WATER SUPPLY DEVELOPMENT AMIDST GROWING SCARCITY: A CASE STUDY OF THE MONTEREY PENINSULA WATER SUPPLY PROJECT

BY

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THESIS

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Abstract

This thesis explores existing water conditions in California and, using economic valuation and policy analysis tools, examines whether desalination is a reasonable solution to growing water scarcity across the state. The author begins with an analysis of historical water development and the current structure of water law in California, which forms the foundation of the state's ongoing water crises. In recent years, as easily accessible water supplies dried up and demand for water continued to surge, water conditions across the state became more contentious and water supply development became more important. The bulk of this thesis uses a case study, the Monterey Peninsula Water Supply Project, to analyze existing water policy and desalination as a solution to the service area's growing water needs. Comparing farmers' willingness to pay with the costs of water production in the Water Supply Project, this paper suggest that courts and the State Water Resources Control Board should re-evaluate and re-allocate existing water rights rather than facilitate investment in costly new water projects.

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Introduction

Today, much of the United States is in a water crisis. Areas across the west coast, southwest, and eastern seaboard are suffering from abnormally dry to exceptional drought conditions (U.S. Drought Monitor Weekly Comparison); (Tabular Data Archive). On the west coast, in particular, conditions have reached a fevered pitch, with over eighty-two percent of California's land in "extreme drought," and fifty-eight percent in "exceptional drought," the highest category issued by the U.S. Drought Monitor Report (The Severity Of California's Drought Captured In Disturbing New Photos). Complicating matters further, the state is already utilizing most of its accessible, cheap water supplies (Hanak, Lund and Dinar xvi). Given these circumstances, policy makers are turning to new strategies for water supply development. Among these new strategies, oceanside desalination is gaining prominence. The question remains, however, whether oceanside desalination is a reasonable long-term strategy for water supply development in light of growing scarcity. This thesis suggests that while oceanside desalination may appear to be a viable, or even the best, solution to local water supply challenges, this technology does not address broader systemic problems, such as allocation and resource use.

To understand current water challenges in California, it is useful to understand the history of water development across the state. Therefore, this thesis begins with a historical analysis of water development and water law in California. Next, it examines the roots of water scarcity in the state, with emphasis on increasing demand and stagnating or decreasing supply. Following this examination, this thesis turns to the Monterey Peninsula Water Supply Project ("Water Supply Project"), a proposed oceanside desalination plant on the Monterey Peninsula. Through publicly available documents and stakeholder interviews, this thesis examines two aspects of the Water Supply Project: 1) the ability of desalination to provide a reasonable solution to California's water scarcity and 2) the privatization of water.

I. Background

a. History of water development and law in California

California's historical water is often broken into four eras, referred to by some (Bywater) as 1) the Laissez-faire Era, 2) the Local Organization Era, 3) the Hydraulic Era, and 4) the Era of Conflict. The Laissez-faire Era took place from the mid-1800s to the late 1800s, when the state's population exploded, small gold-panning morphed into large-scale industrial gold mining, and trade in agricultural products emerged (Bywater 23, 26). Water development was characterized by largely unregulated and uncoordinated water use by individuals, corporations, and local entities (Bywater 23). During this era, the courts determined how riparian rights and prior appropriation rights fit into California's water rights scheme (Bywater 27). Prior appropriation grants "first in-time" users water rights (rights claimed through actual use and diversion) while riparian rights permit landowners to claim water through ownership of water-adjacent water-containing land (Bywater 27). In *Lux v. Haggin*, the California Supreme Court declared that riparian rights would, in most cases, be superior to appropriative rights, though both forms of rights would continue (265).

Next, the Local Organization Era began in the late 1800s, when California's population grew, increasing demands for food and agricultural production (Hanak, Lund and Dinar 30). As a response to these needs, in 1887 the state enacted the Wright Act, which authorized the creation of irrigation districts (Hanak, Lund and Dinar 30). These districts were given "the power to acquire water rights, to construct water projects, and to sell bonds and impose property assessments to support water development and distribution" (Hanak, Lund and Dinar 30). The Wright Act marked a new era of decentralization of water management, as local water and irrigation districts emerged across the state (Hanak, Lund and Dinar 31). Additional legislation facilitated the creation of additional local agencies to create and distribute water supply (Hanak, Lund and Dinar 32).

While this facilitated expanded agriculture, inadequate local capital and inadequate local water supplies frustrated efforts to meet growing water demand, as seen in the Water Supply Project (Hanak, Lund and Dinar 32). Local agencies increasingly drew from local water supplies, which increased water conflicts. In one important case of the era, *Katz v. Walkinshaw*, the court declared that disputes between owners of overlying property would be decided under a

"reasonable use" standard, and remaining safe yields would be claimed by prior appropriators (122). The definition of reasonable use was later expanded, and applies to all water uses today.

By the turn of the twentieth century, the Hydraulic Era was rolling through, and as California's population and industry rapidly increased, so did its demand for water. This era was embodied by federal and state financing of large-scale water projects for non-local water sources (Hanak, Lund and Dinar 33-35). Cities set their sights on importing water from places like the Owens Valley and Sierra Nevada mountains after tapping out local supplies, constructing large dams and aqueducts (Hanak, Lund and Dinar 35). Some areas, however, such as the Monterey Peninsula, were not connected to large water conveyance systems and remained dependent on local or regional water supply.

During this era, the state government played an important role thanks to new legislation. For example, Congress authorized the state to conduct large land reclamation and water transfers (Hanak, Lund and Dinar 36). Congress also established a state regulatory system for the administration of surface water rights (Hanak, Lund and Dinar 37). The Water Commission Act created the Water Commission, the predecessor to the current State Water Resources Control Board ("SWRCB"), which had the authority to grant water permits and licenses (Hanak, Lund and Dinar 38). The SWRCB's powers have grown over the years, and it now has broad powers to, among others, monitor water uses, manage rights for the public interest broadly, and manage rights for water quality, fish and wildlife, and recreational uses specifically (Hanak, Lund and Dinar 38). Today, the SWRCB is instrumental in the allocation of water rights, and played a key role in the water conflict brewing in the Monterey Peninsula.

The modern era, or Era of Conflict, is characterized by just that: struggles for water, in one form or another. The great projects of the Hydraulic Era caused long-term water problems across the state, which resulted in many water struggles ongoing today. These project altered natural hydrologic patterns, which decreased water flows, detrimentally impacted fish populations, and greatly reduced water quality (Hanak, Lund and Dinar 54-55). Hydraulic Era projects also developed much of the cheap, accessible water supplies in the region (Hanak, Lund and Dinar xvi). In the modern era, water management shifted to local agencies, and incremental (rather than large-scale) water management occurred (Hanak, Lund and Dinar 58). At the same time, funding from state

and federal sources decreased significantly (Hanak, Lund and Dinar 58). As a result of these consequences, the Era of Conflict has been one of battles to water rights and struggles to develop water sources in light of dwindling supplies. The Water Supply Project is one ongoing example of such water conflicts in the state, and it illustrates many of the current challenges to water supply development.

b. Current legal structure of water rights in California

California water law is complex but must be understood to examine long-term strategies to develop water supply, like desalination in the Water Supply Project.

i. California water rights

In California, water rights are akin to licenses, and the SWRCB grants users the right to capture or receive water (Hanemann, Lambe and Farber 21). The SWRCB's main functions are to allocate water rights, determine surplus water, examine whether proposals satisfy the reasonable use doctrine, and monitor some diversions (Hanemann, Lambe and Farber 9). Significantly, in California private water rights are also usufructuary, which means water rights derive from use (Fish and Wildlife Service 1-4 to 1-5).

California water rights can be broken down in three ways: 1) riparian rights, 2) appropriative rights, 3) and groundwater or overlying rights (Hanemann, Lambe and Farber 2). Riparian rights grant owners of land the right to water that flows through or lies within their property (Hanak, et al., 2011, figure 1.1). Riparian rights create difficulty in California, where streams and rivers are far between and areas lack multiple sources of water (Hanak, Lund and Dinar figure1.1). Riparian rights and groundwater rights are correlative, which means owners have a right to a "fair and just proportion" of water, and users must reduce their diversions in times of drought (Hanemann, Lambe and Farber 19). Appropriative rights, on the other hand, are based on actual use of water, and grant first users first rights to water (Hanemann, Lambe and Farber 8). Under California law, riparian rights are superior to appropriative rights, so riparian owners generally have first claim to water and appropriators have rights to the remaining water (*Lux v. Haggin* 225)

ii. Reasonable use doctrine

In California, all waters are subject to the "reasonable use" doctrine, "the cornerstone of California's complex water rights laws" (*National Audubon Society v. Superior Court* 319); (Wilson 3). This doctrine requires that all water use is reasonable and beneficial (Wilson 3). Article X § 2 of the California Constitution states "the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented…." Section 2 further states that "the right to water… does not and shall not extend to the water or unreasonable use or… diversion of water." The reasonable use doctrine is further codified in the California Water Code, §100, which states the "… water resources of the State [will] be put to beneficial use… and… the waste or unreasonable use or unreasonable method of use of water [shall] be prevented." Together, these provisions mean reasonable use is a foundation of water law; reasonable use applies to all water uses; and branches of the government can make decisions based on reasonable use. The SWRCB has authority to take actions that "prevent waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water in this state" under Water Code section 275 (Wilson 5).

Several cases have been fundamental in the development of the reasonable use doctrine in California. In *Joslin v. Marin Municipal Water District*, the Joslins owned land in Northern California located just upstream from Tomales Bay (134). Water flowing through the creek on the Joslins' property carried suspended sediment, which the couple collected and sold (*Joslin v. Marin Municipal Water District* 134). In 1962, to support growing residential, commercial, and industrial uses, the Marin Municipal Water District built a dam, which impounded water and stopped the sediment from reaching the Joslins' land (*Joslin v. Marin Municipal Water District* 135). The Joslins sued the Water District, alleging that the alteration to the creek's natural flow, and stored water, deprived them of property (*Joslin v. Marin Municipal Water District* 135).

The Court examined Article X, § 2 of the California Constitution and held the Joslins' riparian rights were subject to, and limited by, the reasonable use doctrine (*Joslin v. Marin Municipal Water District* 138). The definition of reasonable use "depends on the circumstances," and cannot be decided "in vacuo isolated from statewide considerations of transcendent importance" (*Joslin v. Marin Municipal Water District* 140). The court held the Joslins' downstream gathering of sediment, while previously reasonable, became unreasonable due to increased demand for water upstream (*Joslin v. Marin Municipal Water District* 140-41). *Joslin*

demonstrates the importance principle that all water use must be reasonable, and that formerly reasonable uses of water can become unreasonable uses.

In order to apply the reasonable use doctrine, a person or the state uses a judicial or administrative forum to claim another's water use is unreasonable (Wilson 3). While the SWRCB controls water rights allocation, it is primarily the role of California courts to "resolv[e] disputes and *enforc[e]* rights of water rights holders" (*United States v. State Water Resources Control Bd. 104*). *In re Water or Hallett Creek Stream System*, decided in 1988, held that in addition to private parties, the State could assert claims to protect, conserve, and encourage efficient use of water (472). Reasonable use proceedings are often adjudicatory in nature, with disputes involving adversarial parties (Wilson 9). If a court finds a water use unreasonable under *Joslin*, the result is the loss of the water right, without any compensation (*Joslin v. Marin Municipal Water District* 145); (Water Law: Reasonable Use 1778).

