# Appendix 3-4

## References:

All the sources referenced in the preceding technical justification are included in this Appendix 3-4. A summary sheet for the references is included at the beginning of the references which lists the source, publishing year and month (if applicable), title, and location. The location is formatted as follows: page (section), site url, or contact information. The sources are organized in alphabetical order by source and then title. The source information is then followed by reference location information for Attachment 3: page, reference number or table number, benefit the reference is in, and project the reference is in.

All the references included in this Appendix 3-4 have been clipped from their original source documents and include only the cover page of the original document (if applicable) and the specific pages and/or sections referenced. The unclipped source documents in their entire state are included in the accompanying supporting documents CD.

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# Databases, Tables & Calculators by Subject





## CPI Inflation Calculator

**CPI Inflation Calculator**

$ 1.00

in 2008

Has the same buying power as:

$1.10

in 2014

Calculate

About this calculator

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### About the CPI Inflation Calculator

The CPI inflation calculator uses the average Consumer Price Index for a given calendar year. This data represents changes in prices of all goods and services purchased for consumption by urban households. This index value has been calculated every year since 1913. For the current year, the latest monthly index value is used.

# Databases, Tables & Calculators by Subject



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## CPI Inflation Calculator

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$ 1.00

in 2012

Has the same buying power as:

$1.04

in 2014

Calculate

About this calculator
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### About the CPI Inflation Calculator

The CPI inflation calculator uses the average Consumer Price Index for a given calendar year. This data represents changes in prices of all goods and services purchased for consumption by urban households. This index value has been calculated every year since 1913. For the current year, the latest monthly index value is used.

*NOTE: This publication is meant to be an aid to the staff of the CDPH—formerly the Department of Health Services (DHS)—Drinking Water Program and cannot be relied upon by the regulated community as the State of California's representation of the law. The published codes are the only official representation of the law. Refer to the published codes—in this case, Title 17 and 22 CCR—whenever specific citations are required.*

# California Department of Public Health

## *Regulations Related to Recycled Water*

***June 18, 2014 (Revisions effective on 6/18/14)***

*Sections amended, adopted, repealed, or not included in the previous version are highlighted in yellow. If the text in a section, subsection, or paragraph is highlighted, it is new. If only the section/paragraph number is highlighted, it was amended or repealed. Nonsubstantive revisions may not be shown.*

## *Article 2. Sources of Recycled Water.*

### §60302. Source specifications.

The requirements in this chapter shall only apply to recycled water from sources that contain domestic waste, in whole or in part.

## *Article 3. Uses of Recycled Water.*

### §60303. Exceptions.

The requirements set forth in this chapter shall not apply to the use of recycled water onsite at a water recycling plant, or wastewater treatment plant, provided access by the public to the area of onsite recycled water use is restricted.

### §60304. Use of recycled water for irrigation.

(a) Recycled water used for the surface irrigation of the following shall be a disinfected tertiary recycled water, except that for filtration pursuant to Section 60301.320(a) coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2 NTU, the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU for more than 15 minutes and never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes:

(1) Food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop,

(2) Parks and playgrounds,

(3) School yards,

(4) Residential landscaping,

(5) Unrestricted access golf courses, and

(6) Any other irrigation use not specified in this section and not prohibited by other sections of the California Code of Regulations.

(b) Recycled water used for the surface irrigation of food crops where the edible portion is produced above ground and not contacted by the recycled water shall be at least disinfected secondary-2.2 recycled water.

(c) Recycled water used for the surface irrigation of the following shall be at least disinfected secondary-23 recycled water:

(1) Cemeteries,

(2) Freeway landscaping,

(3) Restricted access golf courses,

never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes:

(1) Flushing toilets and urinals,
(2) Priming drain traps,
(3) Industrial process water that may come into contact with workers,
(4) Structural fire fighting,
(5) Decorative fountains,
(6) Commercial laundries,
(7) Consolidation of backfill around potable water pipelines,
(8) Artificial snow making for commercial outdoor use, and
(9) Commercial car washes, including hand washes if the recycled water is not heated, where the general public is excluded from the washing process.

(b) Recycled water used for the following uses shall be at least disinfected secondary-23 recycled water:

(1) Industrial boiler feed,
(2) Nonstructural fire fighting,
(3) Backfill consolidation around nonpotable piping,
(4) Soil compaction,
(5) Mixing concrete,
(6) Dust control on roads and streets,
(7) Cleaning roads, sidewalks and outdoor work areas and
(8) Industrial process water that will not come into contact with workers.

(c) Recycled water used for flushing sanitary sewers shall be at least undisinfected secondary recycled water.

## *Article 4. Use Area Requirements.*

### §60310. Use area requirements.

(a) No irrigation with disinfected tertiary recycled water shall take place within 50 feet of any domestic water supply well unless all of the following conditions have been met:

(1) A geological investigation demonstrates that an aquitard exists at the well between the uppermost aquifer being drawn from and the ground surface.

(2) The well contains an annular seal that extends from the surface into the aquitard.

(3) The well is housed to prevent any recycled water spray from coming into contact with the wellhead facilities.

(4) The ground surface immediately around the wellhead is contoured to allow surface water to drain away from the well.

(5) The owner of the well approves of the elimination of the buffer zone requirement.

(b) No impoundment of disinfected tertiary recycled water shall occur within 100 feet of any domestic water supply well.

(c) No irrigation with, or impoundment of, disinfected secondary-2.2 or disinfected secondary-23 recycled water shall take place within 100 feet of any domestic water supply well.

(d) No irrigation with, or impoundment of, undisinfected secondary recycled water shall take place within 150 feet of any domestic water supply well.

(e) Any use of recycled water shall comply with the following:

(1) Any irrigation runoff shall be confined to the recycled water use area, unless the runoff does not pose a public health threat and is authorized by the regulatory agency.

(2) Spray, mist, or runoff shall not enter dwellings, designated outdoor eating areas, or food handling facilities.

(3) Drinking water fountains shall be protected against contact with recycled water spray, mist, or runoff.

(f) No spray irrigation of any recycled water, other than disinfected tertiary recycled water, shall take place within 100 feet of a residence or a place where public exposure could be similar to that of a park, playground, or school yard.

(g) All use areas where recycled water is used that are accessible to the public shall be posted with signs that are visible to the public, in a size no less than 4 inches high by 8 inches wide, that include the following wording : "RECYCLED WATER - DO NOT DRINK". Each sign shall display an international symbol similar to that shown in figure 60310-A. The Department may accept alternative signage and wording, or an educational program, provided the applicant demonstrates to the Department that the alternative approach will assure an equivalent degree of public notification.

(h) Except as allowed under section 7604 of title 17, California Code of Regulations, no physical connection shall be made or allowed to exist between any recycled water system and any separate system conveying potable water.

(i) The portions of the recycled water piping system that are in areas subject to access by the general public shall not include any hose bibbs. Only quick couplers that differ from those used on the potable water system shall be used on the portions of the recycled water piping system in areas subject to public access.

# Where Rivers Meet-The Sacramento-San Joaquin Delta

An aerial look at the Delta

The Sacramento-San Joaquin Delta is a region where two of California's largest rivers meet. Freshwater from the rivers mingles with saltwater from the Pacific Ocean, creating the West Coast's largest estuary. Composed of 57 leveed island tracts and 700 miles of sloughs and winding channels, the Delta is a unique blend of small town communities, busy ship ports, farmlands, industries, highways, historical sites, and marinas.

When first explored by the Spanish in the 1770s, the Delta was a vast marsh covered with tules and teeming with wildlife. Settlers, mostly unsuccessful Forty-niners, began farming the region shortly after the start of the Gold Rush. To reclaim the land from swamplike conditions, they began to build levees. The levees were raised and strengthened over time and now protect islands whose surface can be 20 feet or more below the outside water level.

Today, the Delta is the hub of the State's water distribution system. About two-thirds of all Californians and millions of acres of irrigated farmland rely on the Delta for water from the State Water Project and federal Central Valley Project. Delta water is vital to California's economy, fifth largest in the world, and its growing population, expected to reach 53 million by 2030 (Department of Finance).

**Many Uses**

As a water distribution system, the Delta not only serves the State and federal projects but also many agricultural and municipal water diverters surrounding and within the Delta itself. Delta water from the State Water Project serves both urban and agricultural areas in the Bay area, the Silicon Valley, the San Joaquin Valley, the Central Coast, and Southern California.

Salmon migrate through the Delta to freshwater rivers to spawn.

# 20x2020 Water Conservation Plan

**February 2010**

# 20x2020
# Water Conservation Plan

February 2010

**This plan was prepared by:**

- California Department of Water Resources
- State Water Resources Control Board
- California Bay-Delta Authority
- California Energy Commission
- California Department of Public Health
- California Public Utilities Commission
- California Air Resources Board

**With assistance from:**

- California Urban Water Conservation Council
- U. S. Bureau of Reclamation

# Chapter 1. Introduction

In February 2008, Governor Schwarzenegger introduced a seven-part comprehensive plan for improving the Sacramento-San Joaquin Delta. The first element of the Governor's Delta plan is water conservation. In the Governor's words, California must have:

> **"A plan to achieve a 20 percent reduction in per capita water use statewide by 2020.** Conservation is one of the key ways to provide water for Californians and protect and improve the Delta ecosystem. A number of efforts are already underway to expand conservation programs, but I plan to direct state agencies to develop this more aggressive plan and implement it to the extent permitted by current law. I would welcome legislation to incorporate this goal into statute."

The Governor's call for greater conservation is reflected in the work of the Delta Vision Blue Ribbon Task Force. The Vision and Strategic Plan of the Task Force call for significantly greater implementation of water use efficiency measures to reduce water export demands on the Delta and its struggling ecosystem and to improve environmental conditions upstream and downstream of the Delta.

Delta protection and restoration are not the only reasons to increase conservation efforts. Global climate change will affect water management in California, and water conservation will help the state not only mitigate climate change by reducing greenhouse gas emissions but also adapt to climate change by reducing water use. Approximately one-fifth of the electricity and one-third of the non-power plant natural gas consumed in the state are associated with water delivery, treatment and use, so efficient use also can reduce water-related energy demands and associated greenhouse gas emissions. Without this program, water-related greenhouse gas emissions in 2020 would be higher than is currently forecast. The Water Energy Subgroup of the Climate Action Team estimates that this plan will reduce emissions by 1.4 million metric tons per year.

Water conservation is also an attractive water management strategy because it can yield multiple benefits. Reduced demand can reduce or delay the capital cost of new infrastructure to treat and deliver water. Reduced use also reduces the demand for wastewater treatment, including capital costs and ongoing treatment costs. There may also be improvements in the quality of receiving waters related to reduced discharge. Landscape water conservation can yield multiple benefits including reduced use of fertilizers, pesticides, and herbicides and reduced escape of these chemicals into surface waters through use of native plants and low water using varieties, reduced production of green waste, and improved habitat value of urban landscapes. These other benefits are particularly important upstream of the Delta, where effluent discharge and over-application of irrigation water often re-enter the natural system and the net water savings from landscape conservation is lower than it is in areas that discharge to the ocean.

The California Water Plan acknowledges the importance of water conservation as an element of statewide water management. The *California Water Plan Update 2005,* as well as the draft *California Water Plan Update 2009,* identifies urban water conservation as the water management strategy that will be most effective at matching supply and demand. California needs a comprehensive plan to increase water use efficiency and achieve the multiple benefits that accompany more efficient use, along with a comprehensive finance plan that supports continuing investment in efficiency.

This *20x2020 Plan* outlines recommendations to the Governor on content and implementation of the requested "more aggressive plan". These recommendations were developed through a collaborative effort of the Agency Team, involving several agencies that are involved in water planning and management. The Agency Team consists of seven state agencies and a federal agency: Department of Water Resources (DWR), State Water Resources Control Board (SWRCB), California Energy Commission (CEC), Department of Public Health (DPH), California Public Utilities Commission (CPUC), Air Resources Board (ARB), California Bay-Delta Authority (CBDA) and the US Bureau of Reclamation (USBR). In addition, the California Urban Water Conservation Council contributed toward the analysis and development of this *20x2020 Plan*. Extensive public input has helped to improve the plan and will be an important part of future refinement and implementation.

Achieving a 20 percent reduction in statewide per capita urban water use is a challenging task. Achieving it by 2020 will require quick and concerted effort throughout the state. However, the urgent threat of water deficiency and overdraft, water needs of the environment, a growing population, and the unknown impact of climate change on water supplies, requires that California move boldly to foster water conservation.

**Conservation versus Efficiency**

The terms water conservation and water use efficiency are often used interchangeably. As used in this report, *water conservation* is defined as a reduction in water loss, waste, or use. The general term water conservation may include *water use efficiency*, in which more water-related tasks are accomplished with the same or lesser amounts of water.

When widespread conservation programs are implemented, water managers may become concerned about demand hardening. This is the phenomenon in which customers lose the ability to easily institute emergency conservation during drought or other crises because they have already captured all their conservation savings. Although this is a legitimate concern, California will still have ample conservation opportunity even after statewide per capita use is reduced by 20 percent, through additional fixture and appliance replacement, reductions in landscape irrigation, and habit change.

## Plan Scale and Scope

To meet the Governor's charge, the Agency Team has worked to develop the *20x2020 Plan* that answers these questions:

- What is per capita urban use now or in some recent base period?
- What would the reduction in per capita use be when the Governor's goal is met?
- How does per capita use vary across the state?
- How does the potential for additional conservation vary across the state?
- Is it feasible to expect that the Governor's goal can be met?
- Will existing measures enable us to achieve the Governor's goal? How does this vary by region?
- Can we expect to achieve the goal with new measures? What would it take to implement them?
- How might implementation (and needed implementation assistance) vary by region?

**This *20x2020 Plan* is intended to be part of a comprehensive program to improve water supply reliability, restore ecosystem health, and improve the Delta.** California must reduce its per capita water use. Other vital parts of a comprehensive program include

# Chapter 2. Establishing a Baseline and Targets

Water use depends on various factors such as population, climate, land use patterns, (lot sizes, square footage of irrigated landscape), the age and condition of the water distribution infrastructure (water losses), and industrial and socioeconomic characteristics (the cost of water and income level of residents) of a region. There are significant variations in per capita use across the state reflecting these factors. The analyses in this *20x2020 Plan* are presented by hydrologic region in part to recognize and account for some of this variation.

In order to achieve a savings target, it is essential to first define a baseline. Data from a number of different sources were assessed, as described in following section. However, the data available for this analysis were not complete and accuracy levels vary significantly among water suppliers. Furthermore, through the existing water use data collection systems, there is a considerable lag time between when data are collected and when they are reported to the various entities. With this in mind, the analyses provided in this *20x2020 Plan* should be treated as initial estimates, based on the best available information. An important step in implementing this *20x2020 Plan* will be to standardize and improve the data collection process. This recommendation is discussed in more detail in Chapter Three.

The baseline and target water use levels described in this plan are for hydrologic regions. This plan does not describe methods to calculate targets for individual water suppliers, and the target for a hydrologic region may not be the appropriate target for a particular supplier within that region, because the regional target may be too low or too high. These targets were developed for planning at the statewide and regional level.

## Establishing a Baseline

The baseline values for each region represent the starting point of the *20x2020 Plan*, and help to determine the progress achieved toward the Governor's goal. Establishing the baseline is a dynamic process. The methodology used to develop the baseline in the planning effort of this *20x2020 Plan* was based on the data and resources available at this time and is a good first step towards accomplishing the *20x2020 Plan*'s goals. There is ample room, however, for improvement and refinement of the baseline as new information becomes available. Accordingly, this plan recommends improved data collection and management.

Over the years, many agencies and organizations – including DWR, DPH, CPUC and CUWCC – have collected urban water use data depending upon their goals and needs. Each dataset has strengths and limitations, as summarized in Table 2.

**Table 2. Dataset Strengths and Limitations**

| Data Source | Strength | Limitation |
|---|---|---|
| DWR – Public Water Systems Survey (PWSS) | • Detailed water production, water delivery, population, and connections data.<br>• Categorized by market sectors (e.g., residential, commercial, industrial, etc.).<br>• Compiled into a central database.<br>• Conducted annually. | • Collected voluntarily, which impacts data completeness and accuracy.<br>• Recent data (2005-present) have not yet been compiled and validated, and are not available for use for this Plan. |
| DWR – Land and Water Use Program (LWUP) | • An extension from PWSS database, with data validated and modified at a sub-county level and validated using professional judgment.<br>• Every area has a water use value. | • Only three (3) years of data are available (1998, 2000, and 2001). |
| California Urban Water Conservation Council (CUWCC) | • Detailed water use data by demand sector/customer type<br>• Includes estimates of water saved through conservation Best Management Practices | • Only entered by Signatories of Memorandum of Understanding (approximately 225 of largest urban water suppliers in 2008)<br>• Values expressed in 2006 dollars. |
| CPUC | • Recent urban water use data readily available.<br>• Mandatory so data set should be complete. | • Limited data points<br>• Only residential data available.<br>• Data for connections and water use only.<br>• Data was reported on annual basis, which limits the analysis for residential indoor/outdoor water use. |
| DPH | • More complete database since the Safe Drinking Water Act requires water suppliers to report water use data annually. | • Not available electronically.<br>• Has not been compiled into a central database. Stored as hard copies in each DPH office across the state. |
| Urban Water Management Plans (UWMPs) prepared by Water Suppliers | • Could provide more detail on water use because plans are prepared by individual water suppliers.<br>• Water suppliers serving more than 3,000 connections or more than 3,000 AFY are required by law to develop and submit UWMPs.<br>• Mandatory but compliance is not 100 percent. | • Developed only once every five years.<br>• Not compiled into a central database and therefore not available electronically.<br>• No data from small water suppliers that serve fewer than 3,000 connections or 3,000 AFY. |

## Supply and Demand Data

Because water production data for any given year includes missing and inconsistent elements, several years of production and delivery data (1995 through 2005) were pooled to derive more stable average estimates of baseline consumption. Based on these data, no discernable trend was observed in the overall statewide and regional per capita water use over this period. Therefore, the most recent year for this period, 2005, has been selected as the baseline year.

