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BEYOND AND BENEATH O'SHAUGHNESSY DAM: OPTIONS TO RESTORE HETCH HETCHY VALLEY AND REPLACE WATER AND ENERGY SUPPLIES

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I. INTRODUCTION

When Congress approved the construction of O'Shaughnessy Dam in Yosemite National Park's Hetch Hetchy Valley in 1913, it concluded a decade-long battle over the future of a rare glacial valley in one of our greatest national parks. Those seeking to make maximum economic use of Hetch Hetchy won out, and the dam on the Tuolumne River has reliably supplied water and power to California's Central Valley and the San Francisco Bay Area for over seventy years.

In 1913, few people had ever seen Yosemite Valley, and far fewer had visited Hetch Hetchy.[1] The question of devoting a large part of a national park to commercial uses was largely theoretical. If Hetch Hetchy were undammed today, it would be visited by millions. The economic and environmental benefits of restoring the valley would be

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[1] *See* JOHN MUIR, THE ENDANGERED VALLEY: THE HETCH-HETCHY IN THE YOSEMITE NATIONAL PARK (1909), *available at* http://www.sfmuseum.org/john/muir14.html.

enormous.

A new water and power supply program would have to be in place before the reservoir is drained and the dam is removed. Current supplies of both water and power can be replaced from other, more reliable sources, improving the economic stability of the service areas. Water from Hetch Hetchy Reservoir can be replaced by a combination of measures. Pumping from Cherry Creek (a Tuolumne River tributary) into the Mountain Tunnel, and from the Tuolumne River below Hetch Hetchy into the Canyon Tunnel, would replace much of the water currently stored in Hetch Hetchy.[2] Other good options include extensive water efficiency improvements and wastewater recycling in the Bay Area, use of water from Don Pedro Reservoir downstream on the Tuolumne River, higher groundwater use in the watershed during droughts, and an increase in the capacity of existing reservoirs.

Draining Hetch Hetchy Reservoir would reduce power generation, but the diversions from Cherry Creek and the Tuolumne River described above could replace most of the lost power. The remaining shortfall could be replaced from a wide variety of sources and improvements, including energy efficiency, solar photovoltaic cells, and more conventional sources such as a combined cycle power plant.

Energy conservation—by itself—could save Bay Area energy consumers more money than implementing the program would cost. Alternatively, the entire program could be paid for by a combination of state general obligation bonds, federal funds, and private donations. The extent to which water and power users should help pay for the restoration of the valley must be determined, but they certainly would benefit financially from the alternative water and power solutions that are implemented.

Removing the reservoir would result in an ecological rebirth of Hetch Hetchy Valley, with substantial revegetation—some by human intervention and some by natural processes—and repopulation by wildlife taking place in less than ten years. Several hundred thousand people per year could be expected to visit the restored Hetch Hetchy Valley, compared to the 50,000 annual visitors to the dam now.[3] This

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[2] GERALD H. MERAL, RESTORE HETCH HETCHY, FINDING THE WAY BACK TO HETCH HETCHY VALLEY: FEASIBILITY STUDY 1 (2005), *available at* http://www.hetchhetchy.org/pdf/restore_hh_full_report_sept_2005.pdf [hereinafter RESTORE HETCH HETCHY]. For diagrams of the Hetch Hetchy system, see SPRECK ROSEKRANS ET AL., ENVTL. DEF., PARADISE REGAINED: SOLUTIONS FOR RESTORING YOSEMITE'S HETCH HETCHY VALLEY 35, 37 (2004).

[3] *See* JESSICA K. RIDER, THE POTENTIAL ECONOMIC BENEFITS OF RESTORING HETCH HETCHY VALLEY 34 (2004), *available at* http://hetchhetchy.water.ca.gov/docs/berkeley_gspp_hetchhetchy.pdf (calling 300,000 annual visitors a conservative estimate); *see also* Terence Chea,

would provide a huge economic benefit to Mariposa and Tuolumne Counties of as much as $60 million per year.[4]

San Francisco built a water and power system that served it well during the twentieth century. Those who planned and built this system are rightfully proud of their accomplishment. Now, in the twenty-first century, we have an opportunity to return Hetch Hetchy Valley to a natural state and make it a much more significant part of Yosemite National Park—and, at the same time, to give San Francisco and its customers and the Modesto and Turlock Irrigation Districts an improved and more reliable utility infrastructure.

The technical feasibility of removing O'Shaughnessy Dam and restoring Hetch Hetchy Valley was confirmed in a July 2006 report commissioned by California Governor Arnold Schwarzenegger.[5] The report analyzed a wide range of cost estimates that were derived from many sources, but it recommended additional studies to determine the financial feasibility of restoration.[6]

In 2007, President Bush recommended that $7 million be spent to continue study of Valley restoration.[7] Congress refused to appropriate the funds.[8] It is possible that the Department of Interior already has sufficient funds to undertake the study.

Section II of this article presents an overview of the natural, human, and political histories concerning Hetch Hetchy Valley and the construction of O'Shaughnessy Dam. Section III then considers the options available to replace water and energy supplies that would be reduced by dam removal. Section IV evaluates the benefits, costs, and financing alternatives related to the proposed removal of O'Shaughnessy Dam and the restoration of Hetch Hetchy Valley. Section V identifies some of the legal issues and obstacles involved in the proposed dam removal, and Section VI describes the Valley as it might be after it is restored.

Take Down Dam Inside Yosemite?, ASSOCIATED PRESS, Aug. 8, 2006, *available at* http://www.msnbc.msn.com/id/14243621/.

[4] RESTORE HETCH HETCHY, *supra* note 2, at 65.

[5] CAL. DEP'T OF WATER RES. & CAL. DEP'T OF PARKS & RECREATION, HETCH HETCHY RESTORATION STUDY 50 (2006), *available at* http://hetchhetchy.water.ca.gov/docs/Hetch_Hetchy_Restoration_Study_Report.pdf.

[6] *Id.*

[7] Douglas Fischer, *Bush Budget Proposes Hetch Hetchy Study*, SAN JOSE MERCURY NEWS, Feb. 7, 2007, *available at* http://www.mercurynews.com/ci_5174242?nclick_check=1.

[8] Michael Doyle, *House Kills Hetch Hetchy Plan*, FRESNO BEE, June 27, 2007.

II. HETCH HETCHY HISTORIES

A. NATURAL HISTORY

1. Geology

Hetch Hetchy's granitic landscape began to take shape more than 100 million years ago when molten material intruded deep within the earth's crust.[9] This material solidified, and overlying rocks eroded away, exposing the granite that was, in some areas, "shaped into bold forms" such as the "cliffs of Yosemite and Hetch Hetchy Valleys."[10]

Some twenty-five million years ago, the Sierra Nevada began to form as flat lowland areas were lifted up and tilted toward the southwest.[11] As the rate and degree of tilt increased, streams flowing toward the Central Valley cut deep canyons into the mountain block.[12]

Three million years ago, glaciers formed among the high mountains.[13] Icefields "in the upper Tuolumne River basin, and in the tributary basins to the north, fed the glacier that moved down the canyon of the Tuolumne River through Hetch Hetchy Valley."[14] Landscape-scale geologic changes continue today.[15]

2. Hydrology

The entire northern part of Yosemite National Park—an area of 669 square miles—is drained by the Tuolumne River.[16] The river originates high in the mountains at the confluence of the Dana Fork, which drains Mount Dana's west-facing slopes, and the Lyell Fork, which flows from the glacier on Mount Lyell.[17] These streams join in Tuolumne Meadows, then flow through the Grand Canyon of the Tuolumne and into Hetch Hetchy Reservoir.[18]

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[9] *See* Yosemite Nat'l Park, Yosemite at a Glance: Geology, www.nps.gov/archive/yose/education/glance/geology/geology.htm (last visited July 26, 2008).

[10] N. KING HUBER, U.S. GEOLOGICAL SURVEY BULL. 1595, THE GEOLOGIC STORY OF YOSEMITE NATIONAL PARK 10 (Yosemite Ass'n 1989) (1987).

[11] *See* Yosemite Nat'l Park, *supra* note 9.

[12] HUBER, *supra* note 10, at 26.

[13] *Id.*

[14] *Id.* at 47.

[15] *See* Yosemite Nat'l Park, *supra* note 9.

[16] Yosemite Nat'l Park, Hydrology and Watersheds, www.nps.gov/archive/yose/nature/wtr_hydrology.htm (last visited July 26, 2008).

[17] *Id.*

[18] *Id.*

3. Biology

Before Hetch Hetchy Valley was dammed:

> open meadows and black oak woodlands stretched along the entire six mile length . . . and from wall to wall. Deer were abundant, feeding on acorns and shrubs. . . . The oak woodlands attracted black bears and provided a staple food for the Indians who hunted the deer. Mountain lions also hunted the deer by hiding in the oaks and occasional conifer woodlands. Sometimes grizzly bears would wander into the valley from the Sierra foothills. . . . There were also predators in the air. . . . Golden eagles nested along the valley rim, and peregrine falcons engaged in aerial attacks above the meadows. . . . But there were more wonders in this valley[:] a plethora of habitats including dry foothill woodland, wet and dry meadows, ephemeral lakes, marshes, black oak and conifer woodlands, springs, seeps, rocky outcrops, grassy benches, cliff crevices, and high montane forests. . . . Almost 700 species of plants inhabited the five square mile valley, by far one of the richest assemblages of plants in California.[19]

B. HUMAN HISTORY

Unlike the narrow, V-shaped canyons cut into downstream mountains and foothills by rivers originating in the upper Sierra Nevada range, the wide, U-shaped valleys of Yosemite and Hetch Hetchy were carved by glaciers and feature walls that drop almost vertically to the broad valley floors.[20] The glaciers scoured rocks and debris, making these areas even more suitable for human occupation.

The Miwoks, a prominent tribe of native Californians, probably started entering the Sierra from the Central Valley at least 2000 years ago, presumably to escape the Central Valley's spring floods and summer heat.[21] The Central Sierra Miwoks were the primary inhabitants of the upper reaches of the Tuolumne River drainage, including Hetch Hetchy Valley.[22]

Because resources in Hetch Hetchy were plentiful, experts think it is

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[19] Stephen J. Botti, *A Place We Never Knew*, 50(1) YOSEMITE 12-13 (1988).

[20] *See* Yosemite Nat'l Park, Geology Overview, www.nps.gov/archive/yose/nature/geology.htm (last visited July 26, 2008).

[21] LINDA WEDEL GREENE, YOSEMITE: THE PARK AND ITS RESOURCES 1 (1987), *available at* www.yosemite.ca.us/library/yosemite_resources/early_history.html#page_1.

[22] *See id.* at 2.

likely that some Indians occupied the valley year-round.[23] Linda W. Greene describes Yosemite before European contact:

> The . . . area's isolation, beauty, and abundance of game, fish, plant foods, and water made it an ideal haven for early peoples. . . . [T]he Miwok hunted grizzly and black bears, deer, and elk, and smaller mammals such as rabbits and grey squirrels. They also utilized several bird species and trout. . . . The native population gathered clover and bulbs in the spring; seeds and fruits in the summer; acorns, nuts, and manzanita berries in the fall; and mushrooms in the late winter and early spring. Black oak acorns, the preferred starch of the California Indian's diet, occurred in the Yosemite region in abundance.[24]

The Miwok word "hetchetci" describes seeds from "a grass growing in Hetch Hetchy valley and from which a mush was made."[25]

Other tribes, mainly the Mono Paiutes and the Washoes, regularly visited and occasionally occupied the Central Sierra.[26] The Miwoks traded baskets, beads, arrows, and manzanita berries to the Paiutes for baskets, obsidian, projectile points, salt, rabbit skin blankets, pinyon nuts, pigments, buffalo robes, and fly pupae.[27] The Washoes received acorns, shell disks, soaproot fibers, redbud bark, and manzanita berries in exchange for pinyon nuts, rabbit skin blankets, dried fish, and buffalo skins.[28]

Early Europeans apparently used Hetch Hetchy Valley to pasture sheep,[29] although there is little historical documentation. The first Europeans in the valley were probably the brothers Joseph and Nathan Screech, who arrived in the late 1840s on a bear hunt.[30]

Yosemite National Park was created on October 1, 1890, a result of John Muir's fight to save the subalpine meadows surrounding Yosemite Valley.[31] The park included Hetch Hetchy Valley. Military units,

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[23] *See id.* at 4 (describing seasonal Miwok occupation and possible winter inhabitation by another tribe, the Paiute).

[24] *Id.*

[25] S.A. Barrett & E.W. Gifford, *Miwok Material Culture*, 2 BULL. OF THE PUB. MUSEUM OF THE CITY OF MILWAUKEE 117, 155 (1933), *available at* www.yosemite.ca.us/library/miwok_material_culture/seeds.html.

[26] RESTORE HETCH HETCHY, *supra* note 2, at 5.

[27] GREENE, *supra* note 21, at 5.

[28] *Id.*

[29] Thomas Atkins, *Hetch Hetchy: Yosemite's Flooded Treasure*, SIERRA MOUNTAIN TIMES, May 29th, 2008, *available at* http://mysierramountaintimes.com/?p=1861.