As Gray writes, *Joslin* marked the transition from a focus on increasing water supplies to reallocating water (1993-1994, p. 258). Following *Joslin*, courts and the SWRCB began to examine relative values of water uses as well as water use efficiency (B. E. Gray, The Modern Era in California Water Law 261). In later cases known as the *Delta Water* Cases and *Imperial*, the courts read Article X, § 2 as conferring the state with broad authority to modify water rights to allocate rights according to economic, social, and environmental goals (B. E. Gray, The Modern Era in California Water Law 271).

While the reasonable use doctrine confers broad allocation rights on the state, courts have infrequently used this doctrine to find specific water uses unreasonable. However, according to a report by the Delta Watermaster to the Delta Stewardship Council and SWRCB, the SWRCB and the courts have deemed some select uses of water unreasonable, including excessive riparian use in competition with new municipal water supply; concurrent, combined diversions by both appropriators and riparians that resulted in important shortages of water for agriculture production; upstream diversions endangering recreational uses downstream; and the diversion of water that threatened water quality standards (Wilson 9). The selective application of the unreasonable use doctrine may illustrate the courts' and SWRCB's unwillingness to deem broad water uses invalid under the California Constitution for political and economic reasons.

c. Growing water scarcity

While there are multiple causes of water scarcity in the state, the most important is the growing imbalance between water demand and supply. This growing scarcity has increased the importance of water supply development and management. The primary drivers of water demand in California are urban dwellers, agricultural production, and environmental conservation. California's population is expected to increase to fifty-three million by 2030, a forty-seven percent increase (B. Gray 146). The Department of Water Resources estimates this will require an additional two-to-three million acre-feet of water per year (B. Gray 146). In addition, demand is increasing as a result of groundwater recharge and environmental needs (B. Gray 146). Further, scientists predict demand for the following water uses may increase as a result of climate change: groundwater extractions, indoor and outdoor irrigation needs, and storage requirements (Hanemann, Lambe and Farber 24).

Water supply in California is primarily a combination of surface water and groundwater, with some recycled and desalinated water (Cohen, Nelson and Wolff 8). The average precipitation in California is about 200 million acre-feet year, but most of this water evaporates (Hanak, Lund and Dinar 72). The remainder of about seventy-five million acre-feet, known as "unimpaired runoff," goes into streams, rivers, and other groundwater retainers (Hanak, Lund and Dinar 72). In 2004, surface water made up sixty-seven percent, groundwater made up thirty percent, recycled water made up roughly one percent, and desalinated water made up less than half a percent of California's water supply (Cohen, Nelson and Wolff 8).

Because of California's hydrology, with few rivers and streams, and California's climate, which is hot and dry in much of the state, significant water supplies are imported from distant regions or neighboring states (Hanak, Lund and Dinar 73). According to California Department of Water Resources data for gross water supplies from 1998-2005, only forty-five percent of water was sourced from local surface water deliveries (Hanak, Lund and Dinar 77). An additional ten percent was from groundwater withdrawal, seventeen percent was from reused surface water, and less than one percent was from recycled water (Hanak, Lund and Dinar 77). While many of the largest urban centers are connected to state or federal water conveyance projects, like the Central Valley Project, smaller coastal regions such as the Monterey Peninsula are not connected, and must develop their own local water supplies.

Today, cheap sources of water have largely been used up (Hanak, Lund and Dinar xvi). In order to meet growing urban and environmental demands, new sources of water supply must

be identified and developed. The search for new water sources will be further frustrated by climate change (Hanak, Lund and Dinar 2). Moderate estimates place California's overall water reduction due to climate change at twenty-five percent: surface water supplies will decrease due to changes in air temperature and precipitation; changes in weather patterns will likely reduce runoff from the Sierras, a main source of water for cities like San Francisco; and droughts will be more frequent and severe, exacerbating groundwater overdraft (B. E. Gray, Global Climate Change: Water Supply Risks and Water Management Opportunities 1454-55; Hanak, Lund and Dinar 23-24).

Across the state, water demand currently exceeds or is expected to exceed supply in the near future (Hanak, Lund and Dinar 75). As a result, Californians have turned to new solutions for water. One alternative raised with increasing frequency is desalination, a process by which salt water is converted into fresh water (Cohen, Nelson and Wolff 12). Because desalination was prohibitively expensive in the past, it accounted for less than one percent of California's water supply just a decade ago (Cohen, Nelson and Wolff 12). As cheap supplies of water dried up and desalination costs decreased, however, it has received increasing attention as a solution to water scarcity (Cohen, Nelson and Wolff 12).

d. Existing water use

Agricultural use accounts for a significant portion of the state's overall water use (Hanak, Lund and Dinar 79). In terms of net use, in 2005 agriculture comprised about 62%, urban uses comprised about 16%, and environmental uses comprised about 22 % of water use (Hanak, Lund and Dinar 89). The share of agricultural water use varies by region, and in the Central Coast, where Monterey is located, 72% of net water was used for agricultural production, 18% percent of net water was for urban use, and 19% of net water was for environmental use as of 2005 (Hanak, Lund and Dinar 88).

Given the diverse crop production in California, the value of agriculture varies greatly across the state, where value is measured in gross revenue per net water (acre foot of water) used (Hanak, Lund and Dinar 91). Relatively low-value agricultural crops such as "field crops" like alfalfa, rice, corn, and other grains have an economic value of about $200 to $600 per acre foot, while high-value fruit and nut crops produce close to $2,000 per acre foot (Hanak, Lund and Dinar 91-92). In 2005, rice, alfalfa, cotton, and other field crops accounted for 43% of

agricultural water use; irrigated pastures accounted for 12% of agricultural water use; and corn accounted for 7% of agricultural water use (Hanak, Lund and Dinar 93). Overall, over 60% of agricultural water use, or 16.3 million acre feet of water, supported low-value crop production (Hanak, Lund and Dinar 93). While some of this crop production supports higher-value meat production, a significant proportion of this agriculture is simple crop production. In a state where water supply is increasingly scarce, those responsible for water rights allocation need to examine continued allocation of water rights to support low-value agriculture.

e. Importance of Water

If ongoing challenges in water supply are not addressed, there may be grave consequences for communities, ecosystems, and the state as a whole. Most importantly, water is a fundamental good, necessary for all. Individual households, businesses, institutions, environmental conservation lands, countless flora and fauna, and California's agricultural sector all rely on water. Current projections show water demand will continue to outstrip supply in coming years, and recent droughts have only exacerbated this trend. As water scarcity increases, water prices may increase greatly, and in some situations act as a regressive tax against lower-income individuals. In dire situations, where water needs greatly exceed water supply, water rationing may be needed. To address scarcity, cities, regions, and the state need to develop strategies to enhance water supply and promote efficient use. More fundamentally, those with authority over water rights need to re-evaluate broader water policies and the implementation of legal doctrines such as reasonable use.

II. The Monterey Peninsula Water Supply Project

The remainder of this paper analyzes the Water Supply Project to examine broader issues of water policy and water privatization. I selected the Water Supply Project as a case study for several reasons. First, the Monterey Peninsula is not connected to the state or federal water conveyance systems. Therefore, water supply development is under the authority of several, regional entities more capable of analysis through stakeholder interviews I conducted in summer 2014. Despite largely local responsibility for water supply, the region's water conflict in recent decades has been a microcosm of broader water issues in the state. In addition, the Water Supply Project involves the use of a technology emerging in popularity in California: oceanside desalination. A technology only nominally used in the past due to its hefty capital costs, desalination is only present at three operational plants in California (Rogers). As desalination costs and available water supplies decreased, desalination's popularity increased, and there are now fifteen proposed desalination projects in the state (Rogers). Last, the Water Supply Project is an example in which a private utility is responsible for the development and provision of public water.

a. Methodology

In the summer of 2014, I conducted a series of interviews regarding the Water Supply Project. I interviewed key stakeholders from seven organizations, including California American ("Cal Am"), local agencies and institutions supporting the project, and an opposition organization. Each of these interviews was conducted via phone. Following their completion, I transcribed the interviews and summarized key findings, noting whether information was confirmed by individual or multiple interviewees. These phone interviews served several purposes. First and foremost, the interviews helped me gain a general understanding of the region's historical water provision and recent water supply development conflicts. The historical information I point to about the region's water provision and failed water supply efforts is based primarily on facts gleaned or confirmed by interviewees. Second, available documents were often incomplete and sometimes contradictory as to the history of water supply projects in the Monterey Peninsula and the current Water Supply Project. Interviews with agencies and managers affiliated with the Water Supply Project helped fill in these gaps and confirm or negate

my analysis of publicly available data. Last, the interviewees helped me identify the most important challenges to the Water Supply Project, and motivations or incentives behind the Water Supply Project. Some of these challenges and incentives are supported by other research, but the interviews were instrumental in the initial analysis of many issues such as alternatives to desalination and privatization issues.

b. Water provision in Monterey

Monterey is a city and county on the central coast of California. Monterey County is rare, in that its water has historically been privately owned and provided (Bloomberg Businessweek). The following examination of water provision in the Monterey Peninsula is based on information from nearly all interviewees, all of whom had significant experience on the Water Supply Project or water management in the area. The region's water developed with several independent, but private, providers throughout the 1800s and early 1900s. In the mid-1900s, Cal Am purchased two privately owned, independent systems and became the area's primary service provider.

Cal Am, a subsidiary of a national utility company, is now the sole provider of water in the "Monterey Peninsula" service area. This service area incorporates six cities and approximately 40,000 connections, serving somewhere between 100,000 to 150,000 individuals. These connections are largely residential (65% are for permanent residents or weekenders). This water supports over $2.3 billion in annual hospitality revenue, $1.5 billion in education expenses, and $1.3 billion in military expenditures. Though there is significant agriculture in the region, Cal Am does not supply water to whole-sale commercial growers on the Monterey Peninsula.

Monterey County draws its water primarily from the Carmel River through wells (State Water Resources Board 2, 6). In July 1995, the SWRCB responded to several petitions that claimed Cal Am was excessively (and therefore illegally) diverting water in the public trust, killing mature riparian forests and destroying steelhead populations (State Water Resources Board ii, 7-8). In Order WR 95-10, the SWRCB found Cal Am did not have legal rights to 10,730 acre feet of water, or about seventy percent of its annual diversions (State Water Resources Board ii). Order 95-10 required Cal Am to reduce its diversions by December 31, 2016 (California-American Water Company 2). After several failed projects, Cal Am submitted the application for the Water Supply Project to the Public Utilities Commission ("PUC") in 2012 (California-American Water Company 2).

c. Water Supply Project proposal

The Water Supply Project proposes a desalination plant and possible purchase of water from a separate water development (the Seaside Groundwater Basin Replenishment Project), which uses aquifer storage and recovery, and water recycling (California-American Water Company 1, 4). As proposed, the Water Supply Project uses slant intake wells to draw water in from under the sea floor (Project Description Overview 181). Most recent publicly available documents state the plant will be sized at 6,250 acre-feet per year (6.4 million gallons per day) (Project Description Overview 181). Cal Am expects to use an existing outfall offshore to distribute wastewater, or brine, into the ocean.