Review of the strengths and limitations associated with the available databases revealed that data provided by DWR (both the PWSS and LWUP databases) contain the most relevant information that could be used for this *20x2020 Plan*. There are a number of uncertainties and possible inaccuracies in these data, but they were the best available at this time.

Because data submittal to DWR is voluntary, the completeness and accuracy of these data vary substantially between water suppliers. Some suppliers did not provide data for certain market sectors and/or certain years. Suppliers also used different methods in measuring water production and delivery. It is also evident that water suppliers had different understandings of specific data fields.

Most suppliers did not provide data on recycled water. If recycled water data were provided, they were removed from the demand data used to calculate per capita use. This plan encourages greater use of recycled water by crediting the substitution of recycled water for potable water as a reduction in potable per capita water use.

Water production of private water suppliers (e.g., residents with private water wells) is not captured in the PWSS database and was therefore also excluded from this analysis.

### Data Development

Table 3 and Figure 4 below show the variations in average GPCD across the state's 10 hydrologic regions from the data analyzed in the PWSS database. This includes the base sectors of total residential, commercial, industrial and other/non-revenue where data were available.

Review of the compiled data by hydrologic region showed significant variations across the state. As expected, the GPCD values were higher in the more arid areas such as the Colorado Basin (Region 10). The coastal regions (1 through 4) have the lowest GPCD, partly because they have a cooler climate, limited water supplies, and higher cost of water, and because these areas have implemented more water conservation programs than many of the inland areas.

**Table 3. Regional Urban Water Use Pattern in 2005**

| Sector Water Use (GPCD) | Hydrologic Region | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8* | 9 | 10 |
| Residential (Single- and Multi-Family) | 115 | 103 | 109 | 126 | 174 | 159 | 180 | | 176 | **255** |
| Commercial and Institutional | 18 | 19 | 17 | 23 | 25 | 27 | 23 | | 19 | **38** |
| Industrial | 8 | 17 | 8 | 9 | 21 | 32 | 43 | | 11 | **3** |
| Un-Reported Water | 24 | 18 | 20 | 22 | 33 | 30 | 39 | | 31 | **50** |
| Total Baseline | 165 | 157 | 154 | 180 | 253 | 248 | 285 | 243 | 237 | 346 |

* Region 8 does not have enough usable data in the PWSS database to compute for baseline values. The LWUP database was used instead. Note that the LWUP database only contains data for 1998, 2000, 2001. The baseline values for this region may not be as reliable as values computed for the other regions.

# California Electrical Energy Generation

## California Electrical Energy Generation* Total Production, by Resource Type (Gigawatt Hours)

For years 1983 - 1999

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| **California Generation plus Net Imports *** | 246,876 | 267,399 | 274,444 | 280,026 | 290,211 | 289,177 | 298,454 | 304,823 | 307,448 | 299,101 | 291,310 | 293,875 | 302,113 | 296,569 |
| Total Hydroelectric | 42,053 | 24,988 | 31,359 | 36,341 | 34,490 | 40,263 | 48,559 | 27,105 | 24,460 | 29,220 | 34,327 | 42,731 | 27,459 | 24,098 |
| Large Hydroelectric | N/A | 20,691 | 26,647 | 30,931 | 29,589 | 34,228 | 41,861 | 23,071 | 20,352 | 24,699 | 29,145 | 36,355 | 23,133 | 20,754 |
| Small Hydroeletric | N/A | 4,297 | 4,712 | 5,410 | 4,901 | 6,034 | 6,698 | 4,034 | 4,108 | 4,522 | 5,182 | 6,376 | 4,326 | 3,343 |
| Nuclear | 43,533 | 33,294 | 34,353 | 35,594 | 30,241 | 36,155 | 32,036 | 35,698 | 32,482 | 31,509 | 32,214 | 36,666 | 18,491 | 17,860 |
| In-State Coal | 3,183 | 4,041 | 4,275 | 4,269 | 4,086 | 4,283 | 4,190 | 4,217 | 3,977 | 3,735 | 3,406 | 3,120 | 1,580 | 1,018 |
| Oil | 449 | 379 | 87 | 103 | 127 | 148 | 134 | 103 | 92 | 67 | 52 | 36 | 90 | 38 |
| Natural Gas ** | 106,878 | 116,369 | 92,752 | 94,715 | 105,358 | 97,110 | 109,316 | 120,459 | 123,036 | 117,277 | 109,916 | 91,276 | 121,761 | 120,896 |
| Geothermal | 13,456 | 13,525 | 13,396 | 13,329 | 13,494 | 13,292 | 13,093 | 13,029 | 12,907 | 12,907 | 12,740 | 12,685 | 12,733 | 12,485 |
| Biomass | 6,086 | 5,761 | 6,196 | 6,092 | 6,080 | 6,076 | 5,861 | 5,743 | 5,927 | 6,096 | 5,960 | 5,986 | 6,121 | 6,466 |
| Wind | 3,604 | 3,242 | 3,546 | 3,316 | 4,258 | 4,084 | 4,902 | 5,570 | 5,724 | 6,249 | 6,172 | 7,598 | 9,242 | 12,694 |
| Solar | 860 | 836 | 851 | 759 | 741 | 660 | 616 | 668 | 733 | 851 | 912 | 1,097 | 1,834 | 4,154 |
| Other | 0 | 38 | 35 | 108 | 48 | 24 | 34 | 15 | 39 | 20 | 12 | 13 | 14 | 14 |
| Direct Coal Imports*** | 23,877 | 23,699 | 23,653 | 23,148 | 24,504 | 24,114 | 14,452 | 14,417 | 14,463 | 13,556 | 13,119 | 13,032 | 9,716 | 11,824 |
| Other Imports**** | 2,897 | 41,227 | 63,941 | 62,253 | 66,785 | 62,967 | 65,263 | 77,799 | 83,608 | 77,615 | 72,481 | 79,633 | 93,071 | 85,022 |
| | | | | | | | | | | | | | | |
| **Total In-State Generation** | 220,102 | 202,473 | 186,851 | 194,625 | 198,922 | 202,096 | 218,740 | 212,606 | 209,377 | 207,931 | 205,711 | 201,210 | 199,326 | 199,723 |
| Governmental and Utility-Owned In-State Generation | 99,733 | 67,208 | 70,484 | 76,406 | 71,246 | 83,213 | 91,801 | 83,085 | 79,345 | 81,897 | 86,369 | 94,169 | 71,162 | 68,941 |
| Total Hydroelectric | 41,001 | 21,449 | 26,395 | 29,984 | 28,992 | 33,210 | 39,979 | 23,203 | 20,676 | 24,367 | 28,271 | 34,437 | 22,693 | 20,506 |
| Large Hydroelectric | N/A | 18,322 | 23,198 | 26,411 | 25,807 | 29,301 | 35,731 | 20,553 | 17,991 | 21,431 | 24,998 | 30,432 | 19,902 | 18,341 |
| Small Hydroeletric | N/A | 3,127 | 3,197 | 3,574 | 3,185 | 3,910 | 4,248 | 2,649 | 2,684 | 2,935 | 3,272 | 4,006 | 2,791 | 2,164 |
| Nuclear | 43,533 | 33,294 | 34,353 | 35,594 | 30,241 | 36,155 | 32,036 | 35,698 | 32,482 | 31,509 | 32,214 | 36,666 | 18,491 | 17,860 |
| In-state Coal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Oil | 157 | 123 | 43 | 41 | 51 | 58 | 51 | 53 | 53 | 45 | 35 | 30 | 29 | 28 |
| Natural Gas | 13,747 | 11,344 | 8,537 | 9,591 | 10,814 | 12,788 | 18,743 | 23,142 | 25,157 | 25,050 | 24,954 | 22,066 | 28,763 | 29,394 |
| Geothermal | 1,252 | 996 | 1,150 | 1,190 | 1,140 | 997 | 970 | 975 | 947 | 903 | 846 | 858 | 875 | 817 |
| Biomass | 34 | 0 | 4 | 4 | 6 | 2 | 20 | 12 | 28 | 18 | 38 | 37 | 39 | 20 |
| Wind | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Solar | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 5 | 11 | 73 | 273 | 317 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | | |
| **Commercial In-State Generation** | 120,369 | 135,265 | 116,367 | 118,220 | 127,676 | 118,883 | 126,938 | 129,521 | 130,031 | 126,034 | 119,341 | 107,041 | 128,164 | 130,782 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Hydroelectric | 1,052 | 3,539 | 4,965 | 6,357 | 5,498 | 7,052 | 8,579 | 3,902 | 3,784 | 4,854 | 6,057 | 8,294 | 4,767 | 3,592 |
| Large Hydroelectric | N/A | 2,369 | 3,450 | 4,520 | 3,782 | 4,928 | 6,130 | 2,517 | 2,361 | 3,267 | 4,147 | 5,924 | 3,231 | 2,413 |
| Small Hydroeletric | N/A | 1,170 | 1,515 | 1,837 | 1,716 | 2,125 | 2,449 | 1,384 | 1,423 | 1,586 | 1,910 | 2,370 | 1,535 | 1,179 |
| Nuclear | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| In-state Coal | 3,183 | 4,041 | 4,275 | 4,269 | 4,086 | 4,283 | 4,190 | 4,217 | 3,977 | 3,735 | 3,406 | 3,120 | 1,580 | 1,018 |
| Oil | 293 | 256 | 44 | 62 | 76 | 90 | 83 | 51 | 39 | 22 | 17 | 6 | 61 | 11 |
| Natural Gas | 93,130 | 105,025 | 84,215 | 85,124 | 94,544 | 84,322 | 90,573 | 97,317 | 97,880 | 92,227 | 84,962 | 69,210 | 92,999 | 91,502 |
| Geothermal | 12,204 | 12,528 | 12,246 | 12,139 | 12,354 | 12,295 | 12,123 | 12,054 | 11,960 | 12,004 | 11,894 | 11,826 | 11,858 | 11,668 |
| Biomass | 6,052 | 5,761 | 6,192 | 6,088 | 6,074 | 6,074 | 5,841 | 5,731 | 5,899 | 6,078 | 5,922 | 5,949 | 6,081 | 6,446 |
| Wind | 3,597 | 3,242 | 3,546 | 3,316 | 4,258 | 4,084 | 4,902 | 5,570 | 5,724 | 6,249 | 6,172 | 7,598 | 9,242 | 12,694 |
| Solar | 857 | 834 | 848 | 757 | 739 | 658 | 614 | 666 | 730 | 846 | 901 | 1,024 | 1,561 | 3,837 |
| Other | 0 | 38 | 35 | 108 | 48 | 24 | 34 | 15 | 39 | 20 | 12 | 13 | 14 | 14 |
| | | | | | | | | | | | | | | |
| **Energy Exports** | N/A | 14,854 | 6,534 | 6,026 | 4,825 | 5,685 | 5,056 | 5,586 | 5,064 | 4,629 | 5,054 | 5,146 | 4,974 | 3,281 |
| Pacific Northwest | N/A | 5,846 | 1,020 | 1,471 | 1,532 | 2,061 | 2,518 | 2,620 | 2,242 | 1,871 | 1,809 | 1,133 | 761 | 809 |
| Pacific Southwest | N/A | 9,007 | 5,514 | 4,555 | 3,292 | 3,623 | 2,539 | 2,966 | 2,822 | 2,759 | 3,245 | 4,013 | 4,213 | 2,472 |
| | | | | | | | | | | | | | | |
| **Energy Imports** | N/A | 79,780 | 94,128 | 91,427 | 96,113 | 92,766 | 84,771 | 97,802 | 103,136 | 95,800 | 90,653 | 97,811 | 107,760 | 100,127 |
| Pacific Northwest | N/A | 12,672 | 28,206 | 23,775 | 22,363 | 22,347 | 22,321 | 27,289 | 26,201 | 21,800 | 26,486 | 36,352 | 40,231 | 35,897 |
| Pacific Southwest | N/A | 67,107 | 65,921 | 67,652 | 73,750 | 70,419 | 62,450 | 70,514 | 76,935 | 74,000 | 64,168 | 61,459 | 67,529 | 64,230 |
| | | | | | | | | | | | | | | |
| **Net Energy Imports** | 26,774 | 64,926 | 87,594 | 85,401 | 91,289 | 87,081 | 79,714 | 92,217 | 98,072 | 91,171 | 85,599 | 92,665 | 102,786 | 96,846 |
| Pacific Northwest | 18,777 | 6,826 | 27,186 | 22,303 | 20,831 | 20,286 | 19,803 | 24,669 | 23,959 | 19,929 | 24,677 | 35,219 | 39,470 | 35,088 |
| Pacific Southwest | 7,997 | 58,100 | 60,408 | 63,097 | 70,458 | 66,795 | 59,911 | 67,547 | 74,113 | 71,241 | 60,922 | 57,446 | 63,317 | 61,758 |

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| **California Generation plus Net Imports *** | 199,609 | 211,900 | 210,172 | 211,028 | 220,371 | 232,926 | 238,567 | 252,355 | 242,343 | 245,535 | 242,026 | 256,719 | 256,367 | 253,621 | 230,243 | 244,577 | 243,077 |
| Total Hydroelectric | 59,351 | 46,880 | 33,898 | 44,478 | 27,140 | 26,692 | 32,742 | 26,092 | 23,244 | 22,373 | 41,595 | 25,626 | 51,665 | 47,883 | 41,400 | 48,757 | 41,627 |
| Large Hydroelectric | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Small Hydroeletric | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Nuclear | 6,738 | 13,467 | 18,911 | 28,000 | 32,995 | 35,481 | 33,803 | 36,586 | 37,167 | 38,622 | 36,579 | 38,828 | 36,186 | 39,753 | 37,267 | 41,715 | 40,419 |
| In-State Coal | 563 | 731 | 865 | 1,033 | 1,163 | 1,791 | 2,479 | 3,692 | 3,050 | 3,629 | 2,549 | 2,655 | 1,136 | 2,870 | 2,276 | 2,701 | 3,602 |
| Oil | 6,535 | 2,632 | 2,790 | 3,126 | 2,143 | 8,158 | 9,275 | 4,449 | 523 | 107 | 2,085 | 1,954 | 489 | 693 | 143 | 123 | 55 |
| Natural Gas ** | 45,486 | 58,248 | 69,771 | 49,260 | 75,437 | 74,221 | 78,916 | 76,082 | 75,828 | 87,032 | 70,715 | 95,025 | 78,378 | 66,711 | 74,341 | 82,052 | 84,703 |
| Geothermal | 7,020 | 9,272 | 10,957 | 13,094 | 14,083 | 14,194 | 15,247 | 16,038 | 15,566 | 16,491 | 15,770 | 15,573 | 14,267 | 13,539 | 11,950 | 12,554 | 13,251 |
| Biomass | 731 | 1,099 | 1,171 | 2,063 | 2,461 | 4,092 | 5,204 | 6,644 | 7,312 | 7,362 | 5,760 | 7,173 | 5,969 | 5,557 | 5,701 | 5,266 | 5,663 |
| Wind | 52 | 192 | 655 | 1,221 | 1,713 | 1,824 | 2,139 | 2,418 | 2,669 | 2,707 | 2,867 | 3,293 | 3,182 | 3,154 | 2,739 | 2,776 | 3,433 |
| Solar | 2 | 11 | 33 | 64 | 188 | 315 | 471 | 681 | 719 | 700 | 857 | 798 | 793 | 832 | 810 | 839 | 838 |
| Other | 0 | 0 | 0 | 6 | 5 | 4 | 4 | 4 | 0 | 2 | 0 | 0 | 0 | 343 | 896 | 230 | 0 |
| Direct Coal Imports*** | 17,001 | 18,080 | 14,112 | 17,588 | 17,544 | 19,243 | 17,223 | 17,710 | 20,392 | 28,806 | 20,358 | 22,440 | 16,788 | 22,590 | 22,411 | 22,570 | 22,802 |
| Other | 56,130 | 61,288 | 57,009 | 51,095 | 45,499 | 46,911 | 41,064 | 61,959 | 55,873 | 37,704 | 42,892 | 43,354 | 47,514 | 49,696 | 30,310 | 24,993 | 26,685 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Imports**** | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| **Governmental and Utility-Owned In-State Generation** | 121,602 | 125,533 | 129,124 | 127,612 | 136,518 | 134,770 | 137,858 | 121,599 | 111,474 | 124,544 | 134,280 | 135,149 | 132,147 | 124,573 | 119,961 | 121,955 | 97,688 |
| Total Hydroelectric | 59,244 | 46,687 | 33,639 | 44,117 | 26,727 | 26,259 | 32,096 | 25,612 | 22,728 | 22,033 | 40,440 | 25,024 | 50,089 | 46,660 | 40,122 | 47,326 | 40,593 |
| Large Hydroelectric | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Small Hydroeletric | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Nuclear | 6,738 | 13,467 | 18,911 | 28,000 | 32,995 | 35,481 | 33,803 | 36,586 | 37,167 | 38,622 | 36,579 | 38,828 | 36,186 | 39,753 | 37,267 | 41,715 | 40,419 |
| In-state Coal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Oil | 6,535 | 2,632 | 2,790 | 3,126 | 2,143 | 8,158 | 9,275 | 4,449 | 523 | 107 | 2,085 | 1,954 | 489 | 693 | 143 | 123 | 55 |
| Natural Gas | 42,742 | 54,168 | 63,654 | 40,517 | 62,222 | 53,040 | 52,249 | 45,262 | 42,353 | 54,338 | 46,738 | 61,474 | 39,448 | 31,856 | 37,048 | 27,699 | 14,995 |
| Geothermal | 6,341 | 8,576 | 10,122 | 11,831 | 12,421 | 11,827 | 10,429 | 9,684 | 8,700 | 9,441 | 8,435 | 7,842 | 5,855 | 5,540 | 5,302 | 5,009 | 1,543 |
| Biomass | 0 | 0 | 6 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 65 | 59 | 71 | 80 | 73 |
| Wind | 2 | 3 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 26 | 13 | 10 | 6 | 3 | 7 |
| Solar | 0 | 0 | 2 | 4 | 2 | 1 | 2 | 2 | 3 | 1 | 3 | 1 | 3 | 2 | 2 | 2 | 3 |
| Other | 0 | 0 | 0 | 6 | 5 | 4 | 4 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | | | | | |
| **Commercial In-State Generation** | 4,876 | 6,999 | 9,927 | 14,733 | 20,810 | 32,002 | 42,422 | 51,087 | 54,604 | 54,481 | 44,496 | 55,776 | 59,917 | 56,763 | 57,561 | 75,058 | 95,903 |
| Total Hydroelectric | 107 | 193 | 259 | 361 | 413 | 433 | 646 | 480 | 516 | 340 | 1,155 | 602 | 1,576 | 1,223 | 1,277 | 1,430 | 1,035 |
| Large Hydroelectric | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Small Hydroeletric | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Nuclear | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| In-state Coal | 563 | 731 | 865 | 1,033 | 1,163 | 1,791 | 2,479 | 3,692 | 3,050 | 3,629 | 2,549 | 2,655 | 1,136 | 2,870 | 2,276 | 2,701 | 3,602 |
| Oil | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural Gas | 2,744 | 4,080 | 6,117 | 8,743 | 13,215 | 21,181 | 26,667 | 30,820 | 33,475 | 32,694 | 23,977 | 33,550 | 38,930 | 34,854 | 37,292 | 54,354 | 69,708 |
| Geothermal | 679 | 696 | 835 | 1,263 | 1,662 | 2,367 | 4,818 | 6,354 | 6,866 | 7,050 | 7,334 | 7,731 | 8,412 | 7,999 | 6,648 | 7,546 | 11,708 |
| Biomass | 731 | 1,099 | 1,165 | 2,055 | 2,461 | 4,092 | 5,204 | 6,644 | 7,312 | 7,362 | 5,760 | 7,173 | 5,904 | 5,498 | 5,630 | 5,186 | 5,590 |
| Wind | 50 | 189 | 655 | 1,218 | 1,710 | 1,824 | 2,139 | 2,418 | 2,669 | 2,707 | 2,867 | 3,268 | 3,169 | 3,144 | 2,733 | 2,773 | 3,426 |
| Solar | 2 | 11 | 31 | 60 | 186 | 314 | 469 | 679 | 716 | 699 | 854 | 797 | 790 | 831 | 808 | 837 | 835 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 343 | 896 | 230 | 0 |
| | | | | | | | | | | | | | | | | | |
| **Energy Exports** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Pacific Northwest | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Pacific Southwest | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | | | | | | | | | | | | | | | | | |
| **Energy Imports** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Pacific Northwest | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Pacific Southwest | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Net Energy Imports** | 73,131 | 79,368 | 71,121 | 51,095 | 63,043 | 66,154 | 58,287 | 79,669 | 76,265 | 66,510 | 63,250 | 65,794 | 64,303 | 72,285 | 52,721 | 47,563 | 49,487 |
| Pacific Northwest | 38,375 | 41,027 | 37,146 | 31,632 | 24,977 | 19,893 | 17,739 | 31,665 | 28,819 | 19,600 | 15,466 | 15,315 | 19,890 | 29,529 | 25,204 | 19,428 | 26,051 |
| Pacific Southwest | 34,756 | 38,341 | 33,975 | 19,463 | 38,066 | 46,261 | 40,548 | 48,004 | 47,446 | 46,910 | 47,784 | 50,480 | 44,412 | 42,757 | 27,517 | 28,136 | 23,436 |

