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Monterey GWR Project: a Sustainable Return on Investment Assessment of Desalination and Water Reuse

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What's a community to do when mandated to find alternative water sources for over half of its existing supply? How do you choose between options? What if one alternative would cost more but provide added benefits to ratepayers and the community?

These are the exact questions California American Water (CalAm) and the Monterey Peninsula Water Management District (MPWMD) faced when evaluating the benefits of moving forward with alternative desalination and reuse projects.

The Situation

In 1995, the California State Water Resources Control Board (SWRCB) found that CalAm was diverting 10,730 acre-feet per year (AFY) in excess of its appropriative right from the Carmel River, so SWRCB directed CalAm to implement actions to terminate this diversion. Fourteen years later, in 2009, SWRCB found that CalAm was continuing to divert 7,000 AFY beyond its legal right and issued a cease and desist order (CDO). WR Order 2009-0060 set a schedule for CalAm to terminate these excess diversions by December 2016. Coupled with pumping restrictions elsewhere in the county, this meant that nearly 70 percent of the historical water supply to the Monterey Peninsula had to be replaced with alternative supplies.

Two solutions had been proposed. CalAm proposed the construction of a 9.6 million-gallon-per-day (mgd) desalination plant to treat seawater pumped from Monterey Bay. The design and construction phases would delay full operation until 2021 at the earliest, four years behind the CDO. MPWMD's alternative proposal made use of existing water resources by incorporating a 4 mgd advanced water recycling/groundwater replenishment project that could be operational by 2019, with a scaled-down version of the desalination plant.

This alternative approach, called the Pure Water Monterey Groundwater Replenishment (GWR) Project, included construction of an Advanced Water Treatment Plant (AWTP) at the existing Regional Wastewater Plant (RWP) and additional conveyance and storage infrastructure. The AWTP would treat existing source waters from (a) municipal wastewater; (b) diverted agricultural irrigation water from drainage; (c) agricultural produce wash water from the City of Salinas Industrial Wastewater Treatment Plant; and (d) urban stormwater. The product water would then be conveyed to wells and delivered by means of groundwater recharge for both domestic and agricultural irrigation uses.

In California, the California Public Utilities Commission (CPUC) sets rules and regulations for private water agencies to ensure

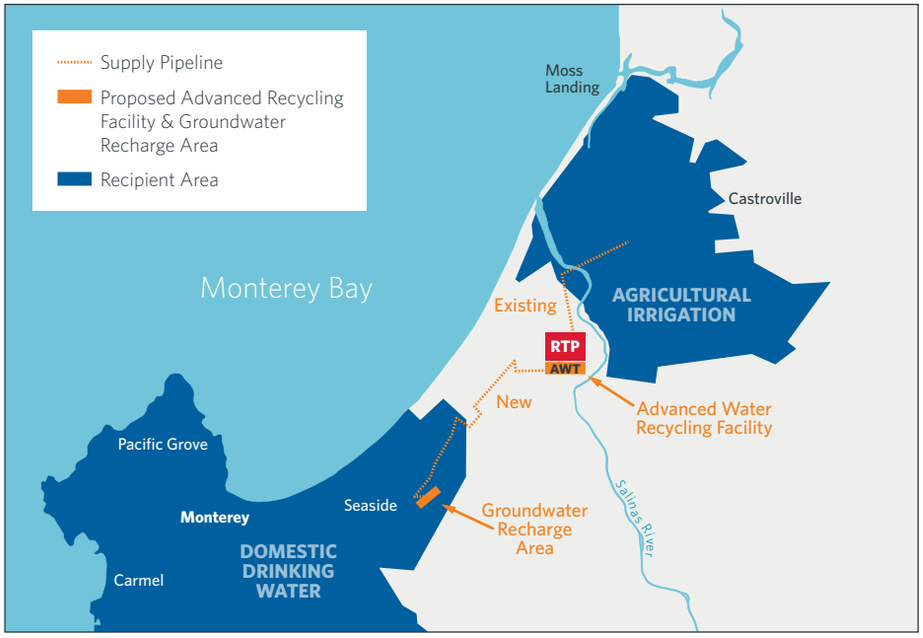

Figure 1: Pure Water Monterey Groundwater Replenishment project map

everyone is receiving high-quality water service at a fair price. All increases in service rates are directly related to the cost of providing high-quality service and are subjected to a public review process and approval by the CPUC. As an investor-owned public utility, CalAm was required to review their proposed desalination plans and rate impacts in pubic hearings before the CPUC.