[30] *Id.*

[31] Nat'l Park Serv., Yosemite, History & Culture, http://www.nps.gov/yose/historyculture/index.htm (last visited July 16, 2008).

including a unit of African-American "Buffalo Soldiers" (some of whom were stationed at Hetch Hetchy), were assigned the task of administering the park.[32] In 1916, Congress authorized the creation of the National Park Service.[33]

C. POLITICAL HISTORY

Nearly every major city in the southwestern United States has reached beyond its watershed for water.[34] The dry climate requires water supplies from the mountains, and so Los Angeles, San Diego, Tucson, Salt Lake City, Denver, Phoenix, and Oakland have all undertaken inter-basin water transfers to slake a growing thirst.[35]

San Francisco is no different. From the middle 1800s to the early 1900s, boosters of San Francisco as an "Imperial City of the West" took every opportunity to extract natural resources—timber, gold, lead, silver, and water—from the rural areas of California and beyond.[36] Chief among the boosters was James D. Phelan, Mayor of San Francisco.[37] Phelan and other San Francisco officials cast their eyes on the Tuolumne River in Hetch Hetchy Valley as the main source for their future public water supply.[38] No other place would do, the boosters claimed, despite the protestations of John Muir, the nation's leading conservationist and an outspoken advocate of preserving Hetch Hetchy Valley.[39] Muir had carefully documented numerous other water sources for San Francisco outside Yosemite National Park.[40] In Hetch Hetchy's defense, Muir exclaimed, "These temple destroyers, devotees of ravaging

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[32] *See id.* (follow "Buffalo Soldiers in Yosemite?" link).

[33] *Id.*

[34] *See generally* MARC REISNER, CADILLAC DESERT (1986).

[35] RESTORE HETCH HETCHY, *supra* note 2, at 6.

[36] *See generally* GRAY BRECHIN, IMPERIAL SAN FRANCISCO: URBAN POWER, EARTHLY RUIN (1999).

[37] Gabriel Metcalf, *The Imagined City: Burnham's Vision*, SPUR, July 2006, at 6, *available at* http://www.spur.org/newsletters/200607SPURnews.pdf (describing Phelan's monumental vision for the development of San Francisco).

[38] John E. Thorson, *Book Review: Imperial San Francisco*, 4 AM. BAR ASS'N WATER RES. COMM. NEWSL., Dec. 2000, *available at* www.abanet.org/environ/committees/waterresources/newsletter/dec00/thorson.shtml.

[39] *See* Nat'l Park Serv., *supra* note 31 ("Hetch Hetchy Valley became the center of a bitter political struggle when the City of San Francisco wanted to dam the Tuolumne River . . . as a source of drinking water and hydroelectric power.").

[40] *See* John Muir, *Let Everyone Help to Save the Famous Hetch-Hetchy Valley and Stop the Commercial Destruction Which Threatens Our National Parks* 6, *available at* www.sfmuseum.org/john/muir6.html (listing "A Dozen Sources of Water Supply [that were] Available for San Francisco").

commercialism, seem to have a perfect contempt for Nature, and, instead of lifting their eyes to the God of the mountains, lift them to the Almighty Dollar."[41]

Despite the fact that Hetch Hetchy Valley was part of Yosemite National Park, there were those who believed that the public lands existed primarily to serve the public's demand for resources. These utilitarians were led by Gifford Pinchot, the Chief of the U.S. Forestry Department.[42] John Muir and his "nature-loving" allies, as well as the Turlock Irrigation District, the Modesto Irrigation District, one of California's United States Senators, John Works, and nearly every major newspaper in the country were aligned on the other side.[43] On September 4, 1913, the New York Times editorialized:

> The only time to set aside national parks is before the bustling needs of civilization have crept upon them. Legal walls must be built about them for defense, for every park will be attacked. Men and municipalities who wish something for nothing will encroach upon them if permitted. The Hetch Hetchy Valley in the Yosemite National Park is an illustration of this universal struggle.
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> . . . The politicians of San Francisco care nothing for matters of natural beauty and taste. They have an eye only for utility, a utility that flows their way. The chief newspapers and organs of public opinion throughout the country have spoken in opposition to the "grab." We trust that the Senate will heed their expression of public sentiment, and, failing that, that President Wilson will veto the measure.[44]

But Wilson failed to do so, and the Raker Act became law.[45] A few years later, San Francisco cut down all the trees on the Hetch Hetchy Valley floor and began to build O'Shaughnessy Dam, which was completed in 1923.[46] Hetch Hetchy Valley had become the "water tank"

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[41] JOHN MUIR, THE YOSEMITE 261-262 (1912).

[42] ERIC KATZ, NATURE AS SUBJECT, HUMAN OBLIGATION AND NATURAL COMMUNITY 231 (1996).

[43] NORRIS HUNDLEY, THE GREAT THIRST 178 (2001); *see* William F. Bade, *The Hetch-Hetchy Situation*, SIERRA CLUB BULL., Jan. 1914, *available at* http://www.sierraclub.org/ca/hetchhetchy/bade_jan_1914_scb.html.

[44] Editorial, *Hetch Hetchy*, N.Y. TIMES, Sept. 4, 1913, *available at* http://www.sierraclub.org/ca/hetchhetchy/ny_times_1913_editorials.html.

[45] *See* H.R. 7207 § 25(A)(5), 63rd Cong. (1st Sess. 1913).

[46] *See* Glen Martin, *Yosemite National Park Underwater Wonder*, S.F. CHRON., Nov. 21, 2004, at A-17.

that John Muir railed against.[47] It took years to finish the construction of facilities to pipe the water from Yosemite through the mountains and foothills, across the Central Valley, through the Coast Range, across San Francisco Bay, and into San Francisco, where the water finally arrived in 1934.[48] Later, the Holm and Kirkwood Powerhouses were constructed downstream on the Tuolumne and its tributaries, outside the boundaries of Yosemite National Park, and added to San Francisco's water and power system.[49]

The fight over Hetch Hetchy was the first highly visible nationwide conservation battle.[50] It galvanized those who were disturbed over the rampant destruction of the environment by logging, mining, market-oriented wildlife hunting, and uncontrolled development.[51] There is little doubt that Congressional passage of the National Parks Organic Act in 1916, three years after the Raker Act, was stimulated by congressional concern that San Francisco's dam in Yosemite National Park would be envied and emulated by others who sought to use national park resources for their own advantage.[52] By enacting the Organic Act, Congress essentially said, "Never Again!" to future would-be exploiters of our national parks.

III. WATER AND ENERGY SUPPLY IMPACTS OF DAM REMOVAL

A. OPTIMAL ALTERNATIVES TO MEET WATER NEEDS

San Francisco told Congress in the early twentieth century that building a dam in Hetch Hetchy Valley was necessary to furnish water for the city, which had outgrown its Bay Area water supply.[53] But today, if Hetch Hetchy Reservoir were removed, new water management methods combined with the construction of other water supply facilities

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[47] JOHN MUIR, *supra* note 41, at 262.

[48] *See* Paul Shigley, *Cities Pressure San Francisco to Repair Hetch Hetchy*, CAL. PLAN. & DEV. REP., Apr. 2002, *available at* http://findarticles.com/p/articles/mi_m0BYL/is_4_17/ai_n25046348.

[49] S.F. PLANNING DEP'T, HETCH HETCHY COMMUNICATION SYSTEM UPGRADE PROJECT ENVIRONMENTAL ASSESSMENT/INITIAL STUDY 3-151 (2007), *available at* http://home.nps.gov/yose/parkmgmt/upload/3.0_-_Affected_Environment_and_Environmental_Consequences_Part_1.pdf.

[50] ROBERT W. RIGHTER, THE BATTLE OVER HETCH HETCHY 4 (2005).

[51] *See id.* at 4-5. However, "defenders of the valley consistently advocated development, including roads, hotels, winter sports amenities, and the infrastructure to support legions of visitors." *Id.* at 6.

[52] Robin W. Winks, *The National Park Service Act of 1916: "A Contradictory Mandate"?*, 74 DENV. U. L. REV. 575, 592 (1997).

[53] *Cf.* RIGHTER, *supra* note 50, at 4 (describing a "city, surrounded on three sides by salt water, [that] was in trouble").

would make it possible for San Francisco and its Bay Area customers to meet their water needs more efficiently.[54] The water needs of the Modesto and Turlock Irrigation Districts (possessing some of the oldest water rights in California) can also be met after the removal of the reservoir.[55]

With the proposed removal of O'Shaughnessy Dam, there are ways to make sure that San Francisco and its customers are made whole, or even better off, with respect to power and water supplies once the reservoir is removed.[56] San Francisco has claimed that the firm yield[57] of O'Shaughnessy Reservoir is 239 million gallons per day, or 267,680 acre-feet per year.[58] Total firm yield of the entire Tuolumne River Hetch Hetchy system is 306 million gallons per day, or 343,000 acre-feet per year, including the water from Eleanor and Cherry Reservoirs.[59] This is 18% of the nine Bay Area counties' water use, only 3% of California urban water use, and about 1% of total California water use.[60] At present, San Francisco draws about 85% of its water (roughly 249,000 acre-feet per year) from the Tuolumne River.[61] Existing conveyance facilities would allow a maximum additional diversion of 89,000 acre-feet per year.[62] This would allow for more than 30% growth in water use in the San Francisco service area.[63]

San Francisco argues in its Water System Improvement Program that, due to urban growth in its service area outside the city limits of San Francisco, it will eventually be necessary to divert up to an additional

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[54] *See* ROSEKRANS ET AL., *supra* note 2, at 3.

[55] *Id.*, at 106 ("The analysis presented in this report shows that replacing the water-supply and hydropower benefits currently provided by Hetch Hetchy Reservoir can be accomplished in technologically feasible, safe, dependable and affordable ways.").

[56] *Cf.* ROSEKRANS ET AL., *supra* note 2, at 3 ("[A] few key projects within San Francisco's $3.6 billion Capital Improvement Program could not only improve the City's ability to deliver water but also allow for the ultimate restoration of Hetch Hetchy Valley.").

[57] Firm yield is the amount of water that San Francisco can expect to obtain from the reservoir in a relatively dry year.

[58] BAY AREA ECON. F., HETCH HETCHY WATER AND THE BAY AREA ECONOMY 5 (2002), *available at* http://www.bayeconfor.org/media/files/pdf/hetchhetchyfinal2.pdf.

[59] RESTORE HETCH HETCHY, *supra* note 2, at 19. Eleanor and Cherry Reservoirs contribute around ninety-seven million gallons a day ("mgd"), a state fish hatchery uses roughly twenty mgd, and miscellaneous losses total roughly ten mgd. *Id.* at n.xxiv (citing SVERDRUP & PARCEL & ASSOCS., HETCH HETCHY WATER AND POWER WATERSHED FIRM YIELD STUDY 1-3 (1981)).

[60] RESTORE HETCH HETCHY, *supra* note 2, at 19.

[61] *See* S.F. PUB. UTIL. COMM'N, 2005 URBAN WATER MANAGEMENT PLAN FOR THE CITY AND COUNTY OF SAN FRANCISCO 11 (2005), *available at* http://sfwater.org/detail.cfm/MC_ID/13/MSC_ID/165/MTO_ID/286/C_ID/2776.

[62] RESTORE HETCH HETCHY, *supra* note 2, at 19.

[63] *Id.*

179,000 acre-feet per year, or 10% of the entire historic flow of the Tuolumne River, to meet these needs.[64] This additional water is above and beyond the full use of their existing facilities, as discussed above. Since the city currently serves approximately 2.4 million people (in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne Counties),[65] it can serve nearly an additional one million people by fully utilizing existing facilities.[66] The city could serve an additional two million people beyond that with the proposed new facilities.[67] In other words, San Francisco proposes to eventually more than double the population of its service area—from 2.4 million to 5.5 million—with water from the Tuolumne.[68] Even without Hetch Hetchy Reservoir, this population increase could be accommodated if better water efficiency, wastewater reclamation, and groundwater management practices were instituted.[69]

The State Department of Finance estimates that population growth in the San Francisco service area will average about 0.5% per year.[70] At this rate, it would take more than 140 years to double the population. The Bay Area as a whole grew about 1% per year from 1990 to 2000. Even at the 1% growth rate, it would take seventy-two years for the projected doubling of the service area's population to occur. Nearly all this growth would be outside San Francisco.[71]

There is an important question about whether continued urban growth in the southern and eastern portions of the Bay Area is a good idea, given the traffic congestion, air quality degradation, and loss of open space that such growth would cause. While the debate about growth in the Bay Area is beyond the scope of this article, there is little if any support for the argument that additional Tuolumne River water must be

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[64] *Id.*

[65] S.F. PUB. UTIL. COMM'N, *supra* note 61, at 5.

[66] RESTORE HETCH HETCHY, *supra* note 2, at 19.

[67] *Id.*

[68] *Id.*

[69] *See* PETER H. GLEICK ET AL., PAC. INST., WASTE NOT, WANT NOT: THE POTENTIAL FOR URBAN WATER CONSERVATION IN CALIFORNIA 1 (2003), *available at* http://www.pacinst.org/reports/urban_usage/waste_not_want_not_full_report.pdf ("The potential for conservation and efficiency improvements in California is so large that even when the expected growth in the state's population and economy is taken into account, no new water-supply dams or reservoirs are needed in the coming decades. Furthermore, the state's natural ecological inheritance and beauty do not have to be sacrificed to satisfy our water needs. In fact, through improvements in efficiency and conservation, we can meet California's future water needs while increasing the amount of water returned to the natural environment—thus ensuring that natural systems are protected and underground aquifers recharged.").