*** Note:** Note: The data in this table is based on corrections and updates as of April 2014.

**** Note:** Electric generation categories, such as natural gas, are attributed based on the primary fuel of the plant. With the recent addition of biogas contracts being applied to existing natural gas plant supply contracts, the Total System Power table is not intended to be used as a measure of the state's progress toward the large variety of renewable generation and greenhouse gas emission goals. It is intended to be used as a guide only.

***** Note:** The Direct Coal Imports category is based on reported ownership shares and contractual arrangements for power purchases by California utilities. Due to legislative changes required by Assembly Bill 162 (2009) and to simplify the characterization of coal power generation, only Utah's Intermountain Power Project and Nevada's Mohave Generation Station (closed as of 2006) are included in the reported Direct Coal Imports for 1983 through 2012 on this table. A more detailed analysis of the role of coal-based power generation within California is outside the scope of this table. The California Air Resources Board is currently undertaking the task of identifying the fuel source of all imported power into California. When comparing coal and other power imports over time, the best approach is to compare the combined value of Net Energy Imports.

****** Note:** In this tabulation, generation located physically out-of-state is included in the energy imports category. The energy imports and exports include all electricity flows in and out of the state as reported by four California Balancing Authorities: California Independent System Operator, Los Angeles Department of Water and Power, Imperial Irrigation District, and Balancing Area of Northern California plus generation at six out-of-state power plants that are within one or more of these Balancing Authorities' control areas but are physically located outside California. These plants include Intermountain Power Plant (coal) in Utah, Mohave Generation Station (coal) in Nevada (now closed), Terra-Gen Dixie Valley plant (geothermal) and Desert Star Plant (natural gas) in Nevada, Termoelectrica de Mexicali Plant and InterGen's La Rosita Plant (natural gas) both of which are in Mexico. Power generated by these plants is not reported by Balancing Authorities as imports, hence their inclusion in this methodology. Finally, imports reported by Balancing Authorities do not include associated fuel source information. Fuel sources for out-of-state power are only reported by load serving entities under Power Source Disclosure and Power Content Label reporting requirements. As presented here, imports are only known for their geographic origin and not their fuel source origin. For a more detailed view of annual imported fuel sources, please refer to Total System Power

# WATER-ENERGY RELATIONSHIP

In support of the
*2005 Integrated Energy Policy Report*

**Matt Trask**
*Environmental Office*
*Systems Assessment and*
*Facilities Siting Division*
*California Energy Commission*

STAFF PAPER



June 2005
CEC-700-2005-011

per day to its customers. Pumping is only needed after the water reaches the Bay Area and is stored in local reservoirs.

The Hetch Hetchy system also includes three major powerhouses that produce power from water released from three reservoirs: Hetch Hetchy, Lake Eleanor, and Lake Lloyd (also called Cherry Lake). Lake Eleanor water drains into Cherry Lake, which then drains through 165 MW Holm Powerhouse as it flows into the Tuolumne River via Cherry Creek. Hetch Hetchy water flows through the 117.6 MW Kirkwood and 100 MW Mocassin Powerhouses. The power system delivers an average of 1.7 GWh of electricity annually to the City and County of San Francisco, the Modesto and Turlock Irrigation Districts and tenants at the San Francisco International Airport.

***All American Canal System***

Completed in 1940, the All-American Canal System carries water from the Colorado River westward along the U.S./Mexico border to irrigate fields in the Imperial Valley in the southeastern corner of California. It is partially administered by the Bureau of Reclamation and partially by the Imperial Irrigation District (IID). The All-American system consists of the Imperial Diversion Dam and Desilting Works, the 80-mile All-American Canal, and the 123-mile Coachella Canal. The system irrigates about 530,000 acres in the Imperial Valley and 78,530 acres in the Coachella Valley; it also supplies water to the federal Yuma Project, which serves farms in Arizona and California near the City of Yuma.

The All-American system includes both generating stations and pumping plants. IID operates nine powerplants along the canal, totaling about 57 MW in generating capacity. Included among those is the 7 MW Pilot Know plant, which has the capability of producing power from water in the canal and returns it to the Colorado River near the Mexican border to meet international treaty requirements. IID is by far the largest user of canal water, feeding into a labyrinth of canals and drains totaling more than 3,100 miles in length. The distribution system consists of 1,472 miles of laterals, while the drainage system consists of about 112 miles of closed drains and 1,341 miles of open drains. The project also includes a small storage feature, the Senator Wash Reservoir and Pumping-Generating Plant, which can store water during times of surplus and discharge it back into the canal when needed.

***Coachella Canal***

Branching off the All American Canal about 12 miles west of Yuma is the Coachella Canal, which carries water northwesterly for 123 miles to the Coachella Valley County Water District's distribution system, which administers the canal. The distribution system is largely underground, consisting of gravity flow concrete pipelines, with a few small pumping plants serving the higher areas. The network of laterals totals about 495 miles in length. The Bureau of Reclamation recently completed a project to line most of the All-American and

Coachella canals, which previously lost more than 70,000 acre-feet of water each year that soaked into the sandy soils beneath the unlined canals.

## Energy Use and Production of Surface Water

***Electricity Requirements for Conveyance***

On the whole, large amounts of energy are needed to carry water across long distances and over great elevation to reach the urban centers of Southern California; however, the actual electricity needed for conveyance of a given water shipment varies from essentially zero to more than 9,000 kilowatt-hours (kWh) per million gallons.

Staff estimates that, on average in California, about 100 kWh of electric energy is needed to convey one million gallons from its source to the treatment plant. Irrigation districts in the North can divert water directly into their canal systems using gravity rather than electricity. On the other hand, water conveyed the entire length of the State Water Project consumed a net total of 6,034 GWh of electricity in 2001. About 6,000 kWh/million gallons is required to pump water through the Colorado River Aqueduct to urban Southern California. (See Table 1, Energy Consumption for Various Metropolitan Water District [MWD] Sources) (Metropolitan Water District 1996)

Conveyance energy use also varies with precipitation, with considerably more energy expended during wet years as the surplus water is transported into storage.

**Table 1: Energy Consumption for Various MWD Sources**

Water Sector Energy Use

| For West Basin MWD (kWh/AF) | |
|---|---|
| **Imported Water** | |
| SWP | 3,044 |
| Colorado River | 2,044 |
| **Groundwater** | |
| Replenished with Recycled Water | 500 |
| Replenished with SWP Water | 3,500 |
| Replenished with CR Water | 2,500 |
| Recycled Water | 490 - 1,280 |
| SW Desalination (estimated) | 4,425 |

DATE: 6/05
SOURCE: California Energy Commission

Staff estimates the state consumes approximately 12,000 GWh each year for all pumping related to water conveyance, storage, treatment, and distribution, and for wastewater treatment and disposal. Staff does not have data available to disaggregate that amount to just conveyance. However, the Energy Commission through its PIER program is funding a study of water-related energy use underway by UC Santa Barbara and the Pacific Institute that is attempting to disaggregate all water-related energy use on both sides of the customer water meter.

### *Hydropower Production and Consumption*

On average, about 12 percent of the electricity delivered to customers in the state comes from in-state hydroelectric production. The amount is highly variable depending on hydrological conditions. The electric system in the state is designed to take advantage of the hydro generation available during the spring runoff. From a system dispatch point of view, one of the worst things that can happen is to watch water spill over the top of dams, bypassing the powerhouse turbines. When dam levels approach these "spill conditions," hydropower can become very cheap. However, hydropower is very valuable later in the year, if available, when it can provide readily dispatchable production during peak load conditions on hot summer days. Unlike large thermal power plants, which are generally limited in their ability to quickly ramp up power production, hydro plants can ramp up very quickly to meet peak load needs.

Installed in-state large hydroelectric capacity totals about 8,470 MW (not including pumped-storage units), with about 1,350 MW of that classified as small hydro; but because of various environmental and operational restrictions, total reliable capacity generally hovers around 6,000 MW during the spring runoff. Looking at recent years, in-state large hydro project production was about 29,667 GWh in 2003, supplying about 11.5 percent of the electricity consumed in the state, while small hydro plants (which are classified as renewable plants, while the larger plants are not) produced 4,669 GWh. Another 9,560 GWh of out-of-state hydropower was imported that year, meaning a total of about 17 percent of the electricity consumed in the state that year came from water power. In the wetter year of 2002, hydropower supplied 19.3 percent of California's electric needs. (2CEC, EAO 2003 and 2004) Over the period 1983 to 2001, California hydropower production varied from a low of about 21,500 GWh in 1992, at the end of a four-year drought, to a high of 59,000 GWh in 1983.

Hydropower facilities in California are licensed by the Federal Energy Regulatory Commission (FERC). In California, 44 projects totaling about 5,000 MW are scheduled for relicensing by 2015. On a capacity basis, this is 37 percent of the state's entire hydropower system, including many of the large projects owned by PG&E and Southern California Edison. Historically, FERC hydro licenses were issued for 30 to 50-year time periods, but that was prior to the adoption of current environmental regulations. Relicensing provides important opportunities – once in a generation opportunities – to bring older licenses and facilities into conformance with modern scientific and regulatory standards.

# CALIFORNIA WATER CODE

## TABLE OF CONTENTS

# WATER CODE
# SECTION 100-112

100. It is hereby declared that because of the conditions prevailing in this State 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, and that the conservation of such water is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare. The right to water or to the use or flow of water in or from any natural stream or watercourse in this State is and shall be limited to such water as shall be reasonably required for the beneficial use to be served, and such right does not and shall not extend to the waste or unreasonable use or unreasonable method of use or unreasonable method of diversion of water.

100.5. It is hereby declared to be the established policy of this state that conformity of a use, method of use, or method of diversion of water with local custom shall not be solely determinative of its reasonableness, but shall be considered as one factor to be weighed in the determination of the reasonableness of the use, method of use, or method of diversion of water, within the meaning of Section 2 of Article X of the California Constitution.

101. Riparian rights in a stream or watercourse attach to, but to no more than so much of the flow thereof as may be required or used consistently with this and the next preceding section, for the purposes for which such lands are, or may be made adaptable, in view of such reasonable and beneficial uses; provided, however, that nothing in this or the next preceding section shall be construed as depriving any riparian owner of the reasonable use of water of the stream to which his land is riparian under reasonable methods of diversion and use, or of depriving any appropriator of water to which he is lawfully entitled.

102. All water within the State is the property of the people of the State, but the right to the use of water may be acquired by appropriation in the manner provided by law.

103. In the enactment of this code the Legislature does not intend thereby to effect any change in the law relating to water rights.

104. It is hereby declared that the people of the State have a paramount interest in the use of all the water of the State and that the State shall determine what water of the State, surface and underground, can be converted to public use or controlled for public protection.

105. It is hereby declared that the protection of the public interest in the development of the water resources of the State is of vital concern to the people of the State and that the State shall determine in what way the water of the State, both surface and underground, should be developed for the greatest public benefit.

106. It is hereby declared to be the established policy of this State that the use of water for domestic purposes is the highest use of water and that the next highest use is for irrigation.

106.3. (a) It is hereby declared to be the established policy of the state that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.

(b) All relevant state agencies, including the department, the state board, and the State Department of Public Health, shall consider this state policy when revising, adopting, or establishing policies, regulations, and grant criteria when those policies, regulations, and criteria are pertinent to the uses of water described in this section.

(c) This section does not expand any obligation of the state to provide water or to require the expenditure of additional resources to develop water infrastructure beyond the obligations that may exist pursuant to subdivision (b).

(d) This section shall not apply to water supplies for new development.

(e) The implementation of this section shall not infringe on the rights or responsibilities of any public water system.

106.5. It is hereby declared to be the established policy of this State that the right of a municipality to acquire and hold rights to the use of water should be protected to the fullest extent necessary for existing and future uses, but that no municipality shall acquire or hold any right to waste water, or to use water for other than municipal purposes, or to prevent the appropriation and application of water in excess of its reasonable and existing needs to useful purposes by others subject to the rights of the municipality to apply such water to municipal uses as and when necessity therefor exists.

106.7. (a) It is hereby declared to be the established policy of this state to support and encourage the development of environmentally compatible small hydroelectric projects as a renewable energy source, provided that the projects do not result in surface disturbances within the following sensitive areas:

(1) Any component of the California Wild and Scenic Rivers System or the National Wild and Scenic Rivers System.

(2) Any river designated for study pursuant to Section 5(a) of the National Wild and Scenic River Act (16 U.S.C. 1276(a)). This paragraph shall not apply to any river which, upon the completion of the study, is not included in the National Wild and Scenic Rivers System.

(3) Any state or federally designated wilderness area.

(4) Any areas designated as a "Critical Condor Habitat" by the United States Fish and Wildlife Service.

(b) State agencies shall not approve small hydroelectric development within the sensitive areas specified in subdivision (a).

(c) Significant adverse impacts associated with small hydroelectric projects shall be identified by those agencies responsible for the preparation of the environmental impact document.

(d) Emphasis on the development of small hydroelectric power generating facilities which are "qualifying small power production facilities" under Section 210 of the Public Utilities Regulatory Policies Act of 1978, shall be on existing dams, diversions, and canals with a sufficient drop so that power may be efficiently generated without significant environmental effects.

(e) For hydroelectric power generating facilities, the applicant shall demonstrate that project revenues will exceed project costs, including the cost of mitigation measures over the life of the project.

(f) Subdivisions (d) and (e) do not apply to projects with a nameplate capacity of less than 100 kilowatts.

107. The declaration of the policy of the State in this chapter is not exclusive, and all other or further declarations of policy in this code shall be given their full force and effect.

108. It is hereby declared to be the established policy of this State that in the development and completion of any general or co-ordinated plan prepared and published by the Department of Water Resources or any predecessor thereof or successor thereto, all uses, including needs of the area in which the water originates, of water shall be given consideration.

Whenever the Legislature authorizes the construction or acquisition by the State of any project which will develop water for use outside the watershed in which it originates, the Legislature shall at the same time consider the authorization and the construction or acquisition of such other works as may be necessary to develop water to satisfy such of the reasonable ultimate requirements of such watershed as may be needed at the time the export project is authorized or as will be needed within a reasonable time thereafter. The authorization with respect to such additional works may provide for state acquisition or construction, in whole or in part, of any such additional works, or financial assistance to other entities in connection with the acquisition or construction of such works, or a combination thereof.

109. (a) The Legislature hereby finds and declares that the growing water needs of the state require the use of water in an efficient manner and that the efficient use of water requires certainty in the definition of property rights to the use of water and transferability of such rights. It is hereby declared to be the established policy of this state to facilitate the voluntary transfer of water and water rights where consistent with the public welfare of the place of export and the place of import.

(b) The Legislature hereby directs the Department of Water Resources, the State Water Resources Control Board, and all other appropriate state agencies to encourage voluntary transfers of water and water rights, including, but not limited to, providing technical assistance to persons to identify and implement water conservation measures which will make additional water available for transfer.