Cal Am initially projected the plant would be operational in 2016 (Project Description Overview), but multiple interviewees confirmed this deadline is no longer viable, and estimated completion anywhere from 2018 to 2019. While the exact timeline is uncertain, it is clear the deadline is largely a function of the PUC's decision making; the PUC is the commission in charge of private utility providers, and it has ultimate authority to approve the Water Supply Project and the environmental impact review required by the California Environmental Quality Act.

After Cal Am's proposal submission, various groups filed suit against the Project as "intervenors" (MacLean). In July 2013, a settlement was reached in which Cal Am agreed to make several changes to its original proposal (MacLean). Some of the important settlement provisions included a technical report on the slant wells, mechanisms for reducing the project's overall costs, further exploration of contingency plans, and re-examination of future water needs (MacLean). In addition, Cal Am agreed to some public oversight through the creation of a "Governance Committee" and an increased role for the local water management district (MacLean).

d. Findings

i. Microcosm of California water rights issues

Monterey's water conflict is a microcosm of broader water conflicts in the state. Broadly, the Water Supply Project illustrates current approaches to water development, and the historical forces that often shape water development. As one interviewee with significant water expertise

stated, the Monterey Peninsula is another instance in which a state agency (here the SWRCB), allocated water rights, imposed water reductions, and ordered development of additional water supply without understanding local conditions or obtaining community input. Perhaps as a result, Order 95-10 led to some protests, lawsuits, and a series of failed projects prior to the Water Supply Project. Relatedly, the case study illustrates the complex and varied stakeholders involved in California water management. Even in the relatively small Water Supply Project, varying interests and multiple agencies are involved, including the SWRCB, the PUC, and the Monterey Peninsula Water Management District.

The Monterey Peninsula and the surrounding region is comprised of urban, environmental, and agricultural users interacting and often competing for water rights, much like the rest of the state. While Cal Am's service area is predominantly residential, institutional, and businesses, agricultural users are present in adjacent areas across Monterey County and the Salinas Valley. As about half the interviewees stated, claims to water rights in regions adjacent to the Monterey Peninsula likely impacted available alternatives in water supply development. For instance, as one interviewees state, one possible solution to water shortages in the Peninsula is water recycling. However, agricultural users in the region draw on wastewater for irrigation. Thus, any proposed project for recycling could, from the farmers' perspective, threaten their water supply, which influenced the direction of the project towards desalination and away from water recycling. As another interviewee explained, there are also currently unused surface water rights on the Salinas River that could be used to provide water for the Peninsula. Predominantly agricultural users in the Salinas Valley, however, contend they have claim to this water, in spite of the fact that the Peninsula only needs 10,000-15,000 acre feet per year, in contrast to the Salinas Valley's estimated 400,000 acre feet per year. While multiple interviewees expressed the belief that recycling or surface rights could solve the Penisula's water supply problems more cheaply and quickly than the Water Supply Project, other proponents of the project disagreed, stating desalination was the best solution for the region's needs. This disparity is likely due to several factors; to begin, recycling and surface water rights are politically sensitive alternatives because of their potential impact to other users' (mostly farmers') water rights; second, Cal Am has ample reason to support the project, including potential profits and control of a valuable resource; and last, political actors, recognizing the imminent need for water, may be supporting the most viable project, and may even believe it's viability makes it the "best" solution. Despite

this disagreement, it seems likely that the sensitive politics of water rights in the region limited practical alternatives to desalination.

ii. Broad consensus around an unreasonable solution

While one organization, Public Water Now, vocally opposes the project, there is a surprising consensus supporting the Water Supply Project amongst officials, agencies, and citizens. An examination of the troubled history of water development in the region illustrates why this may be the case. As nearly all interviewers pointed out, the region's struggle to develop water predates Order 95-10, but Order 95-10 certainly increased pressure to imminently develop water supply, which began a pattern of failed water projects. The first was a dam supported by public funds. Under California's Proposition 218, attempts by local governments to levy or increase taxes require voter approval in a local ballot measure (California Proposition 218). When the dam went to its required vote, it failed.

After the dam failed, a new application examining alternatives was developed, and identified desalination as the best solution. The next proposal, a publicly owned desalination plant, however, failed. The plant size was similar to the currently proposed plant and utilized co-location near a power plant to supply energy. The project was approved in 2009, but as several interviewees familiar with the failed projects described, the public desalination plant became mired in financial and political problems. Public ownership, while beneficial in ways discussed below, made it subject to public financing requirements that proved burdensome in the economic climate of 2009. At the same time, political mis-dealings torpedoed an already struggling project. Criminal charges were brought against a water board member for taking payments from a private firm in connection with the regional desalination project. Not surprisingly, the project was dead in the water by 2012.

The failed projects demonstrates several important points. First, these illustrate how easily voter participation and financing requirements of public projects can hinder, and ultimately kill, water supply project. This makes private projects more appealing and more feasible, as privately owned projects are not subject to these requirements. Second, this history shows how a lack of public participation or community engagement in project development can result in more tenuous, much slower development of water supply. Overall, the failure of the

dam and first desalination plant likely increased pressure for a successful project and may have created mistrust in public agencies' ability to meet the region's imminent water needs.

In April 2012, Cal Am proposed a privately owned desalination plant to the PUC which, not surprisingly, gathered broad support. As a private project, the Water Supply Project did not have to obtain voter approval and could access private financing options. Several interviewers noted Cal Am's private financing abilities were integral to the Water Supply's Project's success. In times of regulatory drought (when existing water supplies are unsufficient) in California, the state allots a minimum health and safety ration of water. Without an additional water supply, Cal Am would not even be able to meet this minimum water allotment on the Monterey Peninsula once diversions are cut. Cease and desist Order 95-10 also set a January 1st, 2017 "cliff date," or diversions reduction deadline (State Water Resources Board). While Cal Am will likely miss the cliff date due to the uncertain approval process, the Water Supply Project is the only real project that could meet local supply needs in the near future. In the face of a potential "economic Armageddon," as one interviewee put it, it makes sense the community and public officials would support any viable project that could possibly meet the cliff date, in this case the Water Supply Project.

The Water Supply Project itself, and the broad consensus supporting it, is also likely a function of successful marketing and outreach. Local politicians from the six Peninsula cities, such as Carmel-by-the-Sea's Mayor, supported the project and engaged in outreach to increase community support for the Project. As multiple interviewees noted, local politicians' support for the Water Supply Project proved instrumental in the project's progress. In addition, while the Water Supply Project is billed as a water supply "replacement" rather than water supply expansion project, some interviewees indicated the project may in reality account for demand growth by using a high baseline and estimating lower-than-accurate economic bounceback (the amount of demand that would increase from the baseline as the economy rebounds from the recession). Next, project proponents state the desalination plant utilizes new technologies (i.e., slant wells) that will reduce environmental impacts. Unlike open intake often used in desalination, slant wells purportedly reduce the risk to marine life by drawing water in from beneath the sea floor. However, as opponents state, slant wells are largely untested in oceanside desalination, and Cal Am is still awaiting the results of a planned test well; despite this uncertainty, the construction of the project and use slant wells was often assumed in my

interviews. Last, Cal Am has plans to draw the large amounts of energy required for desalination from a neighboring land-fill that creates renewable energy. This masks the fact that the Water Supply Project will be a massive energy consumer, and even if that energy is drawn from renewable sources, there is opportunity cost to that use. The vast energy consumed, even if renewable, could support other, potentially better uses.

As discussed above, the Water Supply Project may represent a viable option in a situation where there is an imminent threat of water cuts. In light of the context of failed projects and settlement agreements, the broad consensus around the project is not surprising. What is less clear is whether, despite the broad consensus, the project actually supports long-term, reasonable use of water in California. The Water Supply Project increases water costs for local residential and institutional users while permitting continued water consumption for low-value agriculture across the state.

As described in detail above, the reasonable use doctrine underlies all uses of water in California (Wilson 3). "Reasonableness" is a continuing standard, meaning that a use that was once reasonable may become unreasonable, in light of changing circumstances (Joslin v. Marin Municipal Water District 140-41). As Gray writes, following *Joslin*, courts and the SWRCB began to examine relative values of water uses as well as water use efficiency in its examinations (B. E. Gray, The Modern Era in California Water Law 261). I suggest one way to examine the reasonableness of new water supply development is to compare the cost of water in the new project with the value of water in existing uses. If the cost of the new water exceeds the value of the existing water uses, then it is unreasonable it invest in new water supply and reasonable to re-allocate water. In this case, I examine the Water Supply Project's water costs alongside the economic value of water in existing agriculture (assumed to have some of the lowest valued water). As the California Department of Water Resources' *Economic Analysis Guidebook* illustrates, there are several ways to compare the economic value of water (State of California The Resources Agency 15, 25). Because water is not freely traded on the market (State of California The Resources Agency 17), and consumers' costs of water reflect many regulations (and therefore market distortions), Willingness to Pay ("WTP") is an effective method of valuing agricultural users' water (State of California The Resources Agency 15, 25).

A comparison of the cost of water production in the Water Supply Project with agricultural users' WTP (which reflects the value of water) illustrates the unreasonableness of

the Water Supply Project in light of low-value agricultural use. According to Cal Am's own estimates, the cost of water in the Water Supply Project's desalination plant is about $5,095 per acre foot (California American Water 8); (Appendix A, Table A.2). These calculations are based on assumptions in water use and distribution that could likely significantly impact per acre foot costs of water production. For comparison, another existing water source in Monterey, groundwater from the Begonia Plant, costs $197 per acre foot (Appendix A, Table A.2). Under the most recent 6.4 mgd plant scenario (Project Description Overview), the Water Supply Project's total expected capital costs are approximately $277 million (Appendix B, Table B.2); (Project Description Overview). Pipeline facilities will account for $131 million and the desalination plant will account for approximately $95 million of total project construction costs (Appendix B, Table B.2); (Project Description Overview). In addition, there will be approximately $16 to $17 million in total annual operating and maintenance ("O&M") costs (Appendix B, Table B.4). The primary drivers of O&M costs are power and purchased recharge water (Appendix B, Table B.4).