[70] RESTORE HETCH HETCHY, *supra* note 2, at 19.

[71] S.F. PUB. UTIL. COMM'N, *supra* note 61, at 6 (projecting an approximate annual growth rate in San Francisco of .35% between 2005 and 2030).

diverted to meet growth needs. A larger population need not result in increased consumption of water.[72] Population in the Metropolitan Water District of Southern California has increased greatly in the past decade, with almost no increase in total demand for water.[73]

If population growth comes about through urban infill—as opposed to suburban sprawl—any new water demand created by such growth will be relatively small.[74] Regardless of the amount or location of population growth, the Tuolumne River, already highly stressed both upstream and downstream from Don Pedro Reservoir, cannot support an additional diversion of more than half of its remaining flow.[75] For that reason, if it is decided that San Francisco water customers need more water than is currently being diverted from Bay Area and Tuolumne sources, the additional water should be supplied from even greater utilization of the alternative water sources discussed below—sources that do not require additional diversion from the Tuolumne.[76]

Currently, due to diversions by San Francisco and the irrigation districts, flows in the Tuolumne below La Grange Dam average only 25% of their historical levels.[77] Great damage has been caused by these reductions in flows and by the various impoundments on the main river and its tributaries.[78] Diversion projects have drastically reduced salmon populations, and native Chinook salmon are currently at grave risk of extinction.[79]

While augmented summer flows from Holm Powerhouse have

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[72] GLEICK ET AL., *supra* note 69, at 1.

[73] RESTORE HETCH HETCHY, *supra* note 2, at 20; Tuolumne River Trust, Stop the SFPUC Water Grab!, http://www.tuolumne.org/content/index.php?topic=programs_bayarea (last visited July 31, 2008) ("Los Angeles decreased water use by 16% from 1990 to 2003 despite a 14% increase in population.").

[74] RESTORE HETCH HETCHY, *supra* note 2, at 20.

[75] *See* Tuolumne River Trust, *supra* note 73; *cf.* MCBAIN & TRUSH, A SUMMARY OF THE HABITAT RESTORATION PLAN FOR THE LOWER TUOLUMNE RIVER CORRIDOR 2-3 (1999), *available at* http://www.tuolumnerivertac.com/Documents/tuolplan.pdf (describing the Tuolumne as a river beset by a wide range of impacts from water development).

[76] *Cf.* Tuolumne River Trust, *supra* note 73 (quoting the California Department of Fish and Game's comments on the SFPUC's Water System Improvement Program: "[W]e believe that if implemented as proposed, the WSIP would only exacerbate the current decline of anadromous fisheries in the Tuolumne River. Consequently, we respectfully request that the SFPUC use alternative water sources other than the Tuolumne river system or implement water conservation measures to meet drought year demands and 2030 purchase requests.").

[77] RESTORE HETCH HETCHY, *supra* note 2, at 21 tbl. 1.

[78] *See generally* MCBAIN & TRUSH, *supra* note 75.

[79] Editorial, *Tuolumne Salmon at High Risk of Extinction*, MODESTO BEE, May 2, 2008, *available at* http://www.tuolumne.org/content/article.php/20080505115159394 (citing a recent U.S. Fish and Wildlife Service report that specifically attributes the salmon's precarious state to inadequate releases from Don Pedro reservoir); MCBAIN & TRUSH, *supra* note 75, at 1.

extended the whitewater boating season, desirable boating flows are curtailed when O'Shaughnessy Dam stops spilling, and when Cherry and Eleanor Reservoirs fail to provide boating flows and confine their releases to the bare minimum necessary for fish.[80] Additional diversions will simply worsen conditions for fish and whitewater recreation.[81]

There are many options for ensuring an adequate water supply for San Francisco and its customers. After the reservoir is removed, each of the following steps is likely to be taken:

- Diverting and pumping water from below the dam site into the Canyon Tunnel.
- Increased efficiency of water use.
- Wastewater reclamation (recycling).
- Pumping water from Cherry Creek below Holm Powerhouse into the Mountain Tunnel.

A recent report by the Tuolumne Trust describes the damage that would be done to the Tuolumne River by additional diversions and outlines a plan to avoid those diversions through conservation, water recycling, and other management techniques.[82]

1. Diverting Water from Below the Dam Site After Removal of the Reservoir

While Hetch Hetchy Reservoir would be entirely eliminated under the dam removal scenario, water from the Tuolumne River could still be diverted into the Canyon Tunnel, which leads to Kirkwood Powerhouse.[83] A pump station about a half-mile below the existing dam site would lift water about sixty feet into the Canyon Tunnel.[84] Only water not needed for instream flows to support fish, wildlife, and recreation would be diverted. The pump station and diversion weir would cost around $52 million.[85] Modifications to the Kirkwood turbines and generators plus automation and watershed telemetry costing less than

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[80] RESTORE HETCH HETCHY, *supra* note 2, at 20; *cf.* MCBAIN & TRUSH, & RMC, FOR S.F. PUB. UTIL. COMM'N, UPPER TUOLUMNE RIVER: DESCRIPTION OF RIVER ECOSYSTEM AND RECOMMENDED MONITORING ACTIONS 5-41 (2007) (describing flow fluctuations and management).

[81] Tuolumne River Trust, *supra* note 73.

[82] *See generally* HEATHER DEMPSEY & ERIC WESSELMAN, FROM THE TUOLUMNE TO THE TAP (2007), *available at* www.tuolumne.org/content/fmd/files/FromtheTuolumnetotheTap Report.pdf.

[83] RESTORE HETCH HETCHY, *supra* note 2, at 3, fig. 1A; *see* ROSEKRANS ET AL., *supra* note 2, at 37, fig. 5-7.

[84] RESTORE HETCH HETCHY, *supra* note 2, at 21.

[85] *Id.* (citing 2005 figures).

$20 million would be required.[86] For every kilowatt-hour (kWh) used for pumping this water into the tunnel, six kWh would be generated at Kirkwood Powerhouse.[87]

There is a hump in the Canyon Tunnel that rises fifty feet above streambed elevation in the valley. The hump is seldom a problem now since the reservoir level is kept above that hump.[88] After the dam is removed, pumping from the river below the dam into the Canyon Tunnel will overcome the problem.[89] This will allow water from the river to be used to generate power at Kirkwood Powerhouse.[90] The proposed diversion of additional water from below the dam site into the Canyon Tunnel would be almost invisible from Hetch Hetchy Valley and would intrude little on the natural scenery.[91] A fish screen would keep fish and debris out of the pumps.[92]

The amount of water that could be captured through this diversion would vary greatly depending on the season and the type of water year. In high-runoff years the Canyon Tunnel could be kept flowing at relatively full capacity from December well into July, and significant amounts of water could be diverted during those months, while instream flows would still meet downstream fish preservation and water quality standards and support recreation.[93] In drier years, substantially lesser amounts of water would be diverted into the Canyon Tunnel, and shortfalls in supply would be met by employing the alternate means discussed below.[94]

Currently, a maximum of 1391 cubic feet per second (cfs) can be diverted into the Canyon Tunnel.[95] The same maximum amount could be diverted into the Canyon Tunnel after the dam has been removed.[96] Restore Hetch Hetchy's analysis shows diversions in a median year, with and without the reservoir. If water were pumped from below Holm Powerhouse (as discussed below) into the Mountain Tunnel, there would be no loss of water supply in a median year even with the Hetch Hetchy

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[86] *Id.*
[87] *Id.*
[88] RESTORE HETCH HETCHY, *supra* note 2, at 22.
[89] *Id.*
[90] *Id.*
[91] *Id.*
[92] *Id.*
[93] RESTORE HETCH HETCHY, *supra* note 2, at 22.
[94] *Id.*
[95] *Id.*
[96] *Id.*

Reservoir removed.[97] In a dry year, supplemental water would be needed.[98]

Another option would be not to divert water into the Canyon Tunnel, but to abandon that facility and let all the water flow down the river channel to Early Intake Reservoir.[99] This option would greatly reduce power generation—by an estimated 267 million kWh per year, costing around $15 million per year.[100] Some would prefer this option, since it would leave the river downstream of Hetch Hetchy Valley in a more pristine condition.[101]

A final option would be to divert the water at the O'Shaughnessy dam site into a tunnel discharging into the Canyon Tunnel.[102] This six-mile-long tunnel would cost ten times as much as diverting from the river downstream.[103] This plan would also require leaving twenty feet of the dam in the river to divert water into the tunnel.[104]

With any option, the same amount of water would be available for generation of energy at Moccasin Powerhouse and for export, since water not captured at Hetch Hetchy will be captured downstream at Early Intake.[105]

2. *Water Efficiency*

Increased water efficiency[106] should play a key role in replacing the Hetch Hetchy Reservoir water supply.[107] Water efficiency should be aggressively pursued in outdoor irrigation and indoor domestic, commercial, and industrial uses. Not only is water efficiency highly cost-effective, but reduced use of hot water can also produce great energy savings.[108] Water efficiency could save additional energy costs, because most municipal water must be pumped uphill to serve customers. The

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[97] *Id.*

[98] RESTORE HETCH HETCHY, *supra* note 2, at 22.

[99] *Id.*

[100] *Id.* at 24A tbl. 2.

[101] *Id.* at 22.

[102] *Id.*

[103] RESTORE HETCH HETCHY, *supra* note 2, at 22.

[104] *Id.*

[105] *Id.*

[106] In this article we use the term "water efficiency" instead of "water conservation" because saving water is generally an economically sound practice, and because "water efficiency" more precisely describes the change in water-use practice that should take place if economic savings are the goal.

[107] ROSEKRANS ET AL., *supra* note 2, at 19.

[108] GLEICK ET AL., *supra* note 69, at 50.

first priority in the water efficiency program should be to implement efficiency in the homes of low-income residents, who often have the least efficient showerheads, toilets, faucets, and appliances.[109]

Interestingly, water-rights attorney Stuart Somach makes the argument that the Raker Act could be interpreted to oblige San Francisco to conserve water before exporting water from Hetch Hetchy.[110] He notes that the first agreement between the irrigation districts and San Francisco finds that water must be "properly conserved" by San Francisco.[111]

Maximum water efficiency is the most cost-effective means of replacing water supplied by Hetch Hetchy.[112] The proposed level of water efficiency is high, but that does not mean that these projections are impractical. They were largely developed by a contractor to the California Department of Water Resources, as described below. Water efficiency at this level would require a significant investment, but that level of investment would be lower than that required by many other water supply options. Further, implementing water efficiency now is the best means of "drought-proofing," since water that is not used could be kept in storage, making more water available when a drought arrives.

The Metropolitan Water District of Southern California has greatly expanded its exemplary water conservation program.[113] The district notes that enormous savings can be realized through the use of computerized outdoor irrigation systems that turn on only when lack of rain has caused a deficit in soil moisture.[114] Many existing systems irrigate on a regular basis, rain or shine, needed or not.

Another fruitful source of water savings is indoors in homes,

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[109] *Cf.* GLEICK ET AL., *supra* note 69, at 37 ("We estimate that indoor residential use could be reduced by approximately another 40 percent by replacing remaining inefficient toilets, washing machines, showerheads, and dishwashers, and by reducing the level of leaks, even without improvements in technology.").

[110] *See* SOMACH, SIMMONS & DUNN, FOR ENVTL. DEF., HETCH HETCHY WATER AND POWER ISSUES 2-3 (2004), *available at* www.edf.org/documents/4030_hetchhetchyrestored _AppC.pdf.

[111] *See id.* at 21 n.91.

[112] Many options for improving efficiency involve minimal expenses for repair (e.g., of leaks) or minor purchase and installation (e.g., of low-flow shower heads), as opposed to major appliance replacement. *See generally* GLEICK ET AL., *supra* note 69.

[113] *See* METRO. WATER DIST. OF S. CAL., WATER SAVINGS PERFORMANCE PROGRAM, http://www.bewaterwise.com/WSPP.html (last visited Mar. 23, 2008) (discussing water-saving process improvements and more efficient irrigation equipment); *see also* METRO. WATER DIST. OF S. CAL., WATER SAVING TIPS, http://www.bewaterwise.com/tips01.html (last visited Mar. 23, 2008) (recommending specific water-saving tips).

[114] *See* Save Water, Save a Buck, Weather Based Irrigation Controller, www.mwdsaveabuck.com/devices_01.php?id_dvce=8 (last visited Sept. 23, 2008) (discussing the operation of "Smart Controllers" for irrigation systems).

apartments, and hotels.[115] Many showers and faucets use far more water than necessary. Huge amounts of water and energy could be saved by replacing old washing machines with newer, front-loading, energy efficient models.[116] Although only low-flow toilets can now be purchased, hundreds of thousands of the old, wasteful models are still in use.[117] In addition, leaking float mechanisms in toilets add to the losses. To the extent that master meters still exist in multi-family housing, replacement by individual meters should result in greater water efficiency by making individuals and families pay for their own consumption and thus giving them an incentive to conserve.[118]

Industry consumes far less than residential users, but by increasing internal factory reuse of water and by developing processes that use less water in the first place, factories could save much additional water.[119] There are substantial opportunities for saving water in commercial establishments such as hotels, restaurants, and office buildings.