112. (a) The efficiency of a reverse osmosis water treatment device means the percentage of water which passes through the water treatment device that is available for subsequent domestic use and which is not discharged directly from the device to the waste disposal system of the residence where the device is used.

(b) Notwithstanding any other provision of law, after January 1, 1991, no reverse osmosis water treatment device shall be sold, installed, or rented, for residential use, including any general domestic purposes such as drinking, cleaning, washing, or sanitation, unless the device is equipped with an automatic waste shutoff device or, through other equipment design specifications, achieves or exceeds equal or greater water savings than would occur with an automatic shutoff device.

(c) Effective January 1, 1993, any reverse osmosis water treatment device sold, installed, rented, or under service contract prior to January 1, 1991, for residential use shall be retrofit with an automatic waste shutoff device, or, through other equipment design specifications, achieve or exceed equal or greater water savings than would occur with an automatic shutoff device.

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# Coachella Valley Task Force Targets Golf Water Conservation

November 20, 2013 4:14 pm Brandi Shaffer C&RB News no comments

***A group of golf course managers and water district officials have formed the Coachella Valley Golf Industry Water Conservation Task Force, to focus on reducing the water footprint of the Southern California area's 124 golf courses. In Poway, Calif., city council approved a conditional use permit to allow Maderas Golf Club to start pumping ground water from its wells after being forced to stop in 2011.***

Representatives of golf courses announced plans on November 19 to create a task force focused on reducing the water footprint of the Coachella Valley's 124 golf courses, the Palm Springs (Calif.) *Desert Sun* reported.

The task force will involve managers of golf courses as well as officials of the Coachella Valley Water District, said Craig Kessler, director of governmental affairs for the Southern California Golf Association.

Managers of golf courses are concerned about water, Kessler said, and see a need to "step up to the plate as an industry and figure out how to do business in a way that uses less water, uses it more efficiently."

The Coachella Valley Golf Industry Water Conservation Task Force will mirror similar initiatives in the Los Angeles and San Diego areas, the *Desert Sun* reported.

The group took the step following a series of articles in which *The Desert Sun* documented significant long-term declines in groundwater levels. Kessler said the articles "lit a little fire under us" in deciding to establish a more formal venue for dialogue about water conservation. The group touted past efforts to improve water efficiency through state-of-the-art irrigation techniques, the *Desert Sun* reported.

Officials at the Coachella Valley Water District have also recently pledged to accelerate efforts to connect more golf courses to pipes carrying recycled water and Colorado River water. A total of 22 golf courses in the Coachella Valley now use a mix of treated sewage and Colorado River water, while 28 other courses receive water directly from the river through a canal, the *Desert Sun* reported.

Most of the area's golf courses still rely on groundwater from wells, and those large withdrawals from the aquifer have contributed to declines in water levels. Water agencies' records for 346 wells determined that the average measurements of water levels in the wells went from about 104 feet below ground in 1970 to 159 feet below ground this year, reflecting an average decline of 55 feet, the *Desert Sun* reported.

The Coachella Valley Water District, the valley's largest water agency, confirmed it is forming the task force together with golf representatives, and said details are being worked out, the *Desert Sun* reported.

“I see a lot of opportunity there, and we definitely support that,” John Powell Jr., President of the agency’s Board, said after the announcement.

The goals will include looking at ways of bringing recycled water and Colorado River water to more courses, as well as establishing water budgets for each course with an eye to meeting a state requirement that water districts reduce water use 20 percent by 2020, Kessler said, calling it an effort to plan ahead, and said it also brings “a sense of peer pressure.”

Several golf course managers expressed interest in finding additional ways to conserve water, while also watching their financial ledgers. Some pointed out that removing turf can be costly, and that in other areas such as Los Angeles and Las Vegas, there are programs that partially reimburse courses for such costs, the *Desert Sun* reported.

Many courses in the Coachella Valley have expanses of grass covering 100 acres or more. In Arizona and Nevada, in contrast, golf courses have for years been designed with less turf and more desert landscaping in response to state and local rules, the *Desert Sun* reported.

*C&RB* will closely examine the club industry’s growing role in water management in its two-part series “Fluid Situation,” which will appear in the December 2013 and February 2014 issues. Part one will provide a comprehensive look at the current water management situation and how it is likely to evolve in the future.

In Poway, Calif., Maderas Golf Club will be allowed to once again start pumping ground water from its wells after modifications to a conditional use permit were approved by city council, allowing the course to resume the pumping it was forced to stop in 2011, the San Diego *Union-Tribune* reported.

For the past 27 months the course has been forbidden to use its wells for irrigation because of concerns that water levels of neighboring wells, primarily in the Old Coach Estates area, were getting too low, the *Union-Tribune* reported.

In preparation for Tuesday’s hearing, the owners of the golf club, Sunroad Enterprises, prepared an extensive report stating that the water used by the golf course did not come from the same aquifer as its neighbors and that resuming pumping would not hurt surrounding areas, the *Union-Tribune* reported.

A different study commissioned by northern Poway residents reached a different conclusion stating that there was a connection. And a third independent study, requested by the city and paid for by Sunroad, backed the first Maderas report, the *Union-Tribune* reported.

During a four-hour hearing attended by close to 200 people, many speakers questioned the validity of the Maderas studies and said if there is a danger of depleting water supplies for homeowners then the city should not take the risk. Many accused Maderas of over-pumping for years, causing the permanent depletion of the water supply, the *Union-Tribune* reported.

“There are many of us back there who have only well water,” said homeowner Tom Carter. “I lost my home once in the Witch Creek fire. If I run out of water obviously I lose my home again. I would respectfully request that you consider if there is any risk at all of connectivity that you consider the welfare of your citizens above the bottom line of a golf course.”

Sunroad has said it could save $300,000 to $500,000 annually if allowed to pump, the *Union-Tribune* reported.

Other speakers urged the council to allow the pumps to be turned back on. They said their home values are directly linked to the health of the course, the *Union-Tribune* reported.

City engineers recommended that Maderas be allowed to turn the pumps back on but with several restrictions. Instead of the 280 acre feet (91.2 million gallons) Sunroad originally wanted to pump, the city said only 173 acre feet (56.4 million gallons) should be allowed. Extensive testing would also be required, and should neighboring wells start to suffer, the pumping could be stopped again, the *Union-Tribune* reported.

The main issue for the council was whether it had been scientifically proven that there is no connection between the water beneath Maderas and the water below the nearby houses and beneath the Blue Sky Ecological Reserve to the southeast, the *Union-Tribune* reported.

Mayor Don Higginson and Councilmen John Mullin and Jim Cunningham said they were convinced by the reports that denying Maderas would not help the Old Coach Estates residents because studies showed their wells continued to suffer even after Maderas stopped pumping two years ago. Higginson and Mullin said the lack of rain the past few years likely had far more to do with the homeowner's problems, the *Union-Tribune* reported.

"It's pretty straight forward for me," Higginson said. "There is no hydraulic connection."

Coucilmen Dave Grosch and Steve Vaus felt differently, arguing that the groundwater supply beneath northern Poway must be connected in some way, the *Union-Tribune* reported.

"For me, it stretches credulity to say with absolute 100 percent certainty that there is no hydraulic connection," Vaus said. "And without that absolute 100 percent certainty I'm not willing to risk the well-being of the residents and, more importantly to me, the well-being of Blue Sky."

**TAGS:** BLUE SKY ECOLOGICAL RESERVE COACHELLA VALLEY CALIF. COACHELLA VALLEY GOLF INDUSTRY WATER CONSERVATION TASK FORCE COACHELLA VALLEY WATER DISTRICT COLORADO RIVER CRAIG KESSLER DAVE GROSCH DON HIGGINSON JIM CUNNINGHAM JOHN MULLIN JOHN POWELL JR. LOS ANGELES MADERAS GOLF CLUB OLD COACH ESTATES POWAY CALIF. SAN DIEGO SOUTHERN CALIFORNIA GOLF ASSOCIATION STEVE VAUS SUNROAD ENTERPRISES TOM CARTER WATER MANAGEMENT

## About the author

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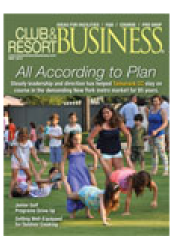

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April 2014

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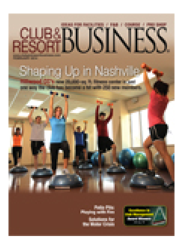

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Protect Coachella Valley from West Nile virus. Together.

Coachella Valley Mosquito and Vector Control District
Est. 1928

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Local woman with WNV fights for her life PG. 3

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# FIGHT THE BITE!

A Special Advertising Supplement

# BATTLING THE VIRUS

## LOCAL WOMAN FIGHTS FOR HER LIFE AFTER BEING BITTEN BY INFECTED MOSQUITO

Esther Gosché, pictured outside her home in Palm Springs, endured a frightening six-month ordeal when she contracted West Nile virus.

Palm Springs residents Esther Gosché and Allen Morris are both retired and enjoy an active lifestyle full of Bocce ball, travel, and visiting with grandchildren. But when Esther contracted West Nile virus after being bitten by an infected mosquito, they were in for an ordeal unlike anything they'd encountered in their 33 years together.

"I've had three children, a hysterectomy, and a brain tumor operation, but I've never felt that bad," Esther says.

Esther began feeling ill in August 2013 with flu-like symptoms. Unlike the flu, Esther's condition never got better.

She experienced two weeks of fever, nausea, a "giant fatigue," and difficulty breathing. Esther's doctor initially thought she had bronchitis and prescribed an antibiotic. But when Esther's temperature climbed to above 102 degrees and she experienced delirium, Allen took her to the hospital.

"I kept saying, 'I don't know what this is. This is not normal,'" Esther says.

Aspirin and hydrating fluids wouldn't break Esther's fever, so doctors moved her into isolation while they tried to diagnose her illness and prevent the spread of what might have been a contagious infectious disease.

"Some of the things that [the doctors] said really got us concerned," Allen says. "We were very, very scared — very concerned that she might not make it through this."

> "DON'T THINK IT CAN'T HAPPEN TO YOU. IT CAN."
>
> ESTHER GOSCHÉ,
> WEST NILE VIRUS SURVIVOR

Finally, Esther's fever came down and she was released to recuperate at home. A few days later, she received a diagnosis: To her shock, she'd tested positive for West Nile virus.

West Nile virus is found in Coachella Valley annually, most often in mosquitoes and sometimes humans — Esther's was one of three confirmed cases of West Nile virus in the Coachella Valley in 2013. According to the Centers for Disease Control and Prevention, around 2,400 people became sick with West Nile virus in the United States in 2013, resulting in 114 deaths.

There is no vaccine for the virus and no cure — Esther's doctors told her to rest and watch for worsening fever. When Esther's condition worsened, she was hospitalized a second time and put on oxygen.

"The impact was so strange ... to not have control, and not know really what I could do to get better," Esther says. "I just had to fight it off."

Esther eventually regained her appetite, and with it her strength. It would take months to feel like herself again, and a full six months before she felt up to the task of driving.

"Recovery is not easy. It takes awhile," Esther says.

Esther is one of the lucky ones. Some people who survive the disease have lifelong neurological effects.

These days, Esther feels much better and says the experience has impressed upon both her and Allen the need to take the threat of West Nile virus seriously, a message they try to pass on to friends, family, and neighbors.

They encourage neighbors to check their property for stagnant water, make sure their pools and fountains are functioning, and be on the lookout for potential breeding sources around the neighborhood — mostly, to be aware.

"Don't think it can't happen to you," Esther cautions. "It can."

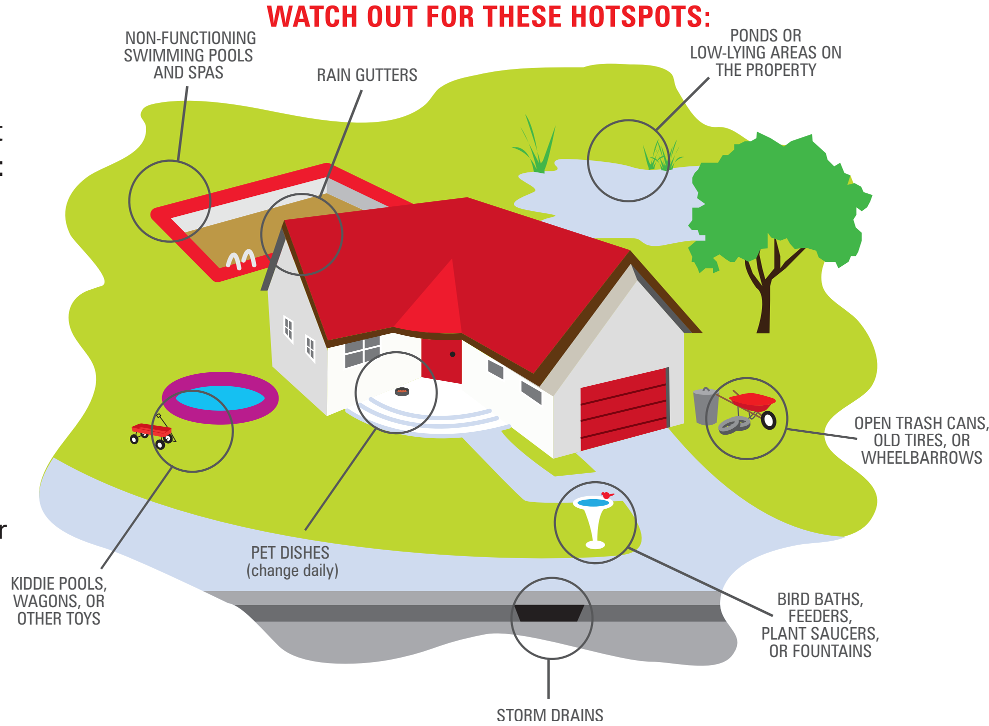
# JOIN THE FIGHT!

How you can help prevent the spread of West Nile virus and other mosquito-borne diseases:

### PREVENT MOSQUITOES FROM BREEDING

- Mosquitoes lay eggs in stagnant water. Inspect your yard every five days, and change or drain standing water.
- Contact CVMVCD for mosquitofish, which feed on mosquito larvae and pupae, to stock in your ornamental pond.
- Report sources of standing water in your neighborhood, such as ditches or non-functioning swimming pools, by calling CVMVCD at 760-342-8287 or 888-343-9399.

### WATCH OUT FOR THESE HOTSPOTS:




### PROTECT YOURSELF AND YOUR FAMILY

- Avoid outdoor activity at dawn and dusk, when mosquitoes that transmit disease are most active.
- Wear long-sleeved shirts and long pants.
- Use an effective repellent with ingredients recommended by the Environmental Protection Agency and follow label directions carefully.
- Make sure doors and windows of your home are fitted with screens to keep biting pests outside – and make sure screens are free of holes.

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**SEPTEMBER 2007**
**(provided on CD and website only)**

Sections 1 through 11 of the Final Recirculated Coachella Valley Multiple Species Habitat Conservation Plan and Natural Community Conservation Plan (MSHCP) (Volume 1 of the Plan) and Appendices I-V (Volume 4 of the Plan) are provided in digital form on the CD and Plan website. These documents incorporate revisions made to respond to public comments. The Final Recirculated MSHCP contains these revisions and any additional revisions made through the plan approval process. The textual changes remove Desert Hot Springs as a Permittee and reflect other project description modifications that were suggested during the 2007 Recirculated Draft MSHCP public review. Because of the project description modifications, a supplemental EIS has been prepared (40 C.F.R. § 1502.9), and the MSHCP was recirculated pursuant to State CEQA guidelines §15088.5.

# 9.0 Species Accounts and Conservation Measures

This section begins with a general conservation approach that applies to all species. The application of this approach throughout the Plan Area varies depending on the species. Following the general conservation approach for all species, individual conservation strategies for each species together with background information on each species is presented. These species conservation strategies are arranged by taxonomic group, beginning with plants. These individual species accounts include all Species Conservation Goals and Objectives that relate to each of the Covered Species, such that a summary of the conservation approach for each species can be found here. There may be some information that is repeated elsewhere in other sections of the Plan that is included here to provide a complete description of the conservation approach for each species.

The following sections, beginning with Section 9.2, describe the general conservation approach, based in part on the species distribution models and known occurrences, for each species covered by the Plan. The species distribution models indicate the occurrence and distribution of known locations, occupied Habitat, and potential Habitat for each covered species. They do not provide data about the abundance of species within a given modeled area. Specific limitations of each individual species model are described in the relevant sections below. The known occurrences or known locations describe locations where a given covered species has been observed or collected. A given known location may represent a site where one or more individuals or a group of organisms of a given species were observed. The known location information is qualitative, not quantitative. These data do not represent a systematic survey of all areas within the Plan boundary where a given species could be expected to occur. The absence of a record for a species in a given location does not necessarily indicate that the species does not occur there. Additional information on development of these models, background on the known locations, and discussion of the limitations of both models and known locations is in Section 3.6 of Appendix I.

# 9.1 General Conservation Approach for Covered Species

This section contains a summary of the general conservation approach for all Covered Species. The implementation of this conservation approach is described in Section 4.0 for protection-related activities, including acquisition, and in Section 8.0, for monitoring, ongoing management, and Adaptive Management activities. The Conservation Area Conservation Objectives for the Covered Species are described for each Conservation Area in Section 4.3. Background information and the complete conservation strategy for each species are found in Section 9.2. The Conservation Area Conservation Objectives from Section 4.3 are repeated in Section 9.2 in summary form to describe all of the conservation measures proposed for each species.

# *9.4 Fish*

This section contains a species account and conservation approach, including Habitat parameters and significant threats, for the one fish species proposed for coverage under this Plan, the desert pupfish. Conservation measures specific to the desert pupfish are also included here.

## *9.4.1* Desert Pupfish *Cyprinodon macularius macularius*

| | | |
|---|---|---|
| **Status** | **Federal:** | **Endangered** |
| | **State:** | **Endangered** |

### 9.4.1.1 Species Conservation Goals and Objectives

Conserve and manage populations within the MSHCP Reserve System according to the following criteria:

Goal 1: Protect occupied Habitat, and associated Essential Ecological Processes, allowing evolutionary processes and natural population fluctuations to occur. Minimize fragmentation, human-caused disturbance, and edge effects to Habitat by conserving contiguous Habitat areas and effective Linkages between Habitat areas.

