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SAN FRANCISCO PUBLIC UTILITIES COMMISSION
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MEMORANDUM

Date: July 20, 2005

To: Gary Bardini, PE
Chief, Hydrology Branch
Department of Water Resources

From: Susan Leal, General Manager
San Francisco Public Utilities Commission

Subject: DWR Request for Information Regarding Hetch Hetchy

More than 2.4 million Bay Area residents and more than 75,000 businesses depend on the Hetch Hetchy water system for their public health and economic vitality. The San Francisco Public Utilities Commission (SFPUC) is first and foremost responsible for continued delivery of safe, reliable, high quality drinking water to our customers. The Hetch Hetchy water system and the O'Shaughnessy Dam continue to be integral to the current and future water reliability and water quality of the San Francisco Bay Area.

Attached please find copies of technical reports prepared in response to questions from the Department of Water Resources (DWR) regarding the impact on our water system of dismantling O'Shaughnessy Dam. Report findings are summarized below. My staff and I look forward to working with you; please do not hesitate to contact me if we can be of further assistance.

Cost to Taxpayers

The SFPUC's preliminary analysis indicates that the cost to restore the Hetch Hetchy Valley and keep the San Francisco Bay Area whole would be, at minimum, $9 billion. Additional unforeseen events, such as environmental mitigation, would likely bring costs to more than $10 billion. To understand the costs, impacts to the entire water system must be evaluated, as well as the new infrastructure necessary to accommodate these changes. A 1987 Department of Energy review of a proposal to remove the O'Shaughnessy Dam estimated costs to exceed $6 billion.

Legal Precedents & Institutional Barriers

In their "Response to Legal Issues Raised by Environmental Defense Proposal," Ellison, Schneider & Harris note:

"The complexity...is staggering. It involves: upending San Francisco's entire century-old water supply system; convincing Congress to both revoke the permanent easement it granted in the Raker Act and to compensate San Francisco for that "taking"; convincing the courts to find that San Francisco's vested pre-1914 water rights should be capped or even reduced and effectively reallocated to others; radically revising San Francisco's

relationship with Modesto and Turlock Irrigation Districts ("Districts"); accepting much greater risk of shortages to its peril as well as that of its customers; somehow providing for the State to assume and implement a role that affirms rights and provides assurances; and conjuring up a means to finance the huge costs of finding replacement water and power."

Water Quality and Environmental Impacts

In their water quality review of Environmental Defense's "Paradise Regained: Solutions for Restoring Yosemite's Hetch Hetchy Valley," Camp, Dresser & McKee conclude:

"Consideration of the 'green' nature of the current SFPUC system is important. Hetch Hetchy represents a pristine watershed combined with a natural treatment unit (i.e., attenuation-sedimentation in Hetch Hetchy Reservoir), operates under complete gravity flow (therefore not susceptible to flow interruptions due to power outages), requires minimal chemical addition, and not only has low energy requirements but generates energy, too. The changes suggested by the ED report would leave a significant 'environmental footprint' with the increased energy requirements due to pumping and replacement of hydro power; increased impacts associated with the production, use and disposal of treatment chemicals and their residuals; construction impacts for new system components; and more."

Central Valley Flood Risk

In their "Assessment of the Flood Control Impacts of the Removal of Hetch Hetchy Dam and Reservoir, Tuolumne River, California," MBK Engineers note, "Rain flood operation at New Don Pedro could be significantly impacted by the removal of the Hetch Hetchy reservoir storage from the Tuolumne River watershed."

Reduced Power Generation and Increased Energy Consumption

In his "Review of Environmental Defense's Estimates of the Cost to Replace Lost Hydropower," economic and financial consultant Robert Logan writes:

"Replacing hydropower with natural gas fired power is like giving away a fully paid house and moving into a rental unit. You risk running out of money and becoming homeless. Any party that decides to analyze the O'Shaughnessy Dam removal case would be prudent to research the feasibility and cost of acquiring natural gas with assured delivery to Northern California over the remaining useful life of O'Shaughnessy. This should be at least enough natural gas to run 100 MW of combined cycle and 118 MW of combustion turbine power plants. Anything less would not meet the prudence standard as it would place the City at risk of lack of supply and unsustainable monetary losses."

RESPONSE TO LEGAL ISSUES RAISED BY

ENVIRONMENTAL DEFENSE PROPOSAL

Prepared By
Ellison, Schneider & Harris

May 2005

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INTRODUCTION

San Francisco has developed its high quality Tuolumne River water supply based on permanent easements granted by Congress and on vested pre-1914 appropriative water rights established pursuant to California law. San Francisco has diligently developed, and continues to diligently develop, its water supply system and reasonably and beneficially uses Tuolumne River water for municipal, industrial, and hydroelectric power purposes. San Francisco supplies water for municipal and industrial purposes to 2.4 million people. Even with its current water supply system intact, it is not always able to fully meet demand; as a prudent utility, it is undertaking a major program to make extensive capital improvements to its system, and, as part of that process, is evaluating supply and demand projections through 2030.

San Francisco's exercise of its rights has been challenged unsuccessfully in court and before the State Water Resources Control Board. The federal government investigated the prospect of forcing San Francisco to remove O'Shaughnessy Dam in the 1980's. The State Department of Water Resources scrutinized whether it could force San Francisco to divert its water at the Sacramento-San Joaquin Delta (without regard to dam removal).

Now Environmental Defense views this as the "opportune time" to remove O'Shaughnessy Dam. The Environmental Defense report entitled "Paradise Regained Solutions for Restoring Yosemite's Hetch Hetchy Valley" (2004) ("ED Report")[1] identifies many of the very difficult legal questions related to removal of Hetch Hetchy Dam and the complex arrangements which would be required for replacement of lost water and power. The ED Report identifies some of the issues explicitly and implicitly identifies others. Neither the main ED Report nor its appendices offer more than an "arm wave" for most of the legal issues the proposal raises.[2]

Environmental Defense recognizes that dismantling a municipality's key water storage facility cannot be done without having a viable alternative in place. Environmental Defense is clear: ". . . water and power **alternatives must be in place before** the [Hetch Hetchy] valley's restoration can begin." (Page 108, emphasis added) The "first step . . . is the development of a plan to replace the reservoir's significant water-supply, water-quality and hydropower benefits."

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[1] All references herein are to the Environmental Defense Report unless otherwise noted.

[2] The ED Report includes three appendices. Appendices A and B address technical issues. Appendix A ("Summary of Technical Analyses Hetch Hetchy Reservoir Replacement Alternatives" (June 10, 2004)) prepared by Schlumberger Water Services for Environmental Defense acknowledges a range of legal issues that affect their analyses and the viability and practicability of their assessments. None of the legal and institutional issues raised in Appendix A are fully addressed or resolved, either in Appendix A or elsewhere in the ED Report. Appendix B ("Water Quality Evaluation for Hetch Hetchy Reservoir Alternatives" (undated, circa 2004) prepared for Environmental Defense by DOA, Inc., also disclaims any role in evaluating the "financial, water supply, and political ramifications of operating the SFPUC water system without the Hetch Hetchy Reservoir . . ." (Appendix B at p. 59) Appendix C, a "Memorandum – Hetch Hetchy Water and Power Issues" prepared for Environmental Defense by Somach, Simmons and Dunn (July 2004). Appendix C assumes "that reasonable, feasible alternatives" to Hetch Hetchy are available. (Appendix C at p. 2) The focus of Appendix C is on the question of whether the City and County of San Francisco ("CCSF") can expand the use of its Tuolumne water rights.

(Page 3) Even though that has not been done, Environmental Defense makes sweeping claims that it has identified "practical, proven water storage, conveyance and treatment alternatives" (page viii) that are "workable solutions" (page ix); that the "water and power issues that present the most obvious political obstacles . . ." are "complex – but surmountable" (page 4); that there are alternative water system "components . . . that would maintain or even improve . . . reliability and safety" (page 42). Overall, Environmental Defense urges that:

> Complexity should not be confused with impossibility. Given the will and the means to accomplish this goal, this initial analysis has found no legal obstacle sufficiently formidable to block consideration of Hetch Hetchy Valley's restoration.

(Page 94)

The complexity, however, is staggering. It involves: upending San Francisco's entire century-old water supply system; convincing Congress to both revoke the permanent easement it granted in the Raker Act and to compensate San Francisco for that "taking"; convincing the courts to find that San Francisco's vested pre-1914 water rights should be capped or even reduced and effectively reallocated to others; radically revising San Francisco's relationship with Modesto and Turlock Irrigation Districts ("Districts"); accepting much greater risk of shortages to its peril as well as that of its customers; somehow providing for the State to assume and implement a role that affirms rights and provides assurances; and conjuring up a means to finance the huge costs of finding replacement water and power. Environmental Defense breaks the biggest issues into four main categories which it summarizes as being reflective of the fact that ". . . changes in federal and state laws are likely to be required for the valley to be restored. . ." (Page 94)

1) Raker Act Amendment: Congress must amend the Raker Act. (Page xix; *see also* pp. 103, 104)

2) State Assurances: The State: ". . . will likely need to affirm San Francisco's water use, diversion and storage rights in a new configuration and otherwise assure San Francisco, Turlock and Modesto Irrigation Districts, BAWSCA [Bay Area Water Supply and Conservation Agency], and others that a fair resolution of the myriad issues raised by such changes in San Francisco's water delivery and power generation system will be legally required prior to restoration." (Page xix; *see also* pp. 101, 105)

3) New Contract Negotiations: "The affected entities – San Francisco, its customers, the Districts and others that have long shared the Tuolumne River's bounty – will need to negotiate new arrangements that respond to the legitimate water and power demands of all." (Page xix; *see also* p. 105)

4) Cost Sharing: "Those who will benefit from the valley's restoration will need to share the cost of making it possible. The state legislature (or the state's voting public) and the U.S. Congress will be asked not only to promulgate the changes in law and to provide the necessary assurances that should accompany restoration, but also to share significantly in the funding of the arrangements required to provide those assurances." (Page xix; *see also* p. 105)

Those very brief and sweeping descriptions fail to reflect that:

1) If Congress amends the Raker Act, it will have to revoke the permanent easement granted to San Francisco by the Raker Act. Such a revocation requires that the federal government compensate San Francisco. (Environmental Defense has chosen euphemistically to characterize revocation of the grant of a permanent easement as "amend and modernize" and "authorize an altered set of purposes for use" (e.g., page 104).)

2) There is no statutory or administrative structure and no agency or agencies with jurisdiction to provide "state assurances" as to San Francisco's exercising its water rights in some "new configuration" or as to "a fair resolution of the myriad issues." Perhaps the changes in state laws that Environmental Defense alludes to would be to authorize (and provide funding for) a state agency to "backstop" all water and power replacement "components" in order to ensure "equivalent water-supply reliability" and replacement of all lost power. Ultimately, however, San Francisco's pre-1914 appropriative water rights can be adjudicated only by the courts, and any adjudication of San Francisco's rights will necessarily include adjudication of all competing rights of at least the Modesto and Turlock Irrigation Districts, and of the state and federal water projects who would benefit from additional flow to the Delta.

3) Negotiating new agreements with the Districts would involve not only incredibly complicated contract negotiations, if agreement could be reached, but would also require actions by the Federal Energy Regulatory Commission ("FERC") and the State Water Resources Control Board ("SWRCB") as to the Districts' New Don Pedro FERC license and post-1914 water rights, and by the United States Army Corps of Engineers ("USACE") as to New Don Pedro flood control rules.

4) The idea that beneficiaries would be identified and would "share the cost of making it possible" ignores the fact that, after nearly a decade, the CALFED "beneficiary pays principle" remains undefined, contentious, and divisive. The idea that the State and Congress will be asked to "provide the necessary assurances" and to "share significantly in the funding of the arrangements required to promote those assurances" ignores the fact that "assurances" are utterly undefined and that state and federal funding is always highly speculative.

THE CIP IS A 2030 PLAN TO IMPROVE SYSTEM RELIABILITY – NOT AN ULTIMATE PROCESS TO CAP SAN FRANCISCO'S WATER SYSTEM CAPACITY AND WATER RIGHTS

Environmental Defense Sees CIP as an "Opportunity" but Calls for a "Parallel" Study

Environmental Defense views San Francisco's Capital Improvement Program ("CIP") as the "opportune time" (page 4) to study removal of O'Shaughnessy Dam, a "once-in-a-lifetime opportunity" (page 12), "an historic opportunity" (page 1). However, Environmental Defense states that it does not want to delay the CIP, and concludes that a "public process to develop a restoration plan would best be initiated in parallel . . . to the SFPUC's CIP . . ." (page 109):

> This [restoration] process should be closely linked [to the CIP]. . . The restoration plan should be distinct from the CIP, however, in order that it not delay the important critical repairs that the SFPUC must immediately make on some parts of its system.

(Page 108)

It is not clear what this separate process would be. In other parts of its report, Environmental Defense urges that ". . . a comprehensive analysis [of 'restoration alternatives'] could well be accomplished within the context of the Corps' process. . ." and that:

> Fortified by the procedural and substantive requirements of the National Environmental Policy Act and the California Environmental Quality Act, the Corps of Engineers review of [the CIP] provides a forum for considering such alternatives. . .

(page 104), noting that environmental review of the CIP is to be consolidated in the USACE San Francisco District Office.

Environmental Defense Takes No Position on CIP Component Projects but Assumes Their Existence for Its Analysis

The CIP entails a complex and challenging permitting process. Under consideration are facilities such as replacement of Calaveras Reservoir, construction of a fourth San Joaquin pipeline, and enlargement of the Sunol Water Treatment Plant. San Francisco's purposes in implementing its CIP are primarily to improve system reliability. Environmental Defense recognizes, for example, that: "Adding a new fourth pipeline would improve reliability both by expanding conveyance capacity and providing a redundant pipeline [to facilitate repairs on the others]." (Page 53) And, as Environmental Defense notes, San Francisco and BAWSCA "are presently

engaged in comprehensive analyses of the potential for increased implementation of proven water-use efficiency measures to decrease future demand." (Page 4)

Environmental Defense is of two minds as to key CIP facilities: "This report shows how a few key projects within [the CIP] could not only improve the City's ability to deliver water but also allow for the ultimate [removal of O'Shaughnessy Dam]." (Page 3) However, Environmental Defense makes it clear that it takes no position on key CIP component projects:

> An expanded Calaveras Reservoir and a fourth San Joaquin pipeline are elements in San Francisco's CIP that would help provide increased water supplies to meet projected increases in demand. Environmental Defense does not assume that these elements will be expanded or take any position at this time on the expansion. This report simply uses these elements of the CIP to project one possible future for the SFPUC against which to compare alternatives. . .

(Page xiii)

> Environmental Defense does not assume, for example, that Calaveras Reservoir will be expanded, nor do we take any position at this time on such expansion.[3] This report simply uses the above three elements of the CIP [420,000 acre-foot Calaveras Reservoir, fourth San Joaquin Pipeline, Sunol Water Treatment Plant 240 mgd capacity] to project one possible future for the SFPUC against which to compare alternatives. . .

(Page 53) Basically, Environmental Defense foresees many regulatory hurdles for these facilities at the same time that it assumes their existence to make up for lost water and power.

Environmental Defense Wants to Cap San Francisco Tuolumne River Diversions to Limit Reliance on Tuolumne River Water

The CIP is a planning effort for facilities to reliably supply water through 2030. It is not a forum for determining the ultimate exercise of San Francisco's Tuolumne River pre-1914 appropriative water rights. San Francisco's water rights allow for increased diversions to serve municipal and other uses over time. Environmental Defense raises the capping issue in the context of CIP planning for 2030 demands and reliability of supply. Environmental Defense suggests that "concerns" will likely be raised ". . . should San Francisco propose either to increase its diversions from the [Tuolumne] River or even just to enhance its physical capability to do so."

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[3] Environmental Defense states that:

> The SFPUC should rebuild Calaveras Reservoir. The ultimate size and configuration of the enhanced facility should be a sensitive function of water-supply needs, costs, dam safety and environmental issues on Calaveras and Alameda Creeks.

(Page 107) It does not indicate what other elements of the CIP it does support, except to note that the SFPUC ". . . should repair the pipelines in the Bay Area that are identified" in the CIP, since: "The reliability of its local conveyance system is inadequate at present." (Page 106)

(Page 99) It views facilities as a threat (as well as possible "components" of its own water supply alternatives):

> . . . The SFPUC has not clearly stated how it plans to meet future increased demand, should the projections in its WSMP [Water Supply Master Plan] change little under the current review process. With the presence of expanded conveyance across the San Joaquin Valley and expanded storage in the Bay Area, however, it does appear that the SFPUC anticipates a Tuolumne River management regime that would sharply increase the diversions of Tuolumne River water to the San Francisco Bay Area.

(Pages 52-53)[4]

RAKER ACT – CONGRESS WOULD HAVE TO REVOKE THE GRANT OF A PERMANENT EASEMENT

Environmental Defense Recognizes There Is a Raker Act Issue

Environmental Defense acknowledges that the Raker Act is one of the most "[s]ubstantial legal and institutional hurdles that must be overcome in order for a restoration scenario to actually come to pass." (Page 104) Environmental Defense's solution is to "amend and modernize the Raker Act and authorize an altered set of purposes for use of national-park land." (*Id.*) Calling amendment of the Raker Act a substantial hurdle is an understatement. The Raker Act represents a balancing of binding commitments between the United States and San Francisco that cannot simply be "amend[ed] and modernize[d]" by Congress.

As recognized by Environmental Defense, the Raker Act has granted to San Francisco a perpetual right-of-way easement for water supply and hydropower generation.[5] There is no question Congress intended to grant San Francisco a permanent easement. The legislative history of the Raker Act recounts the inadequacies of the Act of February 15, 1901 that authorized the Secretary of Interior to grant rights-of-way permits through National Parks revocable in the Secretary's discretion, and that San Francisco required defined and permanent rights commensurate with the substantial investment required for such a large project.[6]

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[4] The tone of the ED Report suggests that Environmental Defense does not support a fourth San Joaquin pipeline, a substantially enlarged Calaveras Reservoir, and possibly other components of the CIP, unless, perhaps, they could further the Environmental Defense dam removal agenda. Environmental Defense's calls for "cooperation", "assurances", "affirmations", and "cost-sharing" presumably apply only to the extent Environmental Defense is furthering that agenda.

[5] Environmental Defense recognizes that the ". . . Raker Act did grant San Francisco the necessary right-of-way and other authorities needed for it to proceed with the construction of O'Shaughnessy Dam and related facilities." (Page 95) Further, "San Francisco's 'leasehold' effectively continues in perpetuity." (Page 97)

[6] "The City of San Francisco would undoubtedly hesitate to expend a large amount of money in the development of a water system if the basis for the right of construction of parts of its system should rest

By complying with all conditions in the Act and diligently developing the project, San Francisco's rights to continue operating, maintaining and rebuilding the Hetch Hetchy system has unquestionably vested. Under the Act, San Francisco's vested rights are terminable and revert to the United States solely in the event San Francisco would attempt to sell hydropower or water in a manner prohibited by the Act. Congress did not reserve the right to alter, amend or repeal the Raker Act with the exception of amending the amount of the annual charges paid by San Francisco.

A Raker Act Amendment Which Requires Destruction of O'Shaughnessy Dam Is a Compensable Taking

The Constitution flatly prohibits the federal government from taking property for public use without just compensation. A grant of a right-of-way easement through public lands is a grant of property defined by the terms of the grant. The Raker Act is a grant of property to San Francisco, a permanent or perpetual easement, that, by its terms, cannot be cancelled or revoked absent some breach of the Act by San Francisco.

San Francisco is mindful that Congress had not unmistakably waived its sovereign powers to manage the National Park and Forest when it granted San Francisco the rights to the Hetch Hetchy project. Nevertheless, this sovereign power does not authorize Congress to amend the Raker Act in a manner that would defeat or frustrate the primary purpose of the grant to San Francisco, which is to develop the Hetch Hetchy system, without paying just compensation as required by the Constitution. Legislation that would require the removal of O'Shaughnessy Dam, or substantial modification to San Francisco's operation of the project, would be a taking of vested San Francisco property.

Environmental Defense appears to anticipate and accept this conclusion:

> . . . the U.S. Congress will be asked not only to promulgate the changes in law [Raker Act] and to provide the necessary assurances that should accompany restoration, but also to share significantly in the funding of the arrangements required to provide those assurances.

(ED Report at p. xix)

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upon a permit of revocable character of an officer of the Government." *Congressional Record, House*, remarks of Rep. French, August 29, 1913, p. 3965. "That [Hetch Hetchy Valley lies within Yosemite National Park] necessitates special legislation, as the ordinary right of way acts do not grant permanent easements in national parks." *Congressional Record, House*, remarks of Rep. Mondell, August 29, 1913, p. 3918. Similarly, the Raker Act "involves the granting to certain municipalities certain rights within the public domain that when once granted can not be withdrawn." *Congressional Record, House*, remarks of Rep. French, August 29, 1913, p. 3964.

Environmental Defense's Concern that Dam Removal Would "Run Afoul" of Raker Act Power Provisions

Environmental Defense is concerned that dam removal would ". . . run afoul of the Raker Act's emphasis on maximizing the production of public power from the Tuolumne River's water supply." (Page 102) It recognizes that all of its scenarios would reduce the electricity available to present and future beneficiaries of San Francisco power production, and that ". . . the availability of surplus energy to sell to [the Districts] . . . would change as a result of restoring the valley." (Page 108) Environmental Defense points out that "less energy would be available to sell to the Districts" (page xvi), and that:

> Given the Raker Act requires San Francisco to sell surplus power to TID and MID at below-market cost-of-service rates, the Districts would shoulder most of the financial burden of decreased power sales as they faced the prospect of replacing Hetch Hetchy energy at market rates.

(Page 85)

Environmental Defense concludes that information from various studies and analyses that would have to be done could: ". . . be used to estimate the financial impacts on SFPUC and the Districts, thereby providing the basis for any compensation for increased power-procurement costs." (*Id.*) It is not clear who would pay any increased costs.[7]

In Appendix C, Environmental Defense expresses a general opinion that, if San Francisco ". . . desires to continue to utilize [its Raker Act] rights-of-way, it must continue to produce . . . power from facilities remaining in the Park." (Appendix C at page 3) This is essentially saying that San Francisco would continue to have Raker Act obligations, including any power obligations that could still be met by the remnants of its system.[8] How Congress might amend the Raker Act is purely speculative. It is not clear what Raker Act amendment Environmental Defense views as necessary. It states only:

> . . . A proposed change as significant as returning Hetch Hetchy Valley to Yosemite National Park will require explicit Congressional action for reasons beyond its hydroelectric-power implications.

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[7] It is also not clear how the issue of "compensation for increased power-procurement costs" meshes with Environmental Defense's statement (regarding less energy being available to the Districts) that: "Several options are available to replace – or eliminate the need for – the lost energy." (Pages xvi-xvii, emphasis added)

[8] These portions of the ED Report are inexplicably written in a way that implies that San Francisco might somehow decide to remove O'Shaughnessy Dam in order to avoid producing power. The Appendix C discussion of Raker Act hydroelectric power provisions includes the argument that San Francisco would not be able to avoid its obligations to produce power because it "elected to restore the Hetch Hetchy Valley" (Appendix C page 36) and that it "must carefully balance any decision to remove its facilities from Hetch Hetchy Valley against this requirement [to continue to generate power for itself and the Districts]." (*Id.* at pages 36-37)

(Page 103) Although confusing, the gist of Environmental Defense's concerns appears to be that the Districts' interests in power provided by the Hetch Hetchy project would play a significant role in any future discussion of amendment of the Raker Act.

SAN FRANCISCO'S TUOLUMNE RIVER WATER RIGHTS

Environmental Defense Points to "Concerns" as to Whether San Francisco Can Increase Tuolumne River Diversions Pursuant to its Water Rights but Does Not Take a Position Against Increased Diversions

Environmental Defense does not explicitly state a position as to San Francisco increasing its diversion and use of Tuolumne River water pursuant to San Francisco's water rights. Environmental Defense expects that San Francisco ". . . would continue to rely on Tuolumne River water for the vast majority of its needs . . ." (Page x) As to San Francisco's exercise of water rights now and in the future, Environmental Defense only notes that "concerns are likely to be raised", citing its Appendix C:

> The analysis in Appendix C examines in considerable detail the concerns that are likely to be raised should San Francisco propose either to increase its diversions from the river or even just to enhance its physical capability to do so. While San Francisco presently takes considerably less water from the Tuolumne than the amount to which it lays claim, others whose interests lie downstream of the City's current points of diversion may well raise substantial objections to any action – such as a fourth pipeline across the San Joaquin Valley – that San Francisco may soon formally propose as part of its Capital Improvement Program.

(Pages 98-99)

Environmental Defense's "Concerns" Are Without Merit

San Francisco Has Valid Pre-1914 Appropriative Water Rights to Divert at Least 400 mgd from the Tuolumne River

Environmental Defense recognizes that the California Supreme Court decision in *Meridian, Ltd. v. San Francisco* "eclipsed" arguments challenging the validity of San Francisco's appropriative rights, and that the court reached a ". . . result in favor of CCSF's right to store enough water to yield the noticed 400 mgd." (Appendix C at pages 10-11) Although Appendix C suggests that "[a]rguably the Meridian court's statement that CCSF's rights were sufficient to yield 400 mgd is dicta . . ." , it also acknowledges that the 400 mgd quantity has been referenced many times, including by the Districts who asserted that 400 mgd was the "legitimate scope of CCSF's water rights in their license proceedings for the New Don Pedro project before the Federal Power Commission in 1961-1963." (*Id.* at page 11) Further, Appendix C points out that the SWRCB

". . . has concluded that something close to the 400 mgd figure represents the extent of CCSF's pre-1914 appropriations out of the Tuolumne." (*Id.*) It is noted that both the First Agreement and Third Agreement between San Francisco and the Districts referred to San Francisco's ultimate requirements for 400 mgd. (*Id.* at page 21) Although it recounts the clear record in support of the 400 mgd quantification, Environmental Defense challenges San Francisco's projected 400 mgd demand as well as the availability of water to meet that demand.

Environmental Defense's Interpretation of Water Availability, Due Diligence, and the Municipal Exemption from Diligence Issues Is Not Correct

In the face of continued and consistent recognition of San Francisco's water rights to divert at least 400 mgd from the Tuolumne River, Environmental Defense poses questions as to the availability of supply to meet such projected demands and whether San Francisco has proceeded with diligence to put its pre-1914 appropriative water rights to use.

Environmental Defense confuses water availability with water rights: "Given its limited water rights . . . in many years very little of the Tuolumne River's flow belongs to the SFPUC." (Page 32) It is not San Francisco's water rights which are limited at times – it is the availability of water that is limited. Environmental Defense points out that there is not enough developed supply to meet the combined projected demands of San Francisco and the Districts, and that: ". . . neither CCSF nor the Districts can rest assured that the Tuolumne River will be able to meet their needs in full indefinitely." (*Id.* at page 28) It is certainly true that supply from the Tuolumne River is limited in some years. While availability of water is a limiting factor as to the extent to which water rights can be exercised from year to year, availability of water (or its unavailability) in any particular year does not define the extent of those rights.

Environmental Defense also makes various assertions that confuse water availability with diligence requirements and effectively ignores the fact that a municipality is not required by California water law to develop its supplies pursuant to its water rights before there is demand to make reasonable beneficial use of those supplies. Environmental Defense complains:

> Although the consensus over time appears to be that CCSF holds pre-1914 water rights to the extent of 400 mgd, this may ultimately prove to be without foundation. CCSF has never developed the capability of diverting 400 mgd, nor has its demand even remotely approached that amount. . . There is some question about how long CCSF may continue to claim the future right to divert 30 percent more than it has been able to use in the past 100 years. Such a right is, at best, inchoate, and may well prove illusory upon closer scrutiny. The law favors reasonable *use* of water [footnote omitted], not nursing a priority which has never been exercised.

(*Id.* at page 12)

> CCSF's apparent inability to divert more than 300 mgd is unrelated to the variant flow of the Tuolumne River. Instead, it is purely the result of CCSF's failure

initially to develop more capacity for transporting water across the San Joaquin Valley . . .

(*Id.* at page 29)

These are extraordinary statements, particularly as applied to a municipal water rightholder. These statements simply do not reflect key provisions in the Civil Code pertinent to diligence requirements that apply to municipalities such as San Francisco that hold pre-1914 appropriative rights. Environmental Defense is off base in reaching the conclusion that San Francisco should have fully developed facilities to divert 400 mgd or more in order to have maintained those rights and not lost them due to lack of diligence. It even believes that its argument: ". . . if pursued, would become more potent over time . . . that CCSF cannot expand its current exports, or perhaps even continue its current diversions from Hetch Hetchy, because it failed diligently to bring to completion facilities needed to fully protect the right." (Appendix C at page 28)

Environmental Defense immediately follows these assertions, however, by noting that: "There are statutory and judicial exemptions from the diligence requirement. Cities could postpone development of water and power that was not immediately needed" (appropriately citing Civil Code Section 1416). (*Id.*) It also notes that an appropriator ". . . who steadily pursued a long-term plan of development could be protected from the requirement to immediately put the full claimed quantity of water to beneficial use." (*Id.* at page 29)

These are accurate reflections of California law applicable to pre-1914 municipal appropriators such as San Francisco. San Francisco has diligently developed its water supply system pursuant to its long-term plan of development, has developed capacity as it has been needed to meet demand, and will continue to do so. There is no argument that will "become more potent over time" that a pre-1914 municipal appropriator must develop supply before it has need, or that it cannot gradually develop its water supply facilities over time consistent with its long-term plan of development. San Francisco is explicitly allowed by the Civil Code, pursuant to which it filed and perfected its pre-1914 appropriative rights, to develop its water supplies in exercise of those water rights in a manner and at a time commensurate with providing supply to meet its demands. A municipality with pre-1914 rights is not required to develop supply before its needs that supply. Its water rights are not lost even where a substantial period of time passes before its rights need to be fully exercised.

Environmental Defense's Arguments Implicate the Senior Rights of the Districts – No Determination Can Be Made of San Francisco's Tuolumne River Rights Without a Determination of the Districts' Rights

Environmental Defense asserts the Districts' water rights and interests as a basis for limiting San Francisco to 300 mgd diversions from the Tuolumne River:

> Presently, San Francisco obtains nearly 300 mgd from the upper Tuolumne River. An expansion of this to 400 mgd presumably would injure the Districts (or perhaps others) in many years. Application of the priority rules may restrict CCSF's diversions from the upper Tuolumne to their present diversion rate of

about 300 mgd. If the Districts suffered injury by CCSF's *existing* diversions, as in periods of drought, either the Raker Act or California's priority system could restrict CCSF diversions.[9] Such constraints might be avoided if CCSF were to change its point of diversion to a location downstream of the Districts and other senior water right holders . . . [or to construct] an intertie to divert water from New Don Pedro to conveyance facilities that run beneath the reservoir. . .

(*Id.* at page 31)

Just how the Districts' interests, including contractual interests and other rights to New Don Pedro, would be affected by the Environmental Defense proposal is not clear. Environmental Defense notes repeatedly that changing the points of diversion or storage of San Francisco's water rights would need to take into account the effect of those changes on others, particularly the Districts. Injury to the Districts seems to be Environmental Defense's key standard to gauge whether San Francisco could continue to exercise its water rights, increase its exercise to at least 400 mgd, change its point of diversion, or how and to what extent it ever exercises its water rights:

> . . . CCSF is plainly entitled to alter its point of diversion for any portion of its pre-1914 entitlement to 400 mgd, or all of it, so long as there is no injury to senior water rights holders, including the Districts.