The California Department of Water Resources has commissioned a comprehensive report on California's potential for urban water conservation. The report, *Waste Not, Want Not: The Potential for Urban Water Conservation in California*, published by the Pacific Institute in 2003, carefully examines the potential for water savings in indoor residential, outdoor residential, commercial, and industrial water use.[120] The report contains enough information about San Francisco in particular and the Bay Area in general to allow reasonable estimates of the potential for water efficiency.[121]

To determine the potential for water efficiency in the San Francisco service area, the Pacific Institute report data was combined with data provided by San Francisco and the Bay Area Water Supply and Conservation Agency ("BAWSCA") on current patterns of water use by residential, commercial, and industrial customers.[122] The estimates presented below are conservative. They do not take into account the following factors, which could increase the efficiency potential in the service area:

- Because the service area contains many older residential and commercial buildings, it is likely that many plumbing fixtures

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[115] *See* GLEICK ET AL., *supra* note 69, at 37.

[116] RESTORE HETCH HETCHY, *supra* note 2, at 23.

[117] *See* GLEICK ET AL., *supra* note 69, at 46.

[118] RESTORE HETCH HETCHY, *supra* note 2, at 23.

[119] *Id.*

[120] GLEICK ET AL., *supra* note 69.

[121] *See id.* at 115-153.

[122] *See id.* at 5-11.

are less efficient than comparable buildings in areas with more recent construction.[123]

- According to the California Urban Water Conservation Council, fewer than half the agencies using Hetch Hetchy water are members of the Council.[124] Those who do belong are supposedly committed to best management practices in water efficiency. In fact, they have done less to implement water efficiency than many other agencies, especially those in Southern California.[125] Although the agencies in the Hetch Hetchy service area have slightly lower per-capita use than other agencies throughout the state, this is due mainly to the mild climate and smaller lot size found in these agencies' jurisdictions.[126] If an analysis were performed taking these factors into account, actual current per-capita use would probably be higher than the state average.

Nearly 80% of residential water use in San Francisco takes place indoors (as compared to 40% in many other regions in California); BAWSCA member cities that provide Hetch Hetchy water to consumers are more similar to other California cities.[127] According to the Pacific Institute report, there is generally more potential for indoor water savings than for outdoor irrigation savings.[128] The BAWSCA members report spending less than $1 million per year on collective conservation programs, or less than a dollar per person per year.[129]

A conservative estimate of total potential water savings in the service area is 123,767 acre-feet per year.[130] Compared to current use, this would be a savings of 44%.[131] This projection is realistic. From 1970 to 1990, per-capita water use has leveled off in most areas of the state; in some areas it has begun to decline.[132] In contrast, BAWSCA projects an increase in water use of 17% by 2030, even though population is projected to increase only 13%.[133]

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[123] *See id.* at 45.

[124] *See* CAL. URB. WATER CONSERVATION COUNCIL, MEMBERS: GROUP 1 WATER SUPPLIERS, www.cuwcc.org/2column.aspx?id=10242 (last visited Oct. 19, 2008) (listing all Group 1 Members of the California Urban Water Conservation Council).

[125] RESTORE HETCH HETCHY, *supra* note 2, at 25.

[126] *Id.*

[127] *See* GLEICK ET AL., *supra* note 69, at 67.

[128] *See id.* at 6-7.

[129] RESTORE HETCH HETCHY, *supra* note 2, at 25.

[130] *Id.*

[131] *Id.*

[132] CAL. DEP'T OF WATER RES., CALIFORNIA WATER PLAN UPDATE BULLETIN 160-93, Ch. 6 (Oct. 1994), *available at* http://rubicon.water.ca.gov/v1cwp/uuse.html.

[133] RESTORE HETCH HETCHY, *supra* note 4, at 26.

The BAWSCA projections ignore not only the huge potential for water efficiency in its service area, but also its own history.[134] Per-capita residential water use in the BAWSCA service area was 115 gallons per day in 1975 (before the 1976-1977 drought) and 104 gallons daily before the drought that began in 1987.[135] Today it is only ninety-three gallons per day.[136] Given the huge additional potential for water efficiency that still exists, why should BAWSCA be projecting an increase in per-capita domestic use? Such an increase is especially unlikely because consumers face higher water bills in the future due to the cost of financing and carrying out much-needed repairs to the Bay Area's part of the Hetch Hetchy system. Of the $4.3 billion allocated for repairs to the Hetch Hetchy system,[137] more than $2 billion will be paid by BAWSCA customers.[138] The average monthly residential bill in San Francisco, for example, is expected to increase from $14 in 2005 to $36 in 2015, largely due to the costs of the Water System Improvement Program.[139] This cost increase is almost certain to result in lower water use.

BAWSCA and San Francisco are undertaking a detailed study of the potential for water efficiency in their service areas, and their projected need for water may be substantially reduced as a result of these studies. As the Pacific Institute report points out, water efficiency is highly cost-effective.[140] Most methods, such as installing low-flush toilets and efficient appliances, save not only water but also energy.[141] The savings in water and energy costs to the consumers will be far greater than the cost of the program.[142]

The total cost of implementing the water efficiency program needs to be determined based on a detailed study. Although that study has not yet been carried out,[143] it appears from the Pacific Institute report that the water can be conserved for an annual cost of less than $400 per acre-foot.[144] Consumers should see considerable net savings in water and

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[134] *Id.*

[135] *Id.*

[136] *Id.*

[137] S.F. Pub. Util. Comm'n, Water System Improvement Program, http://sfwater.org/msc_main.cfm/MC_ID/13/MSC_ID/167.

[138] RESTORE HETCH HETCHY, *supra* note 2, at 26.

[139] S.F. PUB. UTIL. COMM'N, CAPITAL IMPROVEMENT PROGRAM: STATUS REPORT AND UPDATE 64 tbl. 8 (2004), *available at* http://sfwater.org/detail.cfm/MC_ID/13/MSC_ID/167/C_ID/1377/Keyword/capital%20improvement%20program#.

[140] GLEICK ET AL., *supra* note 69, at 115-19.

[141] *Id.* at 6.

[142] RESTORE HETCH HETCHY, *supra* note 2, at 26.

[143] GLEICK ET AL., *supra* note 69, at 2.

[144] RESTORE HETCH HETCHY, *supra* note 2, at 26.

energy bills.

Consumer water bills may not be greatly affected by the implementation of the efficiency program, since most costs over the next ten to twenty years will be associated with the costs of the Water System Improvement Program, designed to repair the aging water delivery system.

3. Water Recycling and Reclamation

For many years, water from wastewater treatment plants has been purified and used for a wide variety of purposes throughout the world. One of the very first wastewater reclamations facilities was Stowe Lake in San Francisco's Golden Gate Park, which treated water that was then used to irrigate the park's lush vegetation.[145] Unlike many other water agencies, San Francisco did not go much further than Golden Gate Park in its wastewater reclamation program.[146] (A minor amount is recycled for truck washing at the Southwest Water Pollution Control Plant, although hydrants are usually used.)[147] While agencies in Southern California, the Central Valley, and parts of the East and South Bay were making enormous strides in recycling their wastewater, San Francisco and most water agencies in other cities on the San Francisco Peninsula did virtually nothing.[148] Most golf courses in San Francisco's service area are irrigated with potable water, while many golf courses in Southern California and elsewhere in the state are irrigated with recycled water.[149] Several agencies in the Hetch Hetchy service area are considering the use of reclaimed water for golf-course irrigation.[150] The private courses around Lake Merced (Olympic Club, San Francisco Golf and Country Club, and Lake Merced Golf and Country Club) have signed contracts calling for them to take at least 75% of their needs from a new tertiary treatment plant in Daly City.[151]

Recycled wastewater cannot be used directly for domestic consumption, but it can be used for many other purposes: almost all types of irrigation, numerous industrial processes, cooling towers for air conditioning and refrigeration systems, groundwater recharge, and

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[145] RESTORE HETCH HETCHY, *supra* note 2, at 27.
[146] *Id.*
[147] *Id.*
[148] *Id.*
[149] *Id.*
[150] RESTORE HETCH HETCHY, *supra* note 2, at 27.
[151] *Id.*

others.[152] Recycled wastewater can also be applied to indoor non-consumptive uses such as flushing toilets.[153] The San Francisco Bay Regional Water Recycling Program has estimated that the potential for increased use of wastewater in the parts of the Bay Area served by San Francisco is 45,600 acre-feet per year, or 17% of the water needed to replace Hetch Hetchy Reservoir's dry-year supply.[154] The annual average cost is $425 per acre-foot for near-term projects and $738 for medium-term projects, for an average cost of $582 per acre-foot.[155]

4. Pumping Water from Below Holm Powerhouse into the Mountain Tunnel

One way to maximize power generation in a post-O'Shaughnessy Dam system would be send as much water as possible through the Mountain Tunnel to Moccasin Powerhouse.[156] It would be possible to capture up to 730 cfs of the water released from Dion R. Holm Powerhouse that is not needed for recreation, fish, or wildlife purposes and to pump that excess directly into the Mountain Tunnel.[157] This project, first suggested by a San Francisco consultant, would generate an additional 159 million net kWh in a median runoff year (i.e., 159 million kWh more than the energy used to pump the water into the Mountain Tunnel).[158] This additional water would replace, in a median year, all the water that would otherwise have been supplied from Hetch Hetchy Reservoir to the San Francisco service area.[159] Restore Hetch Hetchy's estimates put the cost of this pumping plant and pipeline at $76 million.[160] This is a part of a preferable option—one that preserves energy and water supply. It also does the most to provide San Francisco's customers with the highest quality water. This option does reduce revenue from the sale of peaking power.[161]

After removal of the reservoir, it is important that the Hetch Hetchy water system be operated in a way that provides sufficient flows in

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[152] *Id.*

[153] *Id.*

[154] *Id.*

[155] RESTORE HETCH HETCHY, *supra* note 2, at 27 (citing 1988 figures).

[156] *Id.*

[157] *See* SVERDRUP & PARCEL & ASSOCS., HETCH HETCHY WATER AND POWER, SYSTEMWIDE POWER STUDY at p. 7-54 (1981).

[158] RESTORE HETCH HETCHY, *supra* note 2, at 27.

[159] *Id.* at 27, 29.

[160] *Id.* at 29 (citing 2005 figures).

[161] *Id.*

Cherry Creek and the Tuolumne River for the traditional recreational uses of fishing and whitewater boating. Authorization of this pumping plant project would have to include safeguards to protect these recreational flows. Except in the driest years, flows at the confluence of Cherry Creek and the Tuolumne River should be at least 1200 cfs for six hours per day, including weekends, at least through the Sunday after Labor Day.[162] Flows should always be sufficient to keep resident fish healthy. San Francisco Hetch Hetchy Water and Power's General Manager previously stated that recreational flows are feasible as mitigation.[163] In a median water year, providing this flow costs $500,000 for energy replacement compared to non-recreation flow.[164] This is due to forgone power generation.

To add to the amount of water available for diversion into the Mountain Tunnel, it is possible to use the existing Lower Cherry Aqueduct from Cherry Creek to Early Intake Reservoir.[165] However, this aqueduct is very small and bypasses the generators at Holm Powerhouse.[166] This canal should be used only during periods when the pumping station, power tunnel, or both, are shut down for maintenance.[167] All required flows for water quality, recreation, and fisheries would have to be met before water could be diverted into the pumping plant or aqueduct.[168]

B. OPTIMAL ALTERNATIVES TO MEET ENERGY NEEDS

Energy produced by water stored in Hetch Hetchy Reservoir is valuable to San Francisco. It is used to power the Muni system of trolley cars, San Francisco Airport, and other city departments.[169] Remaining power is sold to the Modesto and Turlock Irrigation Districts and other agencies.[170] Hydroelectric energy is very valuable because it can be turned on and off almost instantly.[171] This means it can be used to meet peak loads, when electricity demand is highest and supplies are short.[172]

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[162] *Id.*
[163] RESTORE HETCH HETCHY, *supra* note 2, at 29.
[164] *Id.* at 24A tbl. 2.
[165] *Id.* at 29.
[166] *Id.* at 29.
[167] *Id.*
[168] RESTORE HETCH HETCHY, *supra* note 2, at 29.
[169] *Id.* at 48.
[170] *Id.*
[171] *Id.*
[172] *Id.*

But hydroelectric facilities also have a disadvantage: in dry years they cannot be counted on to produce very much power. In 1977, for example, very little water was left in Hetch Hetchy Reservoir, and the ability to generate power was greatly reduced by the end of the summer.[173] Since San Francisco manages the Tuolumne for water supply first, the power plants on the Tuolumne have no reliable capacity compared to their installed capacity.[174] Installed nameplate capacity on all of San Francisco's hydro generators on the Tuolumne total 385 megawatts ("MW").[175] Actual operating capacity is 415 MW without overheating.[176] Other generators on the Tuolumne are owned by the Turlock or Modesto Irrigation Districts.[177]

In an average year, under the plan presented here, there would be no effect on firm capacity.[178] This is because under the current management of the system for "water first," there is probably no reliable electrical capacity at all, since water would not be released solely to meet electrical capacity needs.[179] A report by Environmental Defense looks at the actual capacity of the powerplants, based on past performance.[180] It concludes that the impact of removal of Hetch Hetchy Reservoir on capacity is minor: losses would exceed 100 MW only briefly during dry fall months and would usually be below forty MW.[181]

In an average year, according to San Francisco's annual reports and website, the Hetch Hetchy system generates 1700 million kilowatt-hours of electrical energy.[182] The city uses about 900 million kWh/yr[183] for the Muni and other city services.[184] This power is generated at three power plants: Dion R. Holm Powerhouse on Cherry Creek, using water from Cherry and Eleanor Reservoirs; Kirkwood Powerhouse on the Tuolumne River upstream from Early Intake Reservoir, using water from the

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[173] RESTORE HETCH HETCHY, *supra* note 2, at 48.