Since 1978, MPWMD, a public agency, has worked diligently to augment the area's water supply, promote water conservation and the integrated use of reclaimed water, and restore and augment the environment along local streamside habitats. With its mission in mind, MPWMD, in conjunction with the Monterey Regional Water Pollution Control Agency (MRWPCA), conceived the Pure Water Monterey GWR project. This advanced water recycling project provides a multi-benefit, integrated, regional solution that reduces the size of the proposed desalination project from 9.6 mgd to 6.4 mgd. Although incorporating the GWR approach may cost more initially in financial terms, MPWMD advocated that the combination of a GWR project with a smaller desalination plant had the potential to generate greater environmental and social value.

Neither the baseline project (the 9.6 mgd Desalination Plant) nor the alternative project (the 6.4 mgd Desalination Plant with the 3.2 mgd Pure Water Monterey GWR Project) could move forward without approval from the CPUC, whose primary concern was ensuring that CalAm could provide water to its ratepayers at a fair price.

What's the best investment?

The question of which option is best can be viewed from multiple angles. From a financial-only perspective, the larger desalination plant proposed by CalAm would generate cost savings to ratepayers in its initial year of use (the primary measure CPUC traditionally uses). However, over their life cycles, the two alternatives appeared very close in financial value.

To tip the scales, MPWMD's option favored the interests of a wider group of people over a longer-term horizon in its proposal for a more balanced water supply. Specifically, MPWMD's sustainability objectives included long-term water supply resiliency, reduced environmental impacts and enhanced social value. Its GWR project would generate value to ratepayers as well as those who reside and work outside the service areas, as they would benefit from incrementally lower pollution emissions. MPWMD recognized that real limits to investments existed but that comparisons between the proposed options should be based on the total value, not just a financial one. In this context, the question became: Which project provides the highest total value, including tradeoffs in financial, environmental and social impacts?

How did HDR help?

MPWMD was looking for a robust triple bottom line (TBL) analysis framework to shed light on the questions above and help support the development of a sustainable water supply for the peninsula. In its search, MPWMD heard about our Sustainable Return on Investment (SROI) process, and various project examples, and contacted us directly to learn more about it.

We had been utilizing the SROI process for over 10 years, and the process had proven to be a differentiator in sustainability services. But what exactly is it? SROI is a sustainability-oriented form of benefit-cost analysis (BCA) founded on a series of analytical principles that together aim to account for short- and long-term outcomes of investments and communicate the value of options from multiple perspectives.

The SROI process is always adapted to a client's needs and project context by using the best available data and methods for systematically computing benefits and costs to compare project options. A key part of this process involves workshops that we facilitate to review data and methods to arrive at consensus for how to handle the uncertainty related to data gaps. The process sometimes helps clients formulate sustainability goals first, but in all cases, the primary work involves estimating the degree to which project options can reliably meet a client's TBL goals.