Objective 1a. Ensure conservation of occupied Habitat within the following Conservation Areas:

- Coachella Valley Stormwater Channel and Delta Conservation Area by maintaining a self-sustaining desert pupfish population in the agricultural drains within the Coachella Valley Stormwater Channel and Delta Conservation Area.
- Dos Palmas Conservation Area, including conservation of known locations.

Please refer to Section 4.3 and Table 9-13 for specific acreages to be protected by this Conservation Objective.

Objective 1b. Ensure maintenance of self-sustaining refugia populations in the following Conservation Areas, consistent with the Desert Pupfish Recovery Plan:

- Thousand Palms Conservation Area
- Dos Palmas Conservation Area

Please refer to Section 4.3 and Table 9-13 for specific acreages to be conserved in refugia populations.

Goal 2: Protect Essential Ecological Processes, which may include hydrological process areas, necessary to maintain Core Habitat, refugia, and agricultural drain Habitat for this species.

<u>Goal 3</u>: Ensure conservation of desert pupfish by maintaining the long-term persistence of self-sustaining populations and conserving Habitat quality through biological monitoring and Adaptive Management actions in the Plan Area.

<u>Objective 3</u>. Implement biological monitoring and Adaptive Management actions. These actions will include Monitoring and Management Programs to be developed by CVWD within one year of Plan approval, to ensure persistence of pupfish populations in the agricultural drains.

***Table 9-13: Summary of Habitat within Conservation Areas Desert Pupfish***

| Conservation Area | Total Acres of Habitat in Conserv. Area | Acres of Disturbance Authorized | Acres of Existing Conservation Lands | Remaining Acres to be Conserved | Total Acres to be Conserved in MSHCP Reserve System | Designation |
|---|---|---|---|---|---|---|
| Thousand Palms | ($15m^2$) | N/A | ($15m^2$) | 0 | ($15m^2$) | Refugium |
| Dos Palmas | ($30m^2$) | N/A | ($30m^2$) | 0 | ($30m^2$) | Core Habitat |
| CV Stormwater Channel & Delta | 25 | N/A | 0 | 25 | 25 | Core Habitat |
| *Total – All Habitat* | *25.05* | *N/A* | *($45m^2$)* | *25* | *25.05* | -- |
| *Total – Core Habitat* | *25.05* | *N/A* | *($30m^2$)* | *25* | *25.05* | -- |
| *Total – Other Conserved Habitat (Refugium)* | *($15m^2$)* | *N/A* | *($15m^2$)* | *0* | *($15m^2$)* | -- |

## 9.4.1.2 Threats, Limiting Factors, and Adaptive Management

Currently, the major threat is the presence of exotic fish species, particularly tilapia (*Tilapia* spp.), sailfin molly (*Poecilia latipinna*), and mosquitofish (*Gambusia affinis*) in Habitats occupied by pupfish. These and other introduced fish species affect pupfish populations through predation, competition, and behavioral interference. Introduced mosquitofish are known to contribute to decline of pupfish in the Salton Sea (USFWS 1993, Jennings 1985). Other non-native species that impact pupfish populations include other tilapia (*Sarotherdon* spp.), carp, sailfin molly, and largemouth bass (BLM 1996, USFWS 1993, Schoenherr 1988, Black 1980). In addition, the non-native bullfrog (*Rana catesbeiana*) is a serious predator of pupfish. Introduced plant species, such as salt cedar (*Tamarisk*), also pose a threat to pupfish populations. Evapotranspiration by salt cedar may result in a lack of water at critical times, especially in smaller Habitats where water supply is limited. Salt Creek is particularly vulnerable to the effects of salt cedar. Other threats within the Plan Area include groundwater pumping, dewatering, water diversion, drain maintenance activities, OHV use, contaminants, the lining of the Coachella Canal, and fluctuations of the Salton Sea. The pupfish requires shallow, slow-moving clear water with a moderate amount of aquatic vegetation and soft substrate. The viable population size is considered to be a minimum of 500 overwintering adults (Ryman and Utter 1987, Soule 1987, Templeton 1990).

If biological monitoring indicates that such actions are warranted, the following actions may be needed to ensure species persistence and long-term viability. This list is not comprehensive but identifies some of the known or likely threats to this species. More detailed information on the Management and Monitoring Programs can be found in Section 8.0. Actions will include:

1. Complete hydrologic studies for the Salt Creek area to determine if the water sources for Salt Creek are adequately protected or if additional water sources may be needed and are available.
2. Ensure agricultural drain maintenance and water supply. This program will include Monitoring and Management Programs, including Adaptive Management, to be developed by CVWD within one year of Plan approval, to ensure persistence of pupfish populations in the agricultural drains (See Section 8.4.5.2). Monitoring will include surveys for pupfish presence in the agricultural drains along with regular sampling of flow, water depth, and selenium concentrations as called for in CVWD's Final Program Environmental Impact Report for Coachella Valley Water Management Plan (Montgomery, Watson and Harza 2002). Upon determination of effects from selenium on desert pupfish reproduction and survival, CVWD will work with the Wildlife Agencies to develop and implement appropriate measures to minimize impacts to pupfish.
3. Control and manage, in cooperation with implementation of the recovery plan, exotic or invasive species in pupfish Habitat, if monitoring identifies this as a threat. At Dos Palmas, non-native fish populations in man-made fishponds that continue to contaminate the Salt Creek drainage should be controlled. Control efforts should also address non-native fish, bullfrogs, and other invasive species that threaten refugia populations. Where non-native fish populations are established in pupfish habitat in the Dos Palmas Conservation Area, CVCC shall develop and submit for review and approval by the Wildlife Agencies, an interim plan within 6 months of Permit issuance that includes measures to control the non-native fish species in these areas present in the ponds at Dos Palmas and/or the surface waters of the Salt Creek watershed. Within 5 years of Permit issuance, CVCC shall develop and submit for the review and approval of the Wildlife Agencies a management strategy for the permanent control of non-native fish within this Conservation Area. Control efforts shall address all non-native fish species. The presence and potential impacts of Asian tapeworm, a potential pupfish parasite, shall be addressed in the Monitoring and Management Programs. Within 5 years of Permit issuance, CVCC shall develop, submit for review and approval by the Wildlife Agencies, and implement a management strategy with the goal of sustaining healthy populations of desert pupfish in the Plan Area in perpetuity.
   a. Remove tamarisk (salt cedar) where it is affecting the amount of water available to pupfish.

mesquite bosque, arrowweed scrub, desert dry wash woodland, southern sycamore-alder riparian woodland, Sonoran cottonwood-willow riparian forest, and southern arroyo willow riparian forest.

The birds begin to arrive in Southern California to breed late in the spring, generally from May 15 through the summer months, until August. Males establish and defend territories beginning shortly after arrival in mid-May. Most birds begin nesting within one week after pair formation, which occurs 10 to 14 days after their arrival. The young fledge in early July and begin to disperse approximately two weeks after leaving the nest.

They construct their nests in dense thickets of willows, mulefat, and other trees and shrubs approximately 4 to 7 meters in height. They virtually always nest near surface water or saturated soil. They have not been found nesting in Habitats where the riparian zone is very narrow, or where the distance between willow patches and individual shrubs is great. The southwestern willow flycatcher is an insectivore, foraging within and above dense riparian vegetation, sometimes adjacent to nest sites.

**Associated Covered Species.** Other riparian species occurring in similar Habitat, including the yellow-breasted chat, summer tanager, least Bell's vireo, and yellow warbler, will benefit from conservation and Adaptive Management actions for southwestern willow flycatcher. Riparian bird species will be considered as a guild in the Plan with regard to their general presence in riparian areas. However, each of these riparian bird species may require slightly different structural features or successional stages for optimal breeding Habitat, which may require different management strategies.

# *9.7.5* Crissal Thrasher *Toxostoma crissali*

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|---|---|---|
| **Status** | **Federal:** | **No official status** |
| | **State:** | **Species of Special Concern** |

## 9.7.5.1 Species Conservation Goals and Objectives

Conserve and manage populations within the MSHCP Reserve System according to the following criteria:

Goal 1: Protect at least two Core Habitat areas that include occupied Habitat, and associated Essential Ecological Processes, allowing evolutionary processes and natural population fluctuations to occur. Minimize fragmentation, human-caused disturbance, and edge effects to Core Habitat by conserving contiguous Habitat patches and effective Linkages between patches of Core Habitat.

Objective 1a. Ensure conservation of Core Habitat including at least 1,307 acres in the following Conservation Areas:

- Dos Palmas Conservation Area
- Coachella Valley Stormwater Channel and Delta Conservation Area

***Table 9-22: Summary of Habitat within Conservation Areas Crissal Thrasher***

| ***Conservation Area*** | ***Total Acres of Habitat*** | ***Acres of Disturbance Authorized*** | ***Acres of Existing Conservation Lands*** | ***Remaining Acres to be Conserved*** | ***Total Acres Conserved in MSHCP Reserve System*** | ***Designation*** |
|---|---|---|---|---|---|---|
| Willow Hole | 294 | 28 | 16 | 250 | 266 | Other Cons. Habitat |
| Thousand Palms | 58 | 0 | 58 | 0 | 58 | Other Cons. Habitat |
| Indio Hills Palms | 3 | 1 | 1 | 1 | 2 | Other Cons. Habitat |
| East Indio Hills | 47 | 5 | 0 | 42 | 42 | Other Cons. Habitat |
| Dos Palmas | 536 | 38 | 155 | 343 | 498 | Core Habitat |
| CV Stormwater Channel & Delta | 896 | 87 | 28 | 781 | 809 | Core Habitat |
| *Total – All Habitat* | *1,834* | *159* | *258* | *1,418* | *1,676* | -- |
| *Total – Core Habitat* | *1,432* | *125* | *183* | *1,124* | *1,307* | -- |
| *Total – Other Cons. Habitat* | *402* | *34* | *75* | *293* | *368* | -- |

### 9.7.5.2 Threats, Limiting Factors, and Adaptive Management

Threats to the crissal thrasher's continued occurrence within the Plan Area include the loss of Habitat to agriculture and urbanization, groundwater overdraft that reduces available water for honey mesquite; water diversions that reduce water availability; Habitat modification for flood control at the Whitewater River delta; tamarisk infestations which degrade and dry up desert saltbush scrub, mesquite bosque, and mesquite hummocks Habitat; and significant fragmentation of available Habitat. Fragmentation increases edge effects, including predation from domestic pets, road mortality, and exotic species invasions. Brown-headed Cowbirds are not known to pose a threat to crissal thrasher. Even with appropriate Habitat management practices, the crissal thrasher population within the Plan Area is small and will probably require immigration from Habitats outside the area being addressed in this Plan to maintain long-term viability.

The following actions may be needed to ensure species persistence and long-term viability if biological monitoring indicates that such actions are warranted. This list is not comprehensive but identifies some of the known or likely threats to this species. More detailed information on the Management and Monitoring Programs can be found in Section 8.0. Actions may include:

1. Evaluate the impacts of groundwater management on crissal thrasher Habitat, particularly mesquite areas, to determine if the water sources for this Habitat are adequately protected or if additional water sources may be needed.
2. Control invasive species if it is determined from the monitoring results that they impact thrasher Habitat. This may include cooperation with the Dos Palmas Ecosystem Management Plan.
3. Schedule activities that may cause disturbance to nesting crissal thrashers to avoid the breeding season from January 15 through June 15 or until the young have fledged.
4. Establish a research element as part of the Monitoring Program that addresses the distribution of the species, its home range size, dispersal distances and barriers to dispersal, and its population density throughout the Plan Area.

## 9.7.5.3 Species Conservation Analysis

**Conservation Area Reserve Design**. The distribution of Habitat for the crissal thrasher is quite patchy, particularly in the vicinity of the Salton Sea where areas occupied by mesquite hummocks and desert saltbush scrub are highly fragmented. The MSHCP Reserve System includes areas of contiguous mesquite hummocks Habitat at Willow Hole and the Thousand Palms Preserve, and mesquite hummocks, arrowweed scrub, and desert saltbush scrub Habitat at Dos Palmas and the Whitewater River delta area.

The Planning Team did not attempt to assess population status as a means of identifying Core Habitat for this species. Instead, the Plan includes the largest acreages of contiguous mesquite hummocks, desert saltbush scrub, and desert sink scrub Habitat available in the Plan Area, primarily in the Dos Palmas and Coachella Valley Stormwater Channel and Delta Conservation Areas. In particular, the Coachella Valley Stormwater Channel and Delta Conservation Area was configured to include the maximum amount of Habitat for crissal thrashers; this included intact stands of desert saltbush scrub and desert sink scrub in the area around Johnson Street south of Highway 111. For each area, see Table 9-22 for a breakdown of Existing Conservation Lands and remaining lands to be conserved.

***Core Habitat Areas:***

1. ***Dos Palmas.*** The Dos Palmas area includes approximately 536 acres that have been delineated, based on vegetation, as modeled Habitat for the crissal thrasher. The Plan will conserve approximately 498 acres of the Core Habitat in this Conservation Area. The presence of both mesquite hummocks and desert saltbush scrub make this area particularly suitable for this species. Additional information on crissal thrasher occurrence and distribution is still needed for this Conservation Area.
2. ***Coachella Valley Stormwater Channel and Delta.*** There are approximately 896 acres of modeled Habitat for this species within this Conservation Area, of which the Plan will conserve approximately 809 acres. The Habitat in this Conservation area is narrow with a high edge to area ratio. More information is needed on the distribution of the crissal thrasher here.

# *9.8.1* Southern Yellow Bat *Lasiurus ega*

**Status** **Federal:** **No official status**
**State:** **Species of Special Concern**

## 9.8.1.1 Species Conservation Goals and Objectives

Conserve and manage populations within the MSHCP Reserve System according to the following criteria:

Goal 1: Conserve existing, naturally occurring, occupied Habitat and additional potential Habitat (presumed to be occupied), and associated Essential Ecological Processes, allowing evolutionary processes and natural population fluctuations to occur. Minimize fragmentation, human-caused disturbance, and edge effects to Core Habitat by conserving contiguous Habitat patches and effective Linkages between patches of Core Habitat.

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Objective 1. Ensure conservation of the natural community that this species depends on, desert fan palm oasis woodland, within the following Conservation Areas:

- Whitewater Canyon Conservation Area
- Willow Hole Conservation Area
- Thousand Palms Conservation Area
- Indio Hills Palms Conservation Area
- Joshua Tree National Park Conservation Area
- Mecca Hills/Orocopia Mountains Conservation Area
- Dos Palmas Conservation Area
- Santa Rosa and San Jacinto Mountains Conservation Area

Please refer to Section 4.3 and Table 9-29 for specific acreages to be protected by this Conservation Objective.

Goal 2: Protect Essential Ecological Processes, including hydrological regimes, necessary to maintain desert fan palm oasis woodland and Other Conserved Habitat for this species.

Objective 2. Ensure protection of Essential Ecological Process areas through Conservation Area Conservation Objectives for Essential Ecological Processes.

Goal 3: Ensure conservation of southern yellow bat by maintaining the long-term persistence of self-sustaining populations and conserving Habitat quality through biological monitoring and Adaptive Management actions in the Plan Area.

Objective 3. Implement biological monitoring and Adaptive Management to ensure persistence of the yellow bat in the Plan area.

## 9.8.1.4 Take Analysis

Significance of the Plan Area to Southern Yellow Bat

The southern yellow bat occurs in extreme southeastern California, the southwest to Texas and the northwestern portion of Mexico, including Baja (Burt and Grossenheider 1976). In California this bat, also known as the southwestern yellow bat, is known only from Riverside, Imperial, and San Diego Counties south to the Mexican border. It has been recorded below 2000 feet (600 meters) in valley foothill riparian, desert riparian, desert dry wash woodland, and palm oasis Habitats (CDFG 1988-1990). Due to a lack of data, the breeding status of the yellow bat in California is uncertain. The southern yellow bat is a California Species of Special Concern although it has no official federal status. Its range may be expanding due to the use of palm trees for landscaping.

The yellow bat is believed to occur throughout the Coachella Valley in palm oases and in residential areas with untrimmed palm trees. There is no estimate of the population size of this species in the Plan Area. However, the Coachella Valley is probably very important to this species, as it has a significant number of the native palm oases in southeastern California. While very few surveys have been conducted for the species in the Plan Area, it is known to occur at the Thousand Palms Preserve (K. Nicol, pers. comm.), Dos Palmas Preserve/ACEC (C. Barrows, pers. comm.), and on the Applegarth Ranch (K. Nicol, pers. comm.) in the Thermal area.

Effects of Take on the Southern Yellow Bat

The focus of Conservation efforts for the southern yellow bat is to ensure conservation of a primary Habitat area, the desert fan palm oases. The Plan ensures the long-term Conservation including Habitat protection, management, and monitoring for southern yellow bat. It includes Conservation of Essential Ecological Processes, including the hydrological regimes that support desert fan palm oases.

There are 1,329 acres of modeled Habitat for the southern yellow bat within the Plan Area. Core Habitat was not designated for this species. The Plan would ensure Conservation of a total of 1,250 acres (94%) of the modeled Habitat or Other Conserved Habitat for southern yellow bat. Approximately 660 acres (50%) of the modeled Habitat are within Existing Conservation Lands and would be managed as part of the Reserve System. The Plan would conserve an additional 590 acres (44%) of the modeled Habitat for southern yellow bat in the Plan Area. There are three known locations for this species, two of which are on Existing Conservation Lands within the Conservation Areas. The third known location is in a palm oasis on land held for conservation by a non-profit land trust.