[174] *Id.* A gas turbine electricity plant has much better reliable capacity, because it is normally available to start up immediately, any time of year. *Id.*

[175] *Id.*

[176] *Id.*

[177] *Id.* at 63 tbl. 6.

[178] RESTORE HETCH HETCHY, *supra* note 2, at 48.

[179] *Id.* Some years ago, when San Francisco operated the system largely for power revenue, it stated that the reliable capacity of the system on the Tuolumne was 260 megawatts. *Id.*

[180] ROSEKRANS ET AL., *supra* note 2.

[181] *See id.* at 70-74.

[182] S.F. Pub. Util. Comm'n, Power for City Departments, http://sfwater.org/mto_main.cfm/MC_ID/12/MSC_ID/145/MTO_ID/344 (last visited July 25, 2008).

[183] Energy is measured in kilowatt hours ("kWh"), kWh per year ("kWh/yr"), or in millions of kWh/yr ("M kWh/yr").

[184] RESTORE HETCH HETCHY, *supra* note 2, at 48.

Canyon Tunnel from O'Shaughnessy Dam in Hetch Hetchy Valley; and Moccasin Powerhouse on Moccasin Creek just upstream from Don Pedro Reservoir, using water from the Mountain Tunnel.[185] Moccasin receives water that previously went through Kirkwood Powerhouse.[186] Moccasin can also generate energy with water diverted from Early Intake Reservoir into the Mountain Tunnel,[187] as would be the case if water were diverted from Cherry Creek (as was done in 1977 and would be done under the plan to divert water from below Holm Powerhouse).[188]

A study by UC Davis graduate student Sarah Null estimated the loss of hydroelectric power, based on the wholesale price of power, to be $12 million per year, but the author did not include the power that could be generated by the diversion of water from Hetch Hetchy Valley into the Canyon Tunnel after the reservoir is gone.[189] In that scenario, the value of the power lost would be about $9 million per year[190] (see the discussion at the end of this section).

The total power reduction in median years would be 550 million kilowatt hours.[191] To put this loss into perspective, California uses 254 billion kWh/yr, so the lost power would be 0.2% (a fifth of 1%) of the state's entire energy usage.[192] But even this small power loss should be mitigated. There are several ways in which this can be done.

Restore Hetch Hetchy's analysis shows energy production in a median water year before and after removal of the dam at the various power plants.[193] Three plans are compared to the actual daily data, but the analysis takes into account the extra energy that would have been generated with a third generator at Kirkwood (which has now been installed). Comparisons were made to three scenarios. The first two (stream releases for recreation and no stream releases for recreation) presumed a diversion just downstream of Hetch Hetchy. The third assumed no diversion at Hetch Hetchy. Differences in energy production as well as revenue differences are shown.

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[185] ROSEKRANS ET AL., *supra* note 2, at 37.

[186] *See id.*

[187] *See id.*

[188] RESTORE HETCH HETCHY, *supra* note 2, at 49.

[189] *See* Sarah E. Null, Re-Assembling Hetch Hetchy: Water Supply Implications of Removing O'Shaughnessy Dam 30 (2003) (unpublished study, *available at* http://cee.engr.ucdavis.edu/faculty/lund/students/SarahNullThesis.pdf).

[190] RESTORE HETCH HETCHY, *supra* note 2, at 49.

[191] *Id.*

[192] *Id.*

[193] *See id.* at 24A tbl. 2. The year 1979 was a median water year. *Id.*

1. Diversion of Water from Holm Powerhouse to Moccasin Powerhouse

As discussed above, it would be possible to divert water from below Holm Powerhouse on Cherry Creek into the Mountain Tunnel and to Moccasin Powerhouse.[194] The amount of new energy that could be generated at Moccasin Powerhouse as a result of building the new pumping plant and pipeline is approximately 160 million kWh/yr, as derived from daily calculations.[195] The cost of this project would be $76 million.[196] This project was proposed by San Francisco's own consultants in 1981.[197] An amendment to the Raker Act might be required to build this project.

2. Energy Efficiency

Energy conservation would be a cost-effective way to offset the energy lost by removing Hetch Hetchy Reservoir.[198] First priority in energy conservation programs should be given to low-income residents, who usually have the least energy-efficient appliances and home insulation.[199]

The most cost-effective form of energy conservation would be to implement the following programs: insulation, weatherization, and replacement of old windows in under-insulated homes, apartments, office buildings, and factories.[200] Other building energy conservation programs should also be implemented, such as giving away energy-efficient light bulbs; retrofitting showers and other hot-water devices; replacing old appliances with modern, energy-efficient versions; and replacing commercial and other lighting with more energy-efficient equipment. Such programs have solid track records and produce substantial energy savings at reasonable costs.[201]

A 2002 report prepared for the Energy and Hewlett Foundations by the Xenergy Company recommends types of energy efficiency programs that should be implemented.[202] The study projected that implementing

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[194] *Id.* at 49.

[195] RESTORE HETCH HETCHY, *supra* note 2, at 24A tbl. 2, 49.

[196] *Id.* at 49.

[197] *Id.* (citing SVERDRUP & PARCEL & ASSOCS., *supra* note 157).

[198] *Id.* at 50.

[199] *Id.*

[200] RESTORE HETCH HETCHY, *supra* note 2, at 50.

[201] *Id.*

[202] MICHAEL RUFO & FRED COITO, XENERGY, INC., CALIFORNIA'S SECRET ENERGY

conservation in California could save 30,090 million kWh of energy by 2011 at a cost of about $11.9 billion and a ten-year savings to energy users of more than $23.2 billion.[203] Using these calculations, the energy conservation programs needed to save the maximum of 550 million kWh/yr that would be lost in median years with the removal of O'Shaughnessy Dam would have a one-time cost of about $218 million, but the programs would save consumers more than $424 million over ten years.[204]

Even though San Francisco uses the energy it produces at the Tuolumne River power plants only within the city, for city departments and Muni, and at the airport, it seems reasonable to implement the energy conservation program throughout the entire area served with Hetch Hetchy water, since the water the area uses generates the energy in the first place.[205]

IV. HETCH HETCHY VALLEY RESTORATION: BENEFITS, COSTS, AND FINANCING

A. LOGISTICS OF THE REMOVAL SCENARIO

Two hundred seventy-three dams were removed in America between 1999 and 2006, according to the conservation group American Rivers.[206] One of them, Edwards Dam in Maine, was the first hydroelectric dam ever removed by the U.S. government for conservation purposes.[207] Striped bass, alewives, shad, sturgeon and other species of fish and wildlife have quickly retaken their former Kennebeck River habitat upstream from the dam site.[208] However, this dam was only about twenty feet high.[209] On the other hand, there are now serious proposals to remove three major hydroelectric dams on the Snake River that have devastated salmon runs,[210] two major dams on Washington's

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SURPLUS: THE POTENTIAL FOR ENERGY EFFICIENCY, at ES-1 (2002), *available at* http://www.ef.org/documents/Secret_Surplus.pdf.

[203] *Id.* at ES-28.

[204] RESTORE HETCH HETCHY, *supra* note 2, at 50.

[205] *Id.*

[206] AM. RIVERS, DAMS SLATED FOR REMOVAL IN 2007 AND DAMS REMOVED FROM 1999-2006, at 1 (2007), *available at* http://www.americanrivers.org/site/DocServer/Dam_Removal_Summary_2007.pdf?docID=6861&JServSessionIda012=0ivbf6c111.app12c.

[207] PBS Online, Wonders of the World Databank: Edwards Dam, *available at* http://www.pbs.org/wgbh/buildingbig/wonder/structure/edwards.html (last visited Mar. 24, 2008).

[208] *Id.*

[209] *Id.*

[210] See Envtl. News Network, *Snake Dams Defy Clean Water Act, EPA Says,* May 2, 2000,

Elwha River to restore salmon populations,[211] and one dam each on the Colorado and Tuolumne Rivers (Hetch Hetchy). On the Colorado, conservationists have proposed removing huge Glen Canyon Dam, one of the most controversial dams ever built.[212] It inundated canyons comparable to those downstream in the Grand Canyon.[213]

Unfortunately, there have been relatively few studies of restoration or natural recovery of river valleys after dams were removed from them. Removing some dams can be difficult, since substantial deposits of sediment have built up behind them.[214] This should not be a problem for Hetch Hetchy.[215] Based on visual inspection during several droughts (e.g., 1955, 1977, and 1991), there is very little sediment behind O'Shaughnessy Dam due to the granitic nature of the upstream watershed.[216]

However, the restoration of Hetch Hetchy Valley poses several different problems. First, construction of the dam was accomplished by using materials from the valley floor, and the old mining scars would be very visible once the reservoir is drained.[217] Second, the bare rock walls containing the reservoir were never home to vegetation, and they will remain non-vegetated. So, either the "bathtub ring" will simply be allowed to fade as lichen colonies gradually return,[218] or major work will have to be done to reduce its visual impact. Finally, the short growing season in this high-altitude valley may require some active restoration efforts to speed the valley's recovery.[219]

A 1988 National Park Service report outlined two basic approaches to the restoration of the valley: passive or active.[220] The National Park

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available at http://archives.cnn.com/2000/NATURE/05/02/snake.dams.enn/index.html (noting that the Environmental Protection Agency and the Fish and Wildlife Service had concluded that dam removal was "the best alternative for salmon recovery.").

[211] *See generally* Russell W. Busch, *Tribal Advocacy For Elwha River Dams Removal On Washington's Olympic Peninsula*, 2 GOLDEN GATE U. ENVTL. L.J. 5 (2008).

[212] *See* Glen Cyn. Inst., History of the River Restoration Movement, www.glencanyon.org/library/riverrestoration.php (last visited July 25, 2008).

[213] *See id.*

[214] *See* Sarah E. Null, *supra* note 189, at 9.

[215] *Id.*

[216] *Cf.* CAL. DEP'T OF WATER RES. & CAL. DEP'T OF PARKS & RECREATION, *supra* note 5, at 22 (comparing the sedimentation behind O'Shaughnessy Dam with the much higher levels behind other dams whose removal has been proposed).

[217] NAT'L PARK SERV., ALTERNATIVES FOR RESTORATION OF HETCH HETCHY VALLEY FOLLOWING REMOVAL OF THE DAM AND RESERVOIR 3 (1988), *available at* http://www.sierraclub.org/ca/hetchhetchy/nps_hh_restoration.pdf.

[218] *Id.* at 5.

[219] RESTORE HETCH HETCHY, *supra* note 2, at 56.

[220] *See* NAT'L PARK SERV., *supra* note 217, at 5-14.

Service and Congress would determine which is better. Passive restoration would simply allow natural processes to revegetate and recontour the newly exposed landscape.[221] Mining scars and other visual alterations of the landscape that occurred during the construction of the dam would be left untouched, to be softened gradually over the decades by rain, snow, and wind. Invasive non-native plants such as Mediterranean annual grasses would rapidly move into the valley, but after some decades they would be partially replaced by forests dominated by fir, pine, and cedar.[222] Black oaks would likely be rare.[223] The conifer forest would be much thicker after a few decades than the one that preceded the dam.[224] Full suppression of fire would make natural-process meadow restoration unlikely.[225]

The second approach would be active. It may be appropriate to more intensively manage the restoration process, given the profound impacts humans have had on the valley for centuries, from the regular fire management practiced by Native Americans, through the period of European settlement and use, to the destruction caused by mining and dam building. This scenario would call for the following types of restoration.

1. Recontouring the Land

During dam construction, aggregate for the concrete was mined from the valley floor near Rancheria Creek.[226] The mined area, spoil piles from this mining, and similar disturbances in the vicinity of the dam site have significantly altered the landform of the valley floor.[227] In order to remove the signs of human impacts from these areas, the spoil piles would need to be removed to uncover the native soil, and the mined areas would need to be backfilled and capped with native topsoil.[228] It may be possible, if permitted, to place the spoil material in the pits for disposal. It may be necessary to remove unsuitable material and import fresh soil if reworking the existing materials proves infeasible.

In recontouring the valley, the goal will be to mimic the native terrain. It is realistic to assume that this may be accomplished through

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[221] *See id.* at 5 (describing "recovery without management").

[222] *See id.* at 6-7.

[223] *Id.*

[224] *Id.* at 8.

[225] NAT'L PARK SERV., *supra* note 217, at 7.

[226] *See id.* at 3.

[227] *See id.*

[228] *See id.* at 3-4.

sampling soils and evaluating subsurface conditions during the removal of the dam. The dam will be removed down to the former streambed at an elevation of 3500 feet, with the outlet made to look as much like the pre-dam photograph from the California Historical Society as possible.[229] The river channel will lead to the new, mostly hidden downstream intake works of the Canyon Tunnel.

Recontouring will require the use of heavy equipment, including excavators, bulldozers, loaders, and possibly scrapers, all of which may be used for other aspects of the restoration work, including stabilizing the river banks and removing the dam. Proper scheduling will be essential to increase the efficiency of operations and to reduce harmful impacts on the landscape and on organisms that may be present.[230] Access to the valley for this type of equipment would require at least the building of rough roads.[231] Some of the paths for these roads are already in place: the old railroad line,[232] some old roads built in the valley for mining and dam construction, and the road to the boat ramp.

