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GROUP PROJECT BRIEF

ANALYSIS OF WATER RESOURCES MANAGEMENT STRATEGIES FOR THE SANTA ANA RIVER WATERSHED REGION: *WATER REUSE, RECHARGE, USE EFFICIENCY*

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INSIDE THIS BRIEF:

GOALS:

- Explore the potential for alternative water demand and supply management strategies within the Santa Ana River Watershed (SARW) Region
- Identify plausible future water resource scenarios for the SARW Region.
- Develop case studies related to Water Reuse, Recharge & Use Efficiency for the SARW Region using current literature.
- Identify possible barriers within the region to implementing alternative water demand and supply management strategies.

OPPORTUNITY

In the semi-arid western United States, water suppliers and planners tasked with providing water to a growing population have historically procured supplemental water from afar, conveying the water through elaborate systems of aqueducts, pipes, pumps and reservoirs. The Metropolitan Water District of Southern California (MWD) imports water from Northern California via the State Water Project (SWP) and from the Colorado River in order to supply its twenty-six member agencies with water. These sources of imported water are limited and fraught with numerous uncertainties regarding future water supply reliability.

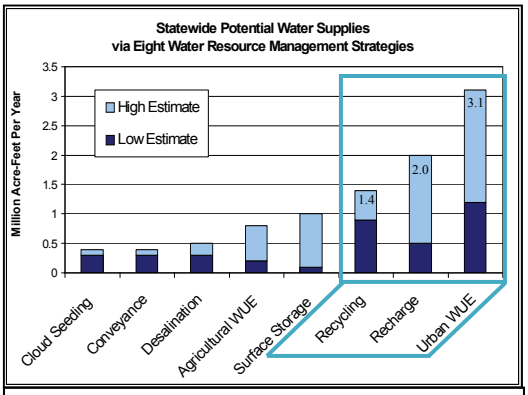

Figure 1— Alternative management strategies for water resources as identified by DWR in the State Water Plan 2005 Update. Combining water use efficiency with recharge and reuse can potentially supply approximately 6.5 million acre-feet of water per year to the State of California. Source: DWR, 2005.

Both California and regional water agencies recognize the need to develop local water resources. For example, the Department of Water Resources (DWR) in its State Water Plan 2005 Update identified Water Use Efficiency (WUE), Groundwater Management and Recharge, and Water Recycling/Reuse as the top three management strategies (Figure 1). For the purposes of our Masters Project, we evaluate the potential for implementing the top three management strategies for each water agency within the Santa Ana River Watershed (SARW) Region (Figure 2) by considering the interplay between plausible future water demand and supply scenarios.

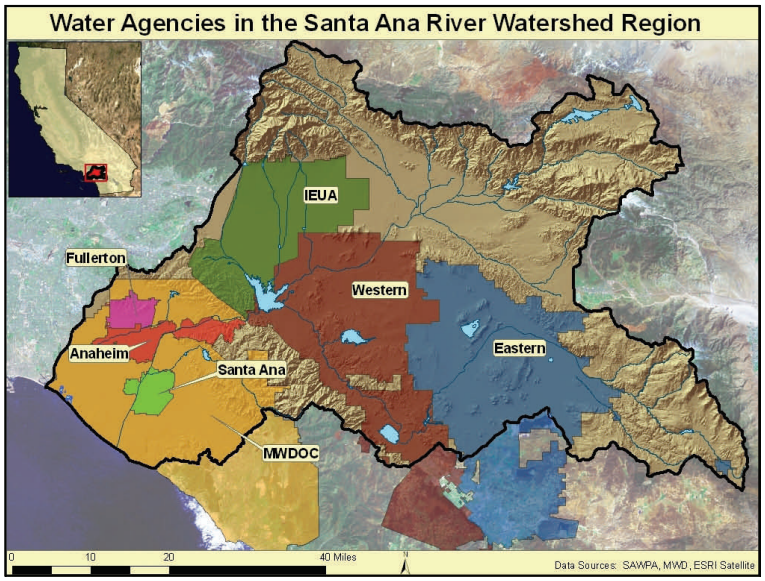

Figure 2 — The Santa Ana River Watershed (SARW) Region and seven water agencies our analysis considers. The watershed drains an area of 2,650 square-miles and contains over 700 miles of the Santa Ana River and its tributaries (SAWPA, "Santa Ana Integrated Regional Water Management Plan 2005).