(*Id.* at page 31)

Given the intricately related water rights of San Francisco and the Districts, any effort to limit the exercise of San Francisco's water rights, to change the relationship of San Francisco and the Districts, or to take any action that would affect the Districts' exercise of their water rights, will likely result in a general adjudication of the Tuolumne River.[10] San Francisco and the Districts

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[9] Given the provisions of the Raker Act related to District water, it is not possible for the Districts to "suffer injury" due to San Francisco's diversions (existing or future) in periods of drought. Environmental Defense clearly recognizes that: ". . . in many years very little of the Tuolumne's flow belongs to the SFPUC. In 1977, the driest year on record, only 3,000 acre-feet accrued to the City. With very limited alternative sources, it is more dependent on storage than most other urban districts." (Page 32) This is true because the Districts' "senior" water rights:

> . . . : are entitled to the river's base flow, with water accruing to the "junior" SFPUC only during periods of high flow. The exact distribution is determined daily by a calculated estimate of what the flow would be at LaGrange . . . absent any dams on the river. Most of the year, all the river's flow below 2,416 [cfs] . . . belong to the two districts. Unless the flow is higher than this threshold, San Francisco and the rest of the Bay Area get absolutely no water. Over the 60-day period from mid-April to mid-June, typically the period of highest river flow due to melting snow, that threshold is raised to 4,066 cfs.

(*Id.*) Generally: "The Turlock and Modesto Irrigation Districts use most of the Tuolumne River's water. Less than one-fifth of it is diverted to the San Francisco Bay Area . . ." (Page 35)

[10] Environmental Defense states that potential harm to the Districts or other third parties "will result", and "litigation will follow" if CCSF continues ". . . to press for the maximum 'entitlement'." (Appendix C at page 28)

have concertedly avoided such an outcome in the past. As Appendix C notes, the ". . . rights and interests of CCSF and the Districts are intertwined, and probably impossible to separate." (Appendix C at page 37)

Environmental Defense's Focus Is on Forcing San Francisco to Change the Exercise of Its Water Rights by Changing Where It Diverts Water

Environmental Defense's analysis ". . . focuses mainly on alternative ways to move and store San Francisco's existing supply to Tuolumne River water." (Page ix) Separate from "concerns" related to San Francisco's underlying water rights, Environmental Defense takes the position that:

> . . . a variety of authorities, including the Raker Act itself, the public trust doctrine, and the California constitution's injunctions against the unreasonable use, diversion or waste of water, seem to require an ongoing consideration of alternatives that might lead to the Valley's restoration.

(Page xix) This "seem to require" language is repeated on page 104 in terms of an "ongoing duty to consider alternatives." What Environmental Defense is suggesting would necessitate novel interpretations and applications of the public trust doctrine, reasonable use requirements, and the Raker Act. The Report's discussion of these concepts and how they might apply to force San Francisco to divert somewhere other than at O'Shaughnessy Dam is terse. Environmental Defense refers to Appendix C for an explanation, but the focus of Appendix C is not on the efficacy of arguments in support of dam removal; it is primarily a collection of arguments which might be made against San Francisco's either expanding its system or increasing the quantity of water it diverts from the Tuolumne River through its existing system.

None of the "variety of authorities" require San Francisco to remove O'Shaughnessy Dam, or to change its exercise of its Tuolumne River rights. Environmental Defense has constructed three novel arguments, all of which are flawed.

Environmental Defense's Arguments that the Raker Act Limits San Francisco's Exercise of its Tuolumne River Water Rights Have No Basis

Environmental Defense argues that Raker Act Section 9(h) somehow requires San Francisco to divert from the Tuolumne River

> . . . only to the extent it had fully developed its other resources. Nothing in this language or the statute fixes this limitation as of a particular time; accordingly, CCSF is arguably under a continuing obligation to develop its own resources, as by recycling, conservation, desalination, and other available means, in order to relieve the pressure of its exports from the Tuolumne River and the Hetch Hetchy Valley.

(Appendix C at page 16) Absolutely no authority is given for this expansive interpretation of Section 9(h). Environmental Defense does not suggest that such a concept was entertained by Congress when it enacted the Raker Act.[11]

Environmental Defense's Arguments that the Public Trust Requires San Francisco to Change Its Exercise of Its Water Rights Are Without Merit

Under the public trust doctrine, the State of California holds its navigable waters and tidelands in trust for the public for navigation, commerce, fisheries, environmental preservation and aesthetics. There is no dispute that the public trust doctrine applies to waters of the State susceptible to navigation, and in limited circumstances to non-navigable streams that affect navigable waters. The public trust doctrine is broad and flexible, and it imposes a continuing duty on the State to consider and manage trust values. The protection of the trust lands and public trust values, however, is not absolute. The State is required to balance the interests of the public trust against non-trust interests. Trust lands may be sold or non-trust uses sanctioned where such uses are not inconsistent with the public trust, or where the non-trust uses of the land outweigh the trust uses. Furthermore, the various public trust values of navigation, commerce, fisheries and environmental protection are not always consistent, and decisions must often be made to favor one trust value over another.

There seem to be two distinct public trust arguments being discussed in the ED Report and Appendix C.[12] One is that water rights are subject to the public trust doctrine and that "San Francisco's appropriative water rights must also be analyzed through the lens of the public trust doctrine." (Appendix C at page 26) This statement is made without discussing the fact that San Francisco's rights are pre-1914 appropriative rights, and, unlike the post-1914 rights at issue in *National Audubon*,[13] are not subject to SWRCB permitting jurisdiction. The SWRCB cannot "reanalyze" a water right allocation that it did not make. The extent to which the public trust might be applied to limit the exercise of a pre-1914 appropriative water right is a question which has not been addressed by the courts. Any attempt by the SWRCB to make such a determination would, in effect, be equivalent to determining the validity of a pre-1914 right. That power resides only in the courts, not in the SWRCB.

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[11] Congress reflected in Raker Act Section 9(h) the fact that San Francisco was involved at that time in a very lengthy process of acquiring the Spring Valley Water Company, whose system was the source of San Francisco's water supply until San Francisco acquired Spring Valley Water Company in 1930. Subsection 9(h) also reflects the Districts' strenuous objections to San Francisco's using Tuolumne River water for irrigation purposes. Congress did not require, however, that San Francisco use the waters which it had or might thereafter acquire to "the fullest practicable extent", which it used in a requirement it imposed on the Districts in the immediately preceding subsection 9(g). Section 9(h) provides that San Francisco, as the Raker Act grantee:

> (h) . . . shall not divert beyond the limits of the San Joaquin Valley any more of the water from the Tuolumne watershed than, together with the water which it now has or may hereafter acquire, shall be necessary for its beneficial use for domestic and other municipal purposes.

[12] See Appendix C, pages 24 *et seq.*

[13] *National Audubon Society v. Superior Court* (1983) 33 Cal.3d 419.

A second public trust argument seems to be that, separate and apart from any application of the public trust to water rights:

> . . . the public trust doctrine must be considered in adopting the [CIP] and, independent of the CIP, in evaluating the continued use of the Hetch Hetchy Valley as a water impoundment for the benefit of San Francisco.

(Appendix C at page 25) This statement is prefaced by the words: "There is no doubt, therefore . . ." without any discussion explaining Environmental Defense's lack of doubt (or the "therefore"). The statement is followed, however, by a key question and a caveat. As to the key issue, Environmental Defense acknowledges that the Raker Act arguably "validly disposed of the public trust resources of the Hetch Hetchy Valley . . ." (Appendix C at page 26) Environmental Defense adds the important caveat:

> It seems unlikely that any court would interpret the public trust doctrine to require removal of O'Shaughnessy Dam and restoration of the valley if doing so resulted in the unmitigated loss of stored water and power generation for San Francisco.

(Appendix C at page 26) No court has imposed a duty based on the public trust doctrine as suggested by Environmental Defense. Environmental Defense offers no legal basis for its novel argument.

In fact, Congress exercised authority to consider and protect public trust interests when it passed the Raker Act in 1913. The federal authorization to use Hetch Hetchy Valley is wholly consistent with the trust, as navigation, fisheries and other trust values have been preserved or enhanced where possible, and not destroyed or abrogated. The legislative history shows that Congress carefully considered San Francisco's need for water, the relative benefit of alternate water sources available to San Francisco, the value of the dam for regional water supply and flood control, and the impact of the dam on aesthetic and other considerations. Congress determined that San Francisco should be granted easements to develop the Hetch Hetchy project because the Hetch Hetchy Valley was the best source to satisfy San Francisco's critical water needs.

Environmental Defense's Arguments that the Reasonable Use Doctrine Requires San Francisco to Change Its Exercise of Its Water Rights Have No Basis

Environmental Defense draws the same basic distinction in analyzing the application of the reasonable use requirement as it attempted to do with regard to the public trust doctrine. Separate and apart from the requirement that water be put to reasonable and beneficial use and not wasted, Environmental Defense asserts that:

> The reasonableness requirement of [California Constitution] Article X, section 2 applies to the CIP and San Francisco's continued diversion and storage of Tuolumne River water at Hetch Hetchy. In general, diversion and storage of

> water is not an unreasonable use. Article X, section 2 compels an analysis, however, of the reasonableness of the particular diversion and storage. A party deemed to be diverting, using or storing water in an unreasonable manner can be required to alter its practices and face "some inconvenience or to incur reasonable expenses." [Footnote omitted.]
>
> Significant issues surround the reasonableness of continued use of Hetch Hetchy Valley for water impoundment. Whether San Francisco even needs Hetch Hetchy is probably the most pressing issue.

(Appendix C at pages 26-27)

Environmental Defense's "reasonableness argument" boils down to whether San Francisco "even needs" Hetch Hetchy Reservoir. No California court has held that a water user who is reasonably using water (which Environmental Defense does not dispute) should be enjoined from continuing to use its facilities because there may be some other way in which it could obtain its water supply. There is no requirement that every water supplier must continually reevaluate whether it really needs its facilities – even when it is actively using those facilities and has relied on those facilities historically. The courts would have to create new law for Environmental Defense's argument to succeed.

Environmental Defense Calls for Utopian Role for the State

Environmental Defense envisions the State being the entity to create a "fair resolution of the myriad issues" that would result from Hetch Hetchy removal. Without any specificity as to what authority or jurisdiction would be the basis for this endeavor, Environmental Defense states:

> The State of California likely will need to affirm San Francisco's water use, diversion and storage rights in a new configuration and otherwise assure San Francisco, Turlock and Modesto Irrigation Districts, BAWSCA, and others that a fair resolution of the myriad issues raised by such major changes in San Francisco's water delivery and power generation system will be legally required prior to restoration.

(Page xix)

One of Environmental Defense's concluding remarks is similar:

> The State of California, in furtherance of various of its regulatory and management roles, will also need to act so as to assure San Francisco's water use, diversion, and storage rights in a new configuration. It [the State] must also assure the City, the Turlock and Modesto Irrigation Districts, BAWSCA, and others that it will legally require a fair resolution – prior to implementation of any restoration scenario – of the myriad issues raised by such major changes in San Francisco's water-delivery and power-generation system.

(Page 105)

Environmental Defense does not claim that existing law can accomplish this state role. If Environmental Defense is contemplating legislation, it does not say so. Given the wide-ranging potential impacts of its proposal – on SFPUC, BAWSCA, the Districts, SWP and CVP contractors, and undoubtedly others – legislation would be problematic. The water right and other property and contractual interests which are at stake are so extensive that litigation would be inevitable.

The SWRCB's Role as to San Francisco's Pre-1914 Water Rights Is Very Limited

If by "State" Environmental Defense means the State Water Resources Control Board, there is a chasm between the utopian role Environmental Defense calls for and the statutory jurisdiction of the SWRCB. The SWRCB does not have authority to define the property right created under a pre-1914 appropriation, as it does in the case of post-1914 appropriations. The SWRCB has neither the authority to condition a pre-1914 appropriation nor to reserve jurisdiction to modify or revoke a pre-1914 right. Environmental Defense agrees: "The courts are charged with defining the validity and scope of water rights of pre-1914 appropriators when the extent of such rights or claims is in dispute." (Appendix C at page 8) Environmental Defense also, however, makes the sweeping statement that the SWRCB is the "regulatory entity principally responsible, along with the state courts, for assuring that the City is taking water in compliance with its state-granted water rights . . ." (Page 104) While the SWRCB has some authority to investigate and consider the status of pre-1914 appropriations, that does not equate to having the authority to determine the validity of pre-1914 rights or to ". . . legally require a fair resolution . . . of the myriad issues . . ." raised by the Environmental Defense's proposal.

MODESTO AND TURLOCK IRRIGATION DISTRICT CONTRACTUAL ISSUES

Environmental Defense's "Solutions" for Replacing Lost Water Supply Revolve Around San Francisco Building an "Intertie" to New Don Pedro Reservoir

In Environmental Defense's opinion, the "most obvious means of assuring reliable delivery of Tuolumne River water would be to tap the SFPUC storage in Don Pedro Reservoir . . ." (Page xi) Without Hetch Hetchy, an "NDP Intertie" ". . . could obviously be one of San Francisco's most promising water-supply options . . ." (Page 99)

There is no question that an "NDP Intertie solution" would require monumental changes in the physical and legal relationship between San Francisco and Modesto and Turlock Irrigation Districts. Environmental Defense recognizes that such an arrangement would also be a monumental feat:

> A Don Pedro physical-access and operations negotiation involving San Francisco, the Districts and, at least on some aspects of these matters, downstream interests, will be an exceedingly intricate enterprise. While perhaps not quite at the scale or with as many stakeholders as some other recent water-related negotiations in the region [such as Bay-Delta and Colorado River negotiations] . . . a new Don Pedro agreement would certainly rival them both for its importance and its likely complexity. Each involved party would seek assurances that its interests will be protected and that the protections are memorialized in the final agreements reached. To achieve these ends, not only would the immediately involved parties be called upon to exercise real statesmanship but so would others. The state and federal governments, for example, would surely need to make important contributions, in their regulatory capacities and otherwise.

(Page 99)

San Francisco Does Not Have Access to Divert Water from New Don Pedro

Appendix C succinctly explains that all water stored in New Don Pedro belongs to the Districts:

> The Districts are the owners of New Don Pedro. . . Under the exchange agreement, increased diversions to the CCSF water system are not made physically from the Don Pedro Reservoir. Instead, CCSF's exchange storage space in the reservoir is operated to store water that is credited to CCSF, and CCSF is allowed to make additional diversions upstream to the extent that a credit exists in the reservoir, thus permitting its use by CCSF when the Raker Act would otherwise obligate it to release water for the benefit of the Districts. This exchange storage and credit system is known as the "water bank" in New Don Pedro. The Districts own and have the exclusive control and use of all water stored in Don Pedro Reservoir, including all water in the water bank. Therefore, the water bank should be more realistically viewed as being "paper water" or accounting storage as far as CCSF's "storage" rights are concerned.

(Appendix C at pages 5-6) As this description indicates, this arrangement between the Districts and San Francisco is both complex and unusual, and having a "water bank" account is not equivalent to having water physically in storage in New Don Pedro.

As Environmental Defense points out:

> The City has no infrastructure for conveying its Don Pedro supplies to the Bay Area, . . . nor has it established the legal right to build any such infrastructure. Thus construction of an intertie between Don Pedro Reservoir and the SFPUC's conveyance system would require the active cooperation of the Turlock and Modesto Irrigation Districts.

(Page 44) The ED Report suggests various alternatives for linking Don Pedro Reservoir to the SFPUC conveyance system, all ". . . assuming that the aforementioned legal and infrastructural issues were resolved. . ." From the Districts' standpoint, the Fourth Agreement is clear that the Districts own and operate New Don Pedro, and that San Francisco has no right to directly access water stored in New Don Pedro.

Water is stored in New Don Pedro pursuant to water rights jointly held by the Districts. The Districts would certainly argue that they are fully using New Don Pedro; it must therefore be anticipated that the Districts would not grant access to San Francisco to store water in and to divert water directly from New Don Pedro. Access rights are addressed for post-1914 water rights in SWRCB Regulations.[14] An applicant cannot ". . . use existing works not owned by him . . ." and, "if the proposed project will require a permit, license, or approval from another public agency . . . and it become[s] evident that regardless of the action taken by the board, such permit, license, or approval could not be secured from the proper agency, the application will be rejected." These sections reflect that the SWRCB will simply not insert itself into access disputes regarding post-1914 water rights.[15]

The implications for the Districts' water rights are not addressed by Environmental Defense. If San Francisco were to obtain agreement from the Districts to use a portion of the capacity of New Don Pedro, San Francisco would be seeking to exercise its pre-1914 Tuolumne River rights at New Don Pedro instead of at Hetch Hetchy. At the same time, however, the Districts' post-1914 appropriative rights for storage in New Don Pedro would not be exercised to the extent that San Francisco would be storing water. Either San Francisco's rights to storage could not be moved and would be lost, or the Districts would have to agree to a diminution in their post-1914 storage rights. A negotiated resolution to this impasse is impossible to envision, no matter how great the "statesmanship" of San Francisco and the Districts.

WATER SHORTAGES AND OTHER BAY AREA WATER SUPPLY AND CONSERVATION AGENCY ISSUES

San Francisco's customers, represented by the Bay Area Water Supply and Conservation Agency have a vital interest in the protection and exercise of San Francisco's water rights. BAWSCA appears prominently in Environmental Defense's various lists of "affected entities" who will require assurances, for whom new arrangements will have to be negotiated, and who will "share the cost" of Environmental Defense's proposed actions. Four aspects of the ED Report are unquestionably of crucial concern to BAWSCA, as well as to San Francisco. One is the prospect of increased frequency and magnitude of shortages; the second relates to the Environmental

[14] Cal. Code Regs. tit. 23 §§ 775, 776.

[15] There are also provisions in the Water Code related to "joint occupancy and use" which would apply where ". . . the full capacity of the works built or constructed . . . under an appropriation of water . . . has not developed or cannot develop full capacity of the stream where the works have been . . . built or constructed. . ." (Water Code §§ 775 *et seq.*) (These Water Code provisions apply to post-1914 appropriations.) There is no basis for concluding that the full capacity of New Don Pedro has not been developed and used by the Districts.

Defense's view that a "key uncertainty" is "whether the SFPUC's delivery objective will increase as currently forecast from 260 to 303 [mgd]." (Page xviii) A third critical issue is the water quality impact of Environmental Defense's proposals. A fourth is the cost of "financing restoration".

Current SFPUC delivery objectives would provide water in all but certain critically dry years.[16] In critically dry years, shortages of 10 to 15 percent are projected. Under the Environmental Defense proposals, Environmental Defense's mantra is that SFPUC will still provide full deliveries to its customers "in most years", and that "additional supply would be necessary to fully meet demands without reducing storage to an unacceptable level or imposing 'shortages', as the SFPUC has done during recent droughts . . ." only in the "driest 20% of years". (Page xiii) The mantra that there will be "no loss of reliability" in "most years" or in only "one of five years" is repeated throughout the report.[17]

As discussed, Environmental Defense calls into question the prospect that San Francisco will fully exercise its water rights to divert water from the Tuolumne River in the future, and asserts that demand-side management of both water and power should replace water supply system improvements. This second issue raises the question of future exercise of San Francisco's Tuolumne River water rights.

In addition to substantially increased frequency and magnitude of potential shortages, and an emerging debate over future Tuolumne River diversions by SFPUC, the water quality impacts stand out as a third vital issue for BAWSCA. Appendix B acknowledges that there are numerous problems associated with a water supply system diverting water of quality substantially inferior to that of the Tuolumne River; it fails to acknowledge, however, the benefits and lack of recurrent problems that SFPUC and BAWSCA enjoy because the Tuolumne River supply is of consistently high quality. It is clear from Appendix B that, if SFPUC uses non-Tuolumne River sources, it subjects itself to considerable uncertainty. (Appendix B at page 51) Even though Environmental Defense calls for "more thorough monitoring and evaluation of various water-source options", it concludes that there is apparently no "technical reason that the SFPUC Hetch Hetchy water supply system could not be operated without Hetch Hetchy Reservoir" provided there are "adequate water treatment facilities" in place and "water filtration is added". (Page 67 and Appendix B at page 59) The specific impacts of water quality issues on BAWSCA member agencies was not included in Environmental Defense's analysis.

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[16] Environmental Defense refers to DWR's San Joaquin basin 60-20-20 index as the definition of "critically dry". See footnote 4 to chapter 7 footnotes (page 114).

[17] See, e.g., page xi ("no loss of reliability from restoring Hetch Hetchy Valley, in most years"); "in the driest 20% of years, a small amount of additional water would be needed" (page xii); there would be adequate water to "fully satisfy projected future demands without Hetch Hetchy Reservoir is all but the driest years" (page xviii); in dry years ". . . alternative supplies would be needed" (page 42); ". . . additional supplies would be necessary in critically dry years, or about 22 percent of the time" (page 56); "in critically dry years, additional supplies would be necessary in order to meet delivery objectives. . . Expanded local storage would be needed in order to meet demand for Bay Area customers. . . Both expanded local storage and new supplies would be necessary to meet demand for Bay Area customers" (page 57); ". . . Bay Area supplies would fully meet customers' needs in four out of five years, on average" (page 106).

Environmental Defense only very broadly discusses cost allocation. Cost allocation, however, will be of great concern to BAWSCA. Environmental Defense provides cost estimates for water and power replacement that do not "fully account for all costs of restoration." (Page 86) On certain issues, Environmental Defense calls for further analysis; power replacement costs, for example, are only provided as "an initial planning-level estimate." (Page 85) Environmental Defense's notions that "all parties must work to fairly allocate costs" (page 4) and that ". . . it is not reasonable to ask San Francisco, its customers, and the Districts to act alone" in incurring "significant costs" (page 105), are only notions, and provide no practical assurances to BAWSCA as to either the magnitude or the allocation of costs.

ALTERNATIVE WATER SUPPLY ISSUES – DELTA DIVERSION ALTERNATIVE

The Environmental Defense analysis of an alternative in which SFPUC would divert its Tuolumne River water at the Sacramento-San Joaquin Delta ("Delta") is highly theoretical. In order to model the alternative, Environmental Defense explains that its "CalSim Delta Alternatives Modeling" had to make some extraordinary assumptions regarding water delivery through the Delta. Namely, they had to assume that SFPUC would receive first priority to use Delta pumping capacity and to use the California Aqueduct for conveyance, ahead of either State Water Project ("SWP") or Central Valley Project ("CVP") contractors:

> No effort was made to set proper priorities for the SFPUC's use of Banks Pumping Plant [SWP]. The SFPUC's use of Banks Pumping Plant was modeled simply by assuming that SFPUC would receive first priority in South of Delta deliveries. This resulted in reductions in deliveries to the SWP and CVP which would not occur in reality but were used as an indication of how much water would have to be acquired South of Delta in order to not have reductions in the SFPUC's delivery reliability.

(Appendix A at page 47)[18]

The critical assumption in Environmental Defense's modeling – that San Francisco would have first priority to wheel water through State Water Project ("SWP") facilities – is surreal. San Francisco would not have the first priority, let alone a high priority, to wheel water through SWP facilities. SWP contractors have first priority to use available conveyance and storage capacity.[19]

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[18] Environmental Defense makes it clear that the ramifications of such an alternative are not understood. Delivering water to San Francisco through the Delta: "would cause changes in operations of the Tuolumne River, Delta, and the SFPUC local system. In addition, the maintenance of SFPUC delivery reliability at Baseline alternative levels would require changes in SWP and CVP operations and possible reductions in project [meaning SWP and CVP] deliveries." (*Id.* at page 37)

[19] State law only requires that the owner of a water conveyance facility allow a "bona fide transferor of water the use of a water conveyance facility which has unused capacity, for the period of time for which that capacity is available, if fair compensation is paid for that use." Cal. Water Code § 1810. However,

Wheeling agreements entered into with the Department of Water Resources ("DWR") to use SWP facilities subordinate transfers to all SWP uses. For example, a 1990 wheeling agreement between DWR and San Francisco provided that "[a]ny obligation to transport the water under this Agreement shall be subordinate to scheduling of the delivery of water to SWP contractors." (Agreement for Wheeling Water from Placer County Water Agency to City of San Francisco.) SWP long-term water supply contracts establish contractors' priorities for water deliveries that include transfer of the contractors' SWP entitlements as well as the contractors' non-SWP water. *See* Standard Contract, Article 12(f).

The prospect of obtaining "South of Delta" water to make up for the fact that SFPUC would not be able to pump its water through the Delta in anywhere near the quantities that it released through New Don Pedro is not evaluated as to its practicality or potential. Given drought water purchase prospects, casually suggesting that SFPUC obtain "South of Delta" water is highly misleading. The timing of through-Delta deliveries is problematic, as Environmental Defense recognizes: "Delta pumping plants are often operated at full capacity, but San Francisco's most critical needs might coincide with periods when some spare capacity is available." (Page 45, emphasis added)[20]

The negotiations that would be required to accomplish a through-Delta diversions are recognized by Environmental Defense as being significant, given the conflicts which would be entailed:

> Diverting from the Delta on a regular basis could result in conflicts with other agencies that already do so, and it would require significant negotiation with the California Department of Water Resources, the U.S. Bureau of Reclamation, and their contractors.

(Page 60) Environmental Defense is not strongly pushing a Delta diversion.[21] It suggests that: "Delta diversions might best be accomplished if used to supplement diversions using a Don Pedro intertie . . ." and that transfers or groundwater exchanges to meet critically dry year needs ". . . could be implemented via a Don Pedro intertie alone . . ." Only if supplies had to be obtained from "other parties" would a "Delta intertie . . . be necessary." (Pages 60-61)

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long-term contractors of the conveyance facility owner "shall have the right to use any unused capacity prior to any bona fide transferor." *Id.* at § 1810(a).

[20] Environmental Defense seems to distinguish between diversions through the Delta and an "intertie to the State Water Project". Environmental Defense discusses both, noting that an SWP intertie to the SWP California Aqueduct

> would not be used in most years. In critically dry years, however, such an intertie would allow the SFPUC access to purchase supplies from a wide variety of agencies throughout the state. Without improved access to its Tuolumne River supplies, the SFPUC would need to use an intertie to the State Water Project much more frequently, requiring significant negotiations with SWP contractors.

(Pages 45-46) The nature and scope of those negotiations is not discussed.

[21] Again, there is confusion between a Delta diversion and a "Delta intertie". (See, e.g., pages 60-61.)

As to the significant legal uncertainties pertaining to any Delta diversion, Environmental Defense suggests that San Francisco's "best case" is that

> . . . San Francisco should be able to successfully assert that the seniority of its water rights in the Tuolumne River are sufficient to allow diversion of amounts equivalent to those rights downstream in the Delta. Certainly such a position would have precedence in its favor. . .
>
> When San Francisco proposes to use a Delta water source that is not based on its Tuolumne water rights, however, its prospects are likely to be less favorable. Although . . . municipal and domestic uses of water are entitled to some preference in California water law, the extent of this preference is unclear. . . San Francisco, like other urban agencies in recent years that have purchased or leased agricultural water rights . . . should be able to successfully consummate those acquisitions. They would be subject, however, to outflow requirements or other restrictions that the [SWRCB] or others – such as the [USBR] or [DWR] – may place on the acquisitions.
>
> California water law is still evolving, especially where the Sacramento-San Joaquin Delta estuary is concerned, and the demands on the Delta system have been growing in all sectors. Thus the regulatory, legal, and political responses to these demands cannot yet be said to have produced a situation wherein any potential diverter from the Delta can be wholly comfortable that its water supplies will be available under all circumstances.

(Page 101)

Because of the considerable legal and institutional uncertainties involved, Environmental Defense ends by suggesting that: ". . . San Francisco must receive assurances commensurate with those relied on by other major Delta-water diverters." (*Id.*) There is no discussion of what those "assurances" would be, but the implication is that SFPUC would somehow be at least on a par with SWP and CVP contractors as to wheeling and conveyance capacity for Delta diversions, and would even have preferential use of facilities. The "Delta alternative" is clearly not a viable alternative given current contractual arrangements, facilities ownership, and the overall California water industry's vigorously competing interests and concerns.

ALTERNATIVE WATER SUPPLY ISSUES – OTHER

The "Groundwater Exchange" Concepts Raise Significant Unanswered Issues

Other than substantially increasing the capacity of Calaveras Reservoir, the two supply alternatives discussed by Environmental Defense to replace lost supply, particularly in dry and critically dry years, are "transfers" and "groundwater exchange". As to groundwater storage and

conjunctive use, Environmental Defense recognizes that the Districts have not been inclined to negotiate:

> While the groundwater basins in the vicinity of the Tuolumne River currently have very significant amounts of water in storage, it is also the case that the districts overlying those basins have thus far shown little inclination to negotiate groundwater banking and exchange agreements with San Francisco. The obstacles to successful negotiation that would allow San Francisco to avail itself of this storage capacity are not so formidable, however, that the City should consider ending its pursuit of this option. Although it took over 30 years to conclude the surface-water-sharing agreement between San Francisco, TID, and MID that led to the construction of New Don Pedro, an agreement for sharing underground storage capacity should not take this long. Ultimately, what is crucial is that those communities overlying the basins – and that are directly affected by any conjunctive-use scheme – be assured that they will receive benefits commensurate with the value of the assets they have agreed to share.

(Pages 101-102) Environmental Defense thus basically sees a "groundwater-exchange project with Tuolumne-watershed parties – including TID, MID, or other adjacent districts" as a project that "would be straightforward and could allow additional surface-water diversions to the SFPUC from Don Pedro Reservoir . . ." (page 58), with the only real issue being "the value of the assets" to be shared.

The "groundwater-exchange" concept would entail additional diversions directly by SFPUC from Don Pedro Reservoir. As is true for any of "NDP intertie", San Francisco does not have the right to directly divert water from New Don Pedro, whether as part of a groundwater conjunctive use program or otherwise. Environmental Defense recognizes that any "groundwater exchange" program in the Tuolumne watershed would entail:

> . . . changes in Don Pedro operations for the management of groundwater resources [which] would require agreements with the Turlock and Modesto Irrigation Districts – whose officials might in turn act as intermediaries for deals with other districts in the eastern San Joaquin Valley – together with incentives for the area's agencies and landowners to participate.

(Page 47)[22]

All of the issues that apply to any direct access by SFPUC to New Don Pedro related to exercise of San Francisco's Tuolumne River water rights apply, as well, to any conjunctive use program involving the Districts (or other agencies with the Districts serving as "intermediaries").

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[22] A very large "modeled capacity" for groundwater recharge ponds and in-lieu recharge are assumed. Environmental Defense assumes that the capacity of groundwater recharge ponds is 200 cfs (145,000 acre-feet per year) and that an in-lieu recharge capacity is 386 cfs (23,300 acre-feet per month). (Appendix A at page 28) Environmental Defense does not appear to address the impacts to the Districts of increased total groundwater reliance, a conjunctive use program (whether via in-lieu or direct recharge), or any other impacts on groundwater basins that would be affected.

Recognition of Uncertainties Related to Transfers

Environmental Defense generally recognizes that "transfers are not easy to negotiate." (Page 48) Nonetheless:

> Analysis for this report considers potential transfers from agricultural districts to the SFPUC during dry years. As in the case of groundwater, the simplest water transfers would involve agreements with water rights holders in the Tuolumne River area. With an intertie to the California Aqueduct, however, the SFPUC could purchase water from a wide variety of sellers statewide.