After the roads are no longer needed for restoration, they will be eliminated through recontouring or would be converted to trails. It is likely that a conveyor system[233] would be the most economical and least environmentally damaging means of removing materials from the valley during dam deconstruction. While the conveyor structure will probably be removed at the end of the work, it is possible that it could be designed to be left in place and modified to act as the principal means of transporting visitors into the valley. In this scenario, the present road could be reserved for maintenance and supply trucks.

2. *Revegetating the Valley*

This part of the management plan would entail five years of collecting and propagating native plant seeds before beginning to drain the reservoir.[234] As the reservoir is drained, aggressive replanting of native plants would take place as soon as the soil dried sufficiently.[235] A

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[229] *See id.* at 2 ("Some vestige of the dam would have to remain in order to allow restoration of the natural river gradient and water table in Hetch Hetchy.").

[230] *See, e.g.*, NAT'L PARK SERV., *supra* note 217, at 2 (warning that blasting may be dangerous to nesting peregrine falcons already resident in Hetch Hetchy).

[231] *See* CAL. DEP'T OF WATER RES. & CAL. DEP'T OF PARKS & RECREATION, *supra* note 5, at 23.

[232] NAT'L PARK SERV., *supra* note 217, at 3.

[233] *See, e.g.*, CAL. DEP'T OF WATER RES. & CAL. DEP'T OF PARKS & RECREATION, *supra* note 5, at 23.

[234] NAT'L PARK SERV., *supra* note 217, at 12.

[235] *See id.*

detailed map of Hetch Hetchy's historic plant communities would be developed,[236] based on late-nineteenth-century and early-twentieth-century descriptions of the Valley by John Muir and others, and on an analysis of historic photographs and stumps remaining in Hetch Hetchy. This map would be used as a basis for restoring those communities as closely as possible to their natural state.[237]

Revegetation would consist of planting and installing protective fencing for a mixture of native trees and shrubs consisting of black oaks, white alder, black cottonwood, Douglas fir, dogwood, willow, azalea, manzanita, and ceanothus.[238] The various species of trees and shrubs would be planted in areas where those species originally occurred, along with an understory of herbaceous plants.[239] Native bunch grasses and sedges would be collected and propagated before the reservoir is drained and would be planted in meadows and oak woodlands as these habitats returned following drainage.[240] Complete restoration would involve the planting of approximately 100,000 woody specimens (trees and shrubs), the dense planting of herbaceous understory species (bunch grasses and forbs), and widespread seeding of native meadow and woodland species for ground cover.

Greenhouse and nursery operations would be developed in the National Park or provided by contract to support ongoing seed collection and plant propagation for as long as is necessary after the reservoir is completely drained.[241] The National Park Service report continues:

> Additional plantings would continue indefinitely to support restoration of certain plant communities. Horticultural techniques would be used to promote survival of plantings for their first two years[] or longer if necessary.
>
> Noxious non-native plants would be eliminated or suppressed throughout Hetch Hetchy [Valley] continuously into the future. In the first five years after . . . the valley was drained, the widespread Mediterranean annual grasses that would [be likely to invade] would be . . . suppressed in certain areas to allow native grasses and sedges a better chance to become established.
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> Prescribed burning would be utilized as a management tool to produce and maintain vegetative communities closely resembling

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[236] *Id.*

[237] *Id.*

[238] *Id.*

[239] NAT'L PARK SERV., *supra* note 217, at 12.

[240] *Id.*

[241] *Id.* at 13.

> those that originally occurred in Hetch Hetchy. Fires would be used to prevent conifer encroachment in oak woodlands and meadows and to produce and maintain open conifer forests with a . . . natural species distribution and composition [of native species].
>
> Although the use of animal breeding and propagation facilities [for native species should not be necessary, "active" restoration] would allow for that option if monitoring efforts indicated their use would significantly enhance the rate of recovery [of their populations]. Capture and translocation techniques would also be used to enhance [the] rate of recolonization [if available habitat remained unoccupied].[242]

Extensive monitoring would be used to document recovery rates, identify problems, and inform changes in management policies (i.e., "adaptive management").[243] Mitigation measures would be undertaken when monitoring identified recovery problems for native species.[244]

In this active restoration scenario, there would be much less invasion of the valley by non-native plants.[245] Vegetative cover would occur more quickly than if nature were simply allowed to take its course,[246] and the valley would be more attractive to visitors more quickly. Prescribed burning would maintain meadows and oak woodlands, more closely mimicking the fire ecology of the valley as it was before European immigrants arrived and began to suppress all fires.[247]

Some of the cost of this active restoration work could be covered by guided tours for fee-paying visitors. There is sure to be a demand from people around the world to see the dam being dismantled and the famous valley recovering. Engineers, ecologists, native plant groups, school groups, and other curious people would be likely to come.[248] In fact, the

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[242] *Id.*

[243] *See id.*

[244] NAT'L PARK SERV., *supra* note 217, at 13.

[245] RESTORE HETCH HETCHY, *supra* note 2, at 59.

[246] Of course, nature will indeed proceed with its own restoration plans. For instance, empirical observation of rocks near the dam that were damaged during dam construction indicates that lichen populations would make substantial progress on north-facing walls in seventy-five years and that characteristic black stains would return on wet, south-facing granite surfaces within five years. *Id.*

[247] Gerald W. Williams, References on the American Indian Use of Fire in Ecosystems (May 18, 2001), www.wildlandfire.com/docs/biblio_indianfire.htm.

[248] RIDER, *supra* note 3, at 27 ("Yosemite National Park Ranger Deb Schweizer argues that new visitors would be generated due to the novelty of the restoration itself. Calling Hetch Hetchy 'the ultimate restoration project' she says it would be very exciting to see the ecosystem restore over time and believes many people would come to see Hetch Hetchy to watch the process.").

restoration of Hetch Hetchy Valley would present exciting and enduring opportunities for public hands-on volunteerism.

B. ESTIMATING THE COSTS AND BENEFITS

Passive restoration would have relatively low monetary costs but would not reap the ecological benefits of active restoration. The costs of active restoration management would be as follows:

Revegetation	$6 million
Stream restoration	$7 million
Landscape restoration	$2 million
Design, engineering	$2 million
Three years of maintenance	$3 million
Total	**$20 million**[249]

A more detailed budget for restoration is available and has been prepared by the conservation organization Restore Hetch Hetchy.[250] It is possible that these costs could be substantially reduced by using labor from the California Conservation Corps or local Corps, volunteers, students, prison labor, and the like.[251] The cost of maintaining and monitoring the revegetation and other restoration work will be about $300,000 to $600,000 per year for subsequent years, until around ten years after revegetation commences. After that time, these costs should drop substantially.[252]

1. Anticipated Human Use of Hetch Hetchy Valley

Human use of the valley after the dam is gone could take various forms.[253] The National Park Service, with broad public input, would ultimately be responsible for determining an access and recreation plan for the valley.[254]

One purpose of restoring Hetch Hetchy Valley would be to return to

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[249] RESTORE HETCH HETCHY, *supra* note 2, at 61 (citing 2005 figures).

[250] *Id.*

[251] *Id.*

[252] *Id.*

[253] *Id.*; *see also, e.g.*; CAL. DEP'T OF WATER RES. & CAL. DEP'T OF PARKS & RECREATION, *supra* note 5, at 38-40 (describing some of the potential "use" and "non-use" benefits of a restored Hetch Hetchy Valley); *see also* RIDER, *supra* note 3, at 32 (exploring various levels of development intensity).

[254] RESTORE HETCH HETCHY, *supra* note 2, at 61.

a "wilder Yosemite."[255] In this scenario, commercial activities such as hotels, stores, restaurants, and other facilities would not be allowed. One alternative would be to allow only hiking trails into the valley. Others would favor more formal trails, allowing bicycles and wheelchairs on trails suitable for their use, and other forms of non-fossil-fueled access to the valley floor.[256]

Low-impact campgrounds (such as the hike-in campground at Camp 4, Sunnyside, in Yosemite Valley) could be built on the valley floor in places not subject to flooding or rockslides. San Francisco would resist such overnight use, since its water supply would still be diverted below the mouth of the valley, and maintenance of the quality of the Tuolumne River so near the point of diversion would be of great importance.[257] If campgrounds are built, it is possible that they could contain sanitary facilities of the type that allow waste to be picked up and removed, or double-walled sewer lines could be built to remove waste from the valley. But a waste-removal system would require roads, or at least wide trails, to allow service vehicles access to the campgrounds. Other steps may need to be taken to preserve the water quality of the Tuolumne River, which will continue to serve as a municipal water supply for much of the Bay Area.[258]

Another question that must be resolved is the use of San Francisco's facilities on the natural bench above the current reservoir. These buildings and residences could be a visitor center where people could stay overnight without actually staying on the valley floor.[259] While the current accommodations provide only basic comfort, they would be very attractive to people seeking to avoid the crowds and congestion in Yosemite Valley.

The current trail system through the Grand Canyon of the Tuolumne should be connected to new trails leading into Hetch Hetchy Valley. This would allow hikers to walk from Tuolumne Meadows directly to Hetch Hetchy. It is possible that a trail could be built up to Falls Creek near one of the waterfalls to connect to the existing trails on the north side.

Rafters and kayakers could be allowed to bring their crafts up into

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[255] *See* RIDER, *supra* note 3, at 33 ("[T]he per person benefits of recreating in a lesser developed Hetch Hetchy Valley would be greater than the benefits of recreating in a more developed Hetch Hetchy Valley.").

[256] "[A]utomobiles should probably be banned, even in the highest development scenario." RIDER, *supra* note 3, at 34 (quoting an analysis by the California Assembly Office of Research).

[257] RESTORE HETCH HETCHY, *supra* note 2, at 61.

[258] *Id.*

[259] *See* RIDER, *supra* note 3, at 32.

the valley.[260] If bicycle trails are built, the boats could be brought up to the head of the valley on handcarts.

To allow greater use of Hetch Hetchy Valley, it would be possible to expand visitor facilities just outside the park.[261] There are already several campgrounds and lodges that would become much more attractive to visitors if they could have day access to the valley.

Fishing in the Tuolumne River would be allowed under current state and federal regulations.[262] Undoubtedly, hang gliders and rock climbers would be interested in using the valley. The Park Service could either allow such use under regulations similar to those that apply in Yosemite Valley[263] or prohibit it based on the wilderness character of the valley and because of some protected wildlife now high on Kolana Rock.

A restored Hetch Hetchy Valley would be a marvelous resource. With proper attention to and respect for Native American cultural sites, the 1900 acres of the valley would be available to the public, compared to the 843 acres of New York's Central Park and the 1003 acres of San Francisco's Golden Gate Park.[264]

According to the National Parks and Recreation Association, visitors to Yosemite National Park spend almost $320 million a year, creating nearly 8900 jobs.[265] Restoring Hetch Hetchy as a visitor destination could increase these figures by as much as 20%, bringing an additional $60 million per year in revenue. Yosemite Valley, currently the main draw to the park, is located on Highway 140; Hetch Hetchy is located near Highway 120[266] and would be especially likely to draw a higher number of visitors from the Bay Area, Sacramento, and the northern Central Valley.[267]

The impact on the local economy of this additional visitation would be substantial.[268] The effects will be felt especially along Highway 120

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[260] *See* CAL. DEP'T OF WATER RES. & CAL. DEP'T OF PARKS & RECREATION, *supra* note 5, at 27 fig. 4-2.

[261] RESTORE HETCH HETCHY, *supra* note 2, at 62.

[262] *Id.*

[263] *Id.*

[264] *Id.*

[265] NAT'L PARKS CONSERVATION ASS'N., NATIONAL TREASURES AS ECONOMIC ENGINES: THE ECONOMIC IMPACT OF VISITOR SPENDING IN CALIFORNIA'S NATIONAL PARKS 2 (Mar. 13, 2007), *available at* http://www.npca.org/pacific/economic_report/mgm.pdf.

[266] RESTORE HETCH HETCHY, *supra* note 2, at 62.

[267] *See, e.g.*, RIDER, *supra* note 3, at 25 (noting, in particular, "that the California region closest to Yosemite National Park, the Central Valley, is experiencing extremely fast population growth—some of the fastest growth in the country. Counties near the Park such as Stanislaus, Calaveras, and Merced in particular are growing rapidly.").

[268] *See, e.g.*, RIDER, *supra* note 3, at 15-24.

from Big Oak Flat to the park border.[269] Hotels, restaurants, gas stations, and gift shops should all see substantially increased patronage.[270] Similar though smaller effects will be seen along the Highway 140 and Highway 41 corridors, which lead directly to Yosemite Valley. Undoubtedly, overall park visitation will increase as a result of the new opportunity to visit Hetch Hetchy Valley.[271] Some visitors would want to visit both valleys, one developed on nineteenth- and twentieth-century ideas, the other on twenty-first-century ideas.[272]

2. *Whitewater Recreation*

The removal of Hetch Hetchy Reservoir and the implementation of various water-supply and energy alternatives could have either positive or negative impacts on whitewater recreation on the Tuolumne River from Holm Powerhouse on Cherry Creek down to Don Pedro Reservoir.[273] Restoration of more natural flows on the main stem of the Tuolumne could mean more days when high water precludes boating and also more days when boating is possible due to unimpaired natural flows.[274]

The final operations plan of the diversion at Hetch Hetchy and Holm Powerhouses should allow for whitewater boating between May 21 and the Sunday after Labor Day.[275] If high water precludes boating more than it would have if the Hetch Hetchy Reservoir were still there, compensating days of boatable power releases from Holm should be provided later in the season to make up for those days.[276] The energy plan proposed above includes 1200 cfs on the Tuolumne for six hours every day during the rafting season.