APPROACH

Background Research:

Our project conducted a literature review and examined UWMPs from the local, regional, and state level. By closely examining these water management plans, our project was able to come up with baseline information about the current and future water demand and supply projections in the SARW region.

UWMPs Reviewed

Local: Metropolitan Water District of Orange County (MWDOC), Eastern Municipal Water District, Western Municipal Water District, City of Santa Ana, City of Fullerton, City of Anaheim, and Inland Empire Utilities Agency (IEUA).

Regional: MWD Regional 2005 UWMP

State: DWR State Water Plan 2005 Update [Bulletin 160-05]

Case studies:

Our project looked at innovative programs, identified new management strategies and the barriers to implementation, and solutions to overcome barriers.

Formulation of Scenarios:

Scenarios utilizing different water management strategies were created from our case studies and background research. The goal was to show the alternative water demand and supply projections that are plausible if the region were to utilize the full potential of increasing water reuse, recharge and WUE.

Recommendations:

With the results of our plausible scenario comparisons, our project formulated recommendations on ways to enhance local water resources in the SARW Region.

SIGNIFICANCE

In order to accommodate the water demands of a growing population and economy, the water agencies within the SARW Region have become pioneers in developing water reuse and recharge technologies and implementing policies and programs addressing water conservation. However, the SARW Region must continue to develop water demand and supply management strategies to ensure future water reliability and local reliance because the region's population is forecasted to be approximately 6.5 million in 2025, an increase of 24% from 2005 (MWD, RUWMP, 2005).

The significance of this Masters Project is to explore the interplay between alternative plausible future demand and supply scenarios. We used the official local and regional 2005 Urban Water Management Plans (UWMPs) to establish the baseline supply and demand projections for the SARW Region. By contrasting these baseline projections with alternative plausible future scenario projections we demonstrate the potential for the region to both reduce and replace imported water supplies with locally-derived sources of water, as shown in Figure 3.

By varying the degree of aggressiveness with which demand management strategies (such as WUE) are implemented, agencies can alleviate the region-wide pressure to develop and procure additional imported sources of water. As a benefit, the water saved via WUE can reduce the amount of water imported into the region.

If water agencies within the SARW Region continue to pursue the development of local water resources through the reuse of municipal wastewater and groundwater recharge, they can replace imported supplies with the developed local resources.

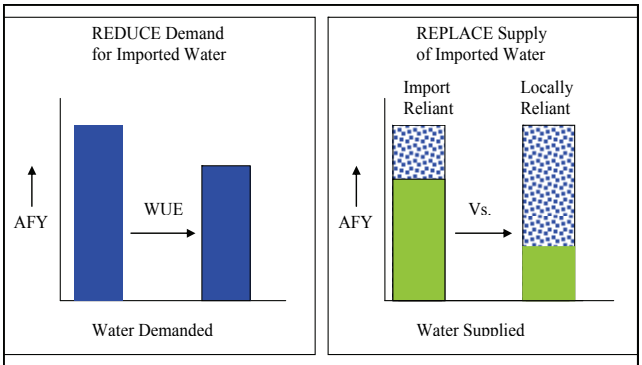

Figure 3 — Water use efficiency can result in reducing the amount of imported water into the region while developing additional local water resources (via reuse & recharge) can make the region less reliant on imported supplies.

Our Masters Project demonstrates the potential for the water agencies in the region to reduce imported water supplies by 45 to 785 Thousand Acre-Feet (TAF), depending on the combination of demand and supply options than can be implemented. As a result, approximately 785 TAF of water could possibly be left in-stream for environmental, recreational, and aesthetic uses.