As noted above, examining farmers' WTP for water is likely the best method of valuing agricultural water. In 2011, Hanak et al., using a State Agricultural Model, derived WTP from loss of revenue due to cuts in agricultural water supply (Hanak, Lund and Dinar 95).[1] As noted above, relatively low-value agricultural crops like alfalfa, rice, corn, and other grains have an economic value of about $200 to $600 per acre foot (Hanak, Lund and Dinar 91-92). Comparing revenue per acre foot of water consumed (see Appendix A, Figure A.3) with marginal WTP (see Appendix A, Figure A.4), low-value agricultural users' marginal WTP in the event of a five percent water cut is likely on the low end of $60 to $99 per acre foot of water. With a 25% water cut marginal WTP likely ranges on the low end of $115 to $249 per acre foot of water. (Appendix A, Figure A.4). As Hanak notes, WTP (in particular short-term WTP) increases as water scarcity increases (Hanak, Lund and Dinar 98). Given California's recent drought, farmers' WTP may exceed even the 25% water cut WTP data discussed by Hanak. From 5% to 25% water cuts, WTP close to doubled; even if recent droughts cut water by about 50%, and re-

[1] The valuation in this thesis relies on agricultural data from *Managing California's Water From Conflict to Reconciliation*, co-authored by Hanak, Lund, Dinar, Gray, Howitt, Mount, Moyle, and Thompson. This report uses the Statewide Agricultural Production Model (SWAP) to calculate marginal WTP for California's agricultural water users. The SWAP is, according to contributing authors of the report, the most accurately calibrated economic model available. Further, this report holds the only current estimates of California agricultural users' WTP for water.

double WTP, WTP would only increase to $230 to $498 per acre foot (see Appendix A, Figure A.4). It is important to note that as conditions of scarcity increase, WTP will not increase indefinitely; rather, it is likely some farmers with low gross revenue will be unable to pay increasing water prices. For instance, irrigated pasture produces on average only $31 per acre foot of water used, and these farmers' WTP would likely top out at well below $230, so farmers would likely stop farming such goods as conditions of scarcity and water prices increase (see Appendix A, Table A.1). By comparing the cost of desalinated water ($5,095) with the WTP of low-value farmers (in the range of $115 to $230 depending on water cuts), continued existing water use for low-value agriculture appears unreasonable.

There are some flaws in this WTP methodology, but these do not negate the value of the data above. WTP may be an underinclusive valuation, as agricultural production may have larger social benefits not captured by Hanak's examination of loss of revenue, but this is difficult to quantify or capture through empirical methodology. Further, Hanak's WTP is based on revenues, which may themselves be impacted by regulations. However, this data still captures what, in light of today's circumstances and farming regulations, farmers are likely WTP in time of water scarcity. Hanak's data was also the most recent for this segment of water users. Even if WTP shifts upward based on these factors, the value of water for at least some farmers would remain below the cost of production given the existing gap between Hanak's WTP estimates and the cost of water production.

Given this disparity, the Water Supply Project should be found, in the broader context of California law, unreasonable. In lieu of investing in capital-intensive projects that dramatically increase water costs, the SWRCB and the courts, as the guardians of this common resource, should re-allocate existing water rights. Looking at revenues per acre across California, low-value agriculture occupies significant regions to the east of the Monterey Peninsula that, theoretically, one could re-allocate water from (Appendix A, Figure A.3); (Hanak, Lund and Dinar 94). In California, water rights are akin to licenses, and the SWRCB grants users the right to capture or receive water (Hanemann, Lambe and Farber 21). One of the SWRCB's primary functions is to allocate water rights and determine the reasonableness of proposals (Hanemann, Lambe and Farber 9). Further, California courts have authority to "resolv[e] disputes and *enforc[e]* rights of water rights holders" once a challenge is brought against a user of water by private parties or the state (United States v. State Water Resources Control Bd. 104). While there

are several ways a re-allocation could take place, it is clear the SWRCB and courts have the authority to re-evaluate existing water uses and re-allocate existing water rights.

If water was diverted from low-value users to the Monterey Peninsula, there would be additional costs, the largest of which would be the conveyance of water and associated infrastructure and energy use. Compared to existing state, federal, and local conveyance projects, the Monterey Peninsula needs very little water; billed as a "replacement" project, the Water Supply Project will provide 9,750 acre-feet of water per year (Project Description Overview). With low growth expected in the region, inteviewees' working on the Water Supply Project estimated the Peninsula will only need about 10,000 to 15,000 acre feet per year in the foreseeable future. In contrast, even local water conveyance projects transport millions or trillions of acre feet (Appendix A, Figure A.1).

Transportation costs will vary depending on where the water is drawn from. If canals are used, water could be re-allocated from low-value uses to the east within about 100 miles (Appendix A, Figure A.3). 150 miles is large enough to account for some increased costs due to unstable terrain. Water transportation occurs in California and other parts of the world, but finding reliable data on transportation costs is difficult because these data are commercially sensitive (Zhou and Tol). Zhou and Tol refer primarily to water transportation from Egypt to the Middle East, but similar values can be applied to water transport in other locations, like California (MIT). Using this data, transporting water via canal would cost approximately the following: 12.3 million to 18.5 million m^3 * 241.4 km * ($0.061/$m^3$ per km) = $1.8 million to $2.7 million to transport 10,000 to 15,000 acre feet per year, or $180 per acre foot. (Zhou and Tol 7). The $180 increase per acre foot is not prohibitively expensive, and these infrastructure costs are minimal compared to the $277 million needed for the total construction of the Water Supply Project.

If a pipeline was used, prices would increase significantly but could vary greatly. California has a well-developed water conveyance infrastructure, and looking at existing federal, state, and local water projects, it seems likely the Monterey Peninsula could be connected to existing infrastructure with about 50 miles of pipeline (Appendix A, Figure A.1). According to MIT's 2012 Mission 2012 Clean Water Project, pipeline estimates vary significantly and are not often publicly released (MIT). However, the Clean Water Project estimates pipelines cost anywhere from $1.5 million per mile to $5.6 million per mile (MIT). If a pipeline was used for

50 miles, it could cost anywhere from $75 million to $280 million. Pipeline costs are likely less than the $277 in total construction costs of the Water Supply Project and additional O&M costs of $16-17 million per year (Appendix B, Table B.3).

If 15,000 acre feet were transported, pipeline transportation would cost $5,000 to $18,666 per acre foot. These are likely high estimates, as the water volumes discussed by the Clean Water Project greatly exceed the Water Supply Project's, but they illustrate that a pipeline may be prohibitively expensive depending on the price of the pipeline. However, if a pipeline was needed, transportation of greater volumes of water would significantly reduce costs per acre feet and would make re-allocation viable in light of farmers' WTP. If, for instance, volume transported is doubled, cost of transportation per acre foot decreases to $2,500 to $9,333 and a pipeline is not prohibitively expensive. Additionally, the distance of pipeline needed could likely be reduced through a re-allocation of existing users' water sources; rather than transporting the water directly from lower-value agricultural users, the state could shift the transportation of water slightly throughout the region for many users to reduce necessary pipeline needed. Given the feasibility of transporting re-allocated water, adjudicatory bodies like the SWRCB and the courts should re-examine and possibly re-allocate water rights away from some existing low-value users towards residential and institutional uses; to determine locations and rights, more thorough quantitative analyses are required.

iii. Solutions

What, then are the solutions? The reasonable use doctrine underlies all uses of water in California, and is a continuing standard (Wilson 3). In *Imperial Irrigation Dist. v. State Wat. Resources Control Bd.*, the court held the SWRCB could, on its own authority, investigate water use that could be unreasonable and take actions to remedy unreasonable use (569). Additionally, the court held that some beneficial use of water does not equate to reasonableness, but must be examined in comparison to water demands, and possibly future water demands; more specifically, "what is a beneficial use, of course, depends upon the facts and circumstances of each case. What may be a reasonable beneficial use, where water is present in excess of all needs, would not be a reasonable beneficial use in an area of great scarcity and great need. What is a beneficial use at one time may, because of changed conditions, become a waste of water at a later time" (*Imperial Irrigation Dist. v. State Wat. Resources Bd.*, 570). Despite the broad

mandate of the reasonable use doctrine, courts have been largely unwilling to find water uses unreasonable.

As evidenced above, the cost of water production in the Water Supply Project ($5,095 per acre foot) greatly exceeds the value of low-value farmers' water (possibly as low as $60 per acre foot of water) (see Appendix A, Table A.2 and Figure A.4). While the cost of water in the Water Supply Project may not be comparable to all places suffering from water scarcity, it is likely comparable to some urban users facing imminent water challenges and relying on costly proposed technologies (like desalination) for increased water supply. Given growing water scarcity across the state, and continued imbalances between demand and supply, it seems unfair and wholly unreasonable to push the costs of capital-intensive projects onto citizens while permitting continued low-value agricultural use throughout the state.

While some argue the market should shift resource use to more highly-valued uses without state intervention, this is not the case in water. In water, users (and their water use) fit into a tightly regulated water use management system in which the source or kind of water use cannot be easily altered (Freyfogle). Therefore, as described in *Joslin* and *Imperial Irrigation Dist.*, the SWRCB should investigate the comparable values of water between municipal and existing low-value agricultural users and find at least some continued low-value agriculture unreasonable under California law. The SWRCB, beginning with the lowest-value uses, such as irrigated pasture, should re-allocate this water to areas in which there is current or future municipal demand. According to 2005 estimates, gross urban water use was 8.7 million acre feet per year (Hanak, Lund and Dinar 86). Low-value agriculture, on the other hand, required about 19.1 million acre feet of water per year (see Appendix A, Figure A.1). Irrigated pasture alone accounts for 3.3 million acres of water use per year, enough to meet future water needs from population growth (see Appendix A, Figure A.1).

Given that California's agricultural sector is the largest in the nation, California has strong agricultural lobbies and interests that are likely to be vocally opposed to the re-allocation of water rights. As recently as 2007, value-added crop and agricultural production accounted for about $22.4 billion, and while the largest of any U.S. state, that comprised only 1.2% of the state's GDP (Hanak, Lund and Dinar 91). While traditionally unreasonable water use resulted in the loss of the right without compensation, this is not the only solution available. In *Imperial Irrigation Dist. v. State Wat. Resources Bd.*, the court upheld the SWRCB's decision to require a

conservation plan and progress reports. This illustrates that the SWRCB has wide latitude in remedial actions to unreasoanble low-value agricultural use. To alleviate farmers' and agricultural lobbies' concerns, the SWRCB could devise a wide range of remedial actions; the SWRCB could, for instance, grant farmers an opportunity to modify water use (i.e., shift to new, higher-value crops) for several years before re-allocating the water use. All in all, the SWRCB has broad authority to devise remedial actions, which could alleviate concerns about unfairness.

iv. Privatization poses significant challenges

Another important aspect of the Water Supply Project is its private ownership by Cal Am. Privatization has varying definitions, but it generally refers to "any time assets and operations that are in public hands are transferred somewhat into private hands" (Hauter, Loyko and Segal 1330). Delivery of public goods by private hands can occur in a number of ways, including conventional market systems, contracts from public agencies, monopolies, contracts for the provision of services, and consumer cooperatives (Goodrich 12). As the sole owner of the Water Supply Project, and the sole provider of public water in the service area, Cal Am has a monopoly.

In recent years, privatization increased in many fields, such as prisons and correctional facilities, garbage collection, transportation, and water provision (Goodrich 14-15). In 1999, only 5% of the global population received privately supplied water; that proportion increased to 12% by 2010, and some expect it to increase to 20% by 2025 (Hanke and Walters 36). The Water Supply Project is unique in that its privatized water emerged as a result of long-standing historical forces on the Peninsula. Despite that, the Water Supply Project does provide an example of capital-intensive, privatized water development in the context of modern regulatory and financing structures.