Our SROI process generates credibility with its objectivity and transparency in the quantification of the impacts of a project. Tasks involved in the process include:

- A comprehensive identification of impacts;
- The formulation of data into a draft model;

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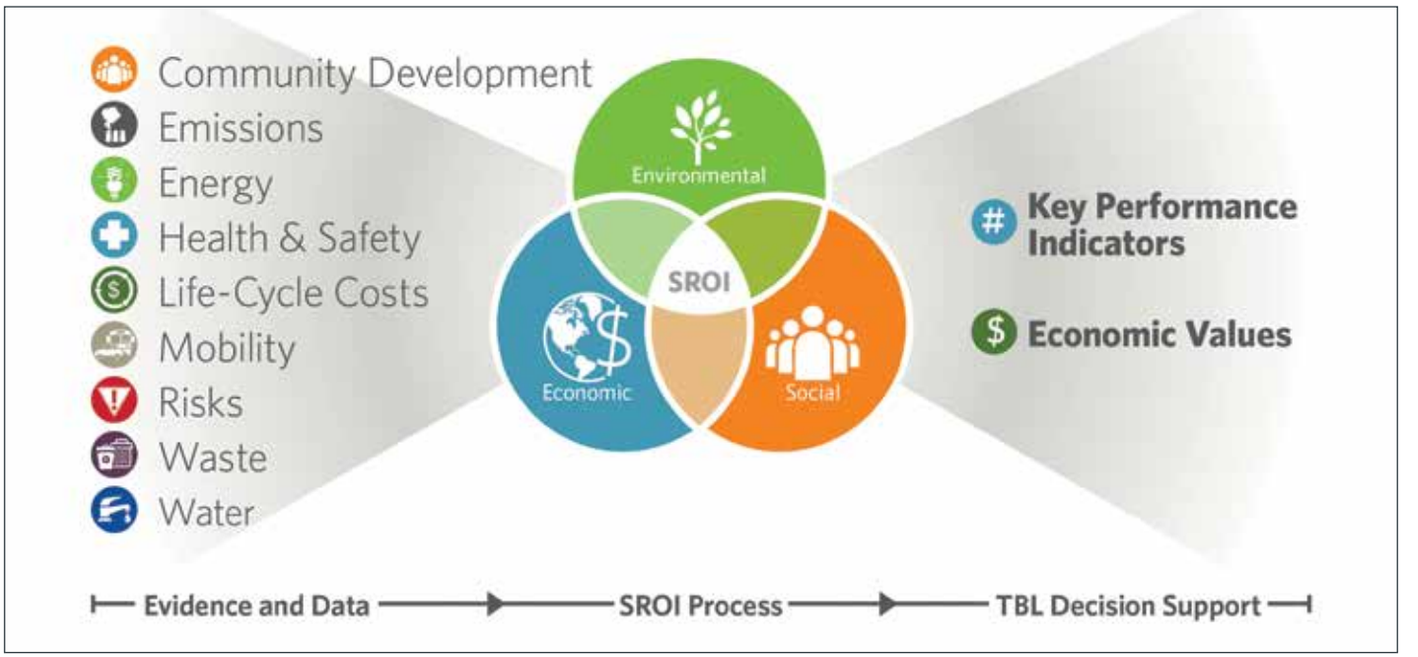

Figure 2: Sustainable Return on Investment (SROI) Process

- Presentation and workshop-based discussion of evidence; and
- An accounting for risk and uncertainty in key drivers of outcomes.

The development of the model frameworks and values used in the monetization of benefits draws on extensive literature research. The use of literature and critical review of evidence in the workshops yields model results that are well vetted and defensible.

In this project, we worked with MPWMD to apply the SROI model and study the differences in environmental and social outcomes (called "externalities" in economics terms) between the two alternatives. (An externality is a non-internalized cost or benefit resulting from one economic agent's actions that affects the well-being of others. For instance, pollution and other forms of environmental degradation are the result of some production processes and are not reflected in the price of the goods or services being produced.) The financial benefits to ratepayers had already been estimated, so the scope of the SROI approach focused on environmental and social benefits that extended beyond the rates that customers would pay. The goal of this study was to provide an objective and defensible accounting of the total value of the water produced by each project. Some of the benefits considered included changes in air quality emissions, avoided pumping of Carmel River water, benefits to agricultural producers, avoided costs of seawater intrusion in the aquifers, and regional infrastructure savings. In addition, our economists provided expert witness testimony before the CPUC regarding the findings of SROI, in support of the GWR project.

How was SROI applied?