Within the Conservation Areas under the worst case scenario, 66 acres of Take of modeled southern yellow bat Habitat (5%) could occur (See Table 9-29 and Table 4-114). Take of southern yellow bat Habitat within the Conservation Areas must be consistent with the Conservation Objectives for this species to: 1) ensure Conservation of existing occupied Habitat and additional potential Habitat; 2) protect Essential Ecological Processes including hydrological regimes needed to maintain desert fan palm oasis woodlands as southern yellow bat Habitat; 3) implement biological monitoring and Adaptive Management to ensure Conservation of Habitat quality and long-term persistence of this species. So, although some Take could occur within the additional 44% of the occupied and potential Habitat for this species. To address specific impacts to desert fan palm oasis woodlands, which provide Habitat for southern yellow bat, the Plan requires Conservation of this natural community in the Whitewater Canyon, Willow Hole, Thousand Palms, Indio Hills Palms, Joshua Tree National Park, Mecca Hills/Orocopia Mountains, Dos Palmas, and Santa Rosa and San Jacinto Mountains Conservation Areas. The Conservation Areas include 2 of the 3 known occurrences for this bat. The third known occurrence is on privately held conservation land outside the Conservation Areas.

Additionally, the Plan calls for Management and Monitoring Programs to ensure the Conservation of this species, including control of activities that degrade southern yellow bat Habitat, control of invasive species if monitoring results indicate it is necessary, and restoration and enhancement of degraded Habitat as necessary according to monitoring results. The Plan calls for evaluation of groundwater management on southern yellow bat Habitat in mesquite areas as described in Section 9.7.5.2. The Plan also provides for data gathering as part of the Monitoring Program that addresses the distribution and Habitat parameters of this little known bat species throughout the Plan Area.

<u>Overall Impacts to Southern Yellow Bat</u>

Under the Plan, 94% of the approximately 1,329 acres of naturally occurring Habitat of the species in the Plan Area will be conserved. The conserved area includes all of the known occupied, naturally-occurring Habitat. It should be noted that a significant amount of potential Habitat occurs on the Agua Caliente Indian Reservation and is not part of this Plan. The Agua Caliente Band of Cahuilla Indians is preparing its own MSHCP, and potential conservation on reservation lands will be addressed in that plan. Under the Plan, Take would be permitted on 82 acres, or 6%, of the naturally occurring Habitat outside the Conservation Areas.

Implementation of the Plan will maintain and enhance population viability of the southern yellow bat by conserving its palm oasis Habitat, providing increased study of the ecology of the species, and by encouraging private landowners to manage potential Habitat in landscaped areas to maintain Habitat values.

## 9.8.1.5 Species Account: Background

**<u>Distribution, Abundance, and Trends</u>**. The southern yellow bat roosts in trees, primarily palm trees. It appears to prefer the dead fronds of palm trees. It feeds on flying insects such as beetles and true bugs, and forages over water and among trees. This species is thought to be non-colonial, although aggregations of up to 15 have been found in the same roost site. Yellow bats probably do not hibernate; activity has been observed year-round in both the southern and northern portions of the range. This species probably forms small maternity groups in trees and palms. Pregnancy occurs from April to June, with lactation occurring in June and July. Females carry from one to four embryos. In Texas, bat pups have been found on fronds that have been trimmed from trees (Mirowsky 1997). There is very little information available on the life history of this species.

**<u>Associated Covered Species</u>**. Because riparian birds may also use palm oases in migration, protection of the oases for the southern yellow bat may benefit least Bell's vireo, southwestern willow flycatcher, yellow-breasted chat, summer tanager, and yellow warbler.

# *9.8.2* Coachella Valley Round-Tailed Ground Squirrel *Spermophilus tereticaudus chlorus*

**Status** **Federal:** **Candidate**
**State:** **Species of Special Concern**

## 9.8.2.1 Species Conservation Goals and Objectives

Conserve and manage populations within the MSHCP Reserve System according to the following criteria:

Goal 1: Protect Core Habitat areas that include occupied Habitat, and associated Essential Ecological Processes, allowing evolutionary processes and natural population fluctuations to occur. Minimize fragmentation, human-caused disturbance, and edge effects to Core Habitat by conserving contiguous Habitat patches and effective Linkages between patches of Core Habitat.

Objective 1. Ensure conservation of Core Habitat within the following Conservation Areas:
- ❖ Snow Creek/Windy Point Conservation Area
- ❖ Whitewater Floodplain Conservation Area
- ❖ Willow Hole Conservation Area
- ❖ Thousand Palms Conservation Area

Please refer to Section 4.3 and Table 9-30 for specific acreages to be protected by this Conservation Objective.

Goal 2: Protect Other Conserved Habitat to provide sufficient area and variety of Habitat types to accommodate for population fluctuations, allow for and genetic diversity, and to conserve the range of environmental conditions within which this ground squirrel is known to occur.

Objective 2. Conserve Other Conserved Habitat for this ground squirrel through adherence to other Conservation Objectives (for another species, a natural community, Essential Ecological Process area, Biological Corridor, or Linkage area) in the following Conservation Areas:
- ❖ Cabazon Conservation Area
- ❖ Stubbe and Cottonwood Canyons Conservation Area
- ❖ Whitewater Canyon Conservation Area
- ❖ Highway 111/I-10 Conservation Area
- ❖ Upper Mission Creek/Big Morongo Canyon Conservation Area
- ❖ Edom Hill Conservation Area
- ❖ Thousand Palms Conservation Area
- ❖ Indio Hills/Joshua Tree National Park Linkage Conservation Area
- ❖ Indio Hills Palms Conservation Area
- ❖ East Indio Hills Conservation Area

12. ***Dos Palmas.*** The Dos Palmas area includes approximately 4,490 acres that have been delineated, based on soil types and vegetation, as modeled Habitat for the Coachella Valley round-tailed ground squirrel, of which the Plan will conserve 4,304 acres. The closest known occurrence is from an observation by Robert McKernan (pers. comm.) in the vicinity of the Coachella Canal west of Dos Palmas, outside this Conservation Area. More distribution and occurrence data would be necessary to confirm the potential for this area to constitute Core Habitat.

13. ***Coachella Valley Stormwater Channel and Delta.*** There are approximately 211 acres of modeled Habitat for this species within this Conservation Area, of which the Plan will conserve approximately 192 acres. Known occurrences of this species in this Conservation Area include an observation from July 2001 by Ken Corey (2001) of USFWS. The Habitat in this Conservation area is narrow with a high edge to area ratio. More information is needed on the distribution of the Coachella Valley round-tailed ground squirrel here.

14. ***Santa Rosa and San Jacinto Mountains.*** There are approximately 1,328 acres of modeled Habitat for this species within this Conservation Area, of which the Plan will conserve approximately 1,193 acres. Most of the modeled Habitat for this ground squirrel is located in the Snow Creek/Windy Point Conservation Area where bighorn sheep Habitat overlaps the sand dune areas.

15. ***Other Conservation Areas.*** There are three Conservation Areas with very limited Coachella Valley round-tailed ground squirrel Habitat, Indio Hills Palms with 145 acres, Joshua Tree National Park with 2 acres, and Desert Tortoise and Linkage with 43 acres.

## 9.8.2.4 Take Analysis

<u>Significance of the Plan Area to Coachella Valley Round-Tailed Ground Squirrel</u>

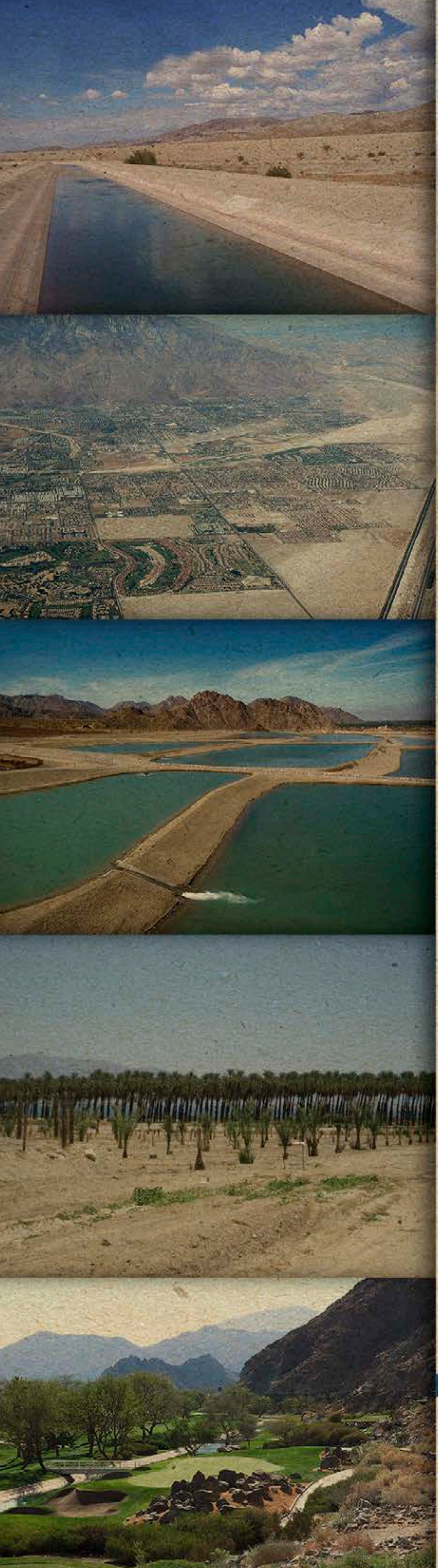
The Coachella Valley round-tailed ground squirrel is a subspecies of the more widely distributed round-tailed ground squirrel (*Spermophilus tereticaudus)* that inhabits desert areas of the southwestern United States and northwestern Mexico.

The Plan Area includes all of the known range for the Coachella Valley subspecies of the more widely distributed round-tailed ground squirrel. This subspecies is endemic to the Plan Area. The Coachella Valley round-tailed ground squirrel is a candidate for listing under FESA and is considered a species of special concern by the State of California. The Coachella Valley round-tailed ground squirrel is associated with sandy substrates, including sand areas within creosote bush and alkali sink scrub (Ingles 1965) and mesquite hummocks. The range for this subspecies essentially corresponds with the valley floor of the Coachella Valley. Within the Plan Area, the current and historical distribution for the Coachella Valley round-tailed ground squirrel is from San Gorgonio Pass to the vicinity of the Salton Sea (Grinnell and Dixon 1918, Hall 1981). Individuals of this species have been observed at the south end of La Quinta near Jefferson Avenue and along the Coachella Canal near Box Canyon. The range of this species in the eastern part of the Plan Area is not well known.

protected in the following Conservation Areas: Cabazon, Stubbe and Cottonwood Canyons, Whitewater Canyon, Highway 111/I-10, Upper Mission Creek/Big Morongo Canyon, Mission Creek/Morongo Wash, Edom Hill, Indio Hills/Joshua Tree National Park Linkage, Indio Hills Palms, East Indio Hills, Joshua Tree National Park, Desert Tortoise and Linkage, Mecca Hills/Orocopia Mountains, Dos Palmas, Coachella Valley Stormwater Channel and Delta, and the Santa Rosa and San Jacinto Mountains. Reserve Design criteria used to establish the Conservation Areas require Conservation of Essential Ecological Processes. The MSHCP Reserve System will incorporate and protect additional sand source/sand transport areas for Snow Creek/Windy Point, the Whitewater Floodplain Conservation Area, Willow Hole and Flat Top Mountain, and the Thousand Palms Preserve.

Additionally, the Plan calls for Management and Monitoring Programs to ensure the Conservation of this species, including control of activities that degrade ground squirrel Habitat, control of invasive species where necessary, and restoration and enhancement of degraded Habitat as necessary according to monitoring results. The Plan also calls for a research element that addresses the distribution, abundance, and Habitat parameters of the Coachella Valley round-tailed ground squirrel throughout the MSHCP Reserve System.

Coachella Valley round-tailed ground squirrel Habitat occupancy rates are substantially higher in mesquite hummocks than other Habitat types (Center for Conservation Biology, University of California, Riverside 2004, L. Ball, pers. comm.). It is therefore desirable to preserve the mesquite hummock areas. Substantial stands of mesquite hummocks and dunes are conserved within the Willow Hole and Thousand Palms Conservation Areas. The Plan includes provisions relative to Conservation of mesquite hummocks to: 1) monitor groundwater to determine whether substantial lowering of the water table occurs. Should monitoring detect such a substantial lowering, appropriate Adaptive Management actions will be taken (See Section 8.0); 2) monitor groundwater levels in the Willow Hole and Thousand Palms Conservation Areas and ameliorate the effects of substantial lowering of the water table on mesquite hummocks and associated Covered Species as a Changed Circumstance; 3) as a Permittee, CVWD will enhance and manage Coachella Valley round-tailed ground squirrel Habitat on land it owns in the East Indio Hills Conservation Area to mitigate and provide for the conservation of impacts to this species from CVWD's operation and management activities in the Coachella Valley Stormwater Channel and Delta Conservation Area. (See Section 4.3.16 for additional details). CVWD will restore and enhance mesquite and Coachella Valley round-tailed ground squirrel Habitat on site in the East Indio Hills Conservation Area if a study determines restoration to be feasible; 4) the potential for mesquite hummock restoration and enhancement will be evaluated through monitoring and Adaptive Management and will be considered in the context of Conservation Objectives for all Covered Species and natural communities.



CVRWMG
Coachella Valley
Regional Water Management Group

Final
Volume I: IRWM Plan Chapters

# 2014 Coachella Valley Integrated Regional Water Management Plan

*Plan Prepared by:*
*Coachella Valley Regional Water Management Group*
*In collaboration with the Planning Partners*

February 2014

City of Coachella | Water District | MSWD Mission Springs Water District | Desert Water | Indio Water Authority

**Final**

# Coachella Valley Integrated Regional Water Management Plan Update

**February 2014**

Prepared by:

**Coachella Valley Regional Water Management Group**

***In collaboration with the Planning Partners***

City of Coachella · Coachella Valley Water District · Desert Water · Indio Water Authority (Your Water. Our Responsibility.) · MSWD Mission Springs Water District

With Support from:

RMC Water and Environment

and

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Generating Value Through Integration



# 2 Region Description

*This chapter complies with the **Region Description Standard** by documenting that the IRWM planning region is defined by the combination of the water systems being managed; common water issues; and that there is sufficient variety of interested parties included in the planning region. As a region receiving water from the Sacramento-San Joaquin Delta, the chapter also discusses how the efforts in the region will help reduce additional future dependence on Delta supplies.*

This chapter provides a comprehensive overview of the Coachella Valley IRWM region, building from the information included within the Region Acceptance Process (RAP) and the 2010 IRWM Plan. This chapter also describes climate change in a legislative context, and discusses potential implications of climate change.

The Coachella Valley IRWM region (Region) is chiefly the same as the Whitewater River watershed and is also known as the Coachella Valley (refer to **Figure 1-1**). The Region's watershed boundaries to the north and west are the rugged, barren mountain ranges of the Colorado Desert, San Bernardino Mountains, Little San Bernardino Mountains, and Mecca Hills. The watershed boundaries to the east are Mortmar, the Salton Sea, and Travertine Rock. The eastern boundary is defined by the watershed that encloses all surface drainage emptying into the north end of the Salton Sea. The Salton Sea is not within the IRWM region. The southernmost boundary follows the shoreline of the Salton Sea southward to include the political boundary of the Salton Community Services District (SCSD), and then follows the SCSD political boundary north to the watershed divide. The watershed boundaries to the south and west are the high precipitous Santa Rosa Mountains and San Jacinto Mountains, which create an effective barrier against the easterly moving coastal storms. The western boundary is composed of a political line that separates Desert Water Agency (DWA) and Mission Springs Water District (MSWD) from San Gorgonio Pass Water Agency.

The Coachella Valley is geographically divided into the East Valley and the West Valley. The boundary between the East Valley and West Valley extends from Washington Street and Point Happy northeast to the Indio Hills near Jefferson Street. The East Valley is considered the area southeast of the boundary line, and the West Valley is northwest of the boundary line (refer to **Figure 2-1**). The geographic divide between East Valley and West Valley is widely used for water resources planning purposes, because the Region's geology varies between the East Valley and West Valley. The West Valley is generally underlain by coarse-grain sediments that allow surface water to percolate to the Region's groundwater basins. In contrast, the East Valley is underlain by several impervious clay layers (an aquitard) that impedes groundwater recharge.

Coachella Valley is located in central Riverside County, although small portions of the Region also lie within San Bernardino, San Diego, and Imperial

### *Colorado River Supply via Coachella Canal*

Colorado River water supplies have been secured by a series of interstate compacts and federal legislation known as the *Law of the River* (CVWD 2010). To quantify its secure Colorado River water allocations, CVWD entered into the Quantification Settlement Agreement (QSA) and twelve related agreements with Imperial Irrigation District, MWD, San Diego County Water Authority, the State of California, and the U.S. Department of the Interior. The QSA enables California to reduce its historic overdependence on Colorado River water to its 4.4 million acre-foot basic annual apportionment through agriculture-to-urban water transfers and other water supply programs. The QSA quantifies CVWD's Colorado River water allotment of 459,000 AFY by 2026.

The Coachella Canal originates 20 miles west of Yuma, Arizona at "Drop 1" of the All American Canal and conveys Colorado River water 123 miles northwest along the western boundary of the Coachella Valley IRWM region to a man-made storage reservoir, Lake Cahuilla. The Coachella Canal conveys flow by gravity and is concrete-lined to prevent seepage loss. The Canal water provided by the Coachella Canal is considered an important part of the Region's groundwater management plan as it provides non-potable water that helps reduce groundwater overdraft via in-lieu groundwater pumping. Along its route, the Coachella Canal distributes non-potable Colorado River water for irrigation to approximately 73,000 acres of agricultural land in the eastern Coachella Valley through nearly 500 miles of buried delivery laterals. The Coachella Canal also provides non-potable irrigation water to several Coachella Valley golf courses along the canal and via the Mid-Valley Pipeline. Lake Cahuilla, at the terminus of the Coachella Canal, was built by CVWD in 1968 to provide operational storage for imported Colorado River water.

Further information about the Mid-Valley Pipeline and the Region's non-potable water system are provided below in *Section 2.2.4*.