Despite the project's broad consensus, the private ownership element did result in earlier protests and opposition efforts. Customers protested Cal Am's proposal, arguing "there have been too many private deals at the expense of ratepayers" (Abraham 177). These protests are not uncommon in the United State and abroad. Wenonah Hauter, Executive Director of Food and Water Watch, a nonprofit advocacy organization, has examined both international and national water privatization (Hauter, Loyko and Segal 1323-1324). According to Hauter, "privatization has been a clear and unequivocal disaster in most places" (Hauter, Loyko and Segal 1325).

As evidenced by many cases, water privatization passes on costs of infrastructure to consumers and incentivizes increasing capital costs of projects (D. A. Cohen 16). In the Water Supply Project, Cal Am will be able to increase water rates to recover its equity financing, which is limited to 27% of capital costs. According to interviews with those working directly on the Water Supply Project, equity financing was reduced from the traditional 54% (in corporate settings) to 27% to reduce costs to consumers. Despite that change, the financial incentive remains; higher capital costs for the desalination plant (an already capital-intensive technology) yields higher profits. This phenomenon is known as the Averch-Johnson Effect; under rate-of-return regulations, utilities increase their returns when they increase investment in infrastructure, which incentives "gold plate" systems (Are We Better Off Privatizing Water?). Cal Am plans to levy surcharges on customers totaling about $90 million and will increase rates for the remainder of equity financing. According to the Water Supply Project's website in 2014, average customer bills will increase 40.9% by 2018 (Appendix B, Table B.7). According to multiple interviews, however, this is in addition to significant water charge increases in the last several years. Price increases raise concerns about economic justice, as increases in water prices may be regressive, increasing water costs for lower-income households proportionally more than high-income households.

Relatedly, rates for private water tend to be higher than rates in comparable publicly-served cities (Hauter, Loyko and Segal 1338-1339). In Pennsylvania, for instance, where a number of communities have been served by private water companies for a "long, long time," much like the Monterey Peninsula, private companies charged four times public companies' prices (Hauter, Loyko and Segal 1338). In 2005-2006, Cal-Am, the company responsible for the Monterey Water Supply Project, charged about thirty-six percent more than public utilities (Hauter, Loyko and Segal 1338).

In addition, private ownership leads to reduced transparency and oversight. The Water Supply Project will be built, owned, and operated by Cal Am. As one interviewee familiar with and generally supportive of the project stated, Cal Am lacks transparency, and this will only increase after construction is complete. The PUC has ultimate authority over the Project, and has two main functions: regulating and rate-making. Opponents argue the PUC's process is a black box, and its main purpose is to help businesses survive, not to help citizens thrive. In those interviews in which the PUC was discussed at length, about half, all interviewees agreed that the

PUC's process could be difficult, inaccessible, or uncertain. As one interviewee with experience with the PUC stated, intervention and oversight by outside entities is often prohibitively cumbersome and expensive. To examine and challenge PUC documents related to rate changes, for instance, parties must have specialized software and often outside legal expertise.

While there is some oversight of the Water Supply Project, it was created for the duration of project development and will likely be dissolved once the plant is operational. The Governance Committee, for instance, is comprised of representatives from the local water authority, Cal Am, and the Monterey County Board of Supervisors, and it emerged as a result of settlement negotiations. As one member of the Governance Committee explained, it is chiefly a reporting mechanism, and does not have authority over operations or rate setting. This is a temporary committee that will likely be dissolved once the Project's construction is complete.

There are, however, benefits to privatization that demonstrate why the Water Supply Project proposal was more successful that its public counterparts. Corporations like Cal Am have a "superior ability to mobilize capital" as compared to public entities (Schorr 314). According to about half the interviewers, this ability to access private financing played an important role in the Water Supply Project's progress. As interviewees noted, when the dam and publicly owned desalination plant failed, Cal Am was able to offer private financing quickly. At the same time, Cal Am's proposal was not subject to a vote, unlike many publicly owned projects. Several of the interviewees, while supportive of the project, did express reservations about the Water Supply Project's private ownership. Despite reservations, however, interviewees noted Cal Am was in a unique position as the primary and historical provider of public water in the service area, and converting this private utility to a public utility would likely be prohibitively expensive. While the Monterey Peninsula service area is a unique example of water privatization, it highlights the importance of examining challenges and benefits of water privatization before committing to private ownership of public goods.

III. Conclusion

California's history of water development, which occurred in four distinct eras, shaped California's contentious water management and led to its complex water law. The SWRCB and the courts, as the arbiters of water rights in the state, have to ensure the hierarchy of rights is enforced and that all water use is reasonable. While water development and water rights have always been combative in California, increased water scarcity due to increasing demand and decreasing supplies has led to imminent water crises across the state.

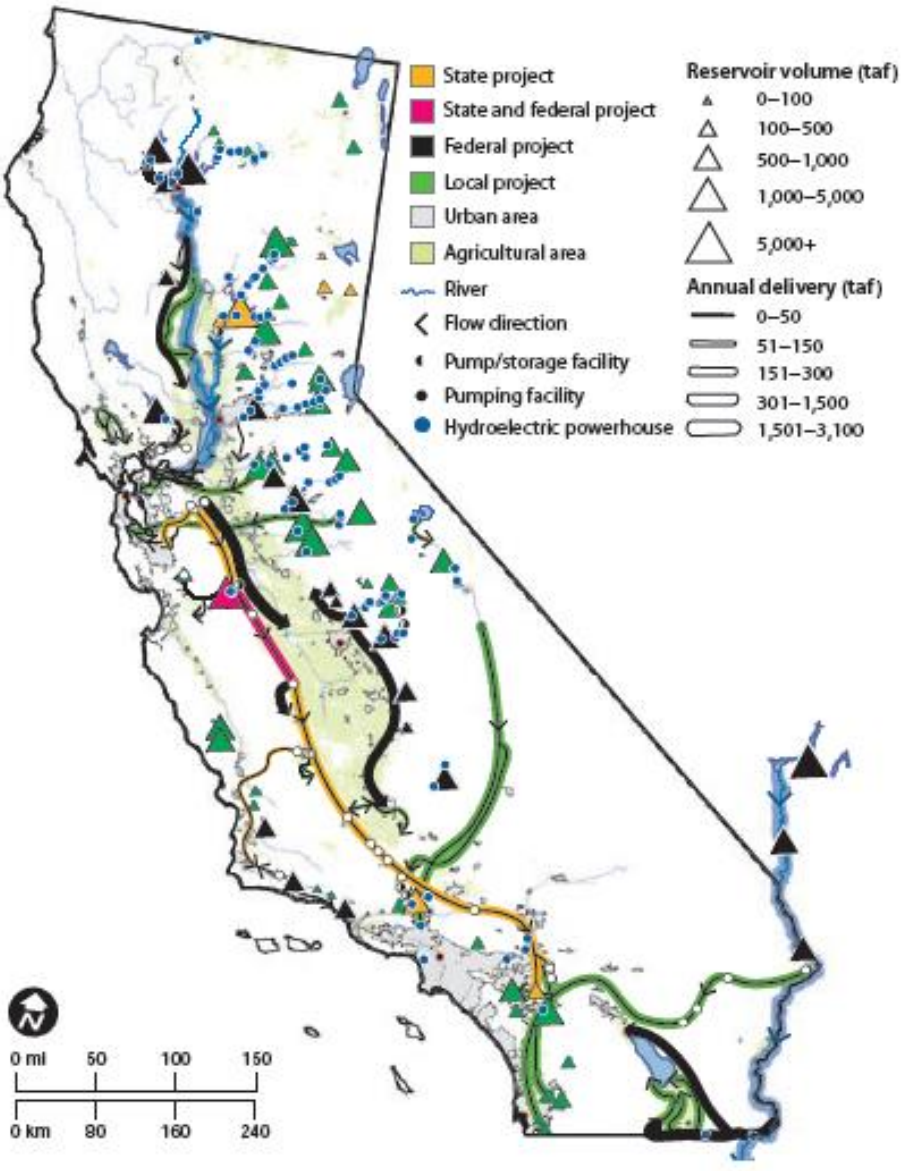
In response to one water crisis in the Monterey Peninsula, the SWRCB ordered reduced diversions for municipal use while permitting continued water use for low-value agriculture across the state. The SWRCB, by ordering development of the region's water supply, facilitated construction of a capital-intensive, environmentally harmful technology. The Water Supply Project, a proposed combination of desalination and purchased water, is a microcosm of many of California's larger water conflicts; it illustrates competition for water rights as well as the complexity of stakeholders and regulatory bodies engaged in water development.

By comparing the cost of water in the Water Supply Project with the value of water in agricultural uses across California, however, it becomes clear that the costs being expended on the Water Supply Project are unreasonable. In order to facilitate more efficient and more reasonable consumption of water in the state, the SWRCB should re-allocate existing rights away from the lowest value agricultural users and towards existing needs in other areas such as the Monterey Peninsula. While the economic value and costs of water transportation may vary significantly across regions and based on local water availability, this analysis highlights an important lesson; that existing uses, often assumed reasonable, may be quite unreasonable in light of changing water conditions across the state. In addition, the Monterey Peninsula's water privatization illustrates important considerations in future water supply development.