(*Id.*)

Environmental Defense states that ". . . transfers could play essentially the same role as groundwater exchanges in providing supply reliability to the SFPUC and its customers." (Page 59) The discussion of transfers is basically limited to noting that SFPUC would not purchase water in most years, but would instead enter into long-term agreements with purchase options to buy water in dry years. The effects this would have on the Districts, if a Tuolumne River transfer through an "NDP intertie" were to be undertaken, are simply not addressed. Environmental Defense notes only generally that:

> . . . The [agricultural] seller could choose whether to switch to a less water-intensive crop, implement alternative irrigation technology, or permit fields to go fallow during years in which transfers take place.
>
> In many parts of California, mistrust between urban agencies and the agricultural districts that hold senior water rights has prevented transactions, whether groundwater exchanges or transfers . . .

(Page 60) The proposition that Modesto and Turlock Irrigation Districts would be willing to fallow during certain years to allow water to be transferred to SFPUC via SFPUC directly diverting water from New Don Pedro is extreme.

CONCLUSION

There are three categories of legal questions raised by the ED Report. The first category includes broad issues of federal and state law. The most crucial question is whether Congress has the power to revoke the easements granted to San Francisco by the Raker Act, and if it does, whether compensation would have to be made to San Francisco. State law governs water rights, and the second enormously important question is whether the State, through the State Water Resources Control Board or otherwise, has the authority to force San Francisco to relinquish its pre-1914 rights to store water in Hetch Hetchy.

The second category of legal questions raised by the ED Report includes a wide array of issues related to the theoretical alternative arrangements to replace the water and power that would be lost due to the removal of O'Shaughnessy Dam. The ED Report envisions San Francisco having considerable flexibility in how it could accommodate losing Hetch Hetchy. The bedeviling details of how San Francisco could ever actually accomplish diversions directly from New Don Pedro, implement a large-scale conjunctive use program with groundwater basins in the vicinity of the Tuolumne River, construct an intertie to the State Water Project California Aqueduct, obtain the right to make reliable and firm diversions from the Sacramento-San Joaquin Delta, and expand Calaveras Reservoir fourfold, are questions that Environmental Defense cannot answer. Environmental Defense only can repeatedly acknowledge that there are many unresolved issues to be addressed with all of these alternative arrangements.

A third category of legal questions includes the full spectrum of redirected impacts that would result from forcing the removal of Hetch Hetchy. Lost water supplies and power generation would have to be replaced. The implications of substantially greater shortages in supply to San Francisco and its customers are not addressed, nor are the extensive effects on the Modesto and Turlock Irrigation Districts. As the Districts have noted, the Environmental Defense proposal impacts the entire Tuolumne River system and what may be viewed as environmental gains in one area may well be offset by losses in another area.[23]

Environmental Defense answers essentially none of the questions it raises. Notwithstanding its assurances that it has outlined "workable solutions", the outstanding questions vastly outnumber plausible answers. Most critically, the risks are not made clear. The risks are tremendous.

It is not sufficient to simply state that "water and power alternatives must be in place" before O'Shaughnessy Dam is removed. The Environmental Defense proposal stands to set off a staggering array of disputes, all of which would likely end in long-term, complex litigation. This would be an extremely unproductive outcome. San Francisco stands ready to defend its water rights, to pursue the facilities work identified in its CIP, to work with the Districts to identify mutually beneficial efforts, and to continue cooperation on the Tuolumne River and in the local system to protect and enhance the environment.

[23] "The Reality Behind Fantasy of Restoring Hetch Hetchy", *Sacramento Bee* (October 25, 2004).

Water Quality Review of Environmental Defense's "Paradise Regained: Solutions for Restoring Yosemite's Hetch Hetchy Valley"

Executive Summary

The San Francisco Public Utilities Commission (SFPUC) asked CDM to review and analyze several sections of the Environmental Defense's (ED) 2004 report on Hetch Hetchy Reservoir entitled "Paradise Regained: Solutions for Restoring Yosemite's Hetch Hetchy Valley," authored by Spreck Rosekrans, Nancy Ryan, Ann Hayden, Thomas Graff, and John Balbus. The ED report (Report), in essence, evaluates the exchange of one public good (high quality water supply with low vulnerability requiring very little in the way of treatment chemicals, green energy production and a reliable, gravity-flow system) for another (restoration of Hetch Hetchy Valley for increased recreational use).

This review focuses on the water quality aspects of the ED report, particularly, Appendix B which was prepared for ED by EOA, Inc., the Executive Summary, and Chapter 8.

ED's Proposal

The ED report proposes several water supply, conveyance and treatment changes to manage SFPUC supply, in conjunction with restoration of the Hetch Hetchy Valley. With the assumption that filtration (and possibly additional treatment) will be provided, the two principal supply options are:

- Don Pedro Reservoir water (along with Early Intake as a run-of-the river diversion during high flow periods) - This would require construction of a new intertie on the Tuolumne River at or below Don Pedro Reservoir to connect to the Hetch Hetchy Aqueduct.
- Sacramento-San Joaquin Delta - This would entail the use of natural channels in the Delta to convey water and construction of an intertie to the California Aqueduct or Delta-Mendota Canal.

The ED report states that water quality served to Bay Area residents cannot be diminished and maintains that "use of alternative sources such as the Don Pedro and Sacramento-San Joaquin Delta systems will deliver water whose quality is comparable to that of the existing Hetch Hetchy system" or even "superior."

Summary of Findings

While meeting current water quality regulations is feasible, even when treating Delta or Don Pedro water, providing water quality that is "comparable," "not diminished" or "superior" is dubious at best. Five principal issues emerged from this review:

1. Vulnerability of Sources was Discounted

Selection of a high quality source with a high level of protection is a central tenet of sanitary engineering. This tenet finds expression in both informal (e.g., "an ounce of prevention is worth a pound of cure") and formal (e.g., the precautionary principle) terms. This tenet appears to have been overlooked or minimized in the report. Changing sources from Hetch Hetchy Reservoir to Don Pedro or to the Delta will progressively and significantly increase the vulnerability to contamination from both known and unknown contaminants. Qualitatively, the three watersheds are vastly different in terms of geology, size, population density, number/types of activities and controlling jurisdictions. For example, in contrast to Hetch Hetchy, recreational use at Don Pedro includes boating and body contact. For the Delta, in addition to boating and body contact, the level of development and contamination increases. The water quality is quite consistent from Hetch Hetchy whereas it is highly variable from the Delta. Quantitatively, differences are apparent: chemically the mineral levels increase (e.g., TDS), certain organic contaminants appear (e.g., MTBE, toluene and benzene in Don Pedro). Microbiologically, *E. Coli*, a sensitive indicator of fecal pollution which is not detected in Hetch Hetchy, is detected in numerous Delta samples. In contrast to ED, the Natural Resources Defense Council recognizes the sharp contrast in the quality and vulnerability of the Hetch Hetchy watershed and the Sacramento-San Joaquin Delta (Olson, 2002).

The ED analysis tends to discount some risks without clearly sound logic (e.g., ED argues that since MTBE was only detected once at Don Pedro, and even though recreational activity continues, that higher levels of treatment (i.e., for MTBE) would not be needed). ED does not observe that benzene and toluene, components of gasoline, were detected and would not be affected by an MTBE phase out (pg. 47) since the same recreational activities continue.

At best, the ED proposal would substitute for Hetch Hetchy Reservoir a riverine source, with quality variations associated with run-off unattenuated by a reservoir, a higher degree of mineralization and increased vulnerability to water quality contamination. At worst, the ED proposal would have the SFPUC drawing from a highly variable source, with 10 times the level of minerals and a high degree of vulnerability to contaminants for which some of the health effects are still unknown (e.g., endocrine disrupting chemicals associated with agricultural run-off and wastewater discharges).

2. The Water Quality Data Analysis Was Not Robust

There were several limitations to the water quality analysis. First, additional available data could have been reviewed which includes additional data on Don Pedro via records of Don Pedro Recreation Authority and additional seasonal/hydrologic variation of Delta water.

Second, data analyzed for disinfection by-products (DBP) was confined to trihalomethanes, while haloacetic acids should have been discussed as well. Further, DBP should have been analyzed by species since moving from Hetch Hetchy to alternate sources would cause a shift in species of compounds formed which is significant toxicologically.

Third, the assumption that in cases where the majority of observed data was below detectable limits for all water sources, the concentrations of the constituent in all waters is equivalent not only does not focus the evaluation on detected contaminants (as claimed), but it may actually focus undue attention on undetected contaminants. For example, by using this technique to compare sources, the ED report states that MTBE concentrations in Hetch Hetchy are similar to that in the Delta. This statement is both outright wrong and misleading. It is a consequence of ignoring the vast difference in vulnerability of the sources and treating all non-detects the same. This incorrect conclusion is drawn simply because the source vulnerability is not explicitly considered and is further dampened by considering non-detects to be present at the method limit.

Fourth, some information presented in the report appears to be incorrect (e.g., average alkalinity value too high, TOC in Don Pedro is based on a single sample that is too low, coliform levels for Don Pedro, etc.). The ED report propagates these errors in projecting future water quality.

3. Emerging Water Quality Issues Were Not Considered

By not considering source vulnerability and confining the analysis to parameters for which there is readily available data, emerging issues were not even qualitatively considered. These include, but are not limited to:

- *NDMA (N-Nitrosodimethylamine) and other nitrogenous disinfection by-products (DBPs)* – The increased levels of organic nitrogen present in Delta water present additional risk for formation of NDMA and other nitrogenous DBP formation.

- *Brominated compounds* – Thought to be of more health significance toxicologically than their chlorinated analogues, these compounds are preferentially formed during chlorination of Delta water, whereas chlorination of Hetch Hetchy water preferentially forms chlorinated compounds. No analysis by species was presented for the trihalomethanes and other disinfection by-products for which data is available (e.g., haloacetic acids) were ignored.

- *Pharmaceuticals* –Use of pharmaceuticals in both humans and animals is a significant contributor to levels in wastewater effluents. Hetch Hetchy does not receive any wastewater discharges, nor are pharmaceuticals expected to be used in significant quantities among horses in the back-country. Delta water receives domestic wastewater discharges and discharges from confined animal feeding operations.

- *Algal Toxins* –Due to the greater likelihood of algal blooms in Delta sources as compared to Hetch Hetchy, the potential for algal biotoxins increases with Delta sources.

- *Pesticides and Herbicides* – Trace amounts of herbicides and pesticides can periodically occur in Don Pedro and Delta water, but due to source control programs, do not occur in Hetch Hetchy water.

4. Environmental Sustainability is an Overlooked Attribute of the Current System

Consideration of the "green" nature of the current SFPUC system is important. Hetch Hetchy represents a pristine watershed combined with a natural treatment unit (i.e., attenuation-sedimentation in Hetch Hetchy Reservoir), operates under complete gravity flow (therefore not susceptible to flow interruptions due to power outages), requires minimal chemical addition, and not only has low energy requirements but generates energy, too. The changes suggested by the ED report would leave a significant "environmental footprint" with the increased energy requirements due to pumping and replacement of hydro power; increased impacts associated with the production, use and disposal of treatment chemicals and their residuals; construction impacts for new system components; and more.

5. Unintended Consequences Need to be Evaluated

With the loss of a gravity-feed system, the necessary addition of pump stations, pipelines and treatment plants come a variety of secondary consequences (e.g., new chemical transport and handling hazards, new residual streams, increased industrial water use due to demand for low TDS water, increased energy consumption, risks associated with construction-demolition, etc. In many alternatives analysis, secondary impacts (if anticipated) can radically alter the decision-making process. These potential impacts have not been adequately addressed.

Other Items

The limitations of this analysis, while acknowledged in Section 6 of the Appendix B, beg broader questions. For example, the assumption that each source will not change in the future should be assessed by the vulnerability or likelihood of deterioration in the future. Or consider NDMA: while it is mentioned briefly, there is no discussion of the difference in organic nitrogen levels between the sources (Delta has higher levels).

Finally, source water quality variability was not considered (though it is noted), and the widely accepted fact that Delta water quality is much more variable than Hetch Hetchy on a monthly and annual basis is neglected entirely. From a treatment and public health perspective, the potential ramifications associated with this variability makes it an important, and conspicuously overlooked, consideration.

Summary

While Delta water and Don Pedro water can be treated to meet current water quality regulations, the treatment costs and secondary impacts are greater than those for Hetch Hetchy and are anticipated to increase in the future. The most fundamental questions remain unaddressed by the ED analysis: will a change in water source have a negative impact on public health? Would degradation of the water supply outweigh other benefits that Bay Area customers and the environment enjoy by virtue of Hetch Hetchy?

Water Quality Review of Environmental Defense's "Paradise Regained: Solutions for Restoring Yosemite's Hetch Hetchy Valley"

CDM was asked by the San Francisco Public Utilities Commission (SFPUC) to review and analyze portions of Environmental Defense's (ED) 2004 report on Hetch Hetchy Reservoir entitled "Paradise Regained: Solutions for Restoring Yosemite's Hetch Hetchy Valley," authored by Spreck Rosekrans, Nancy Ryan, Ann Hayden, Thomas Graff, and John Balbus. The ED report, in essence, evaluates the exchange of one public good (high quality water supply with low vulnerability requiring very little in the way of treatment chemicals, green energy production and a reliable, gravity-flow system) for another (restoration of Hetch Hetchy Valley for increased recreational use). The trade-offs and complexities involved in such an exchange are numerous.

With a focus on water quality considerations, the following sections review and provide comment on direct quotations from the Executive Summary, Section 8 (Water Quality Analysis) and Appendix B of the ED report.

ED's Proposal

The ED report proposes several water supply, conveyance and treatment changes to manage SFPUC supply, in conjunction with restoration of the Hetch Hetchy Valley. With the assumption that filtration (and possibly additional treatment) will be provided, the two principal supply options are:

- Don Pedro Reservoir water (along with Early Intake as a run-of-the river diversion during high flow periods) - This would require construction of a new intertie on the Tuolumne River at or below Don Pedro Reservoir to connect to the Hetch Hetchy Aqueduct.
- Sacramento-San Joaquin Delta - This would entail the use of natural channels in the Delta to convey water and construction of an intertie to the California Aqueduct or Delta-Mendota Canal.

The ED report states that water quality served to Bay Area residents cannot be diminished and maintains that "use of alternative sources such as the Don Pedro and Sacramento-San Joaquin Delta systems will deliver water whose quality is comparable to that of the existing Hetch Hetchy system" "or even superior."

1. Comments on ED Executive Summary

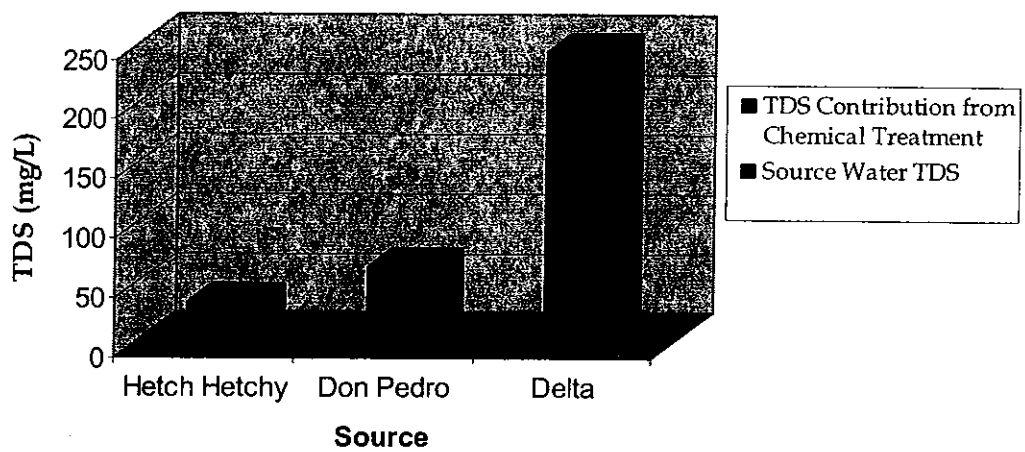
This section provides commentary on direct quotations (page reference noted) from the Executive Summary of the ED report.

1.1 ***"Any plan to restore Hetch Hetchy Valley must assure Bay Area residents who drink Tuolumne River water that the quality of their water will not be diminished if it is stored and diverted further downstream*** **(pg. xiv)."**

With this statement, ED sets the basic guiding principle of the report as nondegradation. Based on this criterion, it is apparent that degradation of water quality is the inevitable result of ED's proposal. This is further supported by the following points:

- Quantitative data indicates that mineral levels increase as pure Hetch Hetchy water passes through rock, soil and sunlight. The data show increases in alkalinity and hardness even at Don Pedro, and much higher levels associated with Delta water. Treatment will increase the total mineral content, as illustrated in Figure 1. Providing comparable levels of Total Dissolved Solids (TDS), an important consideration for both domestic and industrial customers, would require some degree of reverse osmosis (partial treatment with Don Pedro water and full treatment with Delta water). Without additional treatment, increased water use would result amongst industrial customers due to more frequent cooling tower water changes or decreased throughput for high-purity water systems. This could dramatically increase capital costs for installing treatment technology, let alone increased energy and chemical costs.

Figure 1
Effect of Chemical Treatment on Finished Water TDS



- The levels of Total Organic Carbon (TOC) almost triple going from Hetch Hetchy to Delta water. Levels of organic nitrogen, while not well characterized, are also expected to increase. These elevated levels have significant implications for treatment and disinfection by-product (DBP) production, as well as increasing potential for microbial growth in customer plumbing systems.

- Vulnerability to contamination increases with the levels of recreation and development. In Don Pedro, not only is MTBE detected, but other constituents of gasoline such as benzene and toluene occur as well. As Hetch Hetchy has a more protected watershed, such constituents are not only undetected, but are not anticipated to be present at levels beneath the detection limit, as there are no known mechanisms for introduction to the watershed.

1. 2 "Based upon available data **(pg. xiv)...** *"*

The data used in the analysis is incomplete. In particular, additional source and treated water data from Don Pedro Recreational Authority or from Modesto Irrigation District (MID), did not appear to have been analyzed . In addition, the analysis of Delta water quality data neglects the important seasonal and hydrological condition trends that would produce a much more variable water quality than currently experienced with Hetch Hetchy. For example, the TDS levels for SFPUC water normally range from 35 to 60 mg/L. The South Bay Aqueduct TDS varies from 200 to 300 mg/L in a normal year, and from 250 to 600 mg/L in a dry year. In addition, there are seasonal variations in Delta water resulting in diminished quality in the summer and fall. This variability has implications for aesthetic parameters, disinfection by-products and TDS (which can potentially increasing the total supply necessary and/or water purification equipment required by industrial users).

1. 3 "...EOA found that with the addition of existing water treatment technologies, the water quality predicted to result from the Don Pedro or Sacramento-San Joaquin Delta systems should be comparable or superior to the quality of water from the current Hetch Hetchy system **(pg. xiv).**"

Water quality resulting from the Don Pedro or Sacramento-San Joaquin Delta systems would not be superior by any means, for the following reasons:

- As water leaves Hetch Hetchy Reservoir, levels of a variety of constituents increase.

- Conventionally treated Don Pedro water, at a minimum, would have higher barium, chloride and TDS levels both associated with changes in source water quality and the use of chemicals for treatment.

- Conventionally treated Delta water would contain higher levels of hardness, chloride, bromide, nitrate, brominated organic compounds, organic nitrogen and arsenic. Levels would not only be higher but would show higher variability, consistent with the high degree of variability exhibited by Delta source water. This would lead to elevated treatment costs, as well as increased levels of contaminants in treated water.

- The alternative sources suggested in the report are more vulnerable to microbial and chemical contaminants than Hetch Hetchy. This includes both those that can be monitored and those that are of emerging health concern (e.g., pharmaceuticals).

- Based on current health risk data, the potential health effects associated with the compounds that would be uniquely found in Delta but not Hetch Hetchy water (e.g., arsenic, brominated organic compounds, etc.) are generally held to be more significant.

1. 4 "In particular, filtration should reduce the presence of giardia and cryptosporidium to levels lower than those present in the current system. The addition of a water filtration system also provides an extra layer of protection and, along with other precautions in the watershed, would protect customers from contamination resulting from increased recreational use of the restored valley (pg. xiv)."

Filtration will be required to off-set the greater vulnerability of the water source (increased recreation plus loss of natural sedimentation-attenuation processes provided by Hetch Hetchy Reservoir which, with its current long and narrow configuration, acts as a treatment basin). In addition, implementation of technology is not without its own risks. While these are anticipated to be small with a filtration plant treating Tuolumne River/Don Pedro water, filtration does concentrate particulates including pathogens and as such may allow bolus passage of pathogens into the treated drinking water. The risk of this occurring is greater with Don Pedro and Delta water.

In addition, the public health concerns are not confined to microbes as the level of chemical contamination and vulnerability increase as the water travels further from Hetch Hetchy Reservoir. The level of dissolved constituents increases 10-fold between Hetch Hetchy Reservoir and the Delta. This includes increases in levels of hardness, sodium and arsenic.

Addition of filtration will further increase the level of dissolved chemical constituents as a consequence of the treatment chemicals utilized. This not only includes TDS increases associated with coagulation and corrosion control, but includes trace contaminants that are associated with NSF-certified chemicals. A trace contaminant that is associated with treatment chemicals is N-Nitrosodimethylamine (NDMA) that can form in reaction with polymers used for clarification/filtration of the water.

1. 5 "While public safety is paramount, other water quality characteristics such as taste, odor and appearance also matter to consumers (xiv)."

Chemical contamination and the perception that a source is vulnerable to chemical contamination, influences customers. Additionally, the degree of mineralization is important to various industrial users, including those with high purity water requirements and those with cooling towers. An increase in TDS concentration on the order of that found in Delta water would increase the amount of water needed for industrial uses. Further, the high variability exhibited by Delta water could necessitate additional water purification equipment for some industrial users.

1.6 ***"Adding filtration to the treatment process may reduce the amount of chemicals added in the disinfection stage*** **(pg. xiv)."**

While levels of selected chemicals may be reduced, filtration would require addition of multiple new chemicals including ferric chloride, a cationic polymer, a nonionic polymer, and increased levels of corrosion inhibitor.

1.7 ***"Augmenting filtration with additional treatment steps, especially for Delta supplies, will not only ensure the effectiveness of filtration but could also yield finished water that closely matches other aspects of existing water quality*** **(pg. xiv)."**

The implicit question is whether one can treat Delta water to match the current levels of Hetch Hetchy water. That depends, both on what parameters one chooses to match and how much of a technology investment is made. Certain water quality parameters may come close to matching current quality following conventional treatment with advanced disinfection, depending how "close" is defined. For example, it is possible to treat Delta water to produce overall THM concentrations at comparable levels to Hetch Hetchy water. The species formed from the alternate sources, however, are likely to be quite different, with chloroform being dominant for Hetch Hetchy water and mixed bromochloro- species dominant for Delta water. Chloroform is far less significant toxicologically than bromodichloromethane. Consequently, equal concentrations of THMs would have different health risks. In addition, other disinfection by-products formed in Delta water are likely to be more numerous and of greater toxicological significance than those formed in Hetch Hetchy water, which has less organic matter, nitrogenous material and bromide. Some of the by-products that would be formed are currently not quantified, nor is their health significance known.

The finished water salt level, as measured by total dissolved solids, would be much higher with Delta sources than Hetch Hetchy. This would impact industrial users by increasing treatment costs and water use. In addition, higher TDS can impact reuse as well as blending operations (e.g., the Alameda County Water District uses Hetch Hetchy water for blending with their groundwater to meet hardness targets).

1.8 ***"All of the restoration alternatives considered in this study envision that San Francisco's entire water supply would be conventionally treated, including filtration*** **(pg. xvii)."**

Currently, the SFPUC's Hetch Hetchy supply requires minimal treatment. Due to its high quality, filtration is not required. With regulations anticipated to be promulgated in Fall 2005, advanced disinfection, likely with UV or ozone, will be necessary. Under the ED proposed scheme, it may be necessary to include ozone or UV as part of the costs for a new filtration plant.

1.9 ***"Our analysis focused on water treatment technologies in use today in the United States. However, significant advances are being made in this field, and it***

is possible that new water filtration methods will soon cost-effectively provide even cleaner water than is projected using existing technology **(pg. xvii)."**

Source protection continues to be the first and most reliable means of protecting public health, not technology. While it is possible that emerging technologies may cost-effectively provide cleaner water than those in use today, each new technology comes with its own known and unknown risks. Over-optimism about the capabilities of new technology should be tempered. For example, ozone has been widely implemented in the United States as an efficient way of reducing THM and HAA formation. However, the production of bromate, which is of particular health concern, through ozonation of high bromide waters was not thoroughly understood until recently.

1.10 ***"It is also possible that even if San Francisco continues to store its water in Hetch Hetchy Valley, the Environmental Protection Agency may eventually require the City to filter its entire supply*** **(pg. xvii)."**

Current indicators suggest that EPA will not require the City to filter its entire supply, much like Portland, Seattle, Boston and New York City are not required to filter their entire supplies. With greater attention being focused on environmental sustainability (e.g., Baringer, 2005; Sternloff , 2000), a water source that has a relatively protected watershed, a natural treatment unit (i.e., attenuation-sedimentation that occurs in Hetch Hetchy Reservoir), that flows entirely by gravity (and is therefore not susceptible to flow interruptions due to power outages), that requires minimal chemical addition, that not only has low energy requirements but generates energy as it travels to its destination would be ranked very favorably versus the alternative that would replace it.

Conversely, even if filtration were required by EPA, there is a strong conviction amongst sanitary engineers that keeping the highest degree of source protection possible is preferable. Hetch Hetchy Reservoir would provide this feature.

2. Comments on Section 8: Water Quality Analysis

This section provides commentary on direct quotations from Section 8 of the ED report.

2.1 ***"Given that no one process is likely to be a panacea, or even adequate for treating all contaminants, water systems normally use a multiple-barrier approach to ensuring delivery of safe and healthy water. The first step is at-the-source protection of the watersheds themselves* (pg. 64)."**

This is precisely why getting the highest quality source possible is given strong priority. As Dr. Steve Hrudey, in the Journal of the Australian Water Association, January 2001 states:

> *More than a century of experience in public health practice has shown us that prevention is better than cure. These lessons clearly apply to drinking water where we know that, in most cases, source protection measures can prevent problems from developing in the first place.*

Furthermore, the vulnerability of the watersheds increases dramatically as one proceeds from Hetch Hetchy to Don Pedro to the Delta. This vulnerability is why the Natural Resources Defense Council (NRDC) rates Hetch Hetchy very differently than the Delta (Olson, 2003):

> *Source water protection is an essential component of drinking water protection. San Francisco's Hetch Hetchy and, to a lesser extent, Alameda water supplies offer fine examples of strong source water protection. The Hetch Hetchy is located in Yosemite National Park and is protected from most human-caused pollution sources, except occasional recreational use of the watershed.*
>
> *NRDC's review of the most recent available information on the Hetch Hetchy area's watershed in the EPA Envirofacts database, and our review of SFPUC, USGS, and other information on the area immediately around and upstream from the reservoir, leads us to rank the Hetch Hetchy as a 2 on the 1-6 scale, using EPA's IWI criteria (high water quality, relatively low vulnerability).*
>
> *...the Sacramento-San Joaquin Delta is under extreme stress from heavy upstream agricultural use, including heavy pesticide and herbicide applications, and is rated by EPA's IWI as a 5 out of 6, due to "more serious problems" with water quality.*

With a high quality source as its foundation, the SFPUC has the additional barriers of natural pre-treatment (i.e., reservoir attenuation of potential contaminants) and disinfection. The SFPUC's source water protection program is strong and sound. The SFPUC's current multi-barrier approach will be further augmented in the next 7 years by addition of an additional disinfectant to increase the level of treatment.

2.2 ***"Under a rare regulatory exemption, the SFPUC is not presently required to filter its Tuolumne River supplies*** **(pg. 64)."**

Other major municipal areas including Boston, New York City, Portland, Seattle and Tacoma are also not required to filter their supplies. These cities serve a combined population of approximately 15 million people.

2.3 ***"The question is: How would these changes alter the quality of the water that San Franciscans drink*** **(pg. 65)?"**

There are other questions: how would this impact industrial water uses? For example, cooling towers would require more water or installation of treatment. High-tech users would require additional treatment and more water (California Energy Commission, 2003).

2.4 ***"A comparison of water samples from these sources—Don Pedro, the Sacramento-San Joaquin Delta, and Hetch Hetchy Valley—indicated that they had minor differences in overall quality, although Hetch Hetchy samples did have lower levels of several contaminants*** **(pg. 65)."**

The term "minor" is vague, and conveys different meaning when applied to percentage differences, relative concentrations, and health significance. For example, an arsenic concentration of 2 µg/L (the detection limit in the data summary) does not seem too different from 0.2 µg/L), yet the projected difference in theoretical cancer cases, because of arsenic's high potency, is approximately 4 cases in 10,000 people. Use of the assessment "minor" does not adequately capture the subtleties of the health risk associated with certain contaminants.

2.5 ***"Most important, the Hetch Hetchy water was lower in bacterial contamination and slightly lower in levels of giardia and cryptosporidia*** **(pg. 65)."**

More importantly, underlying this observation of lower bacterial contamination is a significant difference in vulnerability. The potential for contamination grows as the water progresses from Hetch Hetchy to Don Pedro and then through the Delta.

While the report cites *Cryptosporidium* and *Giardia* as indicators of vulnerability, a more reliable microorganism for determining vulnerability is *E. Coli*, for which detection methods and recovery are better understood (WHO, 1996). *E. Coli* is a reliable indicator of fecal pollution. Delta water displays numerous detections of *E. Coli* , while Hetch Hetchy does not.

2.6 ***"Several chemical contaminants, including MTBE and barium, were higher in the Delta and Don Pedro Reservoir. The Delta water in particular was higher in arsenic and had a greater capacity to form trihalomethanes than either the Don Pedro or Hetch Hetchy raw waters...*** **(pg. 65)."**

Presence of MTBE shows vulnerability to contamination associated with recreation. While the phase out of MTBE will reduce exposure, it will not end recreational activities and the known and unknown hazards associated with them. Consider that gasoline will continue to be used and that some of its components (e.g., benzene and toluene) have been detected in Don Pedro. In addition to boats and combustion engines, recreational contact of the people in and around Don Pedro also is a source of potential contamination. Hetch Hetchy has no known sources of MTBE contamination.

Barium has a proposed Public Health Goal (PHG) of 0.7 mg/l based on non-carcinogenic effects including increased blood pressure and other cardiovascular effects, gastric upset, kidney damage, and neurological effects ranging from stimulation to paralysis. While levels in Delta water are still well below the proposed PHG value, they are significantly higher than those in current SFPUC supplies as noted by ED. For example, barium was detected in all South Bay Aqueduct samples, with an average reported Delta water concentration of 110 μg/L. In contrast, barium was only detected in half of the samples at Alameda East, and only one out of five samples from Moccasin Reservoir, for an average Hetch Hetchy barium concentration of 5 μg/L (the method detection limit). This represents at least a 22-fold increase in barium concentration from Hetch Hetchy to Delta supplies. While barium concentrations are much lower in Don Pedro than in the Delta, barium was detected in all Don Pedro samples, with an average concentration more than five times that of Hetch Hetchy supplies.