## Surface Water

Surface waters of the Coachella Valley IRWM region consist of the Whitewater River Stormwater Channel (WRSC) and principal tributaries to the WRSC, including the San Gorgonio River, Snow Creek, Falls Creek, Chino Creek, Mission Creek, Morongo Creek, Tahquitz Creek, Andreas Creek, Palm Canyon Wash, Deep Canyon Creek, and the Palm Valley Channel. The WRSC and the majority of its tributaries are ephemeral streams, and are normally dry. Surface water from the above-mentioned creeks and rivers is almost entirely put to a beneficial use, such as groundwater recharge. East of Washington Street the WRSC becomes a man-made channel to convey stormwater and flood flows safely through the East Valley to the Salton Sea. This portion of the stormwater channel is referred to as the Coachella Valley Stormwater Channel (CVSC). Due to the aquitard present in the eastern Coachella Valley, surface water flows from rainwater and irrigation runoff in the East Valley do not recharge the groundwater basin, but rather flow into the CVSC and ultimately to the Salton Sea.

DWA receives about 5 percent of its water supply (or 5,900 AFY) through surface water sources, including Chino Creek, Snow Creek, and Falls Creek. These creeks are all tributary to the Whitewater River. CVWD also conveys mountain runoff from the Whitewater River Canyon near Windy Point to the Whitewater Spreading Facility for groundwater recharge. In addition, the Agua Caliente Band of Cahuilla Indians may divert surface water supplies from Tahquitz Creek, Andreas Creek, and the Whitewater River. Surface water that is not diverted by the tribe is put to beneficial use, such as groundwater recharge.

The health care industry has been strong, even through the recession; jobs in Coachella Valley increased from 10,795 in 2007 to 12,120 in 2011, up 12.3 percent (CVEP 2012). In 2012, Coachella Valley continues to see a mixed picture in the housing sector. While the existing home market has performed modestly well, the Coachella Valley continues to have problems with new home construction and sales, however, in the long-term, housing units are likely to increase. For example, in the City of Coachella, housing units are anticipated to increase to 28,132 in 2035 from 6,624 in 2005 (CWA 2011).

The region has a relatively small share of its employment in manufacturing, finance, and professional services as compared to the national share. Construction jobs, which were once one of the larger employment sectors in the Coachella Valley, have declined by 5,842 between 2000 and 2011 (CVEP 2012).

The economic profile of Coachella Valley varies throughout the Region. While some communities within the Region have annual median household income (MHI) similar to statewide values, the Coachella Valley has several disadvantaged communities (DACs). Please refer to *Chapter 4, Disadvantaged Communities* for detailed information regarding the economic composition and geographic location of DACs within the Coachella Valley. In 2010, the share of families living in poverty in the Coachella Valley ($22,314 for a family of four) averaged 15.7 percent, up from 13.8 percent in 2009 (CVEP 2012). Poverty levels varied from 24.5 percent in Coachella to 2.3 percent in Indian Wells. In this period, the share of the valley's children in poverty averaged 35.8 percent, up from 29.2 percent; it ranged from 48.9 percent in Indio to 5.1 percent in Indian Wells. The estimated 2010 annual median household income is $36,326 in the City of Desert Hot Springs, $44,728 in the City of Palm Springs, and $45,693 in the City of Cathedral City (CVWD et al. 2013).

## Disadvantaged Communities

As described above, economically disadvantaged communities are defined as those communities earning 80% or less than the statewide MHI. U.S. Census data has been used to determine location of DACs and their populations in the Region, but there remain disputes over the accuracy of such data in the Coachella Valley. Planning Partners and local non-profits who work closely with DACs, as well as members of DACs themselves, indicated during the DAC Outreach Program (see *Chapter 4, Disadvantaged Communities* and **Volume II**) that existing DAC maps, based on U.S. Census data, are not accurate. In particular, it is unlikely that U.S. Census data accurately characterizes the rural portions of eastern Coachella Valley, due to lack of access, lack of knowledge of the existence of some communities, and a disinclination by residents to participate in government-administered surveys. Across the Coachella Valley, DAC population density tends to be low, reflecting the rural nature of many of the DACs in the region. For some residents, new development near existing DACs extends municipal water, sewer, and other services to their communities, which also increases cost of living through service charges. The increased cost of living can drive low-income residents to seek more affordable housing, and can lead to a push of low-income residents out of urbanized areas and into more rural communities. As described in *Chapter 4, Disadvantaged Communities*, many of the DACs in the Coachella Valley are populated by immigrants or first-generation families, and language barriers are common. Those DAC residents that are not fluent in English generally speak Spanish. Detailed information on DACs can be found in *Chapter 4, Disadvantaged Communities*, and in **Volume II**.

## Tribes

Most lands within the Coachella Valley are either private lands, public lands administered by the U.S. Bureau of Land Management, or Native American tribal lands. Major Native American reservation lands include (see **Figure 2-14**):

(http://www.ceres.ca.gov/ceqa/guidelines/). The CEQA Guidelines are not prescriptive; rather they encourage lead agencies to consider many factors in performing a CEQA analysis, and maintain discretion with lead agencies to make their own determinations based on substantial evidence.

### Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water

DWR, in collaboration with the State Water Resources Control Board (SWRCB), other state agencies, and numerous stakeholders, has initiated a number of projects to begin climate change adaptation planning for the water sector. In October 2009, DWR released the first state-level climate change adaptation strategy for water resources in the U.S., and the first adaptation strategy for any sector in California. Entitled *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water*, the report details how climate change is currently affecting the state's water supplies, and sets forth ten adaptation strategies to help avoid or reduce climate change impacts to water resources.

Central to these adaptation efforts will be the full implementation of IRWM plans, which address regionally-appropriate management practices that incorporate climate change adaptation. These plans will evaluate and provide a comprehensive, economical, and sustainable water use strategy at the watershed level for California.

### Executive Order S-13-08

Given the potentially serious threat of sea level rise to California's water supply and coastal resources, and the subsequent impact it would have on our state's economy, population, and natural resources, Governor Schwarzenegger issued EO S-13-08 to enhance the state's management of climate impacts from sea level rise, increased temperatures, shifting precipitation, and extreme weather events.

### California Climate Adaptation Strategy

In response to the passage of EO S-13-08, the Natural Resources Agency wrote the report entitled *2009 California Climate Adaptation Strategy* (CAS), to summarize the best known science on climate change impacts in the state, to assess vulnerability, and to outline possible solutions that can be implemented within and across the state agencies to promote resilience to climate change.

### GHG Reporting Rule

While California has taken the lead in climate change policy and legislation, there have been several recent important developments at the federal level. On September 22, 2009, USEPA released its final GHG Reporting Rule (Reporting Rule). Starting in 2010, facility owners that emit 25,000 metric tons of $CO_2e$ or more per year are required to submit an annual GHG emissions report with detailed calculations of facility GHG emissions. These activities will dovetail with the AB 32 reporting requirements in California.

## 2.8.2 Implications of Effects of Climate Change

Coachella Valley imports a majority of its water supply in order to satisfy regional demands. Of the five water purveyors, CVWD and DWA are both SWP contractors and retailers. Annual SWP water supplies delivered to state water contractors (either directly or via exchange agreements as occurs in the Coachella Valley) will depend on the amount of rainfall, snowpack, runoff, water storage, pumping capacity from the Delta, and water demand. Water delivery reliability will thus depend on three major factors: the availability of water at the source; the ability to convey water from the source to delivery points; and the magnitude of demand for water. The availability of the water source will be dependent on the amount of snowpack and water use in the source area. The reliability of the water source may also be contingent on the additional stressors that result from possible temperature increases.

Research on recent California climate variability indicates that the state has been warming at a rate of 0.13°C per decade (U.S. Global Change Research Program 2010). Temperature increases are expected to modify rainfall and runoff, which may in turn affect SWP operations. Precipitation patterns are unpredictable and thus warmer climate can produce wetter *and* drier conditions. Changes in the regional and seasonal distribution of precipitation could cause the most damage. For the SWP, the size of the April 1 snowpack in the Feather River watershed and the storage in Lake Oroville are key components of the annual estimation of the SWP's delivery capabilities from April through September. By and large, increased temperatures due to climate change may reduce the snowpack at a faster rate, thereby releasing snowmelt water earlier than anticipated. This could potentially make water resource areas more susceptible to flooding in the late winter and early spring, quickly depleting water sources for the later seasons when water is crucial (summer and fall). The reliability of water from the source is therefore hindered by any drastic modification of rainfall patterns. Water demand close to the water source could also be expected to increase, creating a domino effect of diminishing water availability and reliability to any SWP contractors downstream; thus possibly leading to water shortages for the Valley. The reliability of SWP water supply is expected to be reduced for the range of future climate projections studied.

Outside of the SWP, the Coachella Canal allows CVWD to provide approximately 300,000 acre-feet per year of Colorado River water to over 1,100 non-potable customers, which mostly consist of agricultural and golf course uses. Past climate records based on changes in spring snowpacks and Colorado River flows indicate that drought is a frequent feature of the Southwest, which includes Coachella Valley, with some of the longest documented "megadroughts" on Earth (U.S. Global Change Research Program 2010). Coachella Valley's arid climate is likely to experience a drier climate. This could lead to an increase in drought (either frequency or duration) because drought is strongly driven by changes in precipitation (U.S. Global Change Research Program 2010). To further complicate the situation, Coachella Valley's population and urban areas are continuing to grow (refer to *Section 2.4 Water Supplies and Demand* for future population projections). The number of customers is estimated to increase and associated water use will grow, leading to greater water supply challenges.

Groundwater will be less directly and more slowly impacted by climate change, as compared to surface water sources. This is because rivers get replenished on a shorter time scale, and drought and floods are quickly reflected in surface water levels. Groundwater, on the other hand, will be affected much slower. Only after prolonged droughts or overdraft conditions will groundwater levels show declining trends. Groundwater pumping in Coachella Valley is already exceeding recharge rates and experiencing overdraft. Continued groundwater pumping at current rates could further decrease water tables and concurrently, reduced recharge associated with climate change could add to the growing problem with groundwater sustainability.

As vulnerability analysis tools become available, this description of potential climate change effects will be updated. Refer to *Chapter 8, Resource Management Strategies, Section 8.5 Adapting Resource Management Strategies to Climate Change* for information regarding climate change adaptation and mitigation.

# 4 Disadvantaged Communities

*This chapter addresses the needs and priorities of the Coachella Region's Disadvantaged Communities (DAC) and consolidates all the various areas of the IRWM planning that relates to DAC issues into this chapter.*

The Coachella Valley Water District (CVWD), representing the Coachella Valley Regional Water Management Group (CVRWMG), entered into a contract with the Department of Water Resources (DWR) to develop a Disadvantaged Community (DAC) Outreach Demonstration Program (DAC Outreach Program) for the Coachella Valley Integrated Regional Water Management Region (Region).

The DAC Outreach Program was implemented from 2012 to 2013 and had the overall purpose of developing and implementing methods to improve DAC participation in the Coachella Valley IRWM process. In addition, the DAC Outreach Program scope included preparing this DAC chapter of the 2014 IRWM Plan Update, which consolidates all the various areas of the IRWM planning that relate to DAC issues.

The DAC Outreach Program is included in Volume II of the IRWM Plan. Volume II also includes a series of appendices containing the results of the DAC Outreach Survey (see Section 4.3.4, below), mapping efforts, DAC demonstration projects (described in Section 4.4, below), and other materials developed in support of the DAC Outreach Program and to improve regional understanding of DACs in the Region. When referencing material or appendices contained in Volume II of the IRWM Plan, text will say "Volume II" and "Appendix VII," respectively. Volume II of the IRWM Plan is designed to act as a stand-alone DAC-focused resource for stakeholders.

## 4.1 History

The CVRWMG agencies have interacted and coordinated with economically disadvantaged communities for a long time. Some of the CVRWMG agencies such as Mission Springs Water District (MSWD) are almost completely within DAC areas. For others, significant areas within their boundaries are DAC areas but by no means do DACs cover their entire service area. No IRWM region in the State is completely without at least small areas that are DACs.

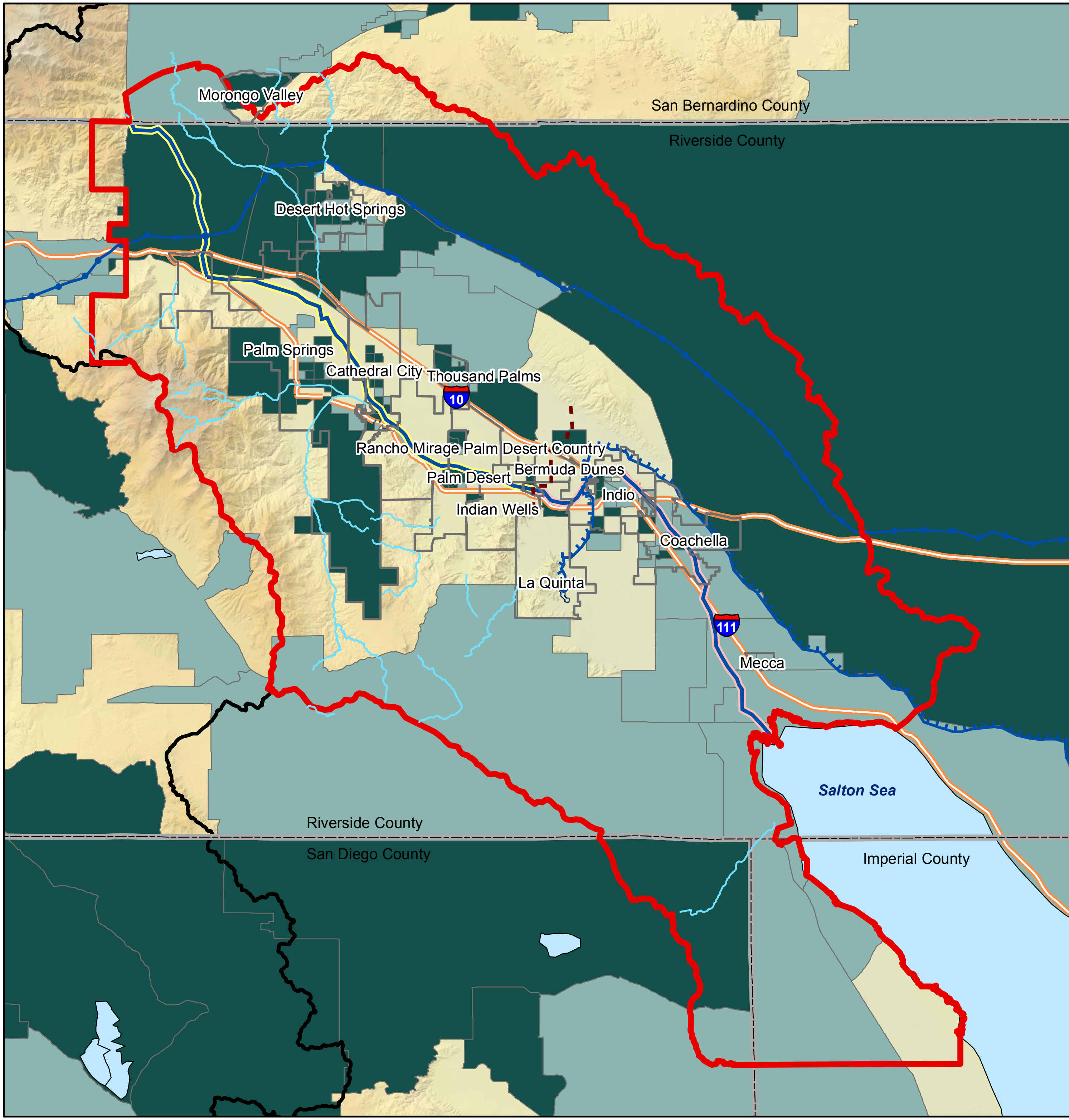
### 4.1.1 Past Outreach

Realization that the Region contained many DACs and those DACs had substantial water-related needs along with other early efforts, such as Coachella Valley Water District's Highway 86 Domestic Water Transmission Main to extend water service to DACs in the eastern Coachella Valley (see below for more information), resulted in the request by the Region to DWR for DAC assistance in 2009.

In addition to IRWM-specific efforts, groups and organizations that work in and represent DACs were also working on solving problems in cooperation

# Coachella Valley Disadvantaged Communities (2010 Census)

## Figure 4-7




- Division between West and East Valley
- Colorado River Aqueduct
- Coachella and All American Canals
- Whitewater River Storm Water Channel
- Coachella Valley Storm Water Channel
- Highways
- Water Bodies
- City
- Coachella Valley IRWM Region
- Colorado River Funding Area

**Disadvantaged Community (DAC)**

- $0 - $36,530 (Severely DAC)
- $36,530 - $48,706 (DAC)

**Source: 2010 U.S. Census Data - American Community Survey Median Household Income (MHI), by block group. DACs are defined as having MHI of 80% of Statewide MHI. For 2010, DACs were households earning $48,706 or less per year. Severely DAC are areas with MHI 60% or less of Statewide MHI. Severely DACs earn less than $36,531 in 2010.**

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Date Updated: Thursday, October 31, 2013
Department: RMC Water & Environment

**Table 4-5: Focus Area Select Statistics**

| Focus Area | Population | House -holds | HH Size | Acres | Density Res/Acre | MHI | Owner % | Renter % | Median Age |
|---|---|---|---|---|---|---|---|---|---|
| White Water | 859 | 312 | 2.8 | 6,318 | 0.14 | $39,375 | 73% | 27% | 40 |
| Desert Hot Springs | 25,938 | 8,650 | 3.0 | 15,131 | 1.71 | $36,326 | 50% | 50% | 31 |
| Garnet | 7,543 | 2,174 | 3.5 | 7,312 | 1.03 | $32,132 | 64% | 32% | 32 |
| Desert Edge | 3,823 | 1,969 | 1.9 | 1,451 | 2.63 | $25,984 | 81% | 19% | 55 |
| Cathedral City | 51,000 | 17,047 | 3.0 | 13,924 | 3.66 | $45,693 | 63% | 37% | 36 |
| Sky Valley | 2,406 | 1,064 | 2.3 | 15,533 | 0.15 | $31,771 | 80% | 20% | 53 |
| Thousand Palms | 7,715 | 2,849 | 2.7 | 15,127 | 0.51 | $42,656 | 78% | 22% | 43 |
| Coachella | 40,704 | 8,998 | 4.5 | 18,528 | 2.20 | $43,012 | 62% | 38% | 25 |
| Thermal Focus Areas | 2,864 | 684 | 4.2 | 6,048 | 0.47 | $33,998 | 40% | 60% | 26 |
| Mecca Focus Area | 8,577 | 2,020 | 4.2 | 4,454 | 1.93 | $26,207 | 47% | 53% | 24 |
| Oasis Focus Area | 6,890 | 1,474 | 4.7 | 12,563 | 0.55 | $25,469 | 24% | 76% | 23 |
| North Shore | 3,477 | 750 | 4.6 | 7,153 | 0.49 | $31,591 | 65% | 35% | 24 |
| Desert Shores | 1,104 | 344 | 3.2 | 463 | 2.38 | $18,958 | 65% | 35% | 30 |
| Salton City | 3,763 | 1,204 | 3.1 | 13,715 | 0.27 | $32,805 | 70% | 30% | 34 |

While this mapping and analysis of the focus areas provides a significantly more detailed picture of the focus areas, not all disadvantaged community areas are completely included in a focus area and some focus areas include relatively more affluent areas within them. This diversity is normal and inherent to any boundary. This view of the communities is adequate to demonstrate important characters and greatly improve the IRWM Plan for DAC characterization. It was presented in several DAC and Project Partner meetings to get feedback on the process as well as the results. All comments received during the reviews were incorporated into the results presented.