APPENDIX A: Water in California and Monterey Peninsula

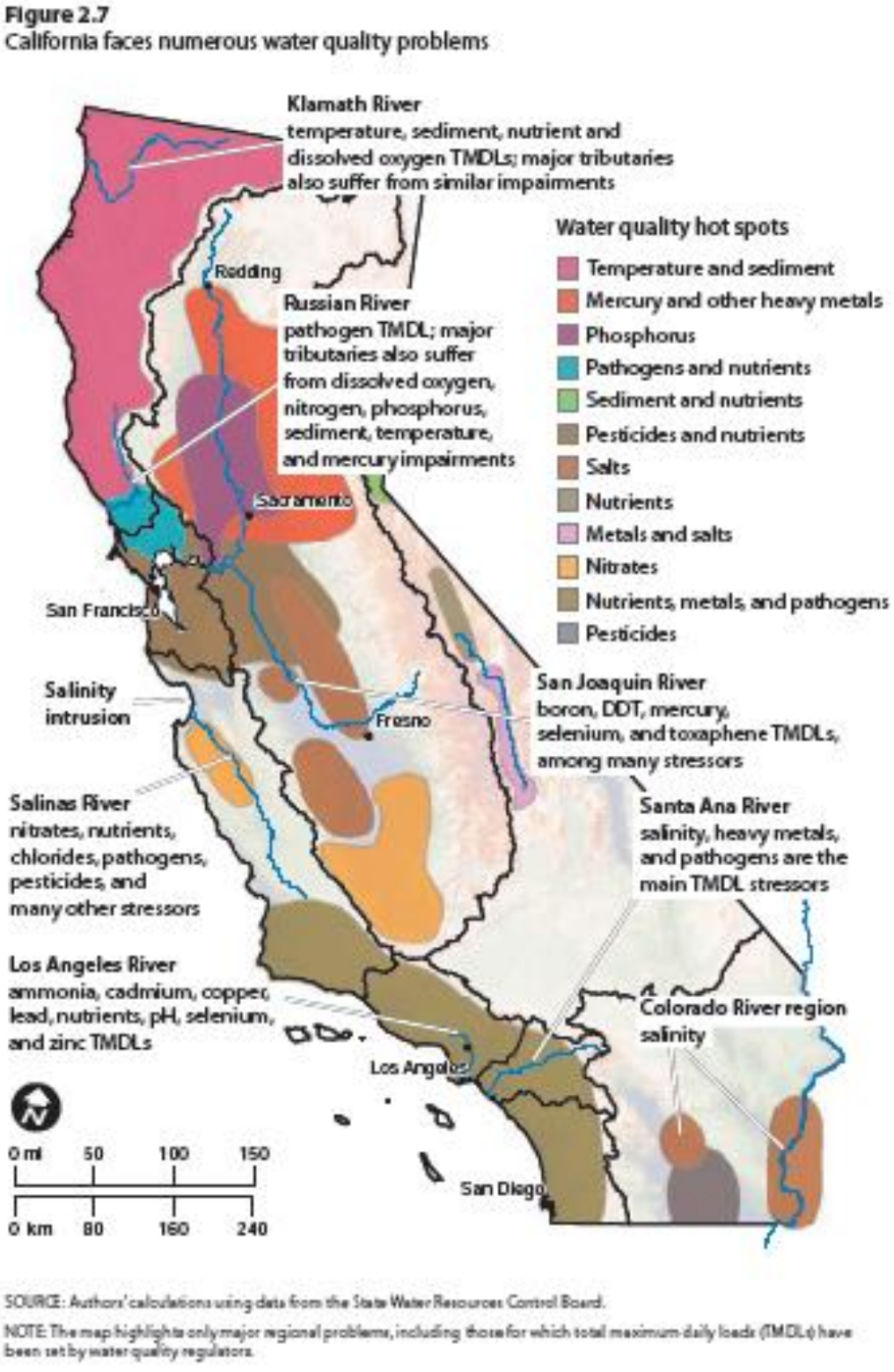
Figure A.1 Water conveyance in California

Figure 2.6
California has an elaborate network of conveyance and storage infrastructure, controlled by different agencies



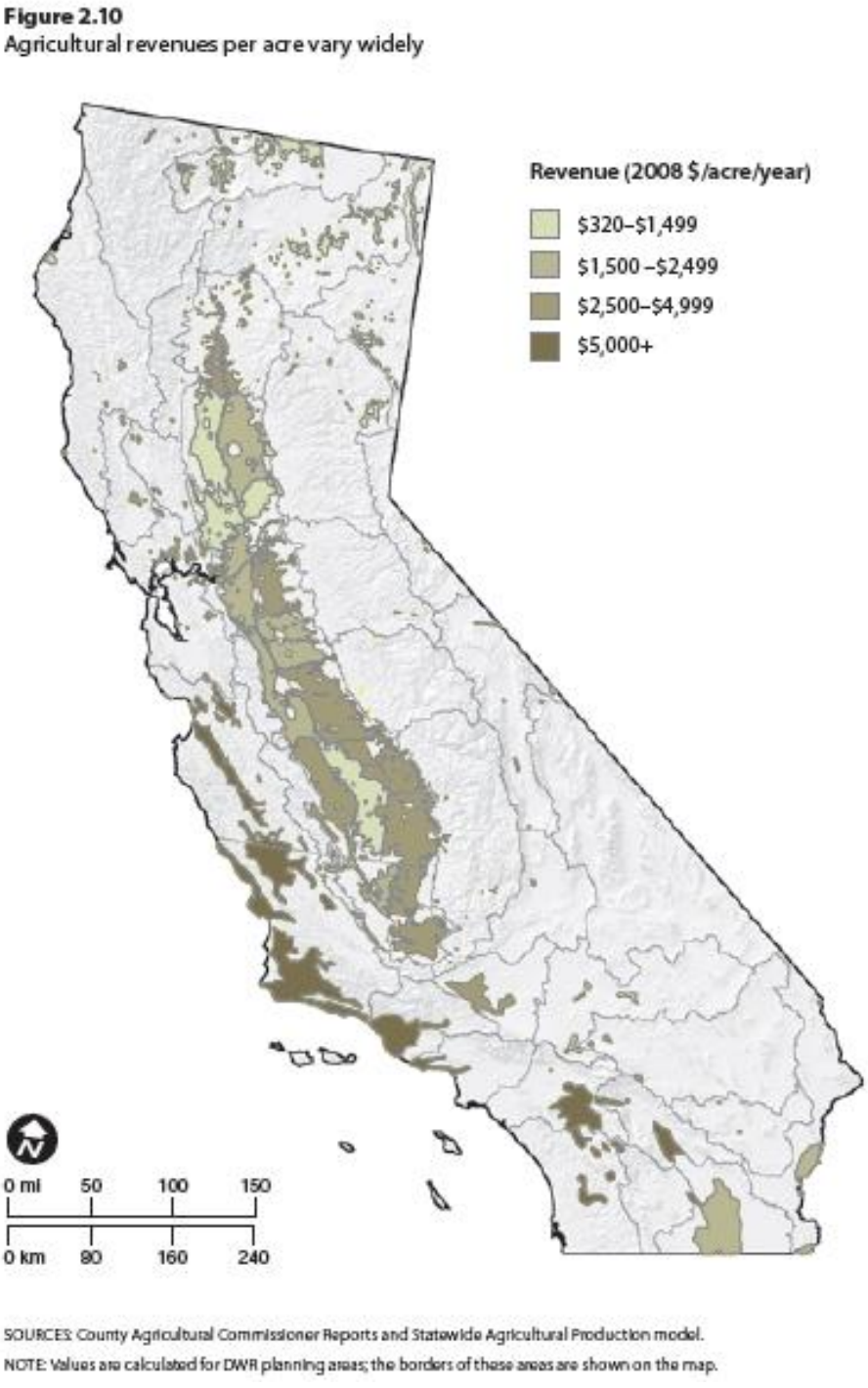
Source: (Hanak, Lund and Dinar 81)

Figure A.2 Water quality problems in California



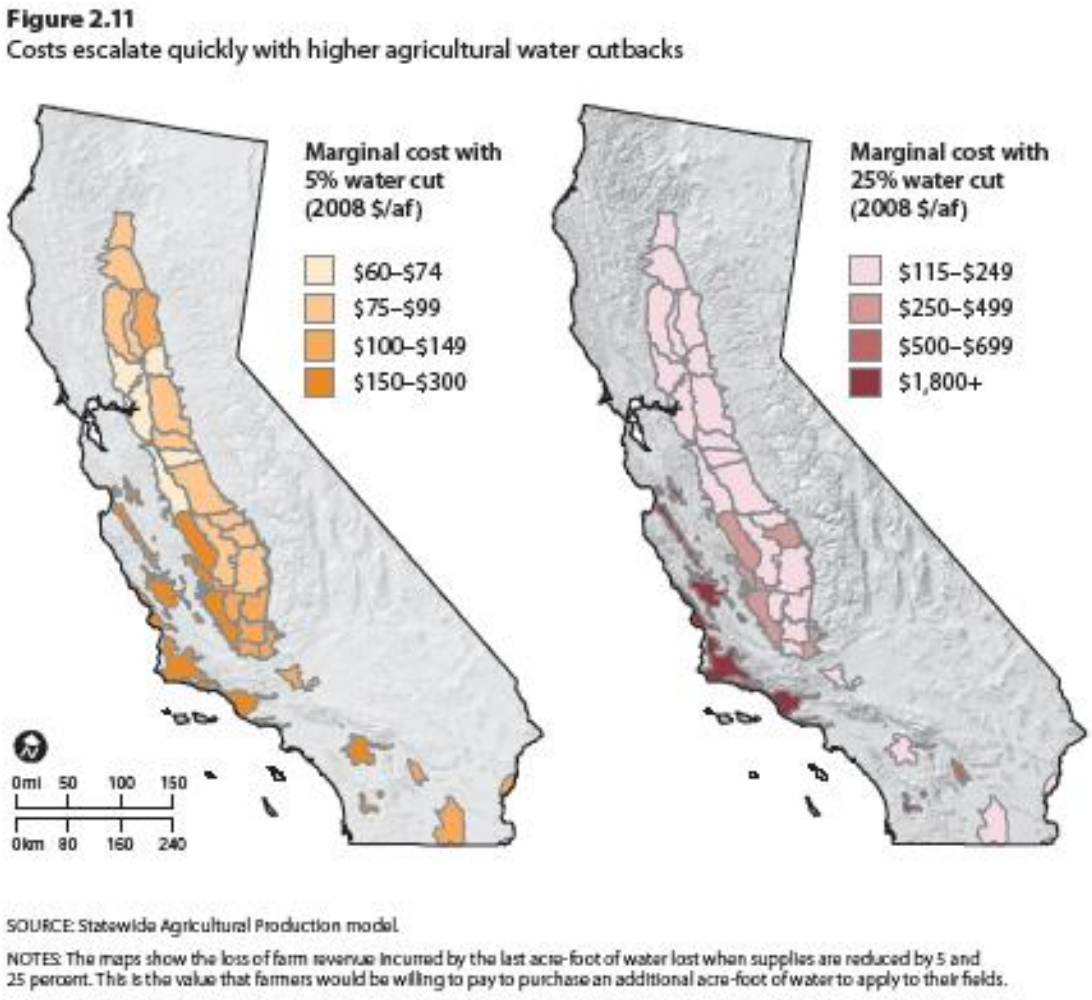
Source: (Hanak, Lund and Dinar 85)

Figure A.3 Revenues per acre, California, 2008



Source: (Hanak, Lund and Dinar 94)

Figure A.4 Cost increases with water cuts, California agricultural land



Source: (Hanak, Lund and Dinar 95)

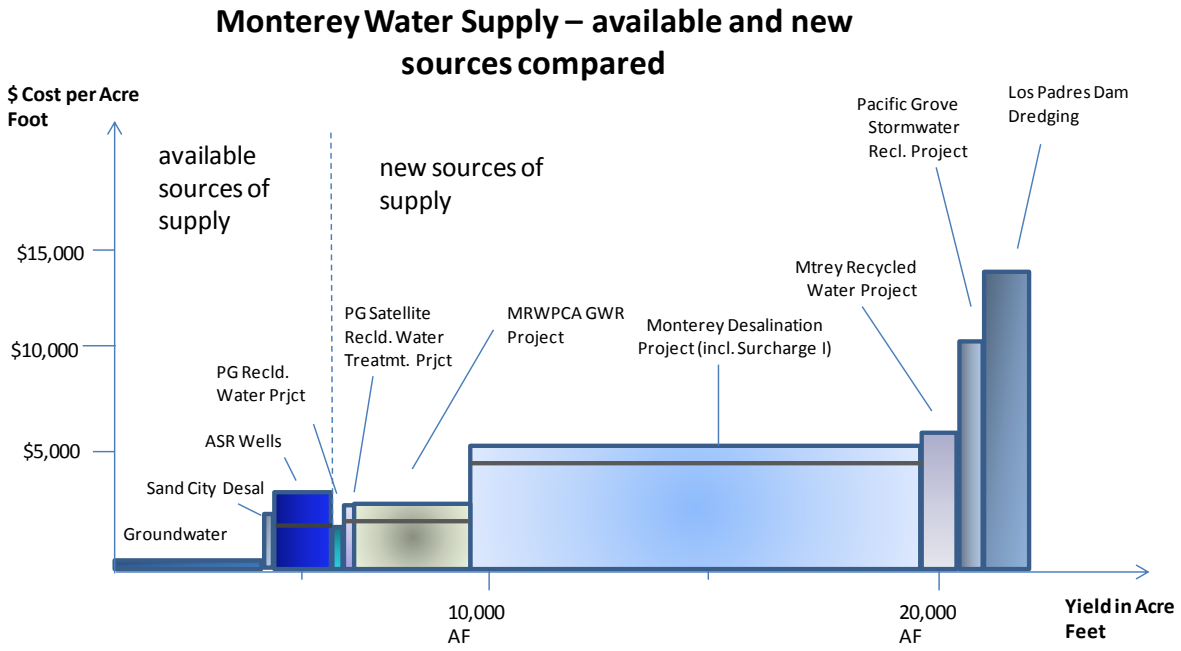
Table A.1 Water use, revenues, and value of water by major crop, California, 2005