DEMAND MANAGEMENT STRATEGIES - WATER USE EFFICIENCY

There are multiple factors that influence the demand of water (e.g. weather, population, housing type, water use efficiency, etc.) for any given region. While it is possible to explore how changes in several of these variables alter demand, our analysis focuses on urban water use efficiency intensity values. These values reflect policy options on the part of water agencies in which management strategies are used to affect the urban demand of water. Alternative demand scenarios developed for this analysis focused on altering the baseline scenario percentage of water use efficiency intensity. This is accomplished by using the Water Scenario Evaluation Model (WASEM), developed to evaluate demand and supply scenarios in Southern California (Wilkinson & Groves, 2006) and modified from the model used in the State Water Plan 2005 Update (Groves et al., "Quantified Scenarios of 2030 California Water Demand." 2005).

We considered three alternative levels of efficiency: one from Pacific Institute's *Waste Not, Want Not* report (Gleick et al. 2003) and two that we created specifically for the SARW region. These alternative demand scenarios were compared against the baseline demand scenario to explore how different management strategies can affect urban demand in the SARW region.

The Pacific Institute's *2003* analysis reported significant potential water savings attributable to new

DEMAND MANAGEMENT STRATEGIES - WATER USE EFFICIENCY—CONTINUED

and emerging technologies and policies. For this reason, we have developed an alternative demand scenario that applies the potential water savings Gleick et al. (2003) report to the region.

However, the Pacific Institute's analysis did not include several important technologies and programs in its evaluation. Thus, two scenarios were crafted specifically for the SARW region which included these previously omitted technologies. [See sidebar for scenario definitions.]

Figure 4 illustrates the plausible future demand projections that result from the different demand scenarios. Note how the baseline trend increased, whereas the other scenarios project stabilized or decreased demands by 2025.

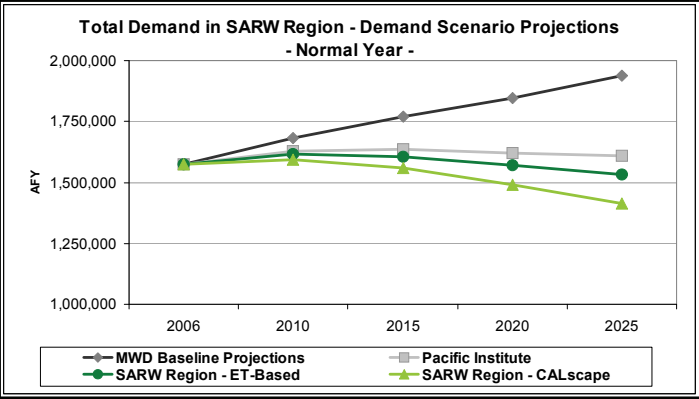

Figure 4 — Plausible future demand projections if varying degrees of Water Use Efficiency intensity are implemented above what baseline projections call for. See sidebar to the right for scenario definitions.

WATER SUPPLY STRATEGIES - WATER REUSE & GROUNDWATER RECHARGE

For this report, three alternative supply scenarios were created that feature increased levels of local resource development above and beyond what the SARW region's water district UWMP project and plan for. The three supply strategies are:

- 75% Maximum Reuse + Baseline Recharge Scenario
- 75% Maximum Reuse + Maximum Recharge Scenario
- Maximum Local Supplies Scenario

These alternative supply scenarios have been created such that they progressively develop additional local groundwater and municipal reuse supplies. For the Maximum Local Supplies Scenario, each water district in the region would be reusing 95% of their treated wastewater by 2025, which is keeping in line with Inland Empire Utility Agency's stated goals, and maximizing the sustainable safe yield of the groundwater basins that underlie each district through recharge. The 75% Maximum reuse scenarios result in each agency reusing 75% of their municipal wastewater that is treated to tertiary levels by 2025. Several agencies in the region are already reusing around 75% of treated wastewater, thus this level of future reuse is certainly plausible.