An evaluation of options begins with setting the "base case." The base case is the reference point for comparing alternatives and often amounts to "no-action" or "doing nothing." In the no-action alternative, we assume the status quo is maintained and nothing new is constructed. In this study, the CDO required action, and with the large desalination plant well into the planning stages, it was assumed that the base case condition would be the construction of the large desalination plant. The analysis of the alternative case—the GWR project combined with a smaller desalination plant—amounted to the difference in the total value between options with results computed as a net present value.

A number of potential benefits were discussed during stakeholder workshops. Ultimately, only some of the external benefits were measurable and monetizable, but as a group, they amounted to key differences in impacts of each project. The environmental and social benefits that were estimated in the project included:

SOCIETAL COSTS FOR EACH ALTERNATIVE BASED ON CRITERIA AIR CONTAMINANTS AND GREENHOUSE GAS

Both alternatives increase the demand for power from the electrical grid, resulting in an indirect impact of increased criteria air contaminants (CAC) and greenhouse gas (GHG) production. The GWR project was found to require less energy than the 9.6 mgd desalination plant. Two streams of benefits arise from the GWR alternative: (i) fewer life-cycle emissions impacts, and (ii) a reduction in the life-cycle emissions associated with extra energy production to offset net power losses from transmission lines. In addition, the GWR project reduces pumping at the local wastewater treatment facilities, which in turn results in lower energy use and pollutant emissions.

AVOIDED COSTS OF PUMPING CARMEL RIVER WATER FOR DRINKING WATER SUPPLY

One of the major needs of the project is to reduce diversions from the Carmel River. Both project alternatives reduce the total annual diversion. However, the GWR alternative can be implemented earlier and

several years of pumping from the Carmel River (approximately 3,500 AFY) can be saved.

AVOIDED GROUNDWATER PUMPING COSTS

A 21-year-old water recycling project in Monterey County called the Castroville Seawater Intrusion Project (CSIP) provides recycled water to farmers for irrigation of their crops. The use of this recycled water allows farmers to reduce their pumping of seawater-tainted groundwater. The GWR and both desalination plant options will provide additional fresh water supplies for use in irrigation toward the CSIP. These fresh water supplies will further offset the need for groundwater supplies in agriculture and in turn help mitigate the effects of seawater intrusion into the groundwater aquifers. The GWR project, paired with the 6.4 mgd desalination plant, would deliver significantly more acre-feet per year to growers than the 9.6 mgd desalination plant. The displaced groundwater supplies would result in a reduction in pumping costs.

AVOIDED CAPITAL AND OPERATIONS AND MAINTENANCE COSTS OF THE SALINAS INDUSTRIAL WASTEWATER TREATMENT PLANT

The City of Salinas currently operates an industrial wastewater treatment plant (IWWTP). The primary source of the industrial wastewater is from agricultural wash water, a by-product from the preparation of produce. The Salinas IWWTP was constructed prior to World War II and faces an estimated $17 million backlog in improvements to bring the facility into compliance with a Municipal Separate Storm Sewer System (MS4) permit.

As part of the GWR project, wastewater from the IWWTP would be diverted for treatment with other source waters to the AWTP. As a result, the City of Salinas would use its storage ponds to collect stormwater for the City's pollution control agency. The City of Salinas would avoid the additional costs of improvements and long-term operations and maintenance at the IWWTP.

AGRICULTURAL PRODUCTION BENEFITS TO GROWERS

The GWR project's recycled water supplies will contain primary nutrients found in fertilizers: Nitrogen (N), Phosphorous (P), as well as others such as Potassium and Zinc. If growers in the basin irrigate with these water supplies, they will be able to substitute the nutrients in the water for some of the fertilizers that they would have otherwise applied. The substitution will result in a financial savings to growers by reducing the cost of fertilizer, specifically the application of N and P.