Crops	Gross water (maf)	Gross water (%)	Net water use (%)	Gross revenue (%)	Irrigated acres (%)	Gross revenues / gross water ($/af)	Gross revenues / net water ($/af)
Irrigated pasture	3.3	12	11	0.4	9	31	47
Rice	2.7	10	9	2	6	127	223
Corn	1.9	7	7	1	7	176	258
Alfalfa	4.9	18	18	4	12	200	287
Cotton	1.9	7	8	3	7	416	551
Other field crops	2.2	8	8	3	13	375	573
Fruits and nuts	7.3	27	29	44	30	1,401	1,875
Truck farming and horticulture	2.7	10	10	42	16	3,724	5,363

Source: (Hanak, Lund and Dinar 92): calculations using data provided by Department of Water Resources staff and drawing from California Agricultural Statistics and county agricultural commissioner reports. Gross water use = 27.3 million acre feet and net water use = 18.9 million acre feet according to Department of Water Resources data.

Table A.2 Monterey water supply, new and existing

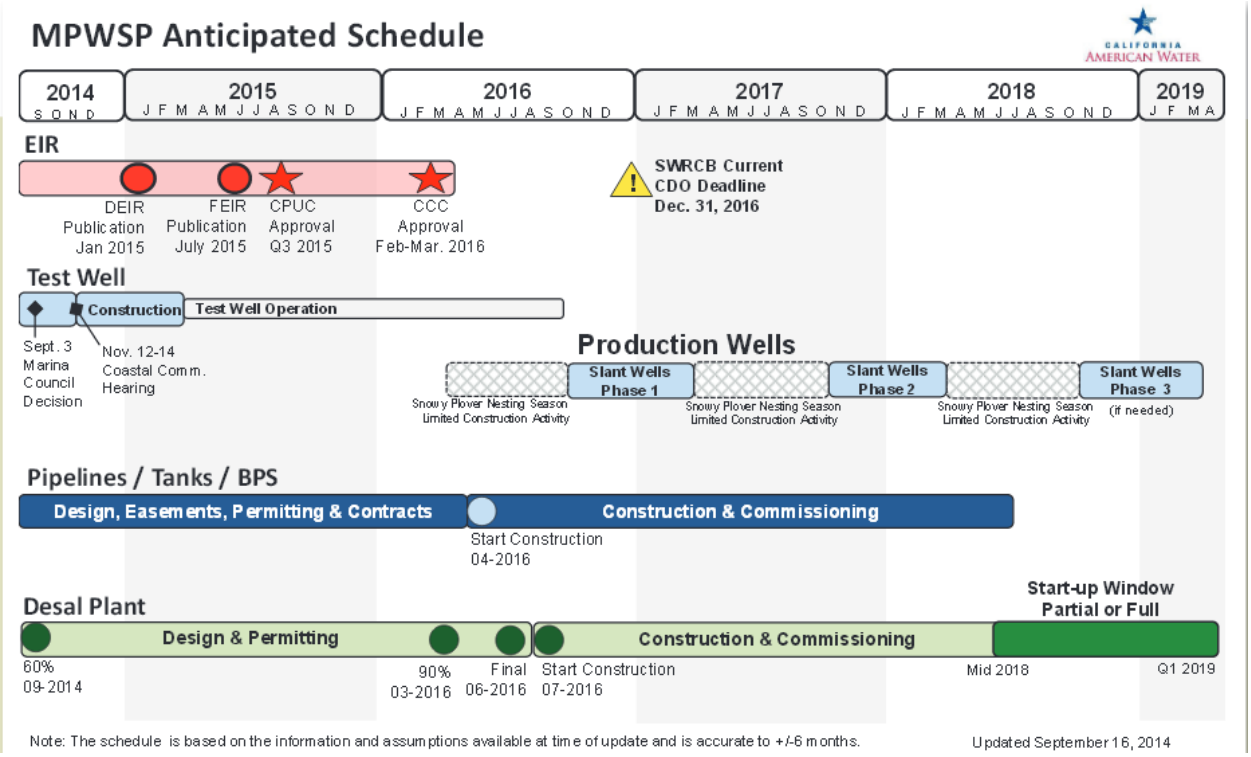
Summary	Existing water			New water						
					Reclaimed water					
	Groundwater / Begonia Plant	SandCity Desal	ASR Wells Well 1-4	Monterey Water Supply Project	Pacific Grove Recycled Water Project	MRWPCA Groundwater Replenishment Project	Pacific Grove Satellite Recycled Water Treatment Project	Monterey Recycled Water Project	Pacific Grove Stormwater Recycling	Los Padres Dam Dredging
Cost ($) per acre foot (AF)	$197	$2,700	$2,221 to $3,282	$5,095	$2,105	$2,500 to $3,000	$2,624 to $3,042	$5,828	$10,400	$12,925
AF	3,376	94	1,320 to 1,950	9,006	100-125	3,500	100-125	800	100-275	854



Source: (Cost Workshops on Water Supply Project Presentation 1 8)

APPENDIX B: Monterey Peninsula Water Supply Project

Table B.1 Project Timeline



Source: (Monterey Peninsula Water Supply Project)

Table B.2 Project Costs

Type	Cost (millions)
Project Costs (with 6.4 mgd desal plant)	
Subsurface Intake System and Supply Return Facilities	$51
Desalination Plant	$95
Pipeline Facilities	$131
Total construction costs	$277
Pre-Construction Cost (included in above construction costs)	$8

Source: (Project Description Overview)

Table B.3 Annual operating and maintenance (O&M) costs

Item	9.0 MGD Plant	5.4 MGD Plant	Estimated 6.4 MGD Plant (using Cal Am data for 5.4 MGD and 9.0 MGD plant)
Power*	$6,500,000	$4,650,000	$4,950,000 (rounded from 4,955,555.56)
Chemicals	$720,000	$560,000	$568,888.89
Membrane / Media Replacement	$520,000	$360,000	$391,111.11
R&R	$1,950,000	$1,600,000	$1,577,777.78
Purchased Recharge Water (Cal Am number assuming $2500 per AF)	$0	$8,750,000	$6,250,000
Purchased Recharge Water (Cal Am number assuming $3000 per AF)	$0	$10,500,000	$7,500,000
Labor and Misc.	$3,070,000	$2,680,000	$2,555,555.56
Total	**$12,760,000**	**$18,600,000 - $20,350,000**	**$16,293,328 - $17,543,328**

*Electric costs based on PG&E's E-20 Tariff – Secondary Firm; 2012 base year rates used; 6 month winter rate of $.102 / KWH and 6 month summer rate of $.150 MWH.

Source: (Cost Workshops on Water Supply Project, Presentation 2, Part 1 21-23)

Table B.4 Comparison of operating & maintenance (O&M) costs between Water Supply Project and former projects

Item	Water Supply Project	RDP	Moss Landing (public dam)
Power	$6,500,000	$5,320,000	$4,420,000
Chemicals	$720,000	$1,020,000	$1,590,000
Membrane/Media Replacement	$520,000	$570,000	$790,000
R&R	$1,950,000	$1,700,000	$3,060,000
Labor & Misc	$3,070,000	$3,870,000	$3,110,000
Total	**$12,760,000**	**$12,500,000**	**$13,000,000**

Source: (Cost Workshops on Water Supply Project, Presentation 2, Part 1 25)

Table B.5 Pre-Construction Costs

Item	Budget	Task	**Status**
Consultants	$520,000	PEA, CEQA,Permitting, Plant Sizing, Cost Estimate & Outfall Analysis	On Track
CPUC / ESA	$500,000	CEQA Work	On Track
Legal	$1,200,000	Legal Workon: CPUC filing, PEA, CEQA, Water Rights, Land.	On Track
Expenses	$30,000	Travel Expenses for CAW Staff	On Track
CompanyLabor	$300,000	For Engineering Team	On Track
Contingency & OH	$376,000		
Sub-Total	$2,926,000		
Slant Test Well	$5,000,000	Cost to Install Slant testwell	Scheduled for winter 2013-14.
Total	**$7,926,000**		

Source: (California American Water 26)

Table B.6 Additional Brine Costs

Option	**Description**	**Most Probable Additional Cost**
1	Modify existing MRWPCA Outfall	$7,700,000
2	New Outfall at Cemex	$19,500,000
3	Discharge with MLPP Spent Cooling Water	$18,500,000
4	Modify Marine RefactoriesOutfall	$22,500,000