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[269] RESTORE HETCH HETCHY, *supra* note 2, at 64.

[270] *See* ROSEKRANS ET AL., *supra* note 2, at xviii.

[271] "[T]his national 'experiment' in restoration would undoubtedly result in a huge number of visitors to the site." RIDER, *supra* note 3, at 28 (quoting an analysis by the California Assembly Office of Research).

[272] *See id.* at 26 ("There is evidence that the relationship between demand for visitation to Yosemite Valley and Hetch Hetchy Valley would be complementary as opposed to competitive.").

[273] "Releases from Cherry also generate hydropower at Holm Powerhouse, often on a schedule that allows whitewater boating on the Tuolumne River in the summer." ROSEKRANS ET AL., *supra* note 2, at 37.

[274] RESTORE HETCH HETCHY, *supra* note 2, at 64.

[275] *See* ROSEKRANS ET AL., *supra* note 2, at 56 n.8 ("Under a restoration scenario, minor changes in operating policy at these reservoirs may be appropriate to accommodate . . . suitable summer whitewater recreation flows for the Tuolumne River above Don Pedro reservoir.").

[276] RESTORE HETCH HETCHY, *supra* note 2, at 64.

C. FINANCING REMOVAL AND RESTORATION

A wide variety of financing tools is available to pay for the various elements of the plan. These tools are described below. The overall plan will cost less than $1 billion, even including filtration.[277] By way of comparison, the state and federal governments spent nearly $500 million to purchase the 7400-acre Headwaters Forest in Northern California.[278] Although it is an ecological treasure, Headwaters Forest receives very few visitors due to its remoteness and restricted access.[279] A restored Hetch Hetchy Valley could attract several hundred thousand visitors a year.[280] In addition, the water and power elements of this plan will provide more reliable water and energy to San Francisco and its customers than O'Shaughnessy Dam and Hetch Hetchy Reservoir do now.[281]

1. User Fees

San Francisco's water and power customers should be made whole financially. This means that the water and power bills of those served today by San Francisco should end up no higher than they would have been if the dam had not been removed.

It could be argued that the U.S. taxpayers (who own Hetch Hetchy Valley) subsidized San Franciscans and their customers for more than seventy years and that it is reasonable for some of that subsidy to be returned by requiring San Francisco to pay all or part of the costs for removing the dam and replacing the lost energy and water. Whatever the merits of this argument, the policy it espouses would immensely complicate the political difficulty of removing the dam.

Another option would be to impose a statewide fee on all water and power users, including those in the San Francisco service area, to pay for removing the dam and replacing any lost water and power. The argument in favor of such a fee is that the restoration of Hetch Hetchy Valley would be of such tremendous statewide benefit that all water and power users should help pay for it. Whatever the logic of such a fee, it would be politically very difficult to impose this solution. Perhaps it could be included as part of a larger water improvement package.

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[277] *Id.* at 55 tbl.5, 65 (citing 2005 figures).

[278] Editorial, *California: State Must Defend Costly Deal to Save Headwaters Forest,* SAN JOSE MERCURY NEWS, Jan. 30, 2007.

[279] RESTORE HETCH HETCHY, *supra* note 2, at 65.

[280] RIDER, *supra* note 3, at 34 (calling 300,000 annual visitors a conservative estimate).

[281] RESTORE HETCH HETCHY, *supra* note 2, at 65.

2. Other Revenues and Avoided Costs

- As described above, sale of aggregate from the dam should net around $9 million.[282]
- The economic value of visits to the valley should be about $60 million a year.[283]
- Consumer energy efficiency savings are estimated at $481 million a year.[284]
- Consumer water efficiency savings are large but unknown.
- Avoided costs of repairing, maintaining, guarding, and modifying aging O'Shaughnessy Dam are unknown but are almost certainly in the millions of dollars per year.[285]
- President Bush once proposed to increase San Francisco's rent for Hetch Hetchy Reservoir to $8 million a year.[286] Any such rental increases would be avoided if the reservoir were removed.[287]

3. San Francisco Revenue Bonds

Voters in San Francisco have been generous in their support of a wide variety of general obligation bonds over the years.[288] Such bonds require a two-thirds majority. In 2001, San Francisco voters approved a solar energy bond to be financed with the savings generated by a series of energy conservation measures.[289]

Much of the financial cost of this program of restoring Hetch Hetchy Valley relates to conservation projects and capital improvements that would help compensate for the water and power lost when Hetch Hetchy Reservoir is removed. Energy and water conservation programs are highly cost-effective. If the California Public Utilities Commission approves a plan that allows the resulting energy savings to be shared between utility customers and the City of San Francisco, revenue bonds

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[282] *Id.*

[283] *Id.*

[284] *Id.*

[285] *Id.*

[286] Edward Epstein, *Bush Budget Soaks S.F. for Hetch Hetchy: Rent Would Jump from $30,000 to $8 Million a Year*, S.F. CHRON., Feb. 4, 2004, at A-1, *available at* www.sfgate.com/cgi-bin/article.cgi?file=/c/a/2004/02/04/MNGNN4OI4A1.DTL.

[287] RESTORE HETCH HETCHY, *supra* note 2, at 65.

[288] *Id.* at 66.

[289] S.F. Comm'n on the Env't, Resolution in Support of Proposed San Francisco Solar Incentive and Loan Program, Res. No. 003-08-COE (Jan. 22, 2008), *available at* www.sfenvironment.org/downloads/library/08coesolarincentiveprogram.pdf.

could be sold to provide initial financing of the energy conservation programs.[290]

4. Existing San Francisco Capital Improvement Program Bonds

In November 2002, San Francisco voters approved $1.6 billion in bonds to make capital improvements to the Hetch Hetchy water system.[291] The Capital Improvement Program includes replacing Calaveras Dam and building the fourth pipeline across the San Joaquin Valley.[292] These facilities might very well make up some of the elements needed to replace the water supply lost by the removal of Hetch Hetchy Reservoir. These bonds will be paid for by increased water charges to San Franciscans, so they should be considered user-financed.[293]

5. Bay Area Water Supply and Conservation Agency

In 2002, the Legislature passed a bill authorizing the Alameda, Santa Clara, and San Mateo County public agencies that purchase treated water from San Francisco to form a new agency, Bay Area Water Supply and Conservation Agency ("BAWSCA"), which came into existence in early 2003.[294] BAWSCA can raise funds to finance improvements to the Hetch Hetchy water system.[295] Its share of the Capital Improvement Program costs will be about $2 billion.[296] To the extent that these improvements are needed to replace the water from Hetch Hetchy Reservoir, they should be eligible for funding by BAWSCA.

BAWSCA has the power to add surcharges to the water bills of people and businesses served by Hetch Hetchy water,[297] so the revenue to retire the bonds sold by the authority will come from user fees. A similar financing authority, the San Francisco Bay Area Regional Water System Financing Authority, was created earlier. Its funding authority is found in

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[290] RESTORE HETCH HETCHY, *supra* note 2, at 51.

[291] SCHLUMBERGER WATER SERVS., FOR ENVTL. DEF., SUMMARY OF TECHNICAL ANALYSES, HETCH HETCHY RESERVOIR REPLACEMENT ALTERNATIVES 8-9 (2004), *available at* www.edf.org/documents/4028_hetchhetchyrestored_AppA.pdf.

[292] *Id.*

[293] RESTORE HETCH HETCHY, *supra* note 2, at 66.

[294] *See* Bay Area Water Supply & Conservation Agency, About BAWSCA, www.bawsca.org/about.html (last visited July 25, 2008).

[295] *See id.*

[296] RESTORE HETCH HETCHY, *supra* note 2, at 66.

[297] *See* Bay Area Water Supply & Conservation Agency, Capitol Improvement Program, www.bawsca.org/improve.html (last visited July 25, 2008) (describing expected increases in water bills).

the California Water Code, which states, "[t]he proceeds of revenue bonds issued by the authority in accordance with this division may be used only on projects designed and intended in substantial part to improve the reliability of the regional water system, including, but not limited to, strengthening the system's ability to withstand seismic events."[298]

It seems very likely that several projects—called "reliability" by San Francisco, but really designed for expansion of the water supply—would be eligible for funding under this section of the Water Code. Although the S.F. Public Utilities Commission is not currently planning to enlarge Calaveras Reservoir[299] or to build the fourth San Joaquin Valley pipeline,[300] these projects could be used to replace water lost due to the removal of the Hetch Hetchy Reservoir. Construction of wastewater treatment-and-recycling facilities[301] and implementation of a water-conservation program could also help to meet this goal.

6. *California General Obligation Bonds*

New California general obligation bonds would be a good source for at least some of the funds needed to finance this project. Proceeds from these bonds could be used to pay for any or all components of the project, including the removal of the dam and the restoration of the valley. It is likely that funds for these purposes would be included as part of a larger water-oriented general obligation bond. Of course, the more that could be financed through revenue bonds or other sources, the less that the state would have to pay through a general obligation bond. The state has traditionally included water conservation in the general obligation bond acts, so there is a good argument that part of the water conservation costs could be included in a general obligation bond.[302] If the state considers a new general obligation bond dealing with energy, it could include the energy conservation and renewable energy generation features of this project, since these would have great benefits to the state as a whole in terms of reduced emissions of air pollution and greenhouse gases.

Restoration of Hetch Hetchy Valley would be a tremendous boost to the tourist economies of the Central Sierra counties near the valley and of

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[298] CAL. WATER CODE § 81658(a) (Westlaw 2008).

[299] *See* ROSEKRANS ET AL., *supra* note 2, at 46.

[300] *See, e.g., id.* at 53.

[301] *See, e.g., id.* at 3.

[302] RESTORE HETCH HETCHY, *supra* note 2, at 67.

the state as a whole.[303] People would come from around the world to see this new feature of our most famous national park. For that reason, since a great national park would be dramatically enhanced, it would be appropriate to include funding for the restoration of Hetch Hetchy Valley in a general obligation bond for state parks. Two of these bonds have been passed in recent years (Proposition 12 in 1990 and Proposition 40 in 1992).[304] Since Yosemite Valley was once run by the state as an early state park, state park funding would be particularly appropriate.[305]

California voters have approved five increasingly large general obligation bonds for water purposes since 1996: Proposition 204 in 1996 ($1 billion), Proposition 13 in 2000 ($2 billion), Proposition 40 in 2002 ($2.6 billion), Proposition 50 in 2002 ($3.4 billion), and Proposition 84 in 2006 ($5.4 billion).[306] It would be appropriate to include Hetch Hetchy restoration funding in any such future bond.[307]

Some will doubt that general obligation bonds are a viable funding source, given the massive amount of bonding undertaken by the state in recent years.[308] But even after the November 2006 election, the state is projected to use less than 6% of the general fund to service general obligation bonds. This is considered within the upper limit for the use of the general fund to repay bonds.[309] The gradual growth of the state's economy will also create new bonding opportunities. This is what happened after the severe recession of the early 1990s.[310]

7. *Federal Financing*

Since the federal government dedicated part of Yosemite National Park to San Francisco for a water supply, it is only appropriate that part of the funds to restore Hetch Hetchy Valley come from the federal government. After all, the National Park Service would be a direct

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[303] *Id.*

[304] *Id.*

[305] *Id.*

[306] *See* Cal. Dep't Water Res., 4 California Water Plan Update 2005, at 902 (2005), *available at* www.waterplan.water.ca.gov/docs/cwpu2005/vol4/vol4-legislation-waterbonds.pdf (describing Propositions 13, 40, and 50); Greg Lucas & Michael Cabanatuan, *Infrastructure Bonds: Voters Backing Governor's Public Works Spending Package,* S.F. CHRON., Nov. 8, 2006, at A18 (describing Prop. 84 in 2006).

[307] A massive bond measure may be on the November 2008 state ballot. Envt. News Serv., *California Officials Propose $9.3 Billion Water Bond for November Ballot,* July 15, 2008, http://www.ens-newswire.com/ens/jul2008/2008-07-15-096.asp.

[308] RESTORE HETCH HETCHY, *supra* note 2, at 67-68.

[309] *See id.* at 68.

[310] *Id.*

beneficiary of the restoration of the valley, not only due to increased revenue from visitors to Yosemite, but also from the increased visibility the park would gain with this huge restoration project.[311] It would be appropriate for the federal government to participate financially in every aspect of this project, including water and power replacement, use of alternative energy, and valley restoration.

Federal funding could come from the following sources:

- *Land and Water Conservation Fund.* These funds, largely collected from royalties on offshore oil production, go to a variety of park and conservation programs.[312]
- *U.S. Army Corps of Engineers.* The Corps could be the appropriate agency to remove the dam. It is increasingly involved in river restoration projects.[313]
- *Direct Appropriation.* Congress typically appropriates funds in the budget for projects of this type. The funds could be included in the National Park Service budget.[314]
- *Yosemite Revenue.* The Park Service now charges $20 per car to enter the park.[315] About half of these funds remain with the park for visitor service, restoration, and so on.[316] Some of these funds could be used to help pay to remove the dam and restore the valley.