OTHER QUALITATIVE BENEFITS

In addition to the monetized benefits, there were other disclosed benefits that could only be defined qualitatively. Those included: benefits of additional flow in the Carmel River to steelhead trout and the California red-legged frog, provision of a drought reserve bank, urban stormwater credits, public perception and outreach of desalination and recycled water sources, achievement of California State Ocean Plan objectives, achievement of California AB 32 carbon reduction objectives, achievement of national marine sanctuary objectives, and additional drought resiliency of water supplies.

What were the results?

The findings of the analysis were presented as the difference in the total value between each option, with results computed as a life-cycle net present value. In other words, the benefits in the comparison of the alternatives were computed as the difference between the GWR project combined with a smaller desalination plant (alternative condition) and the large desalination plant (base case).

The smaller desalination plant with GWR would have a net life-cycle CAC and GHG savings of about $4.2 million over the large desalination plant. Because the GWR project can be online earlier, the project would save an additional $2.3 million over the base case from avoided costs of pumping Carmel River water. The project delivers approximately 4,000

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BENEFIT CATEGORY	BENEFIT	LIFE-CYCLE NET PRESENT VALUE ($ MILLIONS)
ENVIRONMENTAL	Net CAC Emissions Impacts from Project Energy Demand	$1.3
	Net GHG Emissions Impacts from Project Energy Demand	$2.3
	CAC Emissions Impact Reductions from Salinas IWWTP Energy Demand	$0.1
	GHG Emissions Impact Reductions from Salinas IWWTP Energy Demand	$0.2
	CAC Emissions Impact Reduction from Transmission Line Losses	$0.1
	GHG Emissions Impact Reduction from Transmission Line Losses	$0.2
	Avoided Costs of Pumping Carmel River Water for Drinking Water Supply	$2.3
WATER QUALITY	Avoided Groundwater Pumping Costs	$5.4
REGIONAL INFRASTRUCTURE SAVINGS	Avoided Capital Costs of Salinas IWWTP Improvements	$4.0
	Salinas IWWTP Improvements O&M Savings	$9.1
AGRICULTURAL IMPACTS	Savings to Agricultural Producers from Nutrients in Recycled Water	$25.5
	Total Monetized Benefits	**$50.5**

Figure 3: Life-cycle savings difference between the GWR with 6.4 mgd desalination project and the 9.6 mgd desalination project

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AFY more than the base case, resulting in an additional $5.4 million in avoided groundwater pumping costs. This value may be understated, though, as some long-term infrastructure plans for the basin show costs of greater magnitude. The project would result in $13.1 million in life-cycle costs savings from the Salinas IWWTP (not counting emissions savings). Finally, growers could realize approximately $25.5 million in benefits from the nutrients in recycled water delivered through irrigation.

What happened next?

With these findings, MPWMD was able to conclude that the monetized social and environmental benefits offset the cost differential between the larger desalination plant (base case) and the alternative GWR project with the smaller desalination plant (alternative condition). The SROI framework yielded a defensible argument in favor of water reuse. In January 2016, a Water Purchase Agreement between CalAm, MPWMD and MRWPCA was forged for the purchase of 3,500 AFY from the Pure Water Monterey GWR project. The results of our study were presented by one of our SROI expert witnesses before the CPUC in April 2016 to support the alternative project.

Following the April hearing, a joint motion was filed requesting that the CPUC separate the desalination project from the Pure Water Monterey GWR project to allow the GWR project to proceed in a timely manner. In light of the impending CDO deadline, which greatly reduces CalAm's ability to withdraw water from the Carmel River, a timely decision by the CPUC approving the split of the GWR project from the desalination project will allow the public agencies to complete construction and begin taking full advantage of the GWR project by late 2017.

Summary

The MPWMD needed a transparent and defensible framework to compare the environmental and social outcomes of a large desalination plant against its GWR project. They recognized that the best water supply strategy for addressing both the CDO and the long-term objectives of the Monterey Peninsula may not initially be the cheapest. To make best use of public investment, they successfully utilized the SROI process to understand and advocate for the social and environmental benefits of both the base case and the alternative condition project alternatives.

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