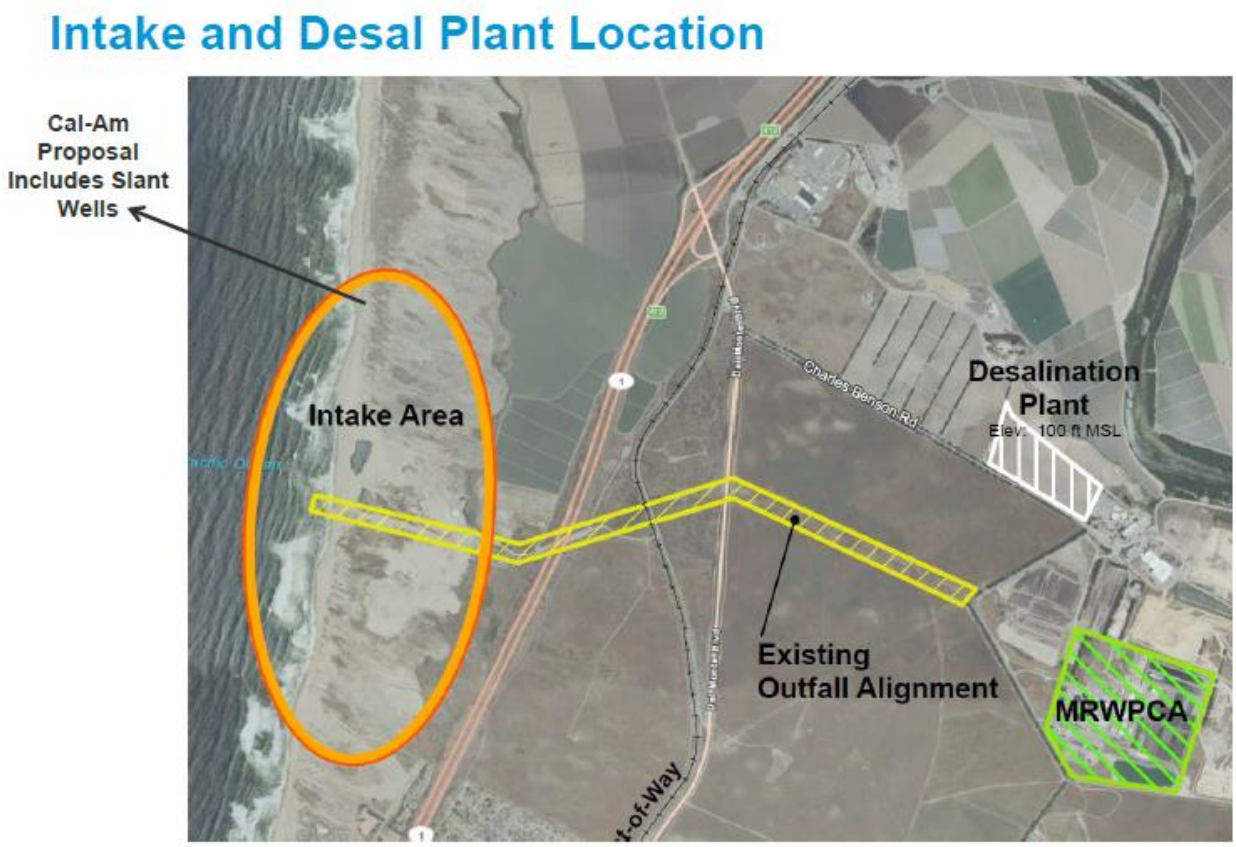
Source: (Cost Workshops on Water Supply Project, Presentation 2, Part 2 26)

Table B.7 Rate increase estimates

Rate increase summary from California American (with 6.4 million gallons per day plant)			
Year	**Charges**	**Typical expected water bill**	**Percent increase over 2013**
Currently	15% Surcharge #1 levied for Project construction costs	$75.74	
2014	Surcharge #1 increased from 15% to 20%	$79.86	5.4%
2015	Surcharge #1 increases to 30% then discontinued in June Surcharge #2 levied at 30% rate for desalination support facilities	$88.42	16.7%
2016	Surcharge #2 increases to annual average of 40% of bill	$97.27	28.4%
2017	Surcharge #2 increases to 48% Several smaller surcharges eliminated, including National Marine Fisheries Surcharge	$97.38	28.5%
2018	Surcharge #2 increases to 56%	$106.73	40.9%

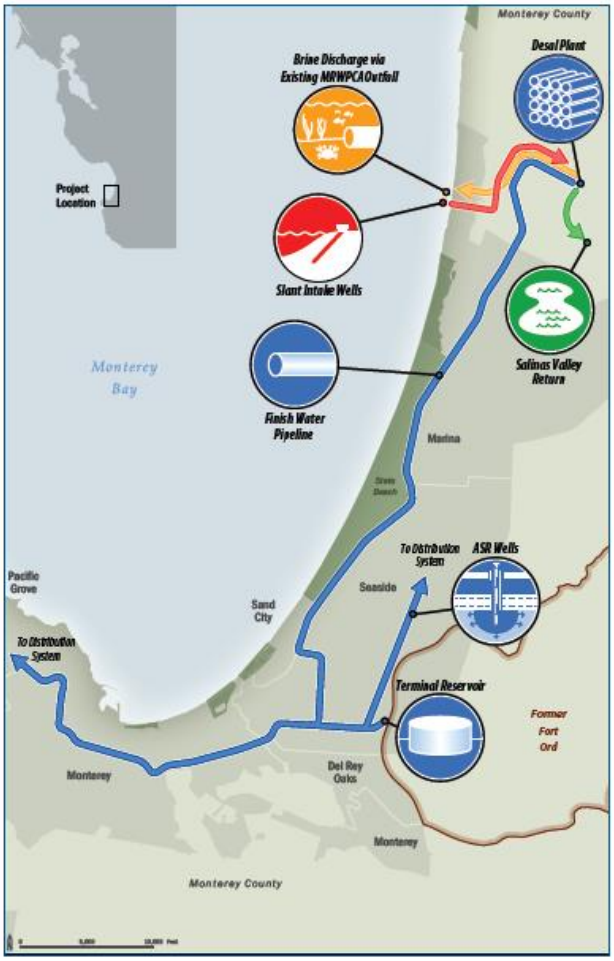
Source: (Monterey Peninsula Water Supply Project)

Figure B.1 Intake and desalination plant location



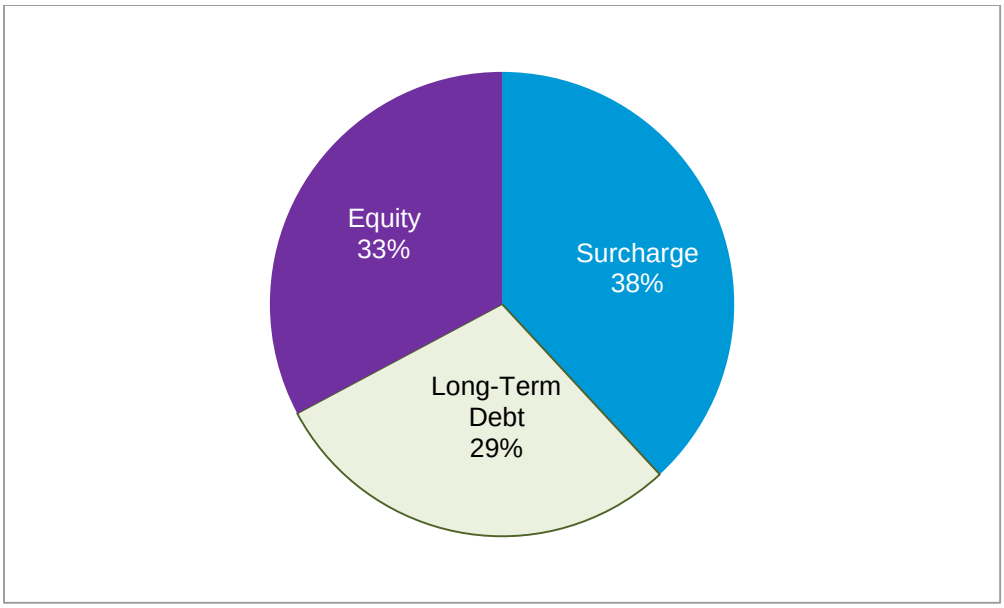
Source: (Cost Workshops on Water Supply Project, Presentation 2, Part 2 22)

Figure B.2 Desalination plant and pipeline map



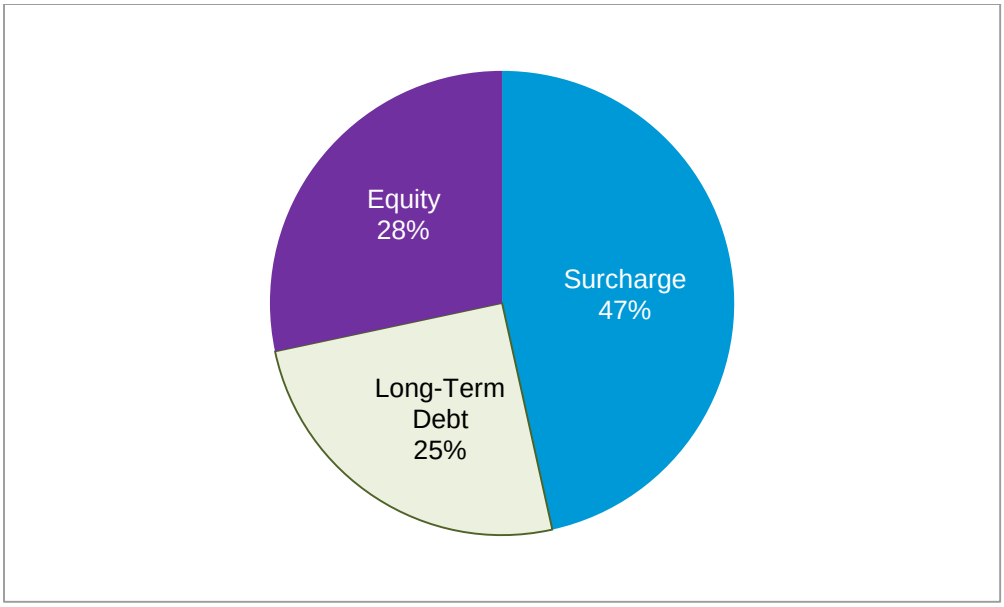
Source: (Monterey Peninsula Water Supply Project)

Figure B.3 Capital cost financing for 9.0 mgd plant



Source: (Cost Workshops on Water Supply Project, Part 3 5)

Figure B.4 Capital cost financing for 5.4 mgd plant (6.4 mgd unavailable during 2012 Cost Workshop)



Source: (Cost Workshops on Water Supply Project, Part 3 5)

Summary B.1 Monterey Water Supply Project Interviews

Between June 2014 and August 2014, I conducted interviews with representatives from seven institutions and organizations: California American (Cal Am), the Monterey Peninsula Water Management District, LandWatch Monterey County, the Planning and Conservation League, the Water Supply Project's Governance Committee, the Monterey Peninsula Regional Water Authority, and Public Water Now. The goal of these interviews was to more fully understand the history of the project generally, to clarify areas of confusion, and to identify alternatives, challenges, or strengths of the project.

In order to accomplish these things, I looked through publicly available documents to identify key stakeholders in the project. I was put in touch with several of these key stakeholders on the project, namely Cal Am, the Governance Committee, and the Monterey Peninsula Water Management District, through my contacts at the law firm Shute, Mihaly & Weinberger LLP, a boutique law firm in San Francisco, California, that worked on the Water Supply Project. Through these initial interviews, I identified additional organizations that worked on the project, were familiar with water provision in the Monterey Peninsula, or opposed the project.

Each interview was conducted via phone and most were one to two hours in length. I drafted a protocol for each interview that laid out questions pertaining to several areas: the interviewer's role and organization, the Water Supply Project's history, the structure of the Water Supply Project, strengths and weaknesses of the Water Supply Project, and attitudes or perceptions regarding the Water Supply Project. During interviews, I noted important findings in my notes. After completing each interview, I transcribed the interview, then summarized and noted the important points made in each interview in a spreadsheet. This allowed me to take note of the type and frequency of responses to important questions, such as alternatives to the project, and also helped me understand the history of the project by comparing and confirming prior interviewees' statements in subsequent interviews.

It is assumed, based on confirmed experience on the Water Supply Project and water provision in the region generally, that interviewees' statements were generally well-founded. In some cases, I verified interviewees' expertise by questioning others working on the project. Throughout my thesis, I explicitly identify areas in which interviewees played an integral role in developing my ideas.

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