Figure 5 illustrates the supply projections that result from the three alternative supply scenarios. By 2025, the maximum local supplies scenario is projected to increase total supplies about 260,000 AF over baseline projections, or 11%.

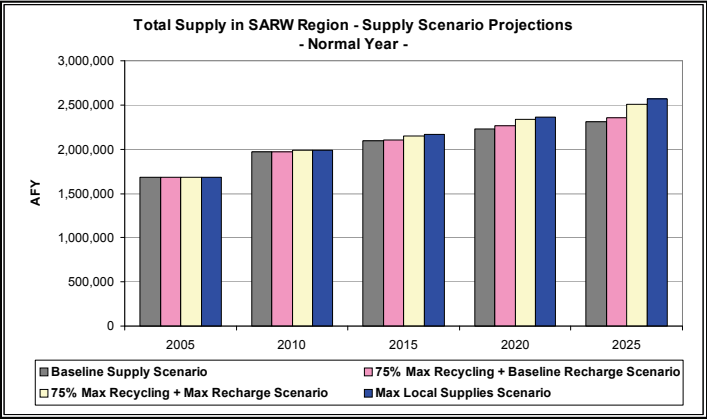

Figure 5 — Plausible future supply projections compared to baseline projections if reuse & recharge management strategies are aggressively pursued.

DEFINING DEMAND SCENARIOS

Demand scenarios were created by adjusting the baseline level of WUE intensity. The baseline demand includes passive WUE measures (such as plumbing codes). However, increasing the WUE intensity by implementing active conservation programs and installing efficient appliances and technologies can significantly increase urban WUE . The three demand scenarios we have used for the purposes of this analysis differ in degree or intensity of WUE by sector and include the following:

Pacific Institute Scenario:

Interior: Replacement of all inefficient appliances and fixtures.

Exterior: Improvement of landscape maintenance & install efficient irrigation technologies.

Commercial, Industrial & Institutional (CII): Use of cost-effective water use practices and technologies.

SARW Region ET Controller Scenario:

Interior: Pac. Inst. efficiency measures + dual-flush toilets.

Exterior: Pac. Inst. Efficiency + ET ("smart") irrigation controllers.

CII: Pac. Inst. efficiency + waterless urinals.

SARW Region CALscapes Scenario:

Interior: Same as above

Exterior: California Appropriate Landscapes (CALscapes) (similar to xeriscaping).

CII: Same as above.

"We talk [water] scarcity, yet we have set [some of] our largest cities in deserts, and then have insisted on surrounding ourselves with Kentucky bluegrass. Our words are those of the Sahara Desert; our policies are those of the Amazon River."

- Richard Lamm, Governor of Colorado 1975-1987

Summary of Barriers

Use efficiency:

Lack of incentives for consumers to conserve water. Lack of supporting policies to encourage the use of water efficient appliances & technologies.

Reuse:

Public perception that recycled water is unsanitary. Lack of uses and infrastructure to recycle water.

Recharge:

Lack of inter-basin coordination. Water quality issues.

Summary of Recommendations

- Develop and implement strategies to maximize urban WUE within the SARW region.
- Increase regional cooperation between water agencies to maximize water reuse opportunities and groundwater recharge.
- Develop a user-friendly database to enhance informational exchange within the watershed to identify collaborative opportunities.
- Identify and quantify the true benefits (ex. energy, non-point source pollution, etc.) of increasing water reuse, recharge and WUE to strengthen the public and political will to implement such strategies.

Plausible Future Scenario Evaluations

Water managers in the SARW Region are tasked with procuring, developing, storing, and delivering the requisite water resources to supply the growing demands of the region. Thus, water managers must balance the delicate interplay between supplying the water demands of today while preparing a portfolio of supply options to meet a dynamic future demand. In our project, we examine plausible future supply and demand balances, or resource mixes, and the degree to which different scenarios result in the SARW Region becoming more locally-reliant in regards to future water supplies.