Arsenic is a primary concern. It occurs naturally, and is widely present in the earth's crust. Natural mineral deposits may contain high levels of arsenic. California is currently in the process of developing a new MCL for arsenic. As arsenic is a carcinogen, its Maximum Contaminant Level Goal (MCLG) is zero. The new PHG, 0.004 μg/L (4 parts-per-trillion), is based on the mortality of arsenic-induced lung and urinary bladder cancers observed in epidemiological studies in Taiwan, Chile and Argentina, where the estimated risk was calculated to be 2.7×10^{-4} (μg/L). This means that the PHG of 0.004 μg/L represents a one in one million theoretical cancer risk. Arsenic is classified as a Group 1 contaminant, "causally associated with cancer in humans". Arsenic has also been shown to be atherogenic, genotoxic, and teratogenic, and causes other adverse effects in exposed children. It is not detected in Hetch Hetchy – it is detected in Delta water at levels equivalent to a 5 in 10,000 theoretical cancer risk. Even though the concentration would be reduced by treatment, it is unlikely that the remaining risk would be trivial.

Concentration of trihalomethanes, while important, is not the only issue. Of additional concern are other disinfection by-products (e.g., haloacetic acids) and the individual species of each disinfection by-product class. Brominated compounds, such as bromate, are thought to be of more significance toxicologically, and are preferentially formed during chlorination of Delta water, whereas chlorinated compounds are formed when Hetch Hetchy water is chlorinated. While bromide levels are typically very low in Hetch Hetchy and the local reservoirs, introduction of Delta water during droughts has increased bromide levels in the system. Use of

ozone, UV or chlorine dioxide minimizes free chlorine contact time, which is the principal treatment factor in forming these compounds suspected to be of greater health significance than their chlorinated analogues. Simple removal of natural organic matter and any significant contact time with chlorine, however, favors the formation of brominated compounds.

The increased levels of organic nitrogen certainly present in Delta water and (possibly in Don Pedro) as compared to Hetch Hetchy present elevated risk of NDMA and other nitrogenous DBP formation. NDMA occurrence in drinking water may result from chlorination of organic nitrogen. Chlorination of organic nitrogen can also result in the formation of nitrogenous DBPs of health and regulatory concern (e.g. nitrosamines, haloacetonitriles (HAN), halonitromethanes, cyanogen halides). Using comparative genotoxicity and cytotoxicity assays, it was concluded that nitromethanes, especially di- and tribrominated nitromethanes, pose high potential human toxicity (Plewa et al.). While the limited available data would indicate that occurrence of HANs and nitromethanes occur at quite low levels, exposure assessments for DBPs containing organic nitrogen have been limited (Singer et al., 1995; Diehl et al., 2000; Krasner et al., 2001). There is some plausibility that nitrogenous DBPs such as NDMA account for the bladder cancer results observed in epidemiology studies of chlorinated drinking water (Bull, 2003).

2.7 ***"...it is known that agencies using Delta water are able to remove arsenic through filtration, as it is largely present as suspended particle*** **(65).".**

The word "largely" is vague. As arsenic is detected in Delta water, and the detection limit is 2 µg/L, it is likely that partial removal is achieved through filtration. The efficacy of filtration alone for arsenic removal will depend on that "non-majority" component of arsenic that is soluble and its concentration. For example, if the total detected concentration is 5 µg/L, and "largely" refers to 3 µg/L which is particulate, this would leave 2 µg/L soluble. Filtration could remove at least 3 µg/L, still leaving 2 µg/L which is soluble, a fraction of which will still remain in the filtered water, which is significant from a public health risk standpoint. Further, how that would compare to current Hetch Hetchy levels is unknown since arsenic has never been detected in Hetch Hetchy.

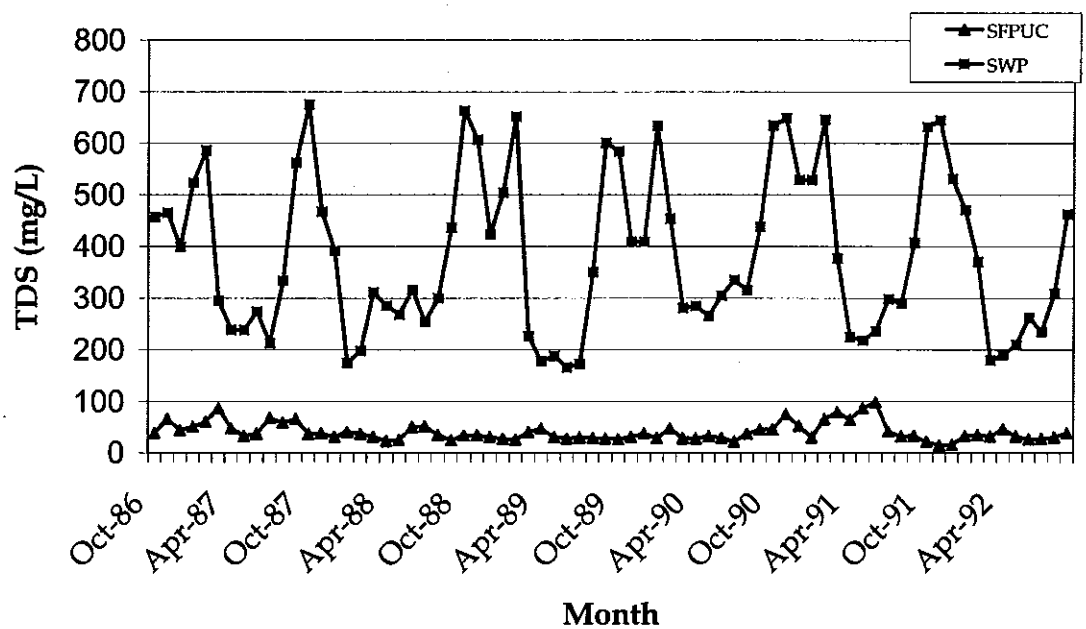
3. Comments on Appendix B: Water Quality Evaluation for Hetch Hetchy Alternatives

This section of the review addresses the quality of the analysis and data sources used, gaps in the analysis, and what CDM would consider to be the remaining questions.

3.1 Data Considered

It is our view that additional available data could have been reviewed: additional data on Don Pedro via records of Don Pedro Recreation Authority and additional seasonal/hydrologic variation of Delta water (see Figure 2).

Figure 2
SFPUC and SWP Extended Dry Year TDS Concentrations



In addition, data for disinfection by-products (DBP) was confined to trihalomethanes, while haloacetic acids should have been discussed as well. Further, DBP should have been analyzed by species since moving from Hetch Hetchy to alternate sources would cause a shift in species of compounds formed which is significant toxicologically. Table ES.1/2.2 and Attachment 1 of Appendix B did not identify haloacetic acids, even though they are currently regulated. Other compounds that should have entered ED's Attachment 1 at a minimum are the haloacetonitriles and halonitromethanes, as these have been cited by EPA and monitored by many utilities during the Information Collection Rule.

3.2 Quality of Information

Lack of analysis of seasonal and hydrological water quality differences biases the comparison of sources. For example, an average TDS of 27 mg/L is shown for Alameda East, compared to 216 mg/L for Delta water (this is untreated TDS - concentration will increase by ~ 30 mg/l with treatment). What this simple comparison does not capture is that the Alameda East value varies very little, while wide swings in Delta TDS occur seasonally as well as with hydrology (see Figure 2). During drought conditions, SFPUC concentrations remain low, while Delta TDS levels increase to upwards of 600 mg/l. Thus, the Delta delivered quality would change in a manner that SFPUC water currently does not.

On page 27 of Appendix B, it states:

> *To facilitate the comparison between the various water sources, it was assumed for the purpose of this evaluation, that in cases where at least 90% of the observed data for a particular constituent were below detectable limits for all water sources, that the concentrations of that constituent in all waters were effectively equivalent. Employing this assumption effectively focuses the water quality evaluation on constituents that were detected (detectable constituents) in the various raw and treated waters.*

The assumption that in cases where the majority of observed data was below detectable limits for all water sources, the concentrations of the constituent in all waters is equivalent not only does not focus the evaluation on detected contaminants (as claimed), but it may actually focus undue attention on undetected contaminants.

This type of analysis can occasionally be useful in evaluating the upper limit of potential contamination in sources for which contaminants are reasonably likely to be present at or below the detection limit. However, if a contaminant has never been detected in a given source, and if it is unlikely that the contaminant is present in the source given a lack of known routes for introduction of the contaminant to the source, the assumption that the contaminant is present at the detection limit can give the false appearance of contamination that is, in reality, unlikely to exist at all. When using this technique to compare sources, the distinction between water qualities can be blurred. On page 29 of Appendix B, it is stated that MTBE concentrations in Hetchy are similar to that in the Delta. This statement is both outright wrong and misleading. It is a consequence of ignoring the vast difference in vulnerability of the sources and treating all non-detects the same. As discussed previously, it is highly unlikely that MTBE is present at any level in SFPUC water, as there is no known method for introduction into SFPUC supplies. Assuming that MTBE is present at the detection limit implies that MTBE would vary in concentration in SFPUC's current supplies (Appendix B, Table 3.2). This incorrect conclusion is drawn simply because the source vulnerability (or, in the case of SFPUC sources, lack thereof) is not explicitly considered and is further dampened by considering non-detects to be present at the method limit. The statement "...the predicted water quality shown in Table 3.2 is based on available data as described previously, and that constituents that were

reported to be principally below detectable limits in all waters are not shown...." at the top of page 34 (Appendix B) is untrue.

In addition to the inaccurate calculations of averages, inconsistent method detection limits are used to calculate standard deviations for contaminants that were never detected with any of the detection limits used. For example, Table 2.3a indicates that all nine samples from Hetch Hetchy Reservoir were below detection for arsenic. However, the average value cited is 3.8 µg/L, presumably the method detection limit. Table 2.4a indicates that all four samples for Moccasin Reservoir are similarly non-detect for arsenic. In this case, the average is presented as 1.8 µg/L, indicative of a different method detection limit than for the Hetch Hetchy Reservoir samples. These different detection limits are then averaged together to derive the weighted average arsenic concentration for SFPUC sources. As described above, even using consistent detection limits to perform this type of calculation can be misleading. Other potentially more reasonable approaches to estimating the occurrence of undetected contaminants include treating non-detects at ½ , ¼ or 0 of the detection limit, and using information about chemical use in a given watershed to guide the expectation of occurrence.

Further, some information presented in the report appears to be incorrect. For example, Table 2.10 (Appendix B, pg. 26) reports an average alkalinity for SFPUC supplies of 92 mg/L, which is significantly higher than expected, and in fact conflicts with the other average of 13 mg/L for same location by nearly an order of magnitude. No discussion of the outlier data is included. In Table 2.12b (Appendix B, pg. 31), this error is compounded for alkalinity.

The value for TOC in Don Pedro is estimated as the detection limit, as only a single 1992 sample was used, and this value (0.5 mg/L) is clearly wrong. This number comes from a single sample that occurred during the 1987-1992 extended drought, and the impact of lower reservoir levels during the drought on algae and TOC have not been adequately characterized by the data review. Based on 49 monthly monitoring samples collected by MID between 2001 and 2005, the mean TOC value is approximately 1.6, with a standard deviation of 0.2, which is more than 3 times the low estimate used in the ED report. Rather than address the outlier data leading the artificially low TOC estimate for Don Pedro, ED propagates this error in projecting future water quality presented in Table 4.2 (Appendix B, pg. 41).

Based on monitoring data obtained from MID (Ward, 2005), ED significantly underestimates microbial contamination in Modesto Reservoir, particularly for total coliform. Long term monitoring data from 1996 through 2005 provided by MID reveals average total and fecal coliform values of 15 and 5 MPN, respectively. Table 2.6 of Appendix B presents average values of 4 and 2 MPN, respectively. Based on the wide variation in quality for various parameters between the two sources, the assumption that Modesto Reservoir data is a good surrogate for Don Pedro data is flawed. In addition, Table 4.2 (Appendix B, pg. 41) neglects arsenic, which actually was detected in Don Pedro.

3.3 Gaps in the Analysis

In focusing the analysis on specific water quality parameters for which there is data, the vulnerability of sources is not considered (e.g., recreational use at Don Pedro which includes boating and body contact, or the increased development and contamination associated with the Delta use). The analysis does not acknowledge a major tenet of sanitary engineering which is obtaining the highest quality source possible. The Appendix B data show the difference in vulnerability by the virtue of MTBE being detected in Don Pedro, but not Hetch Hetchy.

By not considering source vulnerability and confining the analysis to parameters for which there is readily available data, emerging issues were not even qualitatively considered. These include, but are not limited to:

- *NDMA (N-Nitrosodimethylamine) and other nitrogenous DBPs* – The increased levels of organic nitrogen present in Delta water present additional risk of NDMA and other nitrogenous DBP formation. NDMA occurrence in drinking water may result from chlorination of organic nitrogen. Chlorination of organic nitrogen can also result in the formation of nitrogenous DBPs of health and regulatory concern (e.g. nitrosamines, haloacetonitriles (HAN), halonitromethanes, cyanogen halides). Using comparative genotoxicity and cytotoxicity assays, it was concluded that nitromethanes, especially di- and tribrominated nitromethanes, pose high potential human toxicity (Plewa et al). While the limited available data would indicate that occurrence of HANs and nitromethanes occur at quite low levels, exposure assessments for DBPs containing organic nitrogen have been limited (Singer et al., 1995; Diehl et al., 2000; Krasner et al., 2001). There is some plausibility that nitrogenous DBPs such as NDMA account for the bladder cancer results observed in epidemiology studies of chlorinated drinking water (Bull, 2003).

- *Brominated compounds* – Thought to be of more significance toxicologically than their chlorinated analogues, these compounds are preferentially formed during chlorination of Delta water, whereas chlorination of Hetch Hetchy water preferentially forms chlorinated compounds. While bromide levels are typically very low in Hetch Hetchy and low in the local reservoirs, introduction of Delta water during droughts has increased bromide levels in the system. Use of ozone, UV or chlorine dioxide minimizes free chlorine contact time which is the principal treatment factor in forming these compounds suspected to be of greater health significance than their chlorinated analogues. Simple removal of natural organic matter and any significant contact time with chlorine, however, favors the formation of brominated compounds.

- *Pharmaceuticals* –Use of pharmaceuticals in both humans and animals is a significant contributor to levels in wastewater effluents. Hetch Hetchy does not receive any wastewater discharges, nor are pharmaceuticals expected to be used in significant quantities among horses in the back-country. Delta water receives domestic wastewater discharges and discharges from confined animal feeding operations. Metabolites from analgesics, antirheumatics, and lipid regulators were

detected in German well waters (Giger, 1999). Chlorine is generally ineffective for oxidizing these compounds. In data from Berlin, Germany, ozonation removed carbamazepine and diclofenac extremely fast. Bezafibrate and clofibric acid, however, were only eliminated to a limited extent using ozonation. While granular activated carbon (GAC) filtration was also very effective for removal of carbamazepine, diclofenac, and bezafibrate, its elimination of clofibric acid depended on the water quality and on the processing-time of the GAC (Heberer, 2000). The various intermediates that are formed during metabolism and the intermediates formed during treatment are unknown.

- *Algal Toxins* – Associated with blue-green algae, these toxins have had significant impacts on cattle in other countries. In addition to their short-term effects, however, there is evidence that they may be potent liver carcinogens. The World Health Organization has set a 1 μg/l guideline of microcystin-LR. However, some Japanese researchers have suggested, based on their work in China, that the guideline level should be 100 times lower. Little work on quantification has been done in North America. From a treatment perspective, while chlorine is effective for a few of these toxins, ozone is effective in oxidizing most of these toxins. Due to the greater likelihood of algal blooms in Delta sources as compared to Hetch Hetchy, the potential for algal biotoxins increases with Delta sources.

- *Pesticides and Herbicides* – Trace amounts of herbicides and pesticides can periodically occur in Don Pedro and Delta water, but due to source control programs, do not occur in Hetch Hetchy water. Ozonation coupled with GAC can remove these parent compounds, depending on the ozone dose and the GAC condition. Coupling ozone with hydrogen peroxide further improves removal efficiency. A concern raised in *Identifying Future Drinking Water Contaminants* (National Academy of Science, 1999) is that the degradates of herbicides are often found even when very little of the parent compound is detected. As the health effects of many of these degradates are not known, it is unclear how significant they will become. The resistance of these degradates to ozone has not been thoroughly investigated.

- *Tastes and Odors* – Aesthetics probably have the most significant impact on customer satisfaction. Tastes and odors are leading factors contributing to customers seeking alternative sources (i.e., point of use devices, bottled water, etc.) and also serve as surrogates for consumer sense of safety. Stating that the water meets all drinking water regulations, even though tastes or odors are present, is generally unpersuasive to customers (McGuire). As noted by Jardine et al. (1997), customers may sometimes be correct in reasoning that tastes and odors indicate a potential hazard, since many potential water contaminants can pose a health concern at levels below those that can be detected by odor. They conclude:

  > *The absence of offensive tastes or odors in drinking is a necessary, but not a sufficient condition for consumers to be assured of the safety of their drinking water. Unless very specific and reliable evidence can be provided, consumers will have rational grounds to question the security of their water supply.*

> The aesthetic issues that are a key concern for many of Delta customers are most successfully treated by ozone coupled with GAC. Use of ozone in high bromide waters such as those occurring in Delta water, however, can produce bromate, which is of particular health concern.

Further, it is misleading to compare Hetch Hetchy treated water quality to projected raw water quality of other scenarios. TDS increases with treatment. As such, if comparing to raw water TDS for other scenarios, Hetch Hetchy treated water TDS should be corrected by subtracting the amount of TDS pick-up associated with treatment.

While the report cites *Cryptosporidium* and *Giardia* as indicators of vulnerability, a more reliable microorganism for determining vulnerability is E. Coli, for which detection methods and recovery are better understood (WHO, 1996). *E. Coli* is a reliable indicator of fecal pollution. Delta water displays numerous detections of *E. Coli* , while Hetch Hetchy does not.

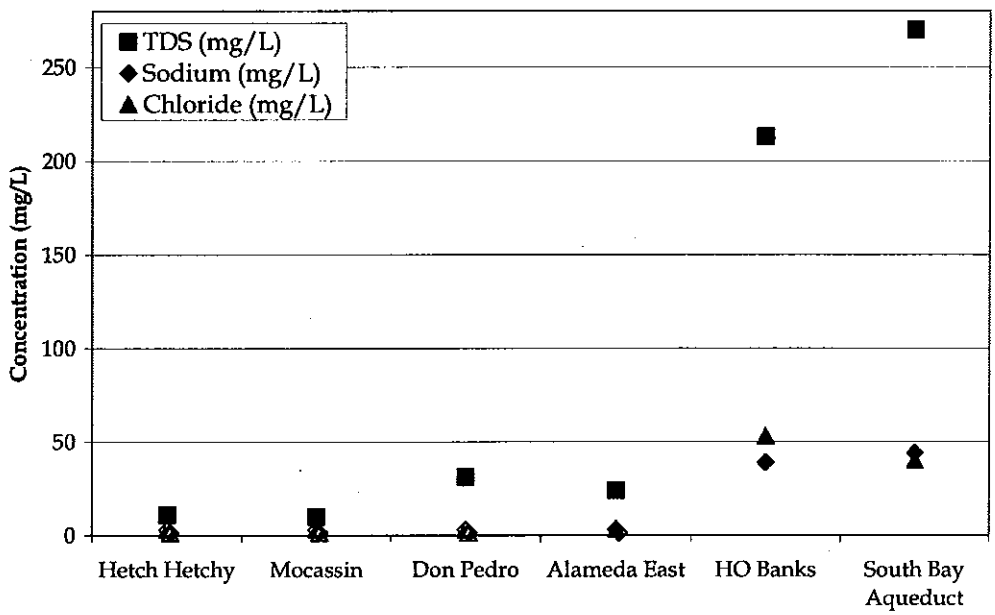
4. Response to Conclusions Drawn by EOA

Three conclusions drawn by EOA in Section 8 of the report are discussed below.

4.1 "A comparison of water samples from these sources—Don Pedro, the Sacramento-San Joaquin Delta, and Hetch Hetchy Valley—indicated that they had minor differences in overall quality... (pg. 65)"

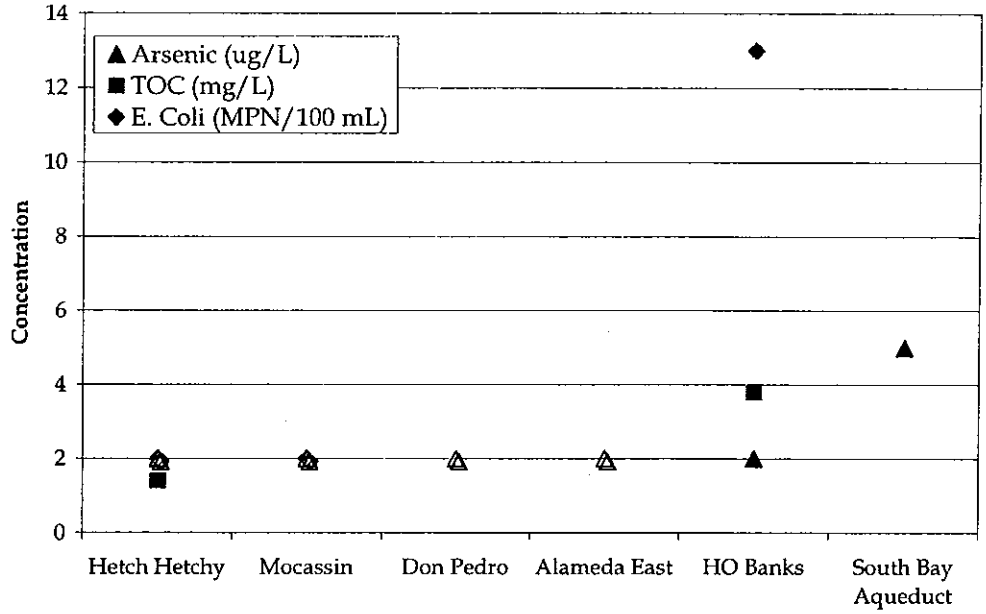
Quality differences between Hetch Hetchy and other water underestimate the significance of source vulnerability as well as the significance of the extremely low TDS and its consequence for municipal and industrial users. Water quality data presented in Appendix B (incomplete) is shown in Figures 3 and 4 for TDS, sodium, chloride, arsenic, TOC and E. Coli to illustrate changes between Hetchy Hetchy, Don Pedro and the Delta. TOC, as one of the major precursors for disinfection by-product formation, is particularly important as precursor removal has been a keen focus of regulatory discussions.

Figure 3
Change in Water Quality Parameters by Source[1,2]



1. Non-detects plotted at the detection limit with open symbols.
2. TDS at Alameda East includes increase associated with addition of lime and sodium hypochlorite.

Figure 4
Change in Water Quality Parameters by Source[1]



1. Non-detects plotted at the detection limit with open symbols.

4.2 "... *With the addition of existing filtration technologies, and based on available data, the water quality predicted to result from use of the Don Pedro or Sacramento-San Joaquin Delta source should be comparable, or even superior, to the quality of water from the current Hetch Hetchy source. In particular, filtration should reduce the presence of giardia and cryptosporidia to levels lower than those present in the current scheme..* **(pg. 66)."**

Direct filtration is not likely to be applicable for alternatives, especially with the design criteria developed for Hetch Hetchy. The MID plant is a conventional treatment plant with moderate filtration rates. Costs are likely to be higher than projected for a direct filtration plant. Furthermore, *Giardia* and *Cryptosporidium* are discussed without noting the *E. Coli* differences between Hetch Hetchy and the Delta. At a minimum, these results highlight the difference in microbial vulnerability.

4.3 ***"The higher levels of MTBE in the Don Pedro water may be more difficult to remove by filtration techniques, though the predicted levels of 1-2 micrograms/liter (mcg/L) are well below the California state standard of 13 mcg/L. It should also be noted that MTBE levels in water sources are expected to decline, as this chemical is no longer added to gasoline in California*** **(pg. 66)."**

The slant of the analysis is colored, not by the precautionary principle, but by a risk-discounting principle (e.g., since MTBE was only detected once at Don Pedro, and even though recreational activity continues, even though with the MTBE phase out, there may be some new risks – in light of all this likely do not need more treatment). It is not mentioned that benzene and toluene were detected in Don Pedro and would not be affected by an MTBE phase-out [pg. 47]).

The limitations of this analysis, while acknowledged in Section 6 of the report, beg broader questions. For example, the assumption that each source will not change in the future could be assessed by the vulnerability or likelihood of deterioration in the future (Delta is more likely to deteriorate than Hetch Hetchy). Or consider NDMA. While it is mentioned briefly, there is no discussion of the difference in organic nitrogen levels between the sources. Finally, variability was not considered (though it is noted), and the widely accepted fact that Delta water quality is much more variable than Hetch Hetchy on a monthly and annual basis is neglected entirely. The potential ramifications from a treatment and public health perspective (e.g., potential acute health concerns associated between disinfection by-product peak concentrations and spontaneous abortions) associated with this variability make it an important, and conspicuously overlooked, consideration.

Can Delta or Don Pedro water be produced that meets current regulations? Yes, Delta and Don Pedro users are doing so today, though at greater costs and lesser quality than the SFPUC. Will they continue to meet regulations in the future? One hopes so, even though treatment costs and secondary impacts will increase beyond the current levels. Yet the most fundamental question remains unaddressed by this analysis: will a change in water source have a negative impact on public health? Would degradation of the water supply outweigh other benefits that Bay Area customers and the environment enjoy by virtue of Hetch Hetchy?

5. Other Thoughts: Secondary Impacts

There are a variety of secondary impacts that would need to be considered in terms of overall analysis. An outline of these items is shown below.

a. Residual streams associated with treatment
    I. Plant solids
    II. Residuals to Bay
        1. Metals
        2. Total dissolved solids
        3. Trace contaminants
b. Cooling tower treatment and other industrial uses
    I. Impacts of higher TDS on increased water use
    II. Discharge of brines if treat
c. Energy consumption
    I. Direct use for pumping and treatment if construct a new filtration plant
    II. Loss of non-polluting green power associated with hydro facilities
    III. Chemical production for treatment: adding a filtration plant would require addition of a metal salt, organic polymers, and higher doses of pH adjusting chemicals.
    IV. Transportation of chemicals
    V. Additional pumping of water and treatment for industrial uses
d. Risks associated with construction (e.g., accidental death or dismemberment)
        1. Demolition of O'Shuagnessy
        2. Connecting pipelines
        3. Treatment plant

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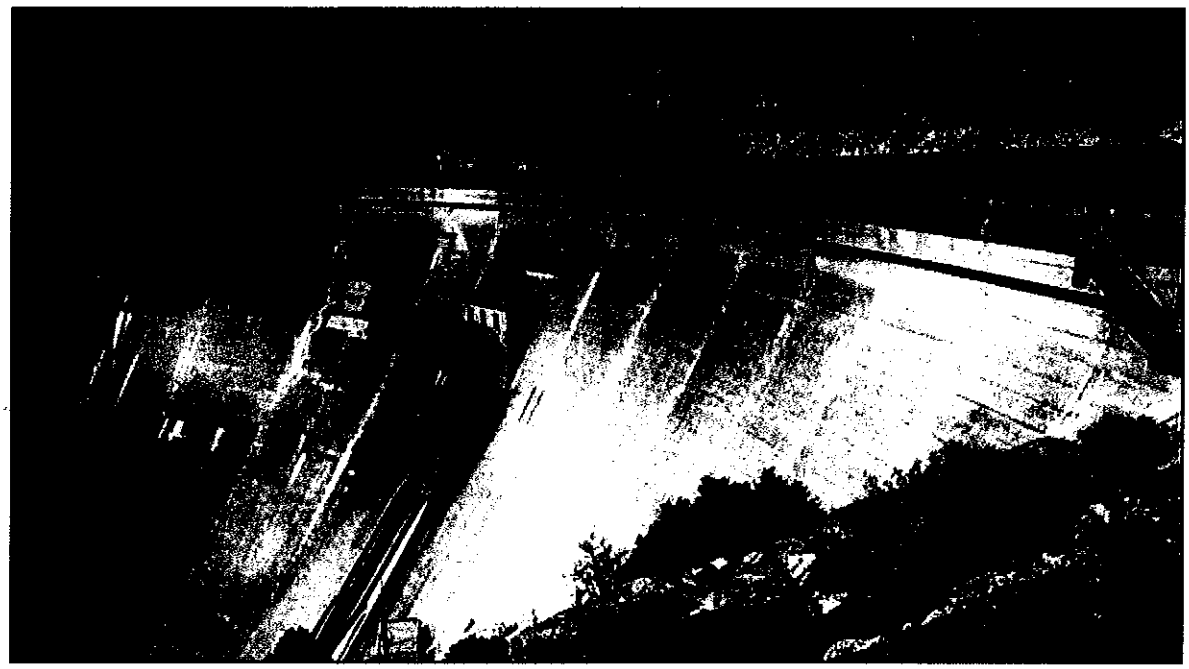
TECHNICAL REPORT

ASSESSMENT OF THE FLOOD CONTROL IMPACTS OF THE REMOVAL OF HETCH HETCHY DAM AND RESERVOIR, TUOLUMNE RIVER, CALIFORNIA



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1. INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this report is to provide an assessment of the flood control impacts to areas downstream from New Don Pedro along the Tuolumne River from the potential removal of Hetch Hetchy Dam and Reservoir. The assessment is primarily a comparison of New Don Pedro Dam operations, with and without Hetch Hetchy Dam, for several historical floods.

1.2 BASIN DESCRIPTION

The Tuolumne River lies on the western slope of the Sierra Nevada. Several large dams regulate the flow of the river. Of these, New Don Pedro is the only reservoir to have federally authorized flood control space. The Tuolumne basin above New Don Pedro Dam has a drainage area of 1,533 square miles. Hetch Hetchy is situated approximately forty miles upstream on the Tuolumne River. It has a drainage area of 455 square miles. New Don Pedro Reservoir is operated by Turlock Irrigation District in collaboration with the Modesto Irrigation District. The upstream reservoirs (Hetch Hetchy, Cherry Valley and Lake Eleanor) have a combined capacity of 660,000 acre-feet and are operated by the San Francisco Public Utilities Commission (SFPUC). All of the Tuolumne River reservoirs store significant water during flood periods and as a result reduce peak flows on the Tuolumne River downstream from New Don Pedro Dam. The flood control benefits to flow reduction are displayed on Figure 1 which shows the peak regulated and unregulated frequency curves for the Tuolumne River at New Don Pedro Dam. More detailed description of the basin geography can be found in the Don Pedro Lake Report on Reservoir Regulation for Flood Control (flood manual; USACE, 1972).

2. HYDROLOGY

2.1 HISTORICAL FLOODING

Several significant flood events have occurred in the recent historical record of the Tuolumne River. The runoff has either been primarily driven by rain or by the melting of snow. The rainfloods are faster acting and more severe over short durations, while the snowmelt floods are characterized by smaller peak flows but much longer durations than the rainfloods. The historical floods on the Tuolumne River were studied and several were selected based on the size of the flood and the availability of flood data for inclusion in the analysis provided in this report.

The rainfloods selected occurred in water years 1956, 1969, 1986, and 1997. Of these, the 1956 and 1997 floods were the most severe floods in the hydrologic record (1897 to 2005). The flood manual (USACE, 1972) shows detailed plots of the 1956 and 1969 flood events.

The snowmelt driven floods selected for inclusion in the analysis occurred in 1969 and 1983. These events were the largest snowmelt floods in the hydrologic record. The

snowmelt floods occurred over several months duration and are distinctly different from the rain flood events which typically last for several days.

2.2 FLOOD-FREQUENCY RELATIONSHIP

Both the Don Pedro Lake Report on Reservoir Regulation for Flood Control (USACE, 1972) and the Sacramento and San Joaquin River Basins Comprehensive Study (USACE, 2002) contain flood-frequency information for the Tuolumne River at New Don Pedro. These include unregulated and regulated flow frequency curves. The Comprehensive Study updated the unregulated flow-frequency curves at several durations with data through water year 1997.

