$M)
Public Benefits			
Ecosystem Improvement in Pacheco Creek	\$1,491.5	\$81.5	\$0
Ecosystem Improvement in San Joaquin River Watershed	\$6.4	\$6.4¹	\$6.4 ¹
Emergency Response	\$792.2	\$26	\$0
Non-Public Benefits			
M&I Water Supply	\$142.5	\$142.5¹	\$142.5 ¹
M&I Water Quality	\$125.4	\$125.4¹	\$125.4 ¹
Total Benefits	\$2,558	\$381.8	\$274.3
Total Costs	\$2,120	\$2,120	\$2,120
Benefit Cost Ratio	1.18	0.18	0.13

¹Directly from Pacheco Reservoir Feasibility Documentation (Valley Water 2021)

In addition to economic feasibility, WSIP requires financial feasibility. As previously discussed, Valley Water’s ability-to-pay analysis is grossly inadequate to support a finding of financial feasibility. In addition, financial feasibility requires “that beneficiaries of non-public benefits are allocated costs that are consistent with and do not exceed the benefits they receive.” (WSIP TR, pg. 3-4). Table 4 shows that the net present value of non-public benefits accruing to Valley Water ratepayers is \$267.9 million, the sum of municipal and industrial water supply and water quality benefits. These benefits are less than one-sixth the \$1,664.4 million in costs that are allocated to Valley Water ratepayers in Table 5-12 of the Feasibility Documentation. The Feasibility Documentation appears to justify the difference with public ecosystem benefits. However, as discussed repeatedly in this review, those public benefits are wildly inaccurate. Furthermore, these public benefits do not accrue exclusively to Valley Water ratepayers as the cost allocation assumes. **As a result of a) an inaccurate ability-to-pay analysis, and b) Valley Water ratepayers have allocated costs that exceed the benefits they receive, the Feasibility Documentation finding that Pacheco Dam is financially feasible is incorrect and unsupported.**

Finally, the revised public benefits also reveal that Pacheco Dam does not generate public benefits sufficient to justify its WSIP grant award. The Maximum Conditional Eligibility Determination was set at \$496.7 million. The calculated benefit ratio for the most likely level of public benefits as 0.01 and the benefit ratio for the maximum plausible public benefits of the project at 0.23 (Table 5). Clearly, the benefits of the Pacheco Dam Project do not justify \$496.7 million in WSIP funding for public benefits.

Table 5. Public Benefit Ratio for WSIP Award

Category	Valley Water Claimed	Maximum Plausible	Most Likely
Total WSIP Maximum Conditional Eligibility Determination Amount (\$ millions)	\$496.7	\$496.7	\$496.7
Present Value of Total Net Public Benefits (\$ millions)	\$2,290.1	\$113.90	\$6.40
Public Benefit Ratio	4.61	0.23	0.01

In conclusion, as a result of multiple fatal errors in the Feasibility Documentation, there is an insufficient basis for the Commission to find that the Pacheco Dam project is economically and financially feasible.

References

- Bestplaces.net. 2021. Cost of Living in San Jose California.
https://www.bestplaces.net/cost_of_living/city/california/san_jose.
- CALFED Science Program Independent Review Panel. 2008. Review of the Delta Risk Management Strategy Phase 1 Report. October.
- California Water Commission. 2016. Water Storage Investment Program: Technical Reference. November.
- California Water Commission. 2018. Public Benefit Ratio Review Summary: Pacheco Reservoir Expansion Project. February 1.
- Delta Protection Commission. 2012. Economic Sustainability Plan for the Sacramento-San Joaquin Delta. January 19. <http://delta.ca.gov/wp-content/uploads/2021/05/Delta-Economic-Sustainability-Plan-2012-508.pdf>
- Department of Water Resources. 2019. State Funds Awarded for Delta Levee Improvement and Rehabilitation Projects. Annual Report to the Delta Stewardship Council. November.
- Doxoinsights.2021. Regional Bill Comparison 2021. <https://www.doxo.com/insights/regional-bill-comparison/>
- DWR, USACE, and DFG (California Department of Water Resources, U.S. Army Corps of Engineers, and California Department of Fish and Game). 2009. *Final Phase 1 Report. Risk Analysis 2005 Base Year Results, Risk Report: Section 14. Delta Risk Management Strategy*. March.
- Freeman, Myrick R., JA Herriges, CL Kling. 2014. The Measurement of Environmental and Resource Values: Theory and Methods.
- Joint Venture Silicon Valley. 2021. 2021 Silicon Valley Poll.
- NOAA: West Coast Region National Marine Fisheries Service. 2013. South-Central California Steelhead Recovery Plan. December.
- Santa Clara Water District. 2017a. Benefit Calculation, Monetization, and Resiliency. A3: Monetized Benefit Analysis. Pacheco Reservoir Expansion Project. August.
[SCVWDPacheco_BMCRA03_Monetized_Benefits_Analysis.pdf | Powered by Box](#)
- Santa Clara Water District .2017b. Eligibility and General project Information A1: Executive Summary. Pacheco Reservoir Expansion Project. August.
[SCVWDPacheco_EGPIA01_ExecutiveSummary.pdf | Powered by Box](#)
- Sunding, David. 2018. Economic Analysis of Stage I of the California Waterfix: Costs and Benefits to Urban and Agricultural Participants. Prepared for California Department of Water Resources. Page 28.
- Valley Water. 2019. Santa Clara Valley Water District Water Supply Master Plan 2040. November.
https://www.valleywater.org/sites/default/files/Water%20Supply%20Master%20Plan%202040_11.01.2019_v2.pdf

Valley Water. 2020. Santa Clara Valley Water District 2020 Water Shortage Contingency Plan. June. <https://fta.valleywater.org/dl/UvrQU06QpP>

Valley Water. 2021. Supplemental Feasibility Documentation Water Storage Investment Program. Pacheco Reservoir Expansion Project. November. <https://cadwr.app.box.com/s/nnojv5aovyd92xspa5ucc4cnyun7h/file/885519971460>

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Dr. Jeffrey Michael is Director of Public Policy Programs and Professor of Public Policy at the University of the Pacific, McGeorge School of Law. Prior to his appointment as Director, he was Executive Director of the Center for Business and Policy Research (CBPR) in Pacific's Eberhart School of Business while holding a joint appointment as Professor of Public Policy at McGeorge. He is based at Pacific's Sacramento campus.

Jeff is well-known for economic forecasts and research reports on business and public policy issues impacting Northern California. Jeff's work with CBPR focused on issues of regional growth and sustainability, including job growth, water resources, transportation, and housing. His research has been published in scholarly journals and books such as the *Journal of Law and Economics*, *Energy Policy*, and *Ecological Economics*, and he has been a principal investigator on over \$5 million in grants and contracts.

Jeff is a recognized expert in California water issues, leading major research projects for state and local government agencies and has been invited to testify as an expert to the legislature and various state boards and commissions on these topics. In recent years, he was recognized as one of six experts to watch on the economics of California water by *Water Deeply*, received the Carla Bard Environmental Education Award from the Bay Institute, and a resolution of commendation from the California Assembly for "invaluable contributions to state policy on water issues.

Jeff is frequently quoted in the local and national press and speaks about the economic outlook and policy issues to civic and business organizations. Before coming to Pacific, he was faculty, Associate Dean, and Director of the Center for Applied Business and Economic Research at Towson University in Maryland. Jeff received his Ph.D. from North Carolina State University, M.S. from the University of Maine, and B.A. from Hamilton College.