V. LEGAL ISSUES AND OBSTACLES

A number of legal issues will have to be resolved in order to clear the way for the restoration of Hetch Hetchy Valley. This discussion considers federal and state law and San Francisco ordinances.

A. FEDERAL LAW

By passing the Raker Act in 1913, Congress authorized San Francisco's construction of O'Shaughnessy Dam in Yosemite National

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[311] *Id.*

[312] Nat'l Park Serv., Land & Water Conservation Fund, www.nps.gov/ncrc/programs/lwcf/history.html#legacies (last visited Mar. 24, 2008).

[313] *See* U.S. Army Corps of Eng'rs, Missions: Environment (July 13, 2002), www.usace.army.mil/missions/environment.html.

[314] RESTORE HETCH HETCHY, *supra* note 2, at 68.

[315] Nat'l Park Serv., Yosemite, Fees & Reservations, http://home.nps.gov/yose/planyourvisit/feesandreservations.htm (last visited Mar. 24, 2008).

[316] RESTORE HETCH HETCHY, *supra* note 2, at 68.

Park.[317] It might seem logical that it would take an act of Congress to modify the Raker Act to allow the removal of the dam and the restoration of the valley, but this may not be the case.[318] Some provisions of the Raker Act have never been implemented, such as the public power provision, despite a Supreme Court ruling on that matter.[319] If San Francisco decided to remove the dam, it is hard to imagine that the Department of Interior would refuse to grant a permit to restore Yosemite National Park because of the Raker Act. Indeed, the Raker Act states:

> Provided, however, [t]hat any changes of location of any of said rights of way or lands may be made by said grantee (San Francisco) before the final completion of any of said work permitted in section one hereof, by filing such additional map or maps as may be necessary to show such changes of location, said additional map or maps to be filed in the same manner as the original map or maps; but no change of location shall become valid until approved by the Secretary of the Interior, and the approval by the Secretary of the Interior of said map or maps showing changes of location of said rights of way or lands shall operate as an abandonment by the city and county of San Francisco to the extent of such change or changes of any of the rights of way or lands indicated on the original maps.[320]

Since San Francisco has not completed several other requirements of the "work permitted," it is certainly conceivable that the Secretary of the Interior would have the discretion to allow the dam to be removed and to allow the continued diversion of Tuolumne River water into the Canyon Tunnel, as envisioned in this article. In any case, the Raker Act is silent on the question of the removal of facilities, and it is hard to imagine that Congress did not delegate to the Secretary the right to permit changes to the original project as required. For example, changes to the dam to improve its efficiency and safety have been approved or tolerated by the Secretary without changes to the Raker Act.[321]

Despite the fact that no change to the Raker Act may be required, the situation would be made clearer via an amendment to the Raker Act. This amendement should clarify that removal of the dam is allowed if accompanied by an authorization of funds to accomplish the removal and

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[317] ROSEKRANS ET AL., *supra* note 2, at 97.

[318] RESTORE HETCH HETCHY, *supra* note 2, at 69.

[319] U.S. v. City & County of S.F., 310 U.S. 16 (1940).

[320] H.R. 7207 § 25(A)(5), 63rd Cong. (1st Sess. 1913).

[321] RESTORE HETCH HETCHY, *supra* note 2, at 69.

to replace the water and power supplies lost by San Francisco and its customers.

San Francisco owns at least some of the land under the reservoir.[322] The city also owns visitor and other facilities near the dam.[323] Existing federal law would allow the Secretary of Interior either to accept this property as a gift from San Francisco or, if necessary, purchase it from the city.[324] Appropriations would be required for the purchase.[325]

San Francisco and the Modesto and Turlock Irrigation Districts would probably prefer not to amend the Raker Act because some parties would seek to remove some of the water rights and other guarantees that maintain a relative peace among the three parties.[326]

B. STATE LAW

There are two important issues of state law that must be resolved:

- *Funding.* The state should pass a law, probably a bond act to be approved by the voters, providing funding to assist in the restoration of the valley and the development of water and power alternatives.
- *Water Rights.* San Francisco's water rights are "pre-1914" rights; they were filed before 1914 and are subject only to narrow review by the State Water Resources Control Board.[327] This allows San Francisco more flexibility than those who hold water rights dating from after 1914.[328]

San Francisco has the right to divert water from Hetch Hetchy Valley for water and power purposes.[329] If diversion into the Canyon Tunnel were to continue after the removal of the dam, then it is possible that no change in water rights would be necessary, since there would be no substantial change in the place of diversion and the purposes of the diversion would remain the same.[330]

Since a smaller amount of water would be diverted than when the

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[322] *Id.*

[323] *Id.* at 70.

[324] *Id.*

[325] *Id.*

[326] RESTORE HETCH HETCHY, *supra* note 2, at 70.

[327] *See* Steven J. Herzog, *The Appraisal of Water Rights: Their Nature and Transferability,* APPRAISAL J., Winter 2008, *available at* http://www.entrepreneur.com/tradejournals/article/176131505_2.html; *see also* ROSEKRANS ET AL., *supra* note 2, at 94.

[328] RESTORE HETCH HETCHY, *supra* note 2, at 70.

[329] *Id.*

[330] *Id.*

dam was in place, there might be an argument that San Francisco's rights should be diminished. But since the water can still be controlled and recaptured downstream at both Early Intake and Don Pedro Reservoirs, such a change in water rights would probably be unnecessary.[331]

Therefore, no changes to San Francisco's water rights would be required if O'Shaughnessy Dam were removed, as long as the city continued to divert water into the Canyon Tunnel.[332] Even a change in place of diversion is allowed under state law.[333]

Since San Francisco is a California city subject to state law, the state might be able to require the transfer of the city rights and land at Hetch Hetchy to the federal government.[334]

C. SAN FRANCISCO ORDINANCES

Law in San Francisco is made by ordinance, and substantial changes in city ordinances would be required to implement the restoration of Hetch Hetchy Valley.[335] Each of the following sections could be dealt with by a separate ordinance, or they could all be combined into one ordinance. Ordinances must be passed by the majority of the Board of Supervisors and signed by the mayor, or they may be passed as initiatives by a majority of the voters.

- *Dam Removal.* San Francisco constructed the dam, and it is logical that San Francisco should remove it. This would require an ordinance authorizing removal of the dam. (Permits would also have to be obtained from appropriate state and federal agencies, especially the Department of the Interior, Tuolumne County, and the California Department of Transportation.) The ordinance might require that substitute water and power facilities be in place before the dam is removed. It would also authorize funding from existing or future funds to pay for removing the dam and building replacement water and power facilities.
- *Replacements for Energy and Water Supplies.* In order to take advantage of state and federal funding for these replacements, an ordinance applying for and accepting the funds would probably have to be passed.

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[331] *Id.*

[332] *Id.*

[333] *See* ROSEKRANS ET AL., *supra* note 2, at ix-xi, xiii (discussing the rights of the S.F. Public Utilities Commission under California law).

[334] RESTORE HETCH HETCHY, *supra* note 2, at 70.

[335] *Id.* at 71.

- *Transference of Facilities at Hetch Hetchy.* An ordinance would be required to sell or donate the land and buildings owned by San Francisco at Hetch Hetchy to the federal government.
- *Other Constraints.* The Third Agreement between San Francisco, Turlock Irrigation District, and Modesto Irrigation District (June 30, 1949, Article 2) seems to limit San Francisco's aqueduct diversion to 400 million gallons per day (619 cfs).[336] This would constrain the ability of San Francisco to construct and operate a new fourth San Joaquin pipeline, since the proposed capacity of that facility, combined with existing diversion capacity, would exceed 400 million gallons per day (mgd).[337] Modesto Irrigation District has indicated an unwillingness to see the fourth San Joaquin pipeline constructed.[338] This is probably not important, since San Francisco has dropped plans to construct the 4th pipeline.[339] In addition, a California Supreme Court ruling in *Meridian, Ltd. v. City and County of San Francisco*, sometimes referred to as the El Solyo Ranch decision, seems to limit the San Francisco diversion through its aqueduct from the Sierra to a maximum of 500 cfs (323 mgd).[340]

V. CONCLUSION: HETCH HETCHY WITHOUT O'SHAUGHNESSY

Let us visit Hetch Hetchy Valley and the Bay Area in 2025 to see what changes have occurred with the implementation of this program. By paying attention to everyone's needs, we all will have found our way back into Hetch Hetchy Valley.

At Hetch Hetchy, restoration has been taking place for eight years, and the reservoir was drained five years ago. Restoration began at the upper end of the valley, where vigorous twelve-year-old pines and oaks are already more than twenty feet high. While non-native plants are present, the combination of a control program and the planting of extensive native gardens have been successful in limiting their spread.

The valley has already been repopulated by Yosemite's diverse wildlife. Bears have found new homes, bobcats and mountain lions are

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[336] *See* SOMACH, SIMMONS & DUNN, FOR ENVTL. DEF., HETCH HETCHY WATER AND POWER ISSUES 22-23 (2004).

[337] *See* SCHLUMBERGER WATER SERVS., *supra* note 291, at 4.

[338] RESTORE HETCH HETCHY, *supra* note 2, at 71.

[339] Press Release, Tuolumne River Trust, SFPUC Proposal to Drop Controversial Pipeline Praised (Oct. 11, 2005) (available at http://www.tuolumne.org/05October_4thPipelineDropped.pdf).

[340] Meridian, Ltd. v. City and County of S.F., 90 P.2d 537, 555 (Cal. 1939).

present, and deer roam throughout the valley. Birds not seen for a century—like John Muir's favorite, the dipper or water ouzel—are plentiful.

A remarkable renaissance in visitation has occurred in Hetch Hetchy and the surrounding mountain communities. Hikers, bicyclists, bird watchers, and other visitors are found by the many hundreds every summer day in the Hetch Hetchy Valley. Campers spend nights under the stars, with almost no distracting lights to ruin their view of the heavens. The spectacular wildflower displays in spring, coupled with the renewed giant waterfalls called Tueeulala, Wapama, and Rancheria, whose cascades now extend all the way to the valley floor, are a prime attraction in the spring. During the summer months, when flows in the Tuolumne are low, kayakers, canoeists, and rafters float lazily through the valley, enjoying the mild weather.

Whitewater boaters below Cherry Creek confluence are thrilled by the high flows in spring and the reliable good flows all summer. Anglers are overjoyed by the quick restoration of native trout populations in the now highly accessible upper Tuolumne. Steelhead can be seen spawning in Alameda Creek again and are responding to cooler summer flow on the lower Tuolumne River.

Climbers are challenged by dozens of new climbing routes, most notably Kolana Rock, and the El Capitan-like rock face on the north side of the Valley. Disabled persons find paths that make their visits easier. In the winter, after cold snows, cross-country skiers enjoy one of the most breathtakingly beautiful experiences anywhere in the Sierra Nevada.

Native Americans are actively engaged in preserving and studying artifacts of their cultural history and providing interpretive and educational opportunities on the Hetch Hetchy Valley floor for park visitors.

Pieces of the dam are on sale in the various Yosemite visitor centers, including the new one on the rim above Hetch Hetchy Valley. In neighboring communities along Highway 120 and nearby side roads, motels are full, and campgrounds are in heavy demand. As is often the case throughout Yosemite, the park's overnight facilities are often full, and neighboring visitor facilities are the beneficiaries.

Overall, Yosemite visitors have increased by more than several hundred thousand, thanks to the irresistible attraction of the newly restored valley.

In the Bay Area, conservation programs have made the region more self-sufficient in energy and water supplies. This has led to greater retention of money in the region, strengthening the local economy. Bay Area low-income residents were given first preference in the energy and

water conservation programs and have greatly benefited from them. They spend less money on water and electricity and are warmer in the winter.

By constructing water-supply features such as reclaimed wastewater plants within the Bay Area, the region has become less vulnerable to droughts. Growth in the region is now served more by more local water sources, reducing pressure on the salmon and other resources of the Tuolumne River.

Bay Area energy supplies have been augmented by new solar and other renewable energy sources made possible by the investment of state, local, and federal funds in the project to restore Hetch Hetchy Valley and replace its water and power supplies. The lowered need for imported energy reduces California's dependence on natural gas supplies from foreign countries.

In the Central Valley, water and power supplies of the Modesto and Turlock Irrigation Districts and their customers have been maintained at historical levels. There has been no increase in costs to the districts as a result of the removal of Hetch Hetchy Reservoir.

Water supplies in the Bay Area are more reliable than when the dam was in place, due to a greater diversity of water sources now available.

Flood control on the Tuolumne through Modesto has been improved by widening the floodway of the river. Higher flood flows can now pass through the city without causing damage. No reduction in flood control was caused by the removal of Hetch Hetchy Reservoir. The widened floodway has made the river more attractive to recreationists, anglers, and local residents.

Everyone involved with the removal of Hetch Hetchy Reservoir agrees that the result was a win for all concerned. The great Hetch Hetchy Valley lives again, water and power supplies have been made whole, and the economy of all affected regions has improved.

If John Muir and David Brower could visit Hetch Hetchy Valley today, they would find it once again "a grand landscape garden, one of Nature's rarest and most precious mountain temples."[341]

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[341] JOHN MUIR, THE YOSEMITE 255 (1912).