Using the methodology illustrated in Figure 2 of potentially reducing imported supplies through demand management strategies and replacing imported water with developed local supplies, the SARW Region has the opportunity to significantly increase its local-reliance with regards to water resources. By combining the various demand and supply scenarios, the potential exists to reduce imported supplies from 45-785 TAF, as shown in Table 1. The potential reductions increase as one moves down the rows (Supply Scenarios) and across the columns to the right (Demand Scenarios).

Potential Decrease of Imported Supplies by Scenario (TAF)

Scenarios	Baseline Demand	Pacific Institute	SARW Region - ET Controller	SARW Region - CALscapes
Baseline Supply	-	330	403	525
75% Max Reuse + Baseline Recharge	45	375	448	570
75% Max Reuse + Max Recharge	195	525	598	720
Maximum Local Supplies	260	590	663	785

Table 1 - Potential reductions range from 45-785 Thousand Acre-Feet as the potential reductions increase as one moves down the rows (Supply Scenarios) and across the columns to the right (Demand Scenarios).

Approximately 785 TAF of imported water may be potentially saved in the region if the SARW Region CALscape demand scenario is combined with the Maximum Local Supplies scenario. Given this combination, it would be possible to reduce imported supplies significantly, such that imports would comprise only ~3% of the total supply by 2025. Additionally, this scenario permutation would stabilize and decrease the supplies required to satisfy demands over time, so that by 2025 the resource mix only increases 6% over 2005 levels (Figure 6). Contrast this with the baseline resource mix in which imported water supplies ~37% of the total supply in 2025.

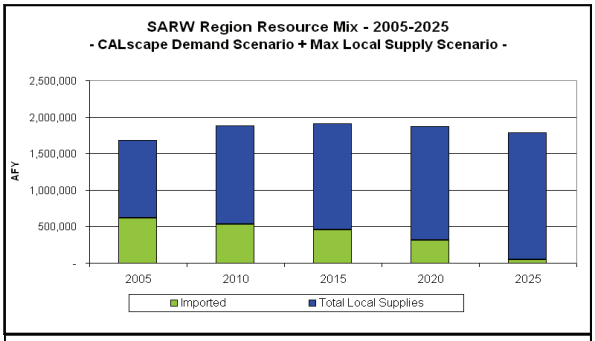

Figure 6 — Resource mix resulting from aggressively implementing alternative management strategies in the SARW Region.

Environmental & Financial Benefits of Increasing Local Water Reliance

Based on our assessment, the top three potential water resources that the DWR 2005 State Plan Update identifies are in fact quite significant for the SARW Region, if not underestimated. The significant reduction in imported supplies in the CALscape Demand + Max Local Supplies scenario would result in an approximate $1 Billion dollar savings by 2025 in avoided costs associated with imported water (Figure 7). As a consequence of aggressively pursuing and developing local water management strategies the SARW Region would become less susceptible to water supply reliability issues related to limited and problematic imported water supplies. Local ecosystems and riparian habitats would benefit from enhanced groundwater management and recharge as additional water would be present and available in the hydrologic system, raising in-stream water levels and protecting against seawater intrusion, even in drought conditions. Regional ecosystems, such as the San Francisco Bay Delta, would also benefit as the burden to supply water resources to the SARW region declines.

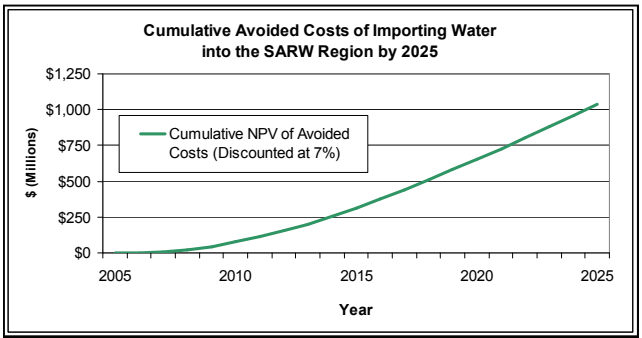

Figure 7 — Approximately $1 Billion dollars could be saved by 2025 in avoided costs associated with imported water if demand management and local resources development strategies are implemented.