Based on its estimated flood-frequency profiles, the Comprehensive Study evaluated the frequency of 15 major historical floods for each of the major river basins that are tributaries to the Sacramento-San Joaquin River Delta. The four rainfloods selected for the analysis in this report were included. The annual probability of exceedence (chance of flow being exceeded in a single year) values for these historical floods for the Tuolumne River at New Don Pedro are summarized in Table 1.

Table 1. Flood-Frequency Statistics for Selected Historical Rainfloods

	Probability of Exceedence for Specified Duration		
Flood Event	1-day	3-day	7-day
1956	1%	1.8%	1.9%
1969	9%	9%	7%
1986	8%	4%	3%
1997	1%	0.9%	0.9%

3. NEW DON PEDRO DAM OPERATIONS

3.1 OPERATIONAL RULES

The operation of New Don Pedro Dam's storage allocated for flood control is governed by the flood control manual (USACE, 1972). This document describes the rules by which New Don Pedro's flood space is to be determined and managed during floods. The prescribed rules come in the form of a flood control diagram (FCD, Chart A-8) and emergency spillway release diagram (ESRD, Chart C-11) which describe the Dam operation during typical and emergency flood situations, respectively. These diagrams are included in this report as Figures 2 and 3, respectively.

The FCD specifies the amount of flood space required in Don Pedro Lake. The volume required is dependent on the time of the year. The FCD also allows for flood space credit to be given for space in the upstream reservoirs Hetch Hetchy and Cherry Valley. There

is no mandated flood operation requirement at the upstream reservoirs, but as space is available in these reservoirs, that space is utilized to determine flood releases from New Don Pedro.

Once water is stored in the New Don Pedro flood space the FCD provides guidance on how to manage the flood waters. The FCD specifies an operation such that flows that exceed 9,000 cfs in the Tuolumne River below Dry Creek will be minimized. The FCD contains the provision that releases are not allowed to be increased by more than 2,000 cfs or decreased by more than 1,000 cfs in any 2-hour period. The FCD guidance is difficult to meet because the water released from New Don Pedro takes approximately 24 hours to reach the target flow location at Dry Creek. Therefore rainfall that occurs after water is released from the dam can cause flows to exceed the target flow.

3.1.1 Snowmelt Parameter

A snowmelt parameter based on projected reservoir inflow from the current date through the end of July allows for conditional space to be provided in advance of the future inflow. The parameter works with the FCD such that more flood space is required when the projected inflow is higher.

3.1.2 Downstream Targets

As described on the FCD, New Don Pedro is required to operate so that flows in the Tuolumne River below Dry Creek do not exceed 9,000 cfs. Operationally, this means that New Don Pedro operators must have knowledge of the downstream tributary flow in order to determine a release that is consistent with this flow target. The obvious exception is when the Dam is at risk due to high storage/inflow combinations and greater releases are required. This situation is explicitly covered by the ESRD (Figure 3) which supercedes the FCD under certain specified conditions.

The key downstream tributary is Dry Creek. The gage for Dry Creek at Crab Tree is used operationally to estimate the tributary flow and New Don Pedro releases are adjusted accordingly. The travel time from the Crab Tree gage to the Tuolumne River and the travel time of water released from New Don Pedro to the Tuolumne's confluence with Dry Creek are approximately the same, so the Dry Creek at Crab Tree gage can be used directly to assist in determining New Don Pedro releases.

3.1.3 Rate of Release Change

The FCD mandates that releases not be increased by more the 2,000 cfs or decreased by more than 1,000 cfs in any 2-hour period. Considering the release restriction for downstream flows of 9,000 cfs, this rate of change criteria does not significantly restrict the flood control operation of the dam.

4. RAINFLOOD ANALYSIS

4.1 WITH HETCH HETCHY CONDITIONS (EXISTING)

The operation of New Don Pedro under "with Hetch Hetchy" conditions refers to existing facilities and existing operational flood control rules. Several assumptions were made with respect to the representation of existing conditions. This section of the report contains an account of these assumptions and shows the results of the analysis.

4.1.1 Methodology

For the events which took place after New Don Pedro was constructed, 1986 and 1997, the actual inflow and outflow values were used. For events occurring before New Don Pedro was built, 1956 and 1969, only the historical reservoir inflow was used. Since the Old and New Don Pedro Dams have different characteristics and Don Pedro Lake is now much larger than it was prior to the construction of New Don Pedro Dam, it was determined that using the historical reservoir outflows would not be appropriate. In lieu of using the historical outflow for these events, the outflow was simulated using the operational rules supplied in the Flood Control Manual (UASCE, 1972). The Dry Creek at Crab Tree flows were not known for these events, so the 1997 flows were used as a surrogate. All of the federally specified flood space (340,000 acre-feet) was assumed to be available at the outset of each of these events, an assumption consistent with other historical events.

4.1.2 Results

1997 Event

Figure 4 shows New Don Pedro 1997 flood operations under "with Hetch Hetchy" conditions. As this plot illustrates, the peak outflow from New Don Pedro was approximately 59,000 cfs, the largest ever released from the Dam.

1986 Event

Figure 9 shows New Don Pedro 1986 flood operations under "with Hetch Hetchy" conditions. As this plot illustrates, despite the large magnitude of this flood event, the peak outflow from New Don Pedro was never more than 7,000 cfs.

1969 Event

Figure 11 shows New Don Pedro 1969 flood operations under "with Hetch Hetchy" conditions. As this plot illustrates, the New Don Pedro outflows would not have exceeded the channel capacity below the Dam for this event.

1956 Event

Figure 13 shows New Don Pedro 1956 flood operations under "with Hetch Hetchy" conditions. As this plot illustrates, the New Don Pedro outflows would not have exceeded the channel capacity below the Dam for this event.

4.2 WITHOUT HETCH HETCHY

The "without Hetch Hetchy" condition refers to the Tuolumne River system without the existence of Hetch Hetchy and under existing operational flood control rules. This section of the report contains an account of the assumptions for the flood control system without Hetch Hetchy and shows the results of the analysis performed to represent the operation of New Don Pedro for historical floods under this condition.

4.2.1 Methodology

The same basic methodology that was applied to the "With Hetch Hetchy" condition was applied to the "Without Hetch Hetchy" condition. The only difference is that the New Don Pedro inflow hydrograph in the "Without Hetch Hetchy" analysis was altered to capture the effects of removing Hetch Hetchy.

The New Don Pedro inflow was altered by removing the Hetch Hetchy outflow component in the historical New Don Pedro inflow record and replacing it with the volume of flow that originated above Hetch Hetchy (inflow) and would have come into New Don Pedro historically if Hetch Hetchy had not been in place. To route this volume of water into New Don Pedro, the Hetch Hetchy historical inflow with a 10-hour travel time (approximately 4 miles per hour over the 40 mile distance between Hetch Hetchy and New Don Pedro) was used.

4.2.2 Results

1997 Event

Figure 5 compares the New Don Pedro inflow hydrographs for the "with Hetch Hetchy" and "without Hetch Hetchy" conditions. This shows the significant increase in New Don Pedro inflow volume that would have occurred as a result of the loss of Hetch Hetchy storage.

Figure 6 shows New Don Pedro 1997 flood operations under "without Hetch Hetchy" conditions. As this plot illustrates, the peak outflow from New Don Pedro would have been approximately 100,000 cfs, significantly larger than the 59,000 cfs released under "with Hetch Hetchy" conditions.

Figure 7 compares the outflow hydrographs and Figure 8 compares the reservoir storage for the "with Hetch Hetchy" and "without Hetch Hetchy" scenarios.

1986 Event

Figure 10 shows New Don Pedro 1986 flood operations under "without Hetch Hetchy" conditions. As this plot illustrates, New Don Pedro would have been able to limit the peak outflow to 7,000 cfs.

1969 Event

Figure 12 shows New Don Pedro 1969 flood operations under "without Hetch Hetchy" conditions. As this plot illustrates, New Don Pedro would have been able to limit outflows and maintain flows within the designated target flow (9,000 cfs) below Dry Creek for this event.

1956 Event

Figure 14 shows New Don Pedro 1956 flood operations under "without Hetch Hetchy" conditions. As this plot illustrates, the peak outflow from New Don Pedro would have been approximately 25,000 cfs, significantly larger than that released under "with Hetch Hetchy" conditions.

4.3 FLOW-FREQUENCY ANALYSIS

In addition to the historical events, a flow-frequency analysis was performed for so that the effects of removing Hetch Hetchy could be seen for a wider range of hydrologic events than those witnessed historically. This range analyzed encompassed the 1/20 AEP to 1/200 AEP flood events. Both existing and without Hetch Hetchy conditions were analyzed.

The New Don Pedro 3-day inflow volumes for each of these hypothetical events were determined from the unregulated flow-frequency relationships given in Sacramento-San Joaquin River Basins Comprehensive Study (USACE, 2002). The 1997 event's New Don Pedro inflow hydrograph was then adjusted upwards or downwards by the ratio of the 1997 3-day flow volume to that from the 3-day flow-frequency curve for the specified frequency. This ensured the inflow volumes for each frequency would be maintained and the 1997 flood event hydrograph shape would be used.

These derived inflow hydrographs were then routed through New Don Pedro, just as with the historical events that were previously described. The Dry Creek at Crabtree flow record for 1997 was adjusted by the same ratio as the New Don Pedro inflow record for each frequency to obtain the Dry Creek flows for the hypothetical events. Table 2 shows the resulting maximum New Don Pedro outflows for each frequency for existing and without Hetch Hetchy conditions.

Table 2. New Don Pedro Maximum Outflow for Given Frequency Flood Event for Existing and Without Hetch Hetchy Conditions

		Peak Flow [cfs]	
AEP	1/AEP	Existing	Without Hetch Hetchy
0.050	20	9,000	9,000
0.040	25	9,000	9,000
0.030	33	9,000	9,000
0.020	50	9,000	22,000
0.013	75	23,000	49,000
0.010	100	34,000	75,000
0.005	200	87,000	129,000

* listed AEP values are for 3-day duration

5. SNOWMELT FLOOD ANALYSIS

For the snowmelt flood portion of this analysis, two historical events were examined, 1969 and the 1983. These events occurred in the late spring/early summer and consisted of snowmelt runoff following extremely wet winters. Water years 1969 and 1983 are two of the wettest in the historical record.

Further analysis of the 1969 event showed that it could not be used in this analysis because of the lack of available data and complexities caused by the fact that the construction of New Don Pedro Dam had not been completed.

5.1 WITH HETCH HETCHY

5.1.1 Methodology

Under the snowmelt operation for the 1983 event, maximum releases were being made for many months. However, there was enough storage capacity in New Don Pedro such that releases did not exceed Tuolumne River channel capacity below the Dam. The "with Hetch Hetchy" condition is represented by the historical flows and storage levels from 1983. Note that releases from the dam include both flood releases and irrigation flows.

5.1.2 Results

Figure 15 shows New Don Pedro 1983 snowmelt flood operations under "with Hetch Hetchy" conditions. As this plot illustrates, maximum releases were being made for many months and by the time inflows began to recede substantially, New Don Pedro had almost filled to its full pool level.

5.2 WITHOUT HETCH HETCHY

5.2.1 Methodology

For the "Without Hetch Hetchy" scenario the change in New Don Pedro inflow hydrograph due to the removal of Hetch Hetchy was calculated with the same methodology used in the rainflood analysis (see Section 4.2 for details). The outflow from New Don Pedro was kept the same as the "with Hetch Hetchy" condition until the storage in New Don Pedro reached full pool level. Once the reservoir filled, outflows were increased to match the inflow.

5.2.2 Results

Figure 16 shows New Don Pedro 1983 snowmelt flood operations under "without Hetch Hetchy" condition. A peak outflow of approximately 16,000 cfs would have occurred, a slight increase over the "With Hetch Hetchy" condition. It is not known if this short duration spike in New Don Pedro outflow would have caused significant downstream flooding, or if modifications to the operation could have avoided the spike.

6. FLOOD CONTROL MITIGATION FOR HETCH HETCHY REMOVAL

The loss of flood storage from the removal of Hetch Hetchy increases the burden on New Don Pedro to control large floods. The amount of additional flood space that would be required in New Don Pedro to offset the increased New Don Pedro outflow due to the loss of Hetch Hetchy was calculated for the 1997 flood event and each of the hypothetical flood events evaluated for the flow-frequency analysis. The results of this analysis indicate that up to 200,000 acre-feet (1/200 AEP event) would be required to offset the increases in peak New Don Pedro outflow due to the removal of Hetch Hetchy.

7. SUMMARY AND CONCLUSIONS

Rain flood operation at New Don Pedro could be significantly impacted by the removal of the Hetch Hetchy reservoir storage from the Tuolumne River watershed. Two of the four historical events analyzed showed a very significant increase in the peak outflow from New Don Pedro than would have occurred under the without Hetch Hetchy operation (69% increase for 1997 and 237% increase for 1956).

For snowmelt floods, the potential for adverse flood control impacts due to the potential removal of Hetch Hetchy are less significant. The additional inflow to New Don Pedro that would result from the removal of Hetch Hetchy in these already wet years would occur over many weeks. Although it has the potential to increase New Don Pedro storage levels to a point where the reservoir would lose control and inflow would have to be released from the reservoir, the operational flexibility provided by the extended snowmelt flood period diminishes the impact. This was seen in the water year 1983 example

described above. Nonetheless, the potential to impact the New Don Pedro snowmelt flood operations exists.

REFERENCES

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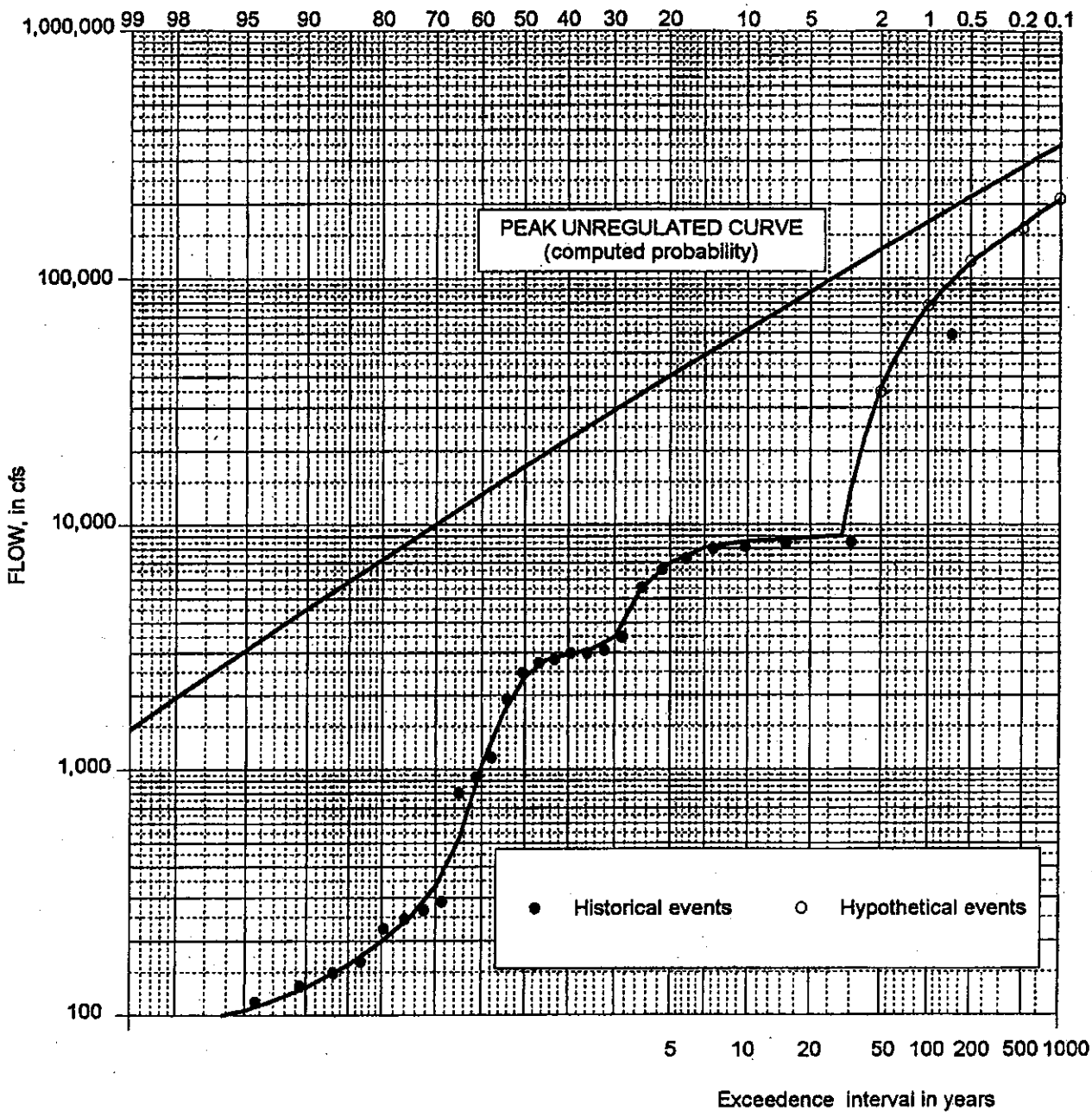
USACE (United States Army Corps of Engineers), 2002. Sacramento and San Joaquin River Basins Comprehensive Study Technical Studies Documentation, Department of the Army, Sacramento District, Sacramento, CA.

FIGURE 1



NOTES:

1. Median Plotting Positions
2. Drainage Area: 1,533 sq. mi.
3. 27 years of record (1971 to 1997)
4. 1997 plots as maximum in 101 years

SACRAMENTO-SAN JOAQUIN BASIN COMPREHENSIVE STUDY

SAN JOAQUIN RIVER BASIN, CALIFORNIA

PEAK RAIN FLOOD FREQUENCY CURVE
REGULATED CONDITION

TUOLUMNE RIVER AT DON PEDRO DAM

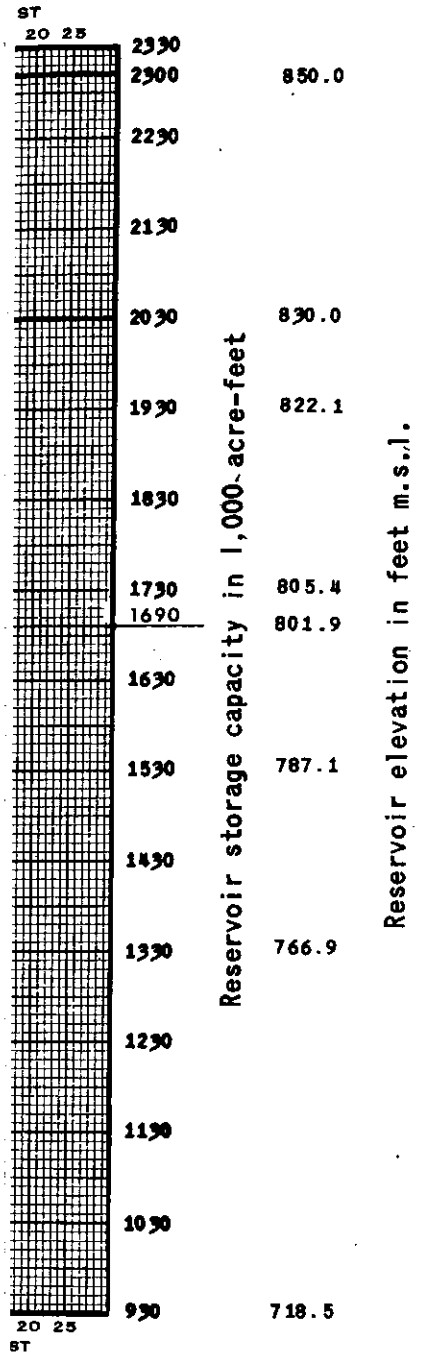
U.S. ARMY CORPS OF ENGINEERS

SACRAMENTO DISTRICT

Prepared by TKP

Nov 98

PLATE 28



NOTES

1. Don Pedro Lake shall be operated for flood control in accordance with this Flood Control Diagram and the accompanying Emergency Spillway Release Diagram. Reservoir releases shall be made in accordance with the diagram requiring greater release.
2. Flood control reservation increases uniformly at a rate of 11,700 acre-feet per day from zero requirement on 8 September to the maximum reservation of 340,000 acre-feet by 7 October. The reservation is maintained at 340,000 acre-feet through 27 April after which, unless additional reservation is indicated by the snowmelt parameters, it will decrease uniformly at a rate of 9,200 acre-feet per day to zero requirement by 3 June.
3. Snowmelt parameter value is the forecasted natural runoff in thousand acre-feet of Tuolumne River inflow to Don Pedro Lake between the given date and 31 July. Dash line parameter extensions below maximum reservation line are used for computation purposes to define gross reservation requirement (before reduction for empty space in upstream reservoirs).
4. The flood control reservation in Don Pedro Lake determined from snowmelt parameters may be decreased by 80 percent of the available empty space in each of Hetch Hetchy and Cherry Valley Reservoirs, respectively, but no reduction will be permitted below 50,000 acre-feet or the rain flood reservation value, and not more than 70% of the creditable portion of the requirement may be allowed for empty space in Hetch Hetchy Reservoir nor more than 30% for empty space in Cherry Valley Reservoir.
5. When space available for flood control is less than that indicated by the diagram (after allowing credit for empty space in upstream reservoirs), water shall be released as rapidly as possible without causing flows in Tuolumne River below Dry Creek to exceed 9,000 c.f.s.
6. Releases shall not be increased more than 2,000 c.f.s. or decreased more than 1,000 c.f.s. in any 2-hour period except as required by the Emergency Spillway Release Diagram.

DON PEDRO LAKE
TUOLUMNE RIVER, CALIFORNIA

FLOOD CONTROL DIAGRAM

Prepared Pursuant to Flood Control Regulations for Don Pedro Dam and Lake in accordance with the Code of Federal Regulations Title 33 Part 208.11

APPROVED: _____
Colonel, USA, Division Engineer, South Pacific Division

APPROVED: M. N. Bennett
Chief, Administrative Officer, Modesto Irrigation District

APPROVED: _____
Manager, Turlock Irrigation District

Effective Date: 27 JUL 1978 File No. TU-1-19-9

CHART A-8

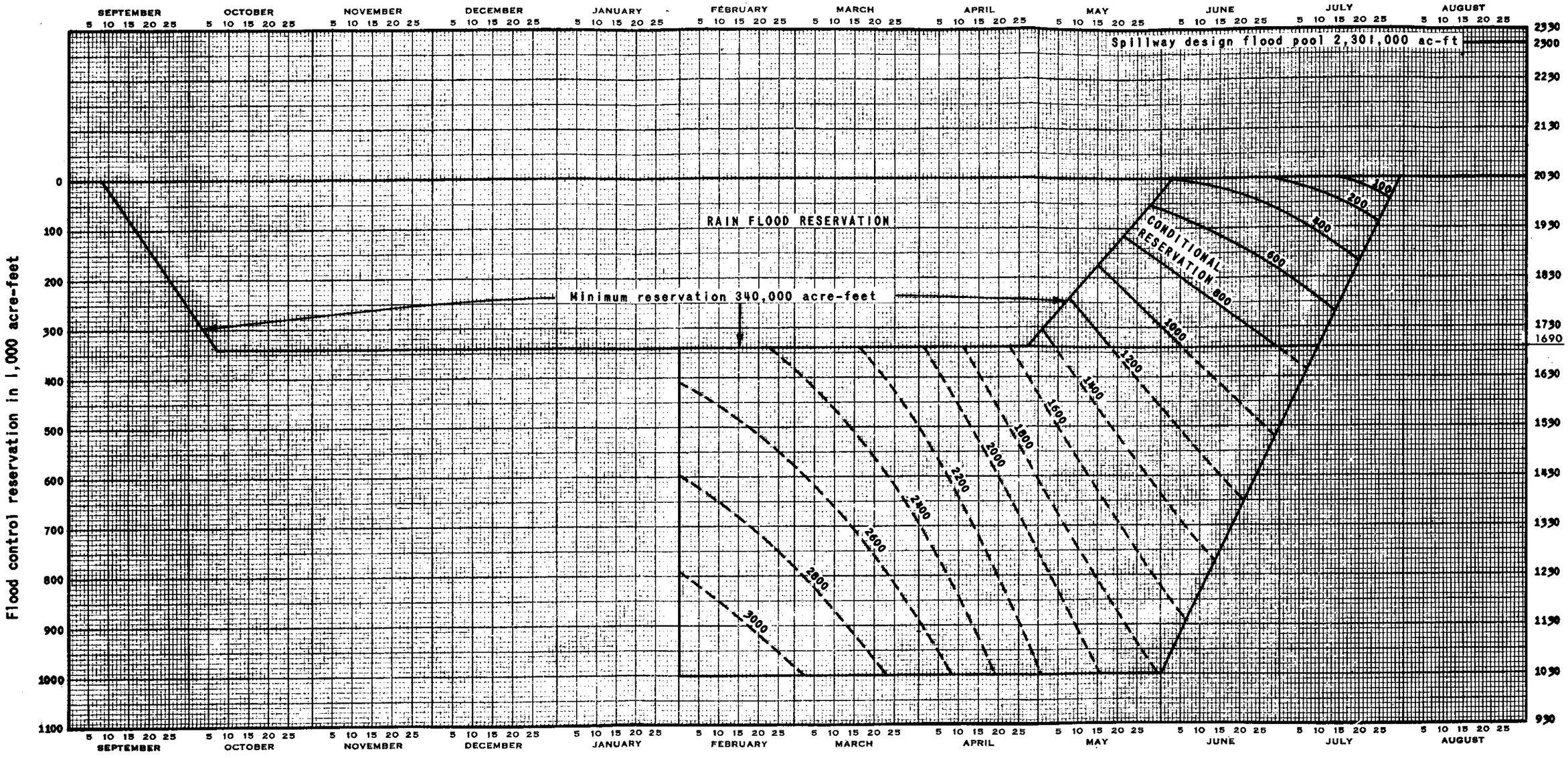
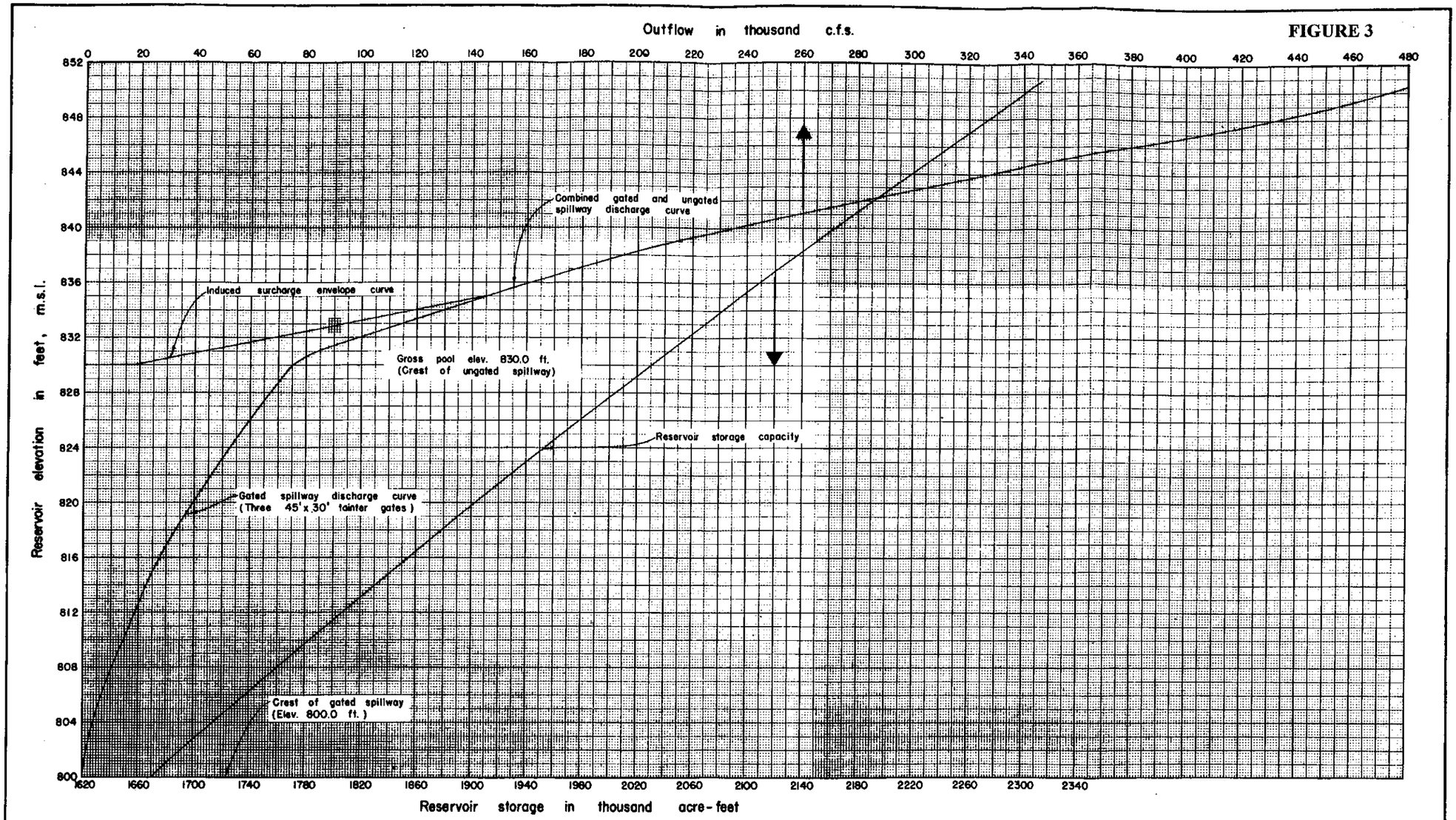


FIGURE 2, PART 2 of 2

FIGURE 3



OPERATING INSTRUCTIONS

1. Follow regular flood control regulation schedule until gross pool elevation 830.0 feet has been reached.

2. Above elevation 830.0 feet, minimum permissible releases are those indicated by the induced surcharge envelope curve. Gate openings (all three gates) shall be adjusted at least once each hour in order for the reservoir elevation to conform with the induced surcharge envelope curve as closely as possible.

3. When the reservoir water surface is dropping, maintain current gate openings until the water surface has reached elevation 830.0 feet (gross pool). Once the pool has dropped below elevation 830.0 feet releases should be reduced each hour by 0.3 of the difference between inflow and outflow until releases are reduced to rates required by the flood control diagram.

DON PEDRO LAKE
TUOLUMNE RIVER, CALIFORNIA

EMERGENCY SPILLWAY RELEASE DIAGRAM

Prepared Pursuant to Flood Control Regulations for Don Pedro Dam and Lake in accordance with the Code of Federal Regulations Title 33 Part 208.11

APPROVED: _____
Colonel, USA, Division Engineer, South Pacific Division

APPROVED: _____
Chief, Administrative Officer, Modesto Irrigation District

APPROVED: _____
Manager, Turlock Irrigation District

Effective Date 27 JUL 1978 File No. TU-1-13-11

CHART A-9

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Figure 5: Comparison of New Don Pedro 1997 Flood Operations
Inflow With and Without Hetch Hetchy

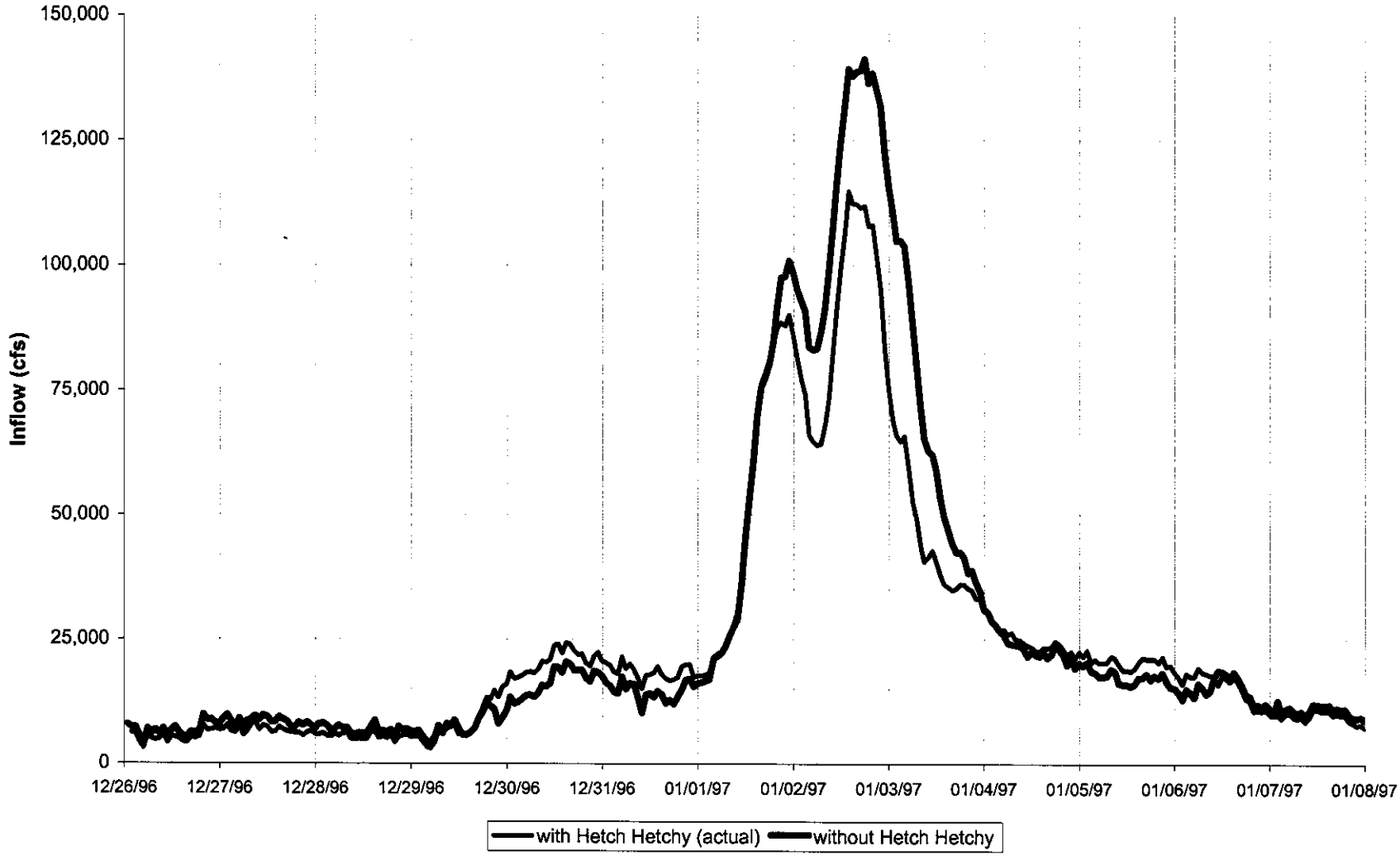

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Figure 6: New Don Pedro 1997 Flood Operations
Without Hetch Hetchy

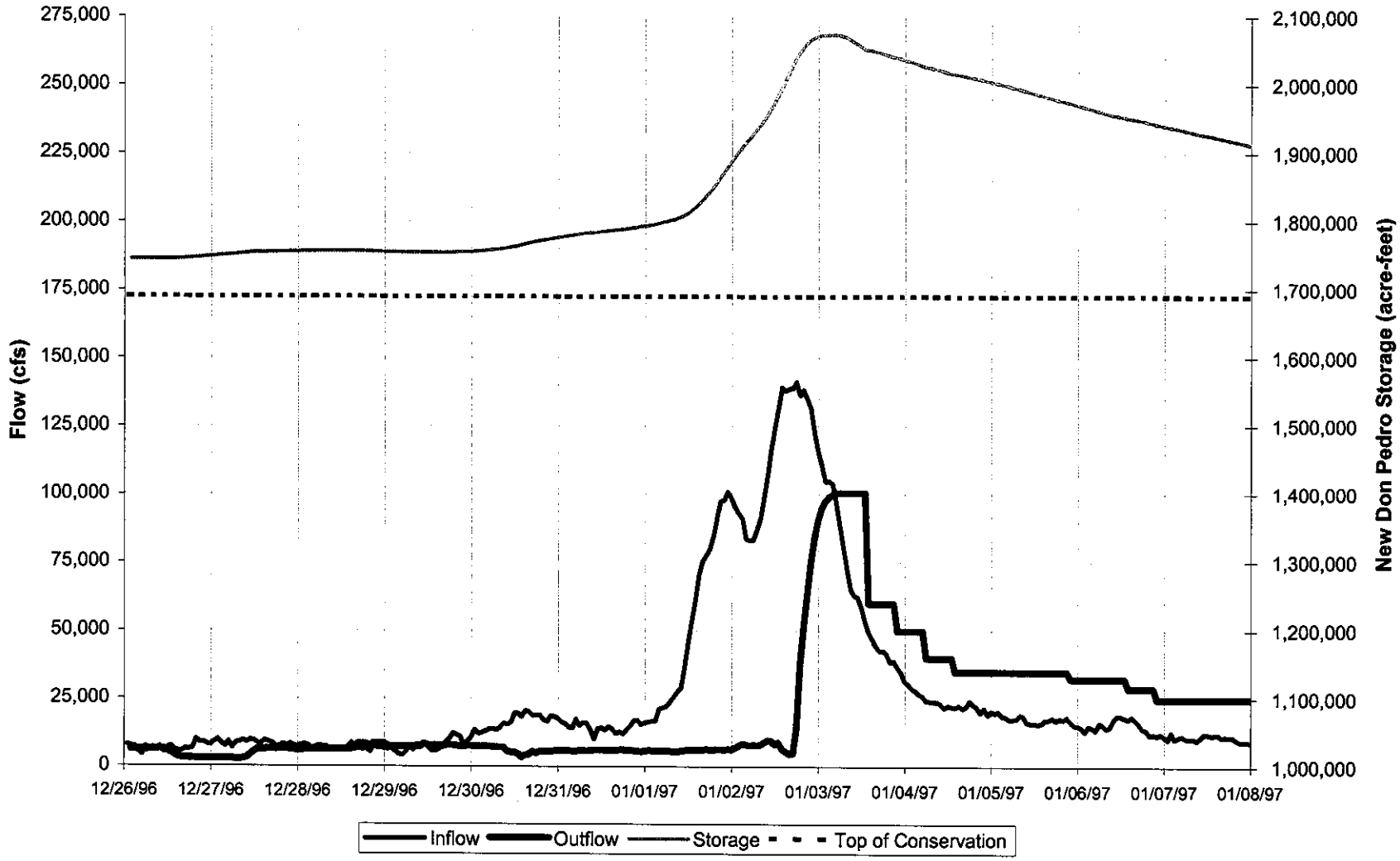

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Figure 7: Comparison of New Don Pedro 1997 Flood Operations
Outflow With and Without Hetch Hetchy

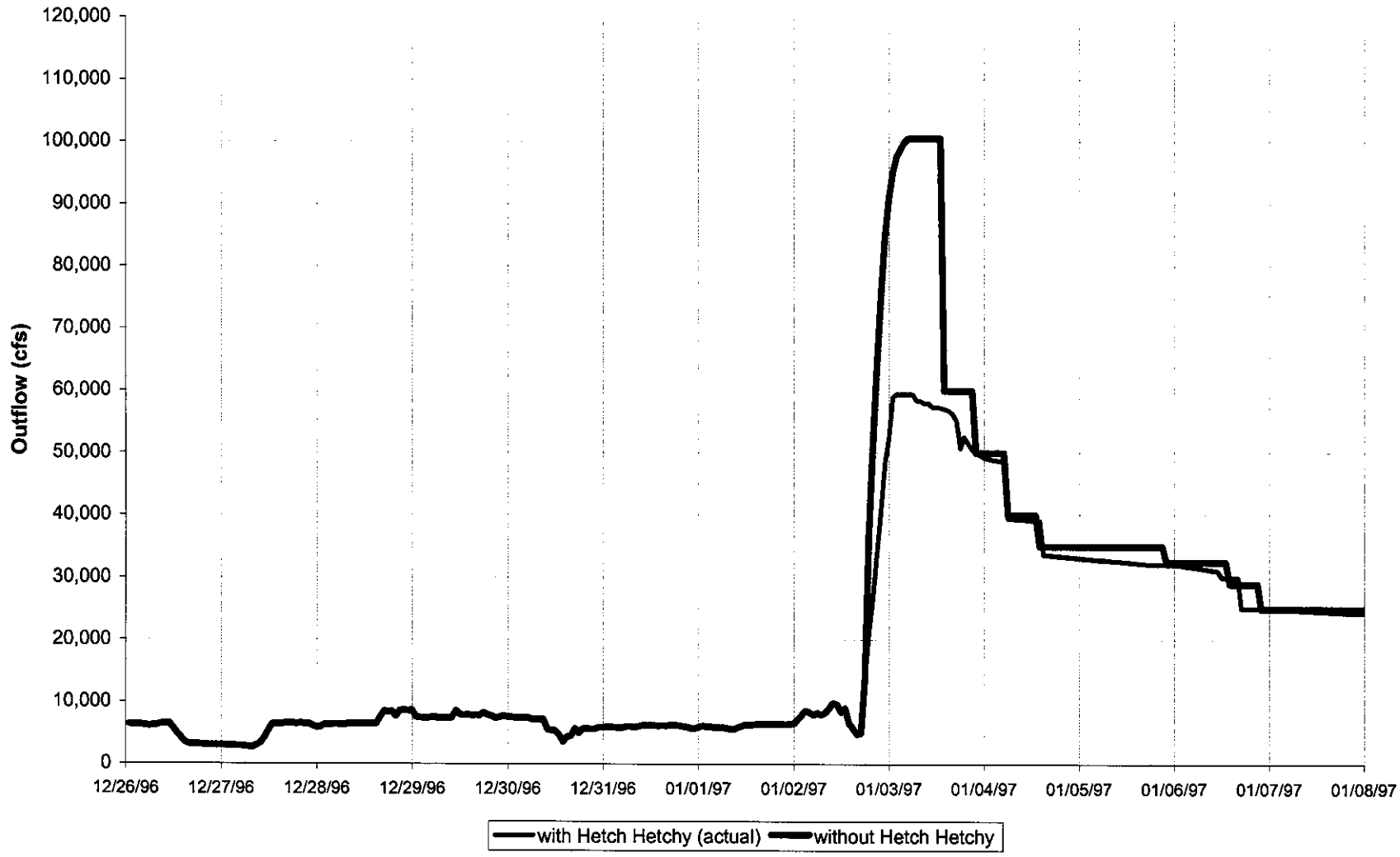

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Figure 8: Comparison of New Don Pedro 1997 Flood Operations
Storage With and Without Hetch Hetchy

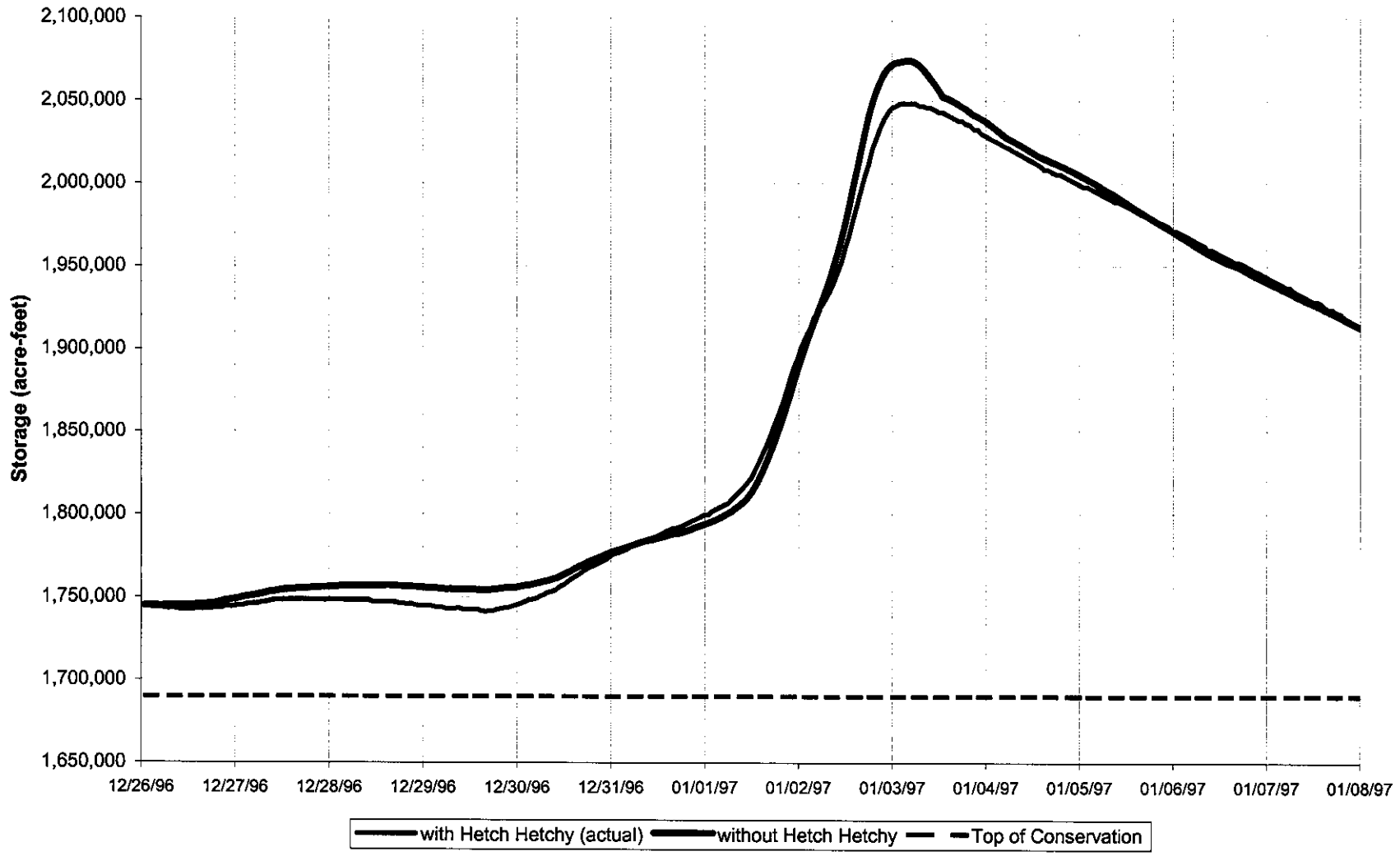

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Figure 9: New Don Pedro 1986 Flood Operations
With Hetch Hetchy (Actual)

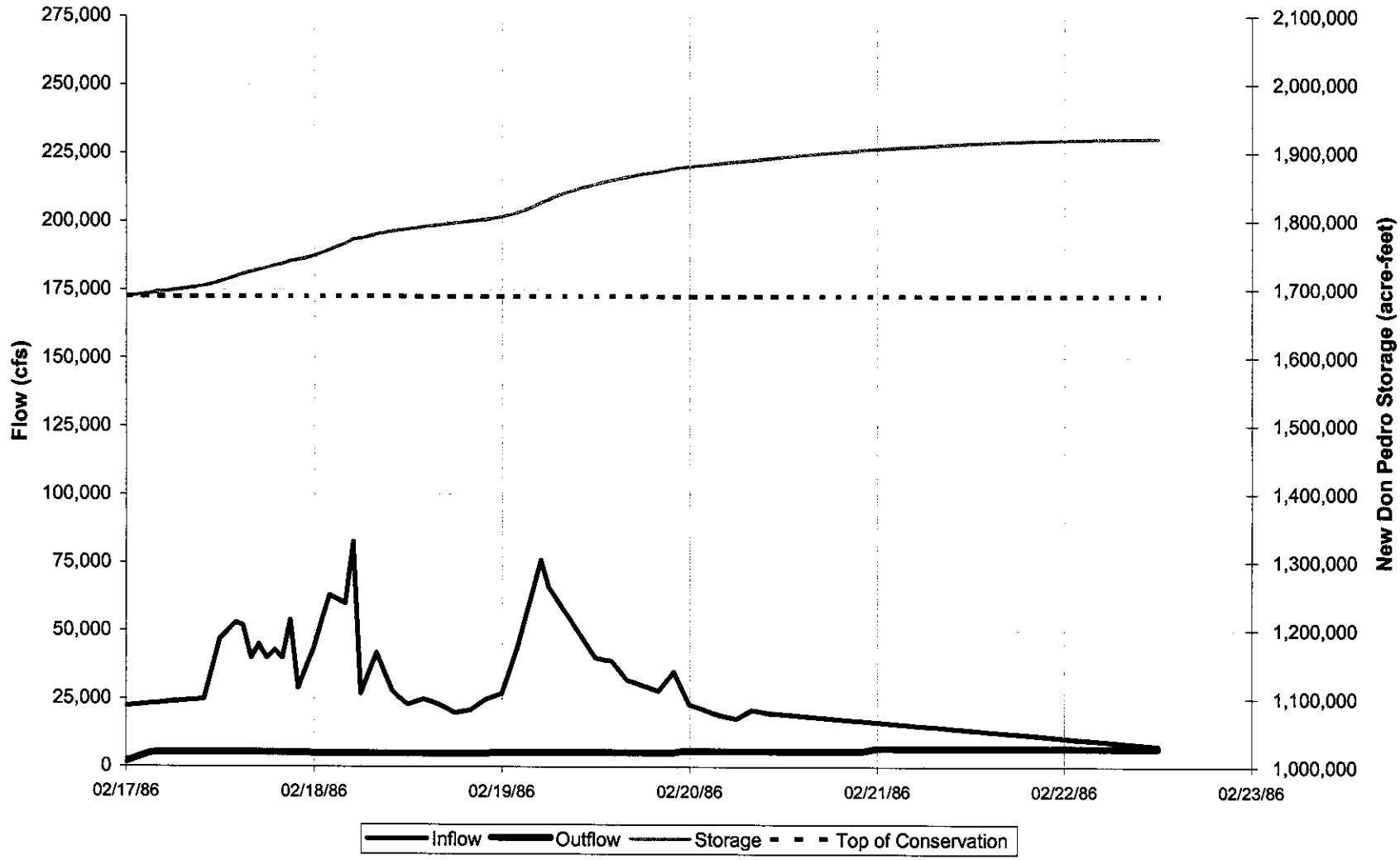

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Figure 10: New Don Pedro 1986 Flood Operations
Without Hetch Hetchy

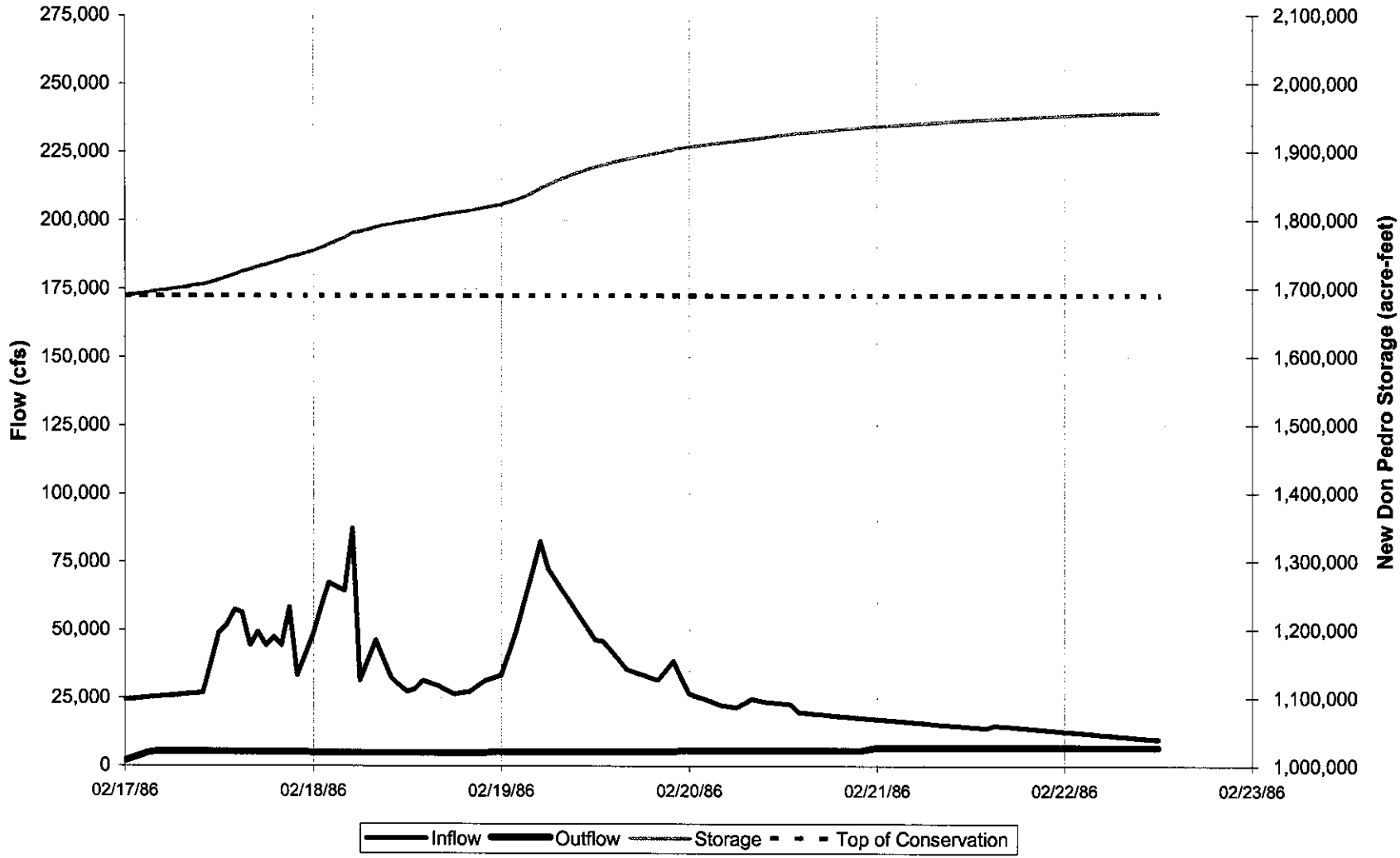

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Figure 11: New Don Pedro 1969 Flood Operations
With Hetch Hetchy

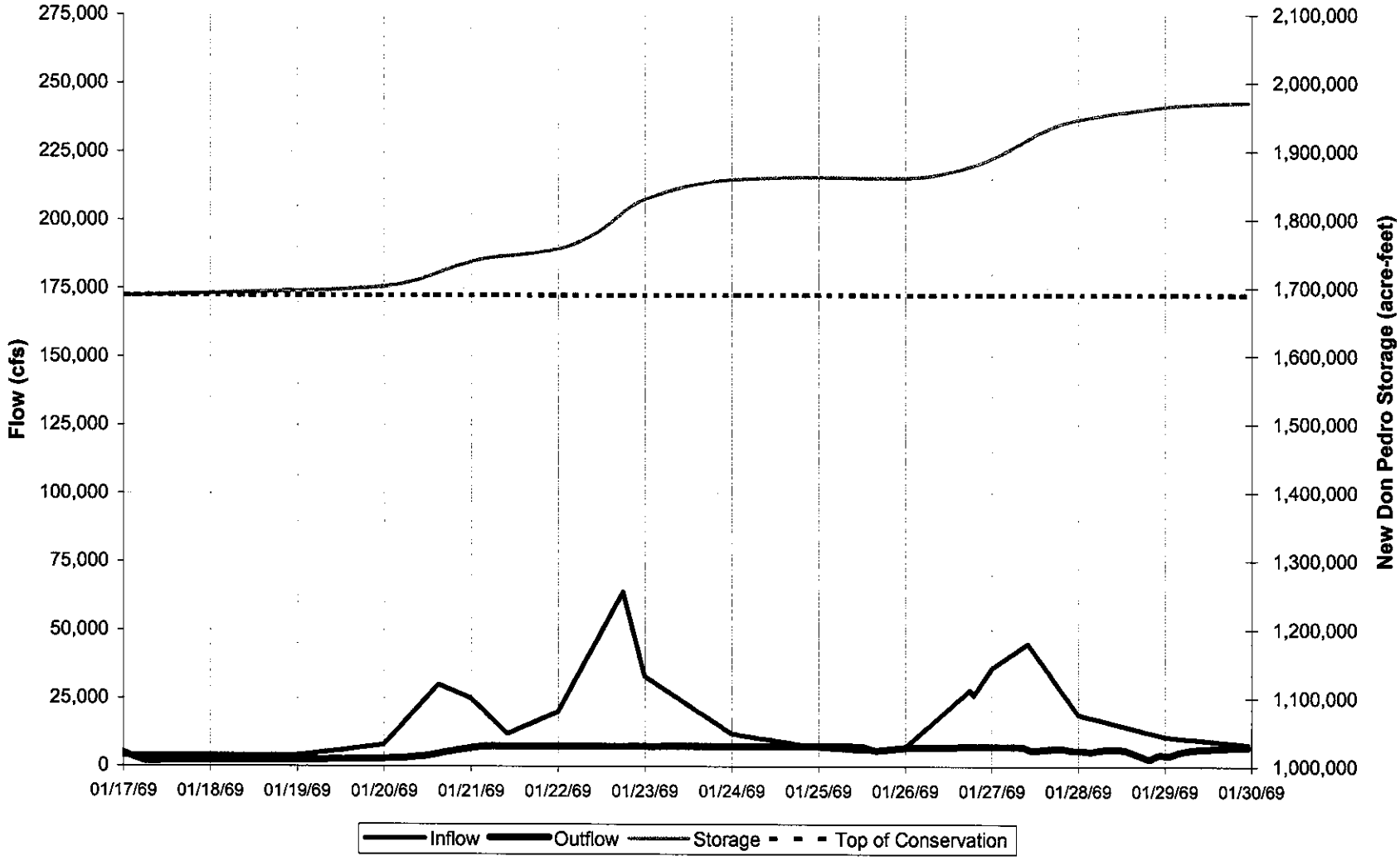

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Figure 12: New Don Pedro 1969 Flood Operations
Without Hetch Hetchy

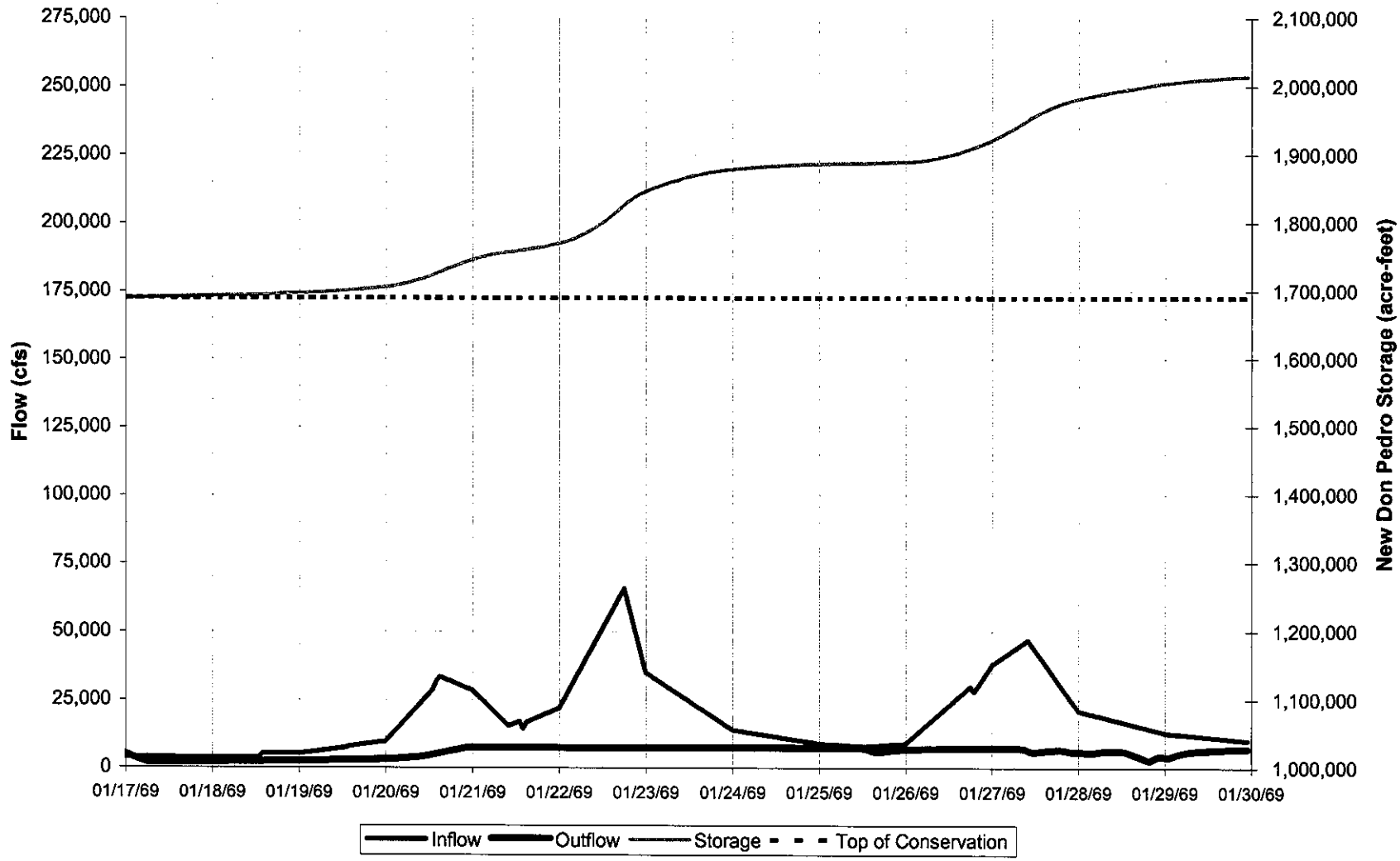

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Figure 13: New Don Pedro 1956 Flood Operations With Hetch Hetchy

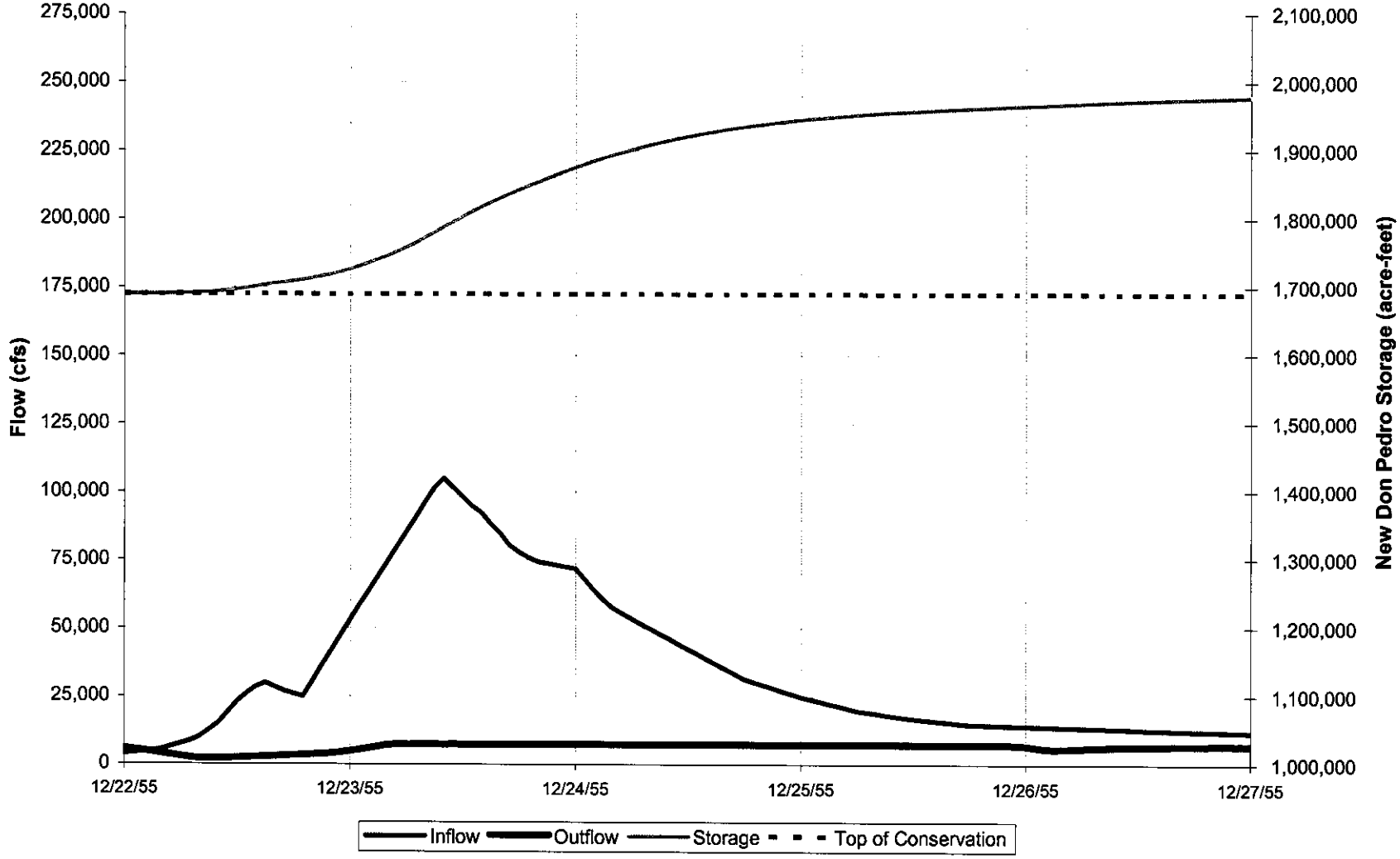

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Figure 14: New Don Pedro 1956 Flood Operations
Without Hetch Hetchy

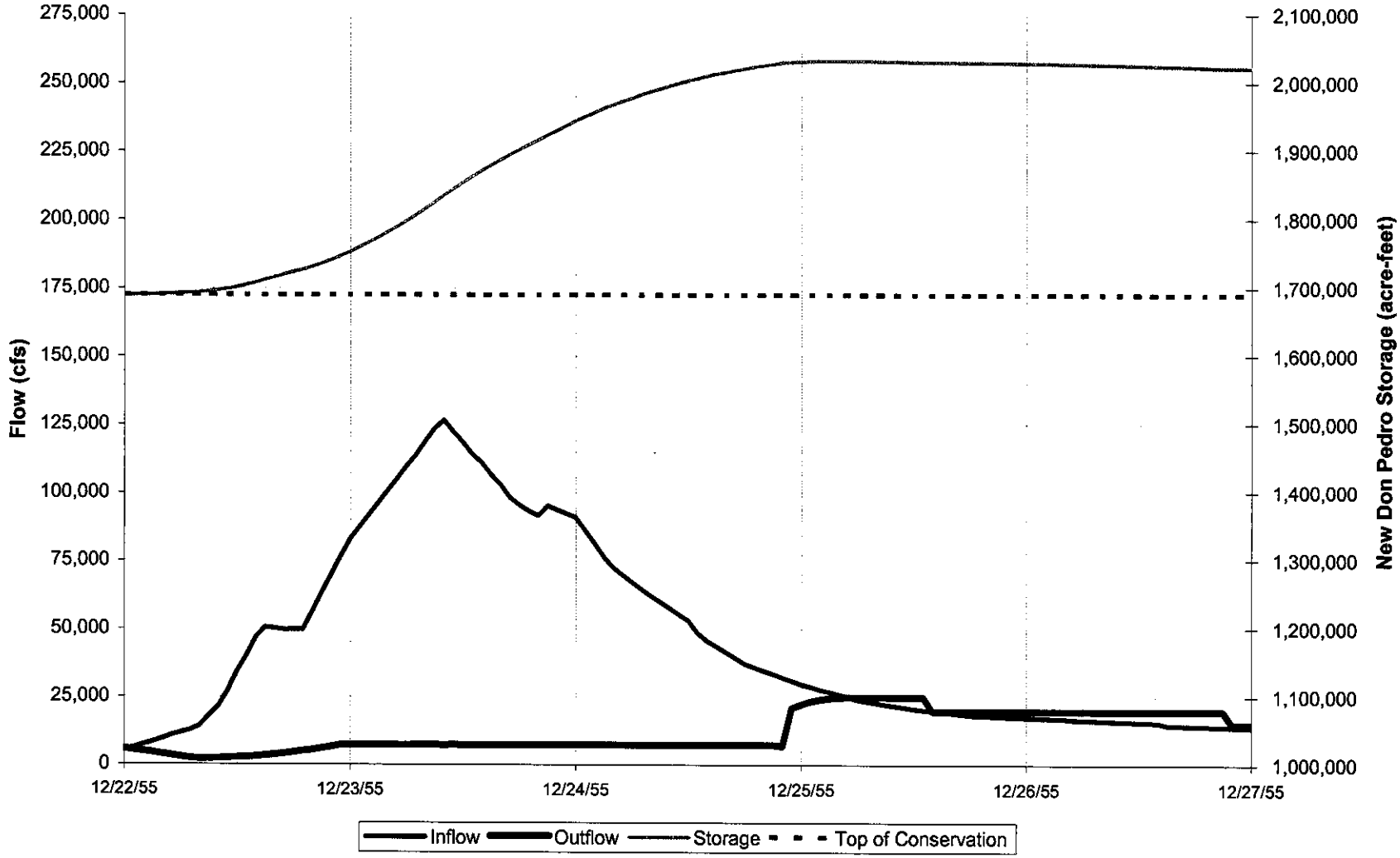


Figure 15: New Don Pedro 1983 Snowmelt Flood Operations With Hetch Hetchy (Actual)

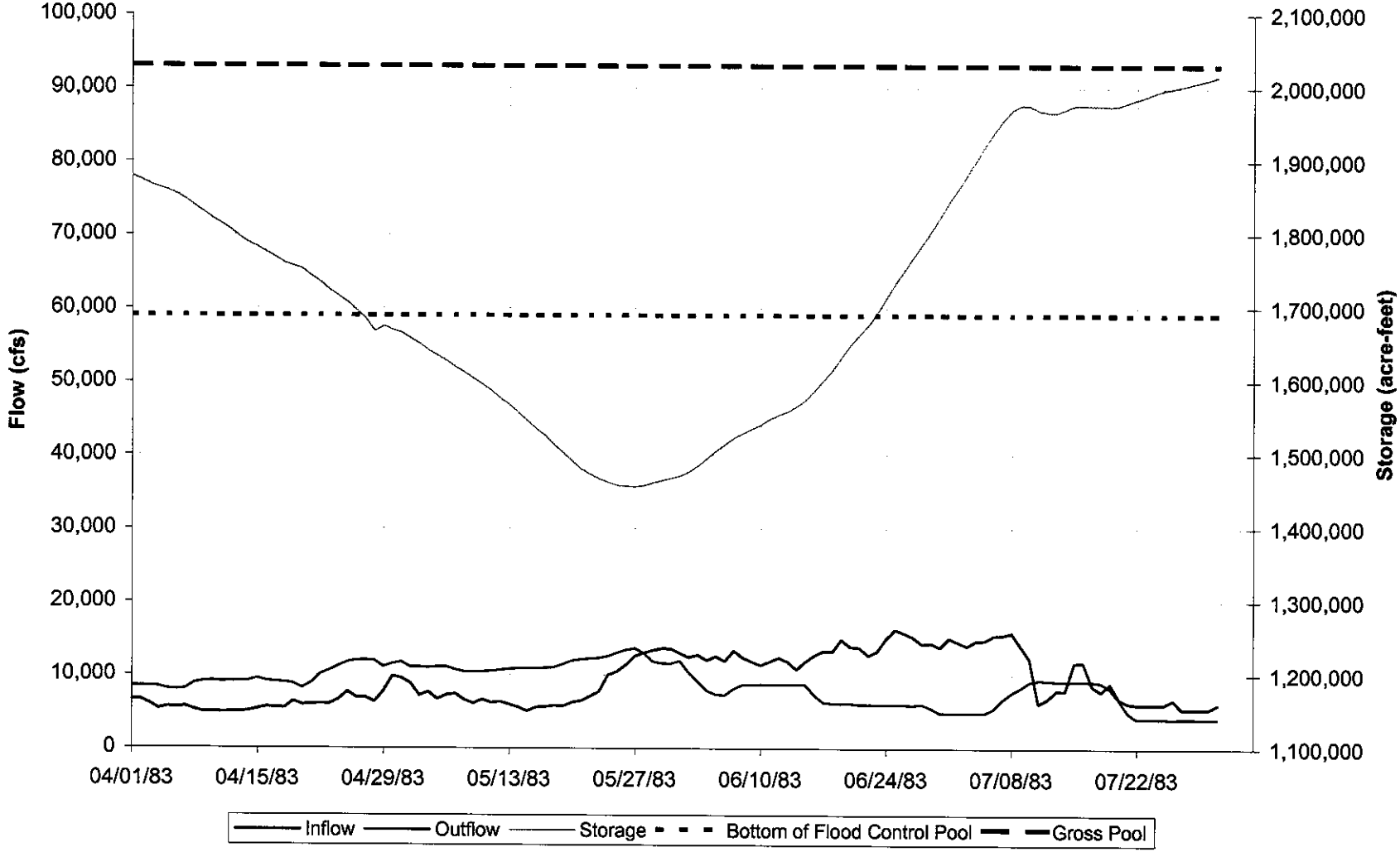
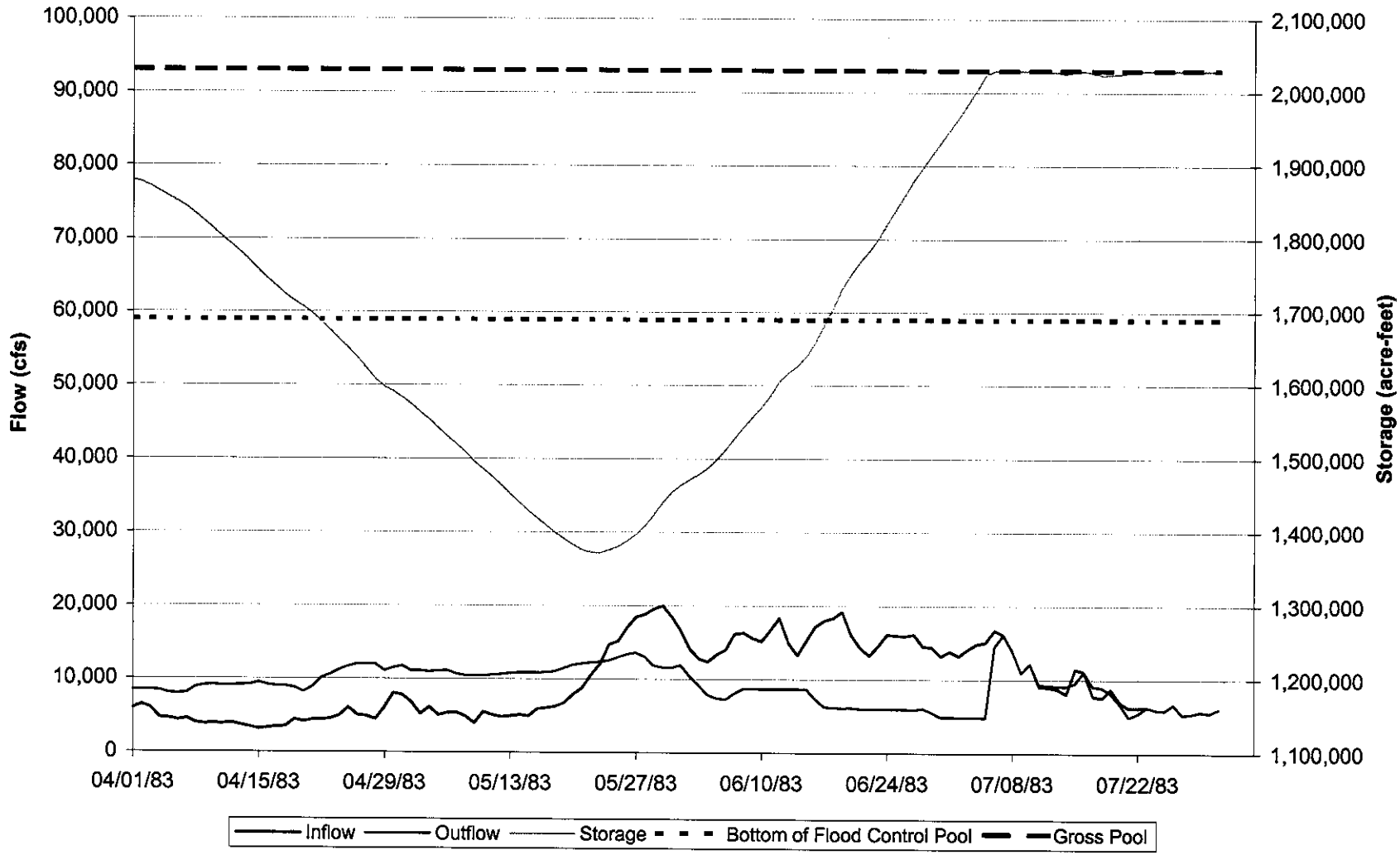


Figure 16: New Don Pedro 1983 Snowmelt Flood Operations Without Hetch Hetchy



Robert F. Logan
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June 22, 2005

To: SFPUC

Re: Environmental Defense Report "Paradise Regained: The Hetch Hetchy Report"

On September 27, 2004, Environmental Defense ("ED") issued its report "Paradise Regained: The Hetch Hetchy Report" ("ED Report"). This memo reviews the estimates in that report of the cost to replace the power lost if the O'Shaughnessy Dam is removed.

Power Lost

The ED Report estimates that the electric power that will be lost if O'Shaughnessy is removed ranges from "as low as 339 million KWh/year" to "as much as 690 million KWh, or 40 percent of average annual energy production" (p. 68). ED calculates that a 40 to 90 MW gas fired combined cycle plant can replace the lost power (40 and 90 MW at an 87.5 percent capacity factor produce 306 and 690 million KWh respectively.) The lower estimate assumes modification of the Canyon Tunnel and construction of a diversion dam to theoretically allow continued operation of the Kirkwood Powerhouse. The reasonableness of the ED estimates is left to others and is not reviewed in this memo.

New Power Uses

The ED plan to replace the current Hetch Hetchy water delivery system requires pumping and water filtration. Both require electricity. The ED Report does not provide a MWH estimate for the new electricity uses. There is in Appendix A (p. A-5) of the ED Report an estimate of $2.2 to $4.5 million per year at $0.055 per KWh for annual incremental electricity costs to operate the replacement water delivery system. This is equivalent to about 4.5 MW to 10 MW on average. The ED cost estimate appears to assume zero cost of scheduling, firming and wheeling power as well as CAISO fees. Without payment of these costs and fees, the power cannot be delivered to the pumps and water filtration plants.

Adding the 4.5 to 10 MW in power needed for the new water electricity uses to the 40 to 90 MW in replacement power needs add 44.5 MW to 100 MW in new generation needs according to the ED Report.

New Capacity Needs

The ED Report addresses the energy but not the capacity requirements in the removal case. Electricity use is not smooth and constant. More electricity is used during the day than at night and on weekdays than on weekends. Capacity must be built to meet the hour of greatest demand known as peak demand. ED only calculates the amount of generation needed to meet average demand. ED does not address the need to meet peak demand and therefore understates the need for new capacity.

In addition, ED does not include reserves in its estimate of new capacity needs. For example, the Resource Adequacy Requirement requires that a Load Serving Entity have 15-17% of capacity above peak demand to assure system reliability. Reserves are necessary for those times when power plants are unavailable for maintenance or a forced outage.

The ED Report does not include any of the costs of meeting peak demand or of reserves. Nor does ED include the costs of scheduling or wheeling this needed capacity or any CAISO fees that might be imposed on this capacity.

Peaking Capacity Lost

The ED Report contains no meaningful estimate of the peaking capacity lost if O'Shaughnessy is removed. ED calculates the loss of capacity from the base case to the removal case by comparing the average hourly rate of energy production and hours available to operate at rated capacity during the most adverse hydrologic conditions encountered over the period of record. (Table 9-3 at page 73) This is not the test for peaking capacity.

The proper test is to measure the ability of the facility to meet system peaks. System peaks are weather driven and occur during a limited number of hours each month. Hence the term "peak." The average hourly rate of energy production has no relevance to peaking capacity. The hours available to operate at rated capacity during the most adverse hydrologic conditions does inform as to the level of peaking capacity.

Table 9-3 of the report shows that both Moccasin and Kirkwood would be able to produce their full nameplate rating during August and September for about 300 hours in the base case. This would only be true for less than 14 hours in the removal case. 300 hours per month is more than enough to meet system peaks in a 744 hour month while 14 are not. The consequence of the removal of O'Shaughnessy is the loss of the 100 MW capacity of Moccasin and the 118 MW capacity of Kirkwood. The removal case therefore results in a loss of 218 MW of peaking capacity.

As discussed below, ED does calculate the cost of adding 40 MW to 90 MW in combined cycle capacity that ED estimates is necessary to replace the electrical output that will be lost in the removal case. However, that would only replace 40 to 90 MW of the 218 MW of lost peaking capacity. ED gives no estimate of the value of the loss of 128 to 178 MW in peaking capacity. The loss of peaking capacity will require additional purchases of capacity and will cause the loss of revenue from sales of capacity. In addition, the loss of the capacity will increase the O&M costs of operating Hetch Hetchy as the SFPUC will have to purchase replacement capacity during maintenance of Holm instead of rotating production as is the current practice.

As noted in the ED Report, the peaking capacity can be replaced with combustion turbines. The cost of 128 to 178 MW of peaking turbines would vary with site location and mitigation costs. I did not find a cost estimate in the ED report for the value of the lost revenue or the cost to replace the lost peaking capacity.

Replacement Options

Energy Efficiency, Dynamic Pricing and Renewables

The ED Report suggests that energy efficiency, dynamic pricing and renewables might replace or eliminate the need for Hetch Hetchy energy. The ED report does not base the cost of replacing the power lost in the removal case on any of these options. One reason may be that these options tend to require firming because they are considered intermittent resources. The CAISO does not regard energy efficiency, load shifting anticipated from dynamic pricing and wind and solar renewables as comparable to investments in natural gas fired generation. This may be why even though ED suggests that energy efficiency, dynamic pricing and renewables can do the job in the removal case, ED ultimately relies on a natural gas fired power plant to calculate the cost of replacement power in the removal case.

Energy Efficiency

The ED report states that "increased energy efficiency could certainly offset some of the need to build new power plants, and at lower cost". ED bases this statement on estimates prepared by the staff of the California Energy Commission ('CEC") and a consulting firm of the electricity savings that might be achieved by continuation of the California Public Utilities Commission ("CPUC") mandated ratepayer funded energy efficiency programs.

The CPUC orders the investor owned utilities under its jurisdiction to collects fees from its ratepayers to fund energy efficiency incentive programs. The utilities then use the fees collected from the ratepayers to offer incentives for certain energy efficiency programs. For example, the utility offers to pay part of the cost of converting to fluorescent lighting or a more efficient air-conditioner. Those customers that accept the incentive then enjoy lower electric bills and the utility avoids building new power plants and investing in transmission and distribution upgrades. These savings from the CPUC program are not available to replace output from Hetch Hetchy in the removal case.

Instead, ED is suggesting that the SFPUC, TID and MID imitate the CPUC and copy the public investment in energy efficiency program as a means to offset some of the need to build new power plants and transmission and distribution infrastructure to replace the lost output from Hetch Hetchy. ED seems to believe that the SFPUC can implement such a program "in San Francisco". This is not true. PG&E under the direction of the CPUC already offers its ratepayers in San Francisco incentives to conserve electricity. These savings are not available to the SFPUC. Only savings due to energy efficiency in municipal use would be available. The City of San Francisco already has invested in energy efficiency in municipal use and additional investment potential exists but is limited.

TID and MID may be able to benefit from an energy efficiency investment program. However, as ED concedes: "Calculating exactly how much of this potential could be realized in San Francisco and the Districts is beyond the scope of this study". ED also concedes that "practical constraints make it unlikely that the replacement of Hetch Hetchy power could be entirely eliminated by new investments in energy efficiency".

Practical constraints include lack of studies on the extent of cost effective energy efficiency measures available in the TID and MID areas and what incentives work best with the TID and MID customer base. The TID and MID boards would need to determine whether their constituents want to be charged a fee (some might say a "tax") to fund the proposed energy efficiency measures. Designing an acceptable cost effective publicly funded energy efficiency program takes time. The CPUC program cited by the ED Report has evolved over 25 years and has resolved many issues in that time. Equity issues raised by publicly funded energy efficiency programs can be difficult. For example, would charging $1.00 per month to 1,000 of the poorest families who use fans to deal with summer heat so that each month a family wealthy enough to own a 4,000 square foot house with central air-conditioning may be given a $1,000 incentive to buy a more efficient air-conditioner be acceptable? Should all of the family owned businesses be forced to contribute to a fund to subsidize a highly efficient lighting system for a big box competitor?

In discussing the CPUC mandated publicly funded energy efficiency program, ED emphasizes with italics that the savings are expected to be achieved with "*no net cost*". (p. 76) What ED fails to mention is that the CPUC plans to have the investor owned utilities charge $500 million per year in fees to their ratepayers to fund these energy efficiency programs. The belief is that the savings from not building and operating additional power plants in the future will offset the cost of the energy efficiency efforts. So it may be true from a societal perspective over the long run there will be no net cost. Up front there will be significant costs and the savings are not guaranteed to be permanent.

The ED report also discusses the potential for dynamic pricing to displace peak energy use. ED claims "that as much as 95 MW of peak energy use could be displaced with dynamic pricing in these regions". First, ED makes the same mistake regarding the City of San Francisco and municipal use. Second, dynamic pricing is experimental. As the "2003 Integrated Energy Policy Report" states "The report recommends continued collaborative assessment with the CPUC to gain a more complete understanding of the extent to which dynamic pricing is appropriate for various types of customers". (p. 11)

Renewables

The ED report states that "Renewable energy – wind, geothermal and solar – is another viable option for replacing the hydroelectric generation foregone with the restoration of Hetch Hetchy Valley". ED offers no specifics. ED does not claim that any specific renewable technology can be used to replace lost Hetch Hetchy power. Nor does ED give a cost estimate for power delivered from renewables to serve municipal uses.

Although ED cites a Los Angeles Department of Water and Power wind project with a 30 year levelized cost of $52/MWh (p. 83), this is not a delivered cost. As ED notes "San Francisco would need to 'firm up" the capacity of purchased wind energy, much as it now does with the output from its Hetch Hetchy facilities". (p. 78) The two types of firming are not at all comparable. Hetch Hetchy is recognized as a firm resource because it can produce power up to a limit when called upon. All of solar and wind must be firmed. Only the incremental portion of Hetch Hetchy must be firmed.

Transmission costs must also be factored into the equation. As the ED Report states, the City of San Francisco is not suitable for solar and wind facilities in the magnitude under discussion. Sites outside the City would need to be acquired as well as transmission paths into the City.

The ED Report indirectly concedes that renewable power is not cost effective when the report states "alternatives ... are poised to gain a bigger share as the state's investor-owned utilities comply with a new law that requires them to meet 20 percent of their customer's needs with renewable energy by 2017". The law is necessary to develop renewables beyond the level that the market currently supports. This reality is conceded by ED as they base their estimate of the cost of replacement power on a natural gas fired power plant.

<u>Natural Gas Combined Cycle Power Plant</u>

As stated earlier, the ED Report estimates that the removal of O'Shaughnessy will result in the loss of 339 to 690 million KWh of average energy production. ED calculates that a 40 to 90 MW gas fired combined cycle plant can replace the lost power. (40 and 90 MW at an 87.5 percent capacity factor produce 306 and 690 million KWh respectively.)

The ED Report cites a California Energy Commission ("CEC") report for a 20 year levelized cost estimate of $0.055 per KWh for the output from a gas fired combined cycle unit. The product of 339 and 690 million KWh and $0.055 is $18.6 and $38 million per year respectively. Over the 20 year period (used by ED) at a 5 percent discount rate this equates to about $230 and $475 million respectively. This cost estimate based on the CEC forecasts represents one point of view. Realistically, the O'Shaughnessy Dam will last much longer than 20 years and many analysts believe that natural gas prices will be much higher than forecast by the CEC in the report cited by ED.

Another point of view can be seen in Attachment A, "Sempra Energy LNG" dated December 10, 2003. This is a copy of a slide presentation made by Sempra before a joint hearing on natural gas issues held by

the CPUC and the CEC in December 2003. The Sempra presentation is available on the CPUC and CEC websites.

Slide 2 of the Sempra presentation shows the Sempra outlook for L48 (lower 48) natural gas production through 2020. As the slide shows, Sempra expects L48 production to fall roughly by half by 2020. (This is similar to the actual decline in L48 oil production post 1970.) The CEC forecast of natural gas prices is based on an assumption that L48 production will increase steadily through 2020 and only eventually enter a slow decline. If the optimists are wrong on L48 natural gas availability, then the SFPUC must ask whether there will even be sufficient natural gas available from L48 production to operate all of the natural gas fired power plants in the United States as well as all other domestic natural gas demand 20 years from now.

Attachment B shows a table titled "EIA Historical Data: Natural Gas Production, Wells Drilled and Wellhead Prices 1990-2003". This is data from the Energy Information Administration, the official energy data gathering organization of the United States government. As the table shows, since 1996 natural gas wells drilled have doubled, wellhead prices have more than doubled and production is flat. Analysts expect that when the data is published later this year, it will show that in 2004 even higher prices elicited continued efforts to develop natural gas but the result was still flat to declining production.

Since 1996, the optimists have been forecasting continuous increases in United States natural gas production. They have been wrong for the last nine years. Relying on a forecast of natural gas prices that assumes continuing increases in L48 natural gas production does not appear to be a sound basis to rely on in deciding whether to switch from hydroelectric power to natural gas fired electric generation.

The argument for moderate natural gas prices is that L48 production will not decline dramatically and any shortfall will be made up with Alaskan North Slope, unconventional sources and LNG. North Slope and unconventional sources are high cost, and even if LNG is imported into the United States, this is no guarantee that natural gas prices will not increase dramatically. The United States will have to compete with China and India for LNG. The dollar may continue to weaken. Natural gas may become priced at multiples of today's prices.

The current issue of Forbes business quotes Stephen Leeb president of Leeb Capital; Management and author of 'The Oil Factor' as follows:

"The problem we have is that there are 2.3 billion people in Chindia," Leeb says, using shorthand for a combined China and India. "Today, China and India use the energy-equivalent of 5.5 barrels of oil per person per year, while rich nations use 39. No matter how rosy your thinking is as to the global supply of oil, there is no way there is going to be enough to satisfy the demands of an extra 2.3 billion people coming online."
http://www.forbes.com/home/energy/2005/01/10/cx_da_0110doomoil.html

Since oil and natural gas are substitutes, higher oil prices mean higher natural gas prices. Demand for natural gas is strong. Supply is uncertain. The cost of natural gas to replace lost power production in the removal case may run into the billions of dollars. The issue is who will take that risk in the removal case.

Conclusion

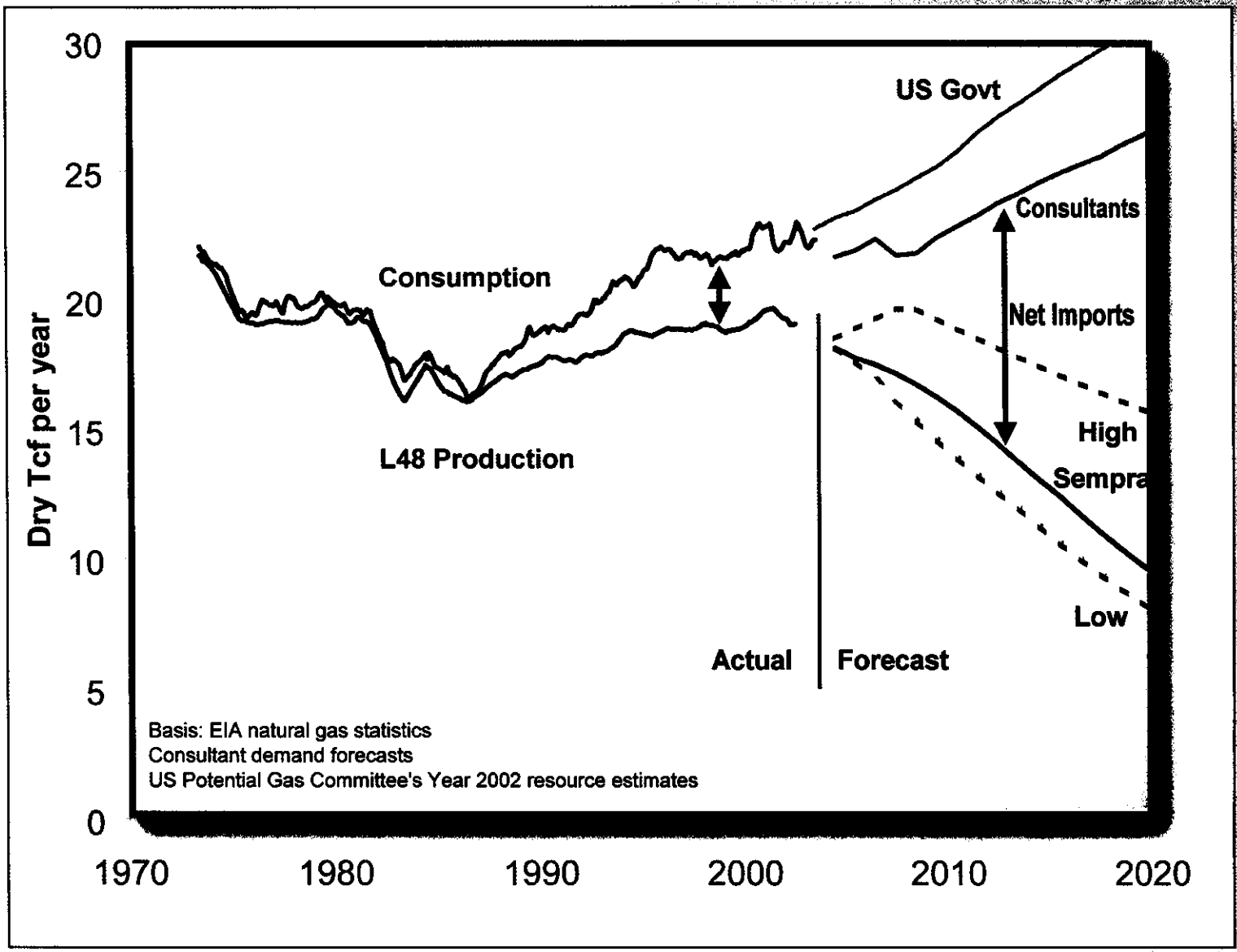
Replacing hydropower with natural gas fired power is like giving away a fully paid house and moving into a rental unit. You risk running out of money and becoming homeless. Any party that decides to analyze the O'Shaughnessy Dam removal case would be prudent to research the feasibility and cost of acquiring natural gas with assured delivery to Northern California over the remaining useful life of O'Shaughnessy. This should be at least enough natural gas to run 100 MW of combined cycle and 118 MW of combustion turbine power plants. Anything less would not meet the prudence standard as it would place the City at risk of lack of supply and unsustainable monetary losses.

Sempra Energy LNG

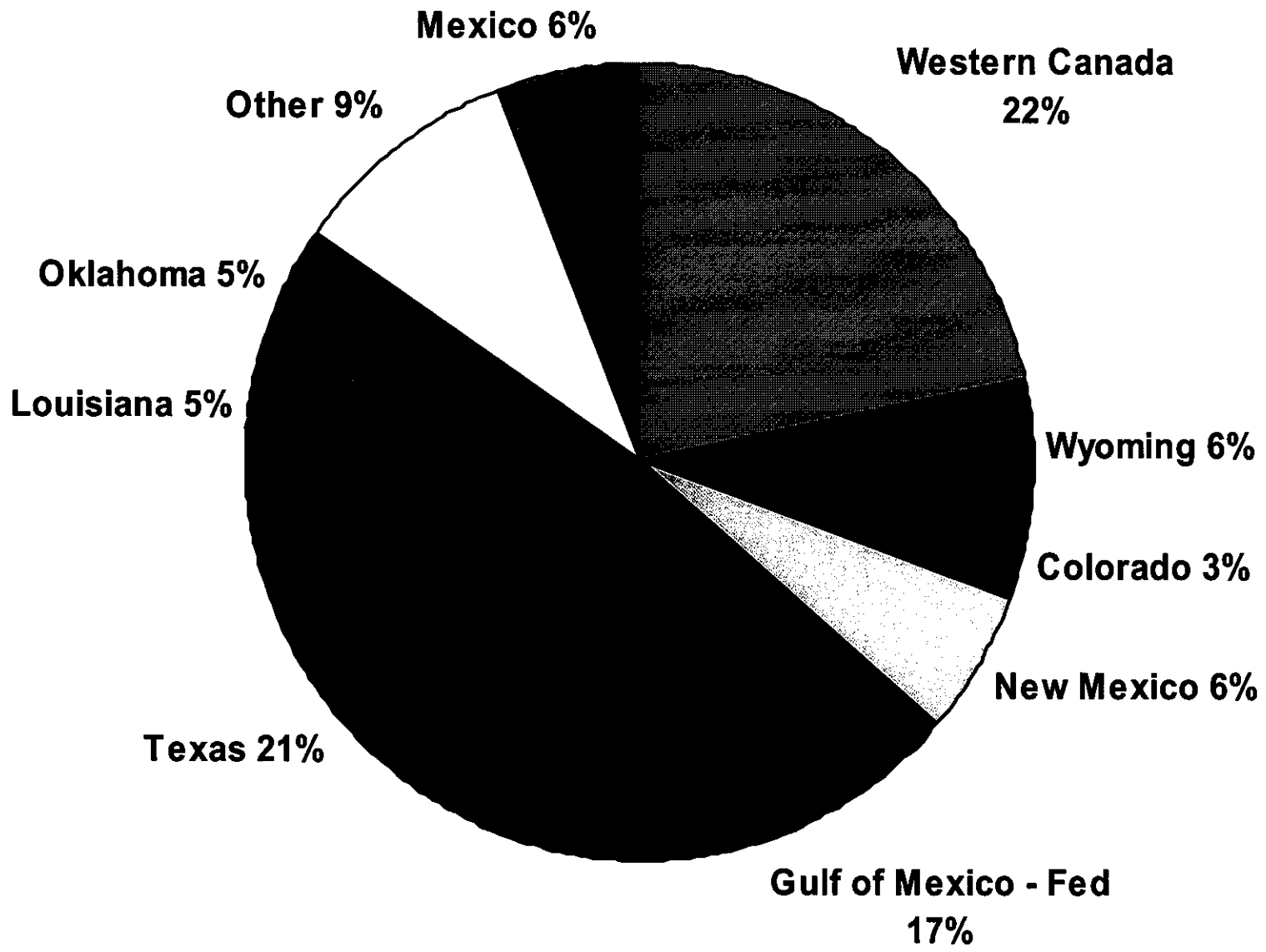
Greg Bartholomew
Vice President, Gas Strategies

December 10, 2003

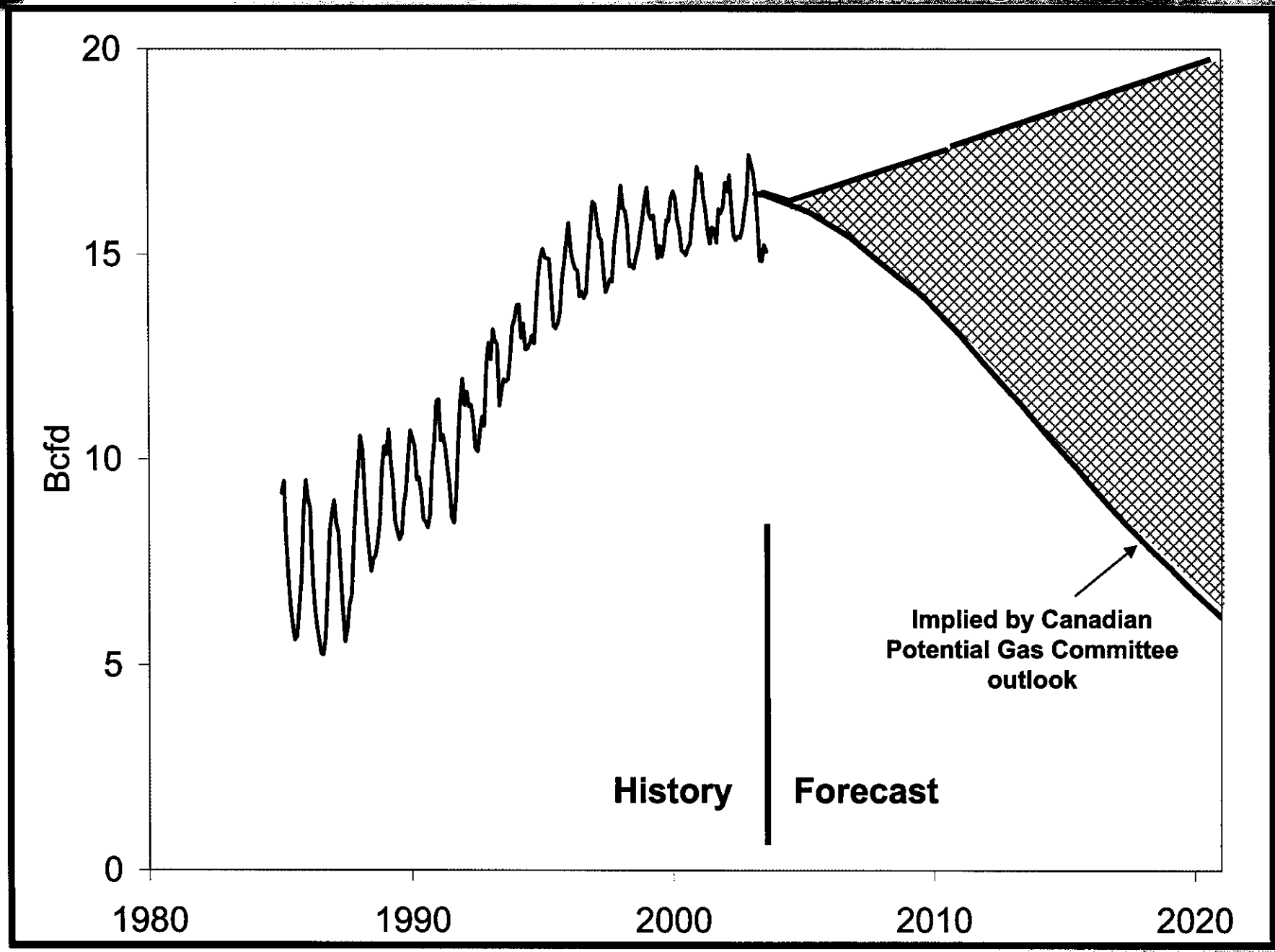
U.S. Natural Gas Supply & Demand



North American Gas Production

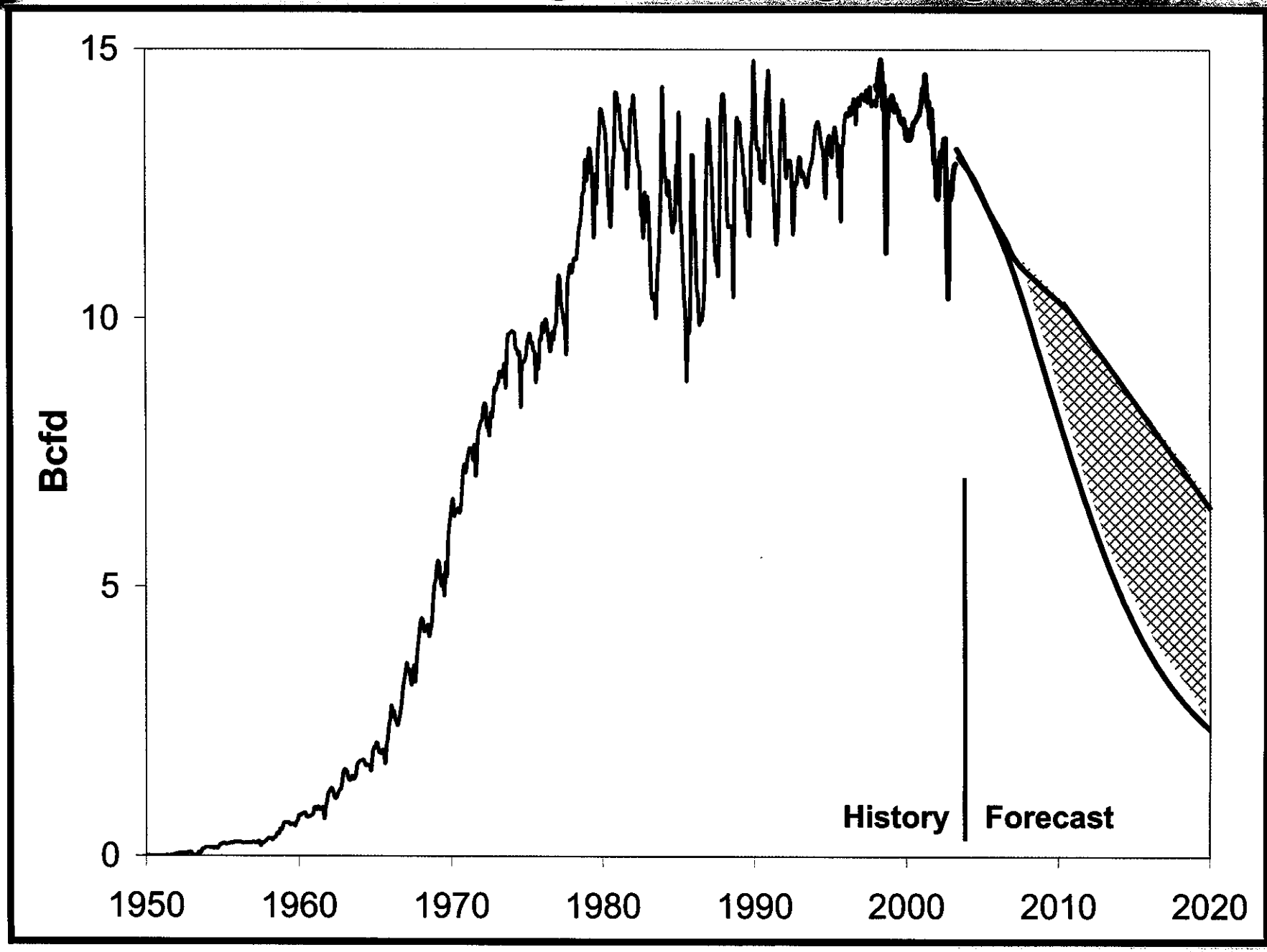


Is WCSB gas production peaking?

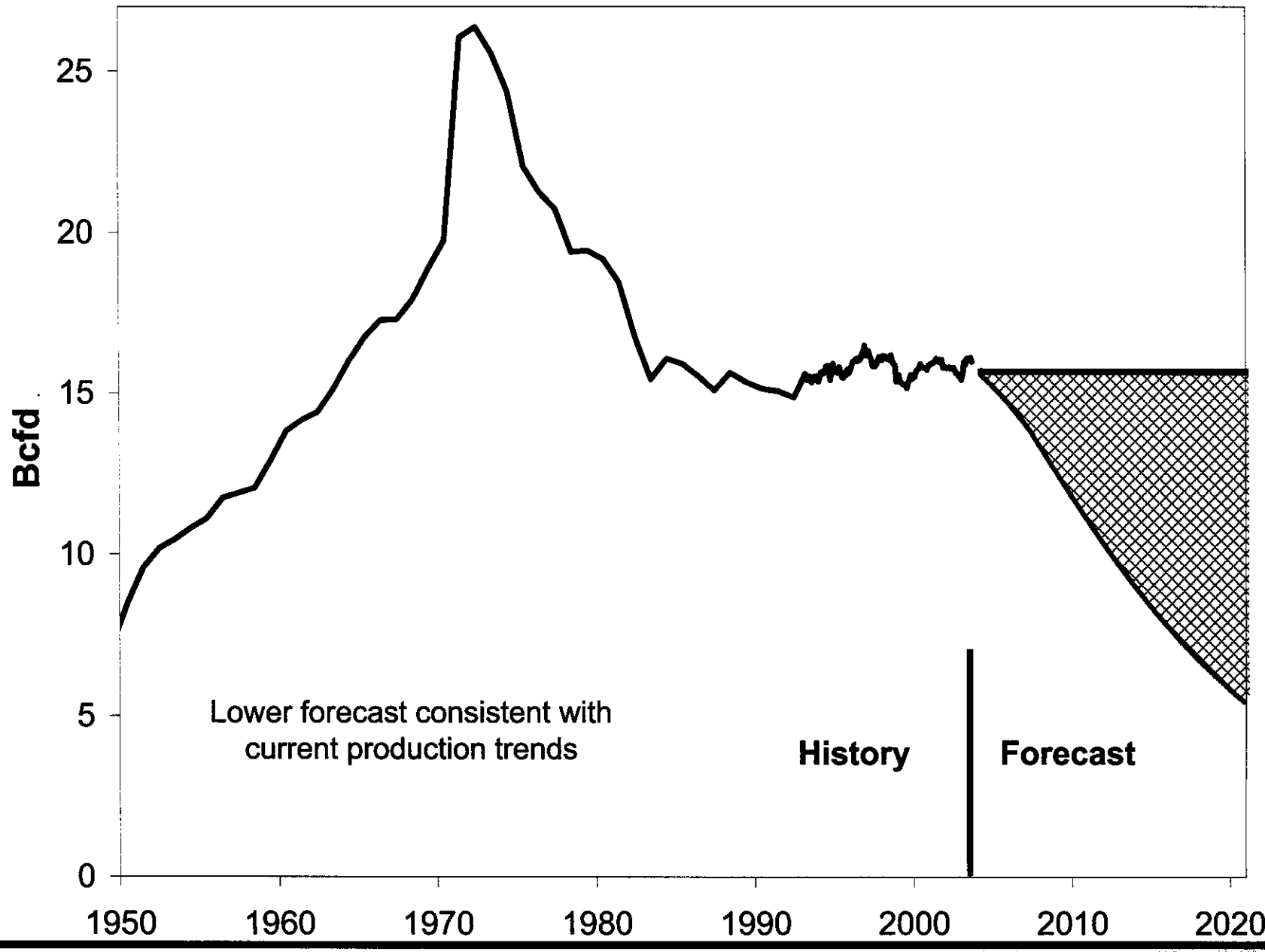


Sempra Energy

Gulf of Mexico gas also beginning to decline

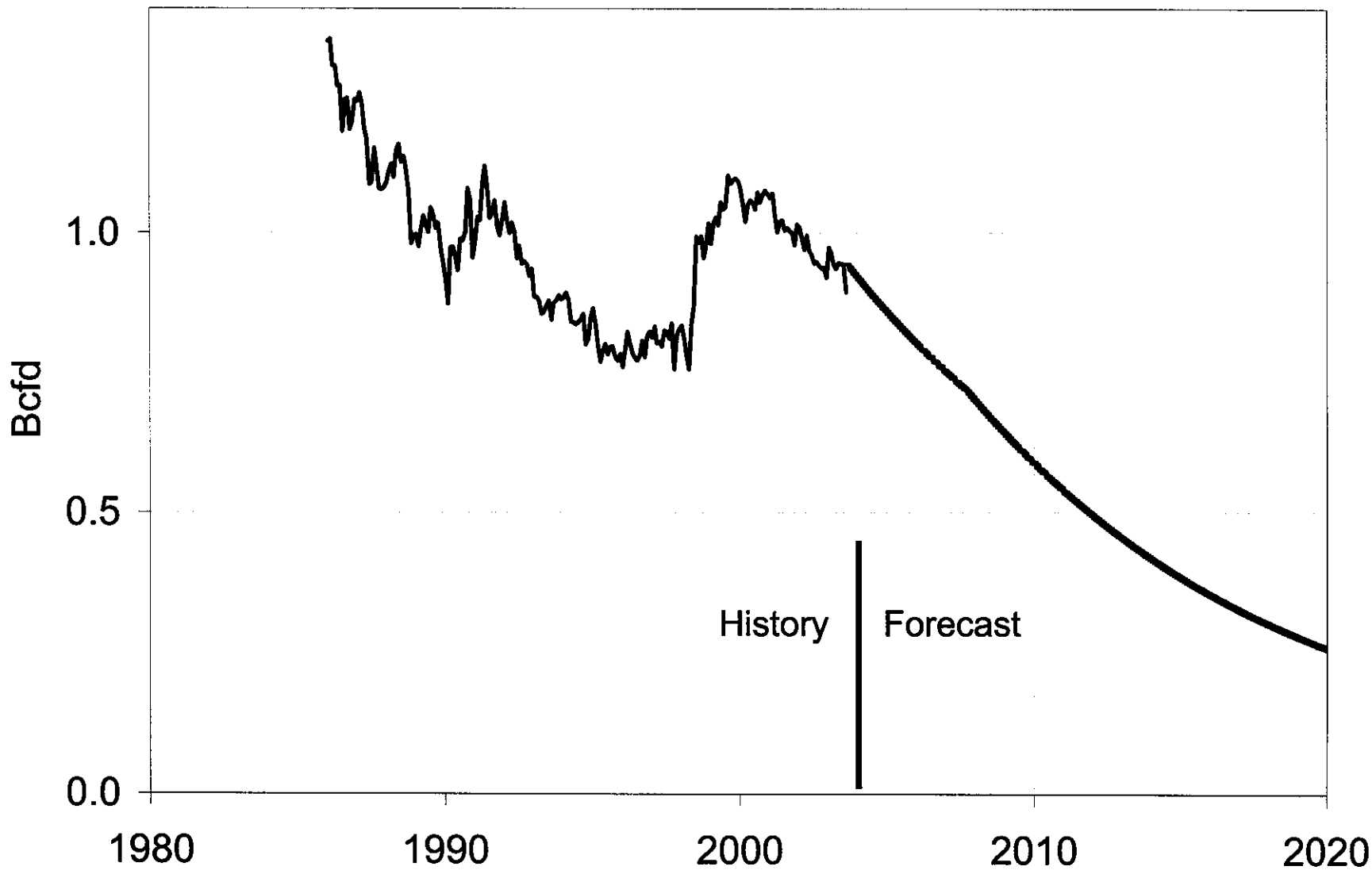


Texas gas production set to decline again

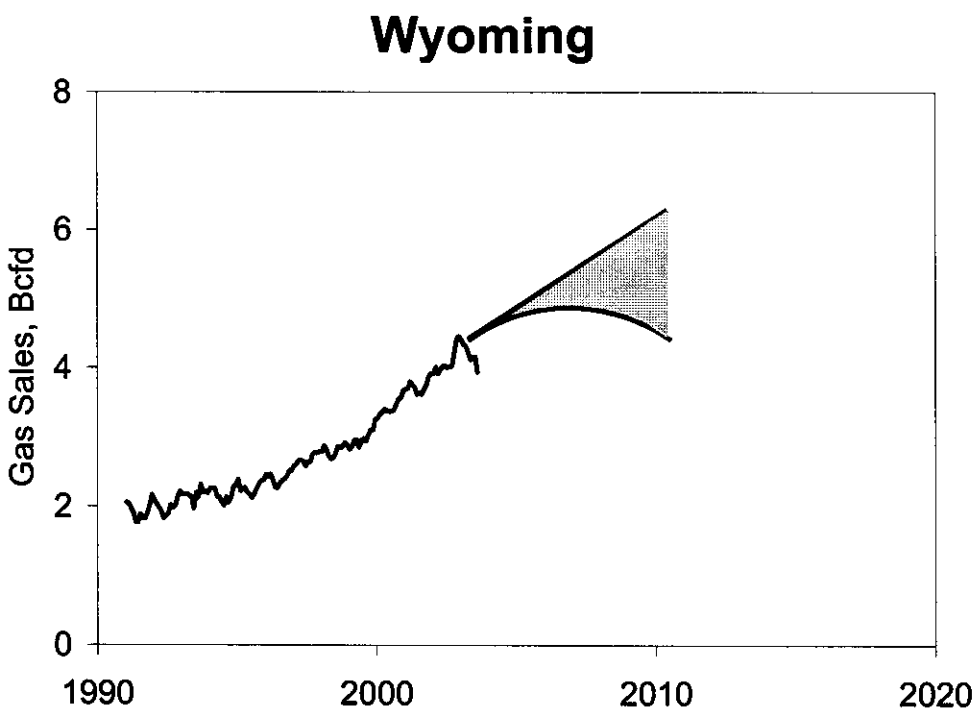


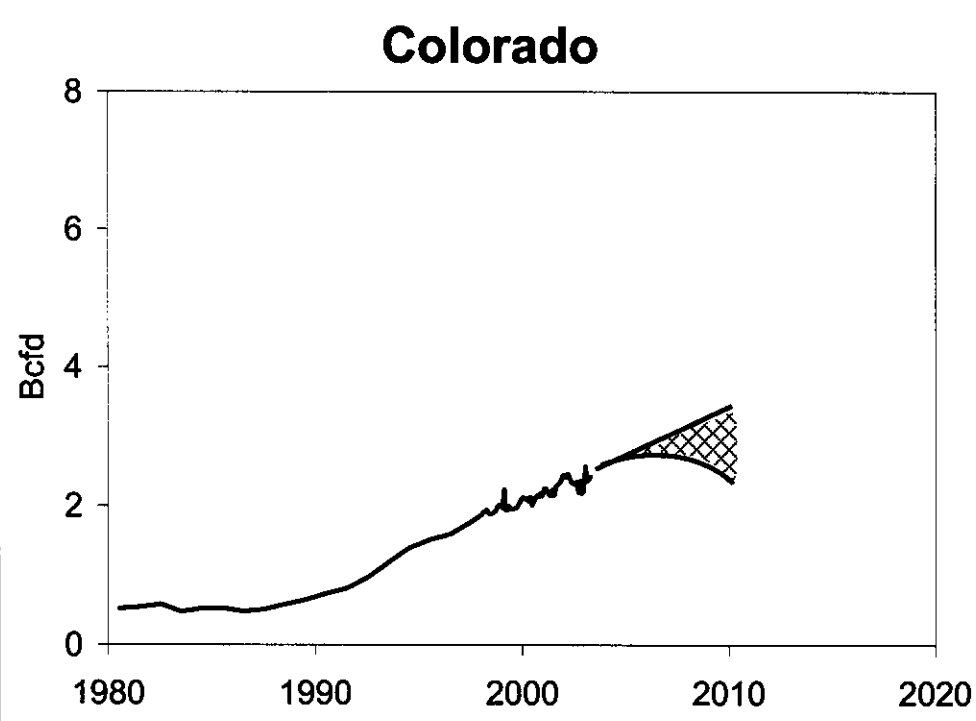
California Natural Gas Production

includes Federal OCS

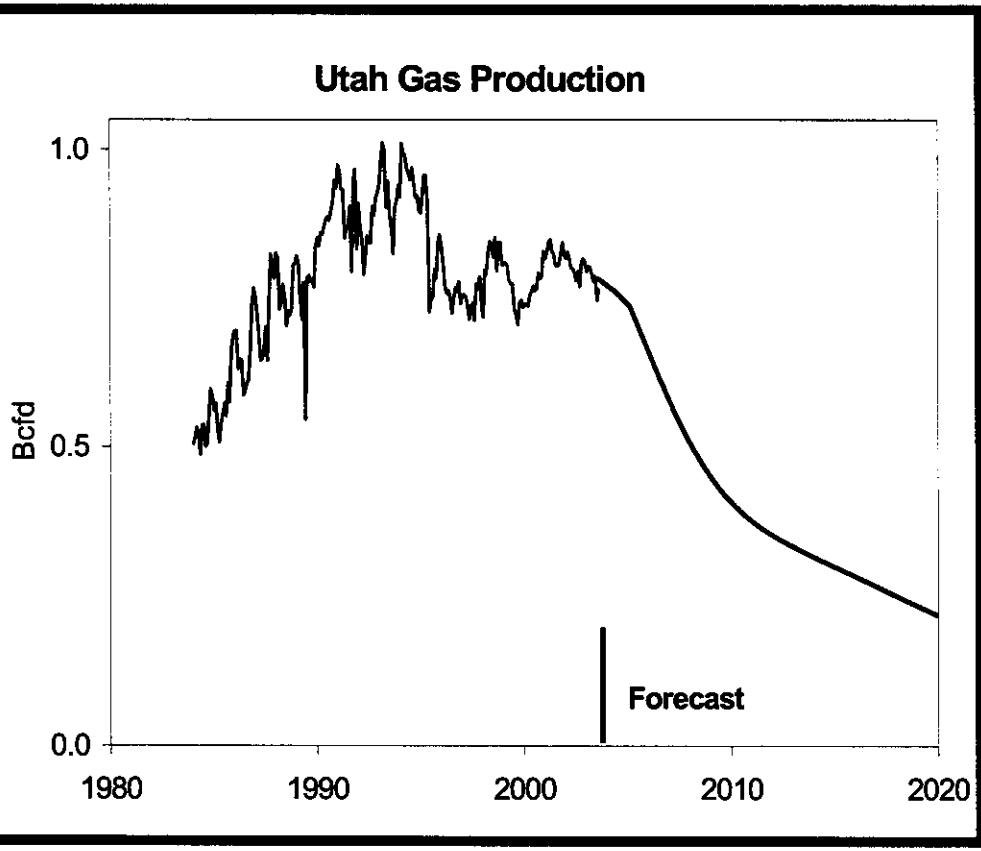


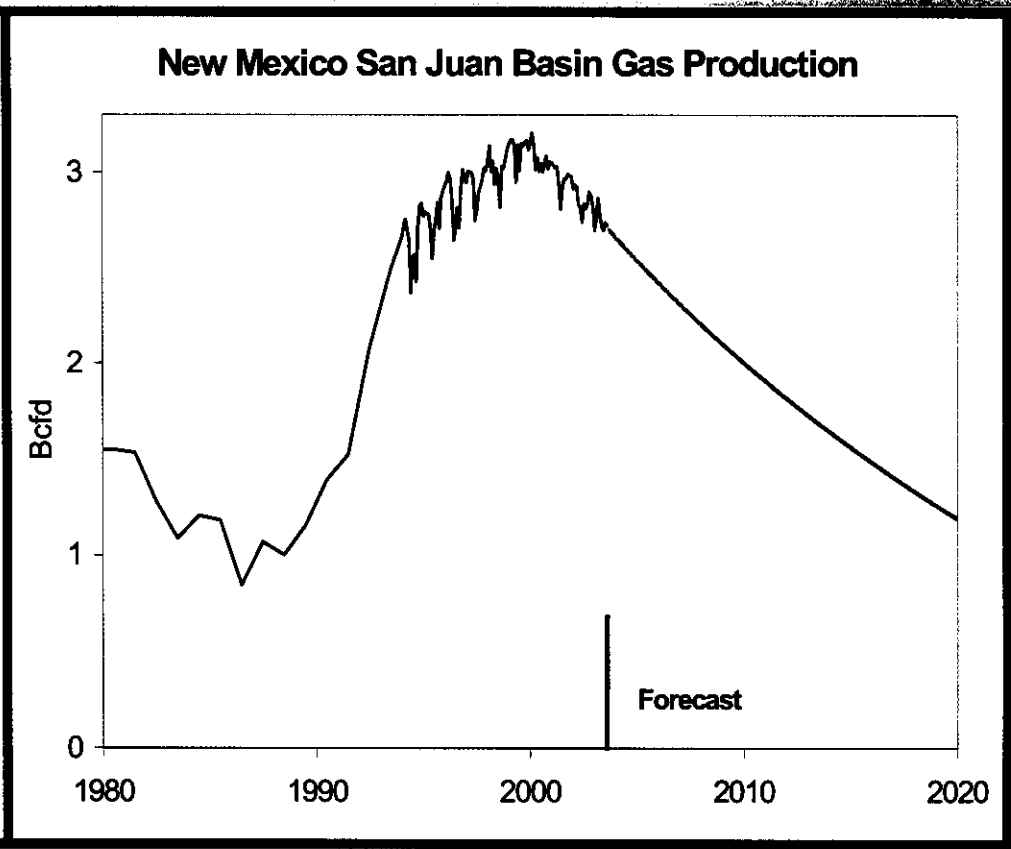
Unconventional gas production in Wyoming and Colorado unlikely to grow fast enough





Utah & New Mexico SJB also declining





If the gas resource assumptions for the CEC, NPC, DOE forecast models are correct:

- why are reserve replacement rates so low?
- why are the production rate declines so high?
- why aren't drilling rig counts higher?
- why are the majors / large independent E&Ps allowing their North American production to decline?

Is California willing to bet its future on timely production from "very difficult" and environmentally-sensitive non-conventional gas resources?

California has little choice but to allow the development of LNG terminals – the only decision is where and how

LNG is the low-risk and low-cost solution for satisfying California & North America's natural gas demand requirements

EIA Historical Data: Natural Gas Production, Wells Drilled, and Wellhead Prices 1990 – 2003

Year	Natural Gas Production (Bcf)	Gas Wells Drilled	Wellhead Price ($/Mcf)
1990	17,810	11,044	1.71
1991	17,698	9,526	1.64
1992	17,840	8,209	1.74
1993	18,095	10,017	2.04
1994	18,821	9,538	1.85
1995	18,599	8,354	1.55
1996	18,854	9,302	2.17
1997	18,902	11,327	2.32
1998	19,024	11,144	1.96
1999	18,832	10,877	2.19
2000	19,182	16,455	3.69
2001	19,616	22,083	4.00
2002	18,964	16,155	2.95
2003	19,068	19,722	4.98

Since 1996 natural gas wells drilled have doubled, wellhead prices have more than doubled and production is flat.