### 4.3.4 DAC Outreach Survey and Mapping

Part of the DAC Outreach efforts included a survey questionnaire administered to Coachella Valley residents in May and June of 2013. Surveys were administered in both Spanish and English to improve the number of responses and better capture the concerns and issues identified by residents.

#### Opinion Survey Process Summary

The goal of the survey was to assess the topic areas of drinking water, wastewater management, and flooding in communities in the Coachella Valley that are considered severely economically disadvantaged by DWR. The survey questionnaire was administered by three non-profit organizations with Loma Linda University as the overall coordinator. El Sol Neighborhood Educational Center (El Sol) and Pueblo Unido Community Development Corporation (PUCDC) were the organizations responsible for gathering and training surveyors and administering surveys in the West Valley and the East Valley. Over 300 surveys were administered and the results were tabulated and summarized in the Disadvantaged Communities (DAC) Mapping and Characterization Project Report (see **Appendix VII-B**, for the complete report). Results summarized within this section of the IRWM Plan are from a select collection of individual questions to understand opinions and perceptions of residents.

# 6 Objectives

*This chapter addresses the **Objectives Standard** and establishes which regional conflicts and water management issues the IRWM Plan is designed to address.*

This section identifies the goals and objectives of the IRWM Plan and establishes planning targets that can be used to gauge our success in meeting the objectives for the Coachella Valley IRWM region. The goals and objectives are based on regional issues and needs that are discussed in detail in *Chapter 3, Issues and Needs.*

## 6.1 Goals and Objectives

*This section presents the IRWM Plan intent, goals, and objectives, and then explains the collaborative process and tools used to establish objectives.*

When the CVRWMG established the Coachella Valley IRWM program in September 2008, CVRWMG members articulated the following overall intent:

*"3.1.1 This MOU is to memorialize the intent of the Partners to coordinate and share information concerning water supply planning programs and projects and other information, and to improve and maintain overall communication among the Partners involved. It is anticipated that coordination and information sharing among the Partners will assist the agencies in achieving their respective missions to the overall well-being of the region"* (see **Appendix VI-C**).

Through input and discussion by the CVRWMG, Planning Partners, and other stakeholders, five regional goals were established for this IRWM Plan.

***IRWM Plan Goals***

1. Optimize water supply reliability,
2. Protect or improve water quality,
3. Provide stewardship of water-related natural resources,
4. Coordinate and integrate water resource management, and
5. Ensure cultural, social, and economic sustainability of water in the Coachella Valley.

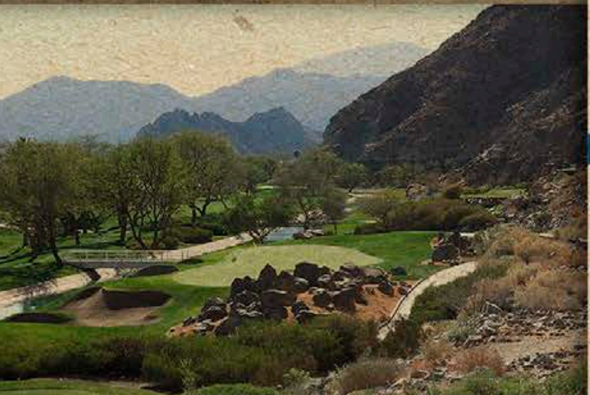
Through a series of facilitated public workshops and meetings, the CVRWMG, Planning Partners, and stakeholders developed thirteen specific IRWM Plan objectives to accomplish the five broad IRWM Plan goals. Detailed descriptions of each of the objectives are presented in the following sections along with the rationale for development and inclusion of each objective.

<table>
<tr><th>Objectives<br>Specific, observable outcomes</th><th>Targets<br>Measurable and tangible actions to achieve the objectives</th><th>Measurements<br>Measurements that can be used to evaluate progress towards meeting targets (may be qualitative or quantitative)</th><th>Location of Measurement Information in 2014 IRWM Plan</th></tr>
<tr><td>D. Maximize local supply opportunities, including water conservation, water recycling and source substitution, and capture and infiltration of runoff.</td><td>Achieve compliance with SBx77 for conservation savings</td><td>Baseline per capita water use (in gallons per capita per day or GPCD) are shown below, along with each agency's targets to reduce water demand by 2020 as required by SBx77. Compliance with SBx77 will be measured by whether agencies meet their 2015 and 2020 targets, as reported in agencies' UWMPs.[1]
<table>
<tr><th>Agency</th><th>Baseline (GPCD)</th><th>2015 Target (GPCD)</th><th>2020 Target (GPCD)</th></tr>
<tr><td>CWA</td><td>202</td><td>192</td><td>181</td></tr>
<tr><td>CVWD</td><td>591</td><td>532</td><td>473</td></tr>
<tr><td>DWA</td><td>736</td><td>663</td><td>589</td></tr>
<tr><td>IWA</td><td>283</td><td>255</td><td>226</td></tr>
<tr><td>MSWD</td><td>327</td><td>296</td><td>265</td></tr>
</table>
Source: CWA 2011; CVWD 2011; DWA 2011; IWA 2010; MSWD 2011</td><td>Total water demands are reported in Chapter 2, Region Description, Section 2.4.2 Water Demand.</td></tr>
</table>

[1] Please note that the GPCD numbers for CVWD and DWA appear high relative to the other reported GPCDs due to the conservative calculation used to derive these numbers. As discussed in *Chapter 2, Region Description*, water demands from seasonal residents are included within GPCD calculations that are used to assess water conservation targets. The GPCD calculations rely upon historic water demand data, which includes water demands from all users in the Coachella Valley (permanent and non-permanent residents); however, population numbers for the GPCD calculations only include permanent residents. The use of all water demands but only a portion of water users within the Region has resulted in conservative (higher) GPCD estimations.







CVRWMG
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Regional Water Management Group

Final
Volume II : Disadvantaged Communities

# 2014 Coachella Valley Integrated Regional Water Management Plan

*Plan Prepared by:*
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*In collaboration with the Planning Partners*

February 2014

City of Coachella | Water District | MSWD Mission Springs Water District | Desert Water | Indio Water Authority

# Final

# Coachella Valley Disadvantaged Community Outreach Demonstration Program Report

**Prepared by:**

RMC Water and Environment

In association with:

Integrated Planning and Management Inc.

**February 2014**

# Section 1 Executive Summary

In 2011, the Coachella Valley Regional Water Management Group (CVRWMG), represented by the Coachella Valley Water District (CVWD), entered into a contract with the Department of Water Resources (DWR) to develop a Disadvantaged Community (DAC) Outreach Demonstration Program (DAC Outreach Program) for the Coachella Valley Integrated Regional Water Management Region (Region). The DAC Outreach Program was supported by a separate stream of funding associated with the Proposition 84 Integrated Regional Water Management (IRWM) Program specific to conducting outreach to DACs, and concluded at the end of 2013.

The Coachella Valley is home to numerous disadvantaged communities (DACs). DACs are defined as areas having a mean household income (MHI) that is 80 percent or less than the state MHI. Severely economically disadvantaged communities are defined as those communities with a MHI of less than 60 percent of the statewide MHI. DACs can face multiple water-related challenges, which can be more difficult to address as compared to other residents due to a lack of financial and other resources. The Coachella Valley IRWM Region, shown in **Figure 1** below, is managed by the CVRWMG, which is comprised of the five Coachella Valley water purveyors: CWA, CVWD, DWA, IWA, and MSWD.

The overall purpose of the Coachella Valley DAC Outreach Program, in addition to improving participation in the development of the 2014 Coachella Valley IRWM Plan Volume I, was to identify DAC issues, address DAC issues through project development and support, and provide DWR with suggestions for improving DAC involvement in IRWM planning and IRWM Program activities on a statewide-level. This report chronicles the work, activities, and outcomes from the DAC Outreach Program in the Coachella Valley and makes recommendations that could be incorporated into the statewide IRWM Program. While the Coachella Valley DAC Outreach Program has been very successful in the Coachella Valley, techniques used locally may not necessarily work as well in other regions of the State. Therefore, this report recommends elements of a model program, not a complete program that DWR should implement in other DAC areas of California.

This report includes the main body of work for the DAC Outreach Program, which is Volume II of the 2014 Coachella Valley IRWM Plan. This volume also includes a series of appendices containing the results of the DAC Outreach Survey, mapping efforts, DAC demonstration projects, and other materials developed in support of the DAC Outreach Program and to improve regional understanding of DACs in the Region (see below for more information). When referencing material or appendices contained in Volume II of the IRWM Plan, text will say "Volume II" and "Appendix VII," respectively and will say "Volume I" and "Appendix VI" in reference to materials associated with Volume I. Volume II of the IRWM Plan is designed to act as a stand-alone DAC-focused resource for stakeholders and Volume I contains the IRWM Plan Chapters and Appendices, which were completed through a separate planning effort.

## 1.1 Program Recommendations

Elements of a statewide model program that are recommended for DWR's consideration (refer to **Section 6** for more information) include the following:

1. Utilize assistance from and partner with community-based local non-profit organizations;

# Section 2 History of DAC Outreach

The CVRWMG agencies have interacted and coordinated with economically disadvantaged communities for a long time. Some of the CVRWMG agencies such as Mission Springs Water District (MSWD) are almost completely within DAC areas. For others, significant areas within their boundaries are DAC areas but by no means do DACs cover their entire service area. The following sub-sections detail DAC outreach efforts conducted prior to initiation of the 2014 Coachella Valley IRWM Plan Volume I and DAC Outreach Program.

## 2.1 Pre-Coachella IRWM Outreach Efforts

In the period just prior to and during the formation of the Coachella Valley IRWM Program, DAC groups in the region were becoming more organized. For instance, the IRWM Disadvantaged Community Planning Group was formed in 2007 to track the progress of DAC Outreach Programs being developed under Proposition 84. Many factors caused this group and others to organize and address pertinent issues affecting DACs such as economic development, roads, flooding, schools, and other issues affecting health and safety and quality of life. During this same time, arsenic became regulated at lower levels, and problems with septic systems and water supply became more important to the DAC groups. Early efforts on behalf of the water supply agencies, Colorado River Regional Water Quality Control Board (Regional Board), and Riverside County were successful; however, water-related needs of DACs proved to be substantial, requiring additional support. Community groups stepped in to assist with these issues, as they had also identified other problems facing their communities. Specifically, affordability of water and wastewater services and water quality of available water supplies were key issues for DACs.

## 2.2 2010 Coachella Valley IRWM Plan Efforts

In 2010, IRWM-related planning was initiated and DAC needs and issues were identified as special and different than other groups. The DAC Issues Group was formed that same year to provide direct outreach to DACs as part of the IRWM Program and gain input on water-related DAC issues. Several DAC representatives were also invited to join the Planning Partners - representatives from local cities, County of Riverside, tribal governments, disadvantaged community representatives, and other local water management stakeholders that serve in an advisory role for the development of the IRWM Plan and grant applications.

The Planning Partners, during the development of the 2010 IRWM Plan, worked to identify DAC water-related issues and projects to address those issues. Three projects, the Short-Term Arsenic Treatment Project and a septic-to-sewer conversion project, were funded by the Proposition 84 Implementation Grant in 2011. Those projects are more fully described in Section 2.3 below.

### 2.2.1 Characterized Issues and Needs

During the development of the 2010 IRWM Plan, water-related issues concerning DACs in the Coachella Valley were identified and are detailed below.

1. ***Affordability***: Addressing DAC water-related issues without increasing rates
2. ***Connection to the Sewer System***: The need for septic to sewer conversion is great, but jurisdictional issues and high costs may delay or prohibit construction

3. ***Drinking Water Quality***: Other groundwater sources, such as wells above the perched aquifer, hot water basin wells, and agricultural wells, are not suitable for drinking. In places where local groundwater wells supply water that does not meet drinking water standards, other water sources such as hauled water can be scarce or entirely inaccessible
4. ***Water Supply***: Many DACs are not within urban areas, making water supply even more difficult. One example is concentrated communities of farm workers in rural areas in the eastern Coachella Valley. Rural water treatments systems (generally onsite point of source or other new technologies) and training are needed in these rural/remote areas to ensure residents have a reliable supply of water that meets drinking water standards
5. ***Flooding and Stormwater***: Flooding and stormwater management improvements are needed to address flooding hazards in DAC areas, particularly in portions of the eastern Coachella Valley that are not protected by regional flood control infrastructure and unincorporated communities that do not receive stormwater services from an incorporated city

### 2.2.2 Identified Projects

Preliminary work with DAC groups in the Coachella Valley IRWM Region prior to development of the Coachella Valley IRWM Plan resulted in the projects that would benefit DACs. Each of these projects, which are summarized below, has multiple partners and benefits, but the primary beneficiaries are DACs.

1. ***Bacterial Indicators Total Maximum Daily Load (TMDL)***: Implementing projects to ensure that discharges do not contribute to the load of bacterial indicators is required to ensure compliance with the Regional Board TMDL for bacterial indicators. These projects will include implementation of best management practices and solutions to prevent dry weather runoff flows from entering regional facilities such as the Coachella Valley Stormwater Channel. Along with complying with the TMDL for bacterial indicators, the project will result in improvements to water quality by specific DACs who do not have access to other water supplies.
2. ***Integrated Resource Development and Protection Project***: Septic to sewer conversion that provides alternatives to failing septic tanks and generates additional wastewater to water reclamation facilities, thereby providing additional water that will be beneficially reused and protect groundwater supplies.
3. ***Water-Related Health and Safety Improvement-Riverside County***: This project would work with existing groups to provide improvements to water and sewer systems as the County closes hazardous housing areas.
4. ***Integrated Regional Groundwater Quality Protection Project***: Septic to sewer conversion that complies with a State mandate to eliminate septic tanks, generates recycled water, reduces dependence on imported water, and protects regional groundwater supplies.
5. ***Eagle Canyon Dam Integrated Flood Control and Regional Watershed Project***: Addresses safety, flood control and economic development issues for the DACs in Cathedral City, Palm Springs, Riverside County, and Tribal lands. This is the priority project for Riverside County Flood Control and Water Conservation District-Zone 6.
6. ***DAC Conservation and Water Testing Pilot Project***: DACs frequently pay significant costs for water that is wasted due to leaks they cannot afford to fix, or do not drink tap

## Survey Indications

98 percent of the survey respondents qualify as severely DAC based on self-reported annual income, indicating that areas of focus used when selecting survey sites were correctly identified as potential DACs, and indicating that the Coachella Valley IRWM Region has a good understanding of where DACs are located. Though many of the respondents live in DACs, and reported water and wastewater issues, very few respondents indicated that they knew of any community groups or organizations that help with health, water, or other problems. This indicates that communities may not have knowledge of available resources to contact in the event of a problem or a concern regarding water and wastewater systems. This result also indicates a need to provide outreach and education, especially to those DACs that are located within the jurisdictions of incorporated cities (particularly in the West Valley) that may be well-served by contacting their jurisdictions to report code compliance and other resolvable issues.

A perception of poor quality tap water was reported by 33 percent of respondents, while 53 percent believed their tap water was of moderate quality (refer to **Figure 9**). Only 35 percent of respondents reported that they drink tap water (refer to **Figure 10**). However, 47 percent of respondents reported occasionally running out of drinking water, whether it was tap water or purchased water (e.g., bottled water), and 18 percent of respondents reported having contaminated water. Despite the perception of contaminated drinking water, a number or respondents reported that they drink tap water, oftentimes without further treatment (e.g., boiling, filtering). Survey respondents gave a variety of answers when asked who provided their water, indicating a lack of understanding of who was responsible for water supplies and safety, and therefore who to contact to report water issues. Due to the severely economically disadvantaged nature of the surveyed communities, it is also possible that residents drink tap water despite water quality concerns due to cost concerns associated with bottled water. This indicates that water supply provisions to the DACs must be cost-effective in order to be effective.

Survey respondents were asked what type of wastewater system they used and if they had experienced any wastewater system failures, indicated by smells, wet ground around the system, puddles during dry weather, grass near the system, or problems with sink or toilet flows (draining). Problems with wastewater systems were reported by 54 percent of respondents, with wastewater system failures more prevalent in the East Valley than the West Valley (refer to **Figure 11**). The survey also found that the reported wastewater system fail rate among survey respondents was significantly higher than the reported 1-4 percent for California, and even the national failure rate of 10-20 percent. Overall, 30 percent of the wastewater failures reported by residents occur only once per year, though West Valley respondents reported more frequent wastewater system failures than East Valley respondents (refer to **Table 9** in the DAC Mapping and Characterization Project Report, which is available in **Appendix VII-B**), indicating that West Valley communities may have more severe wastewater problems than East Valley communities.

Flooding was reported by respondents in a few of the study areas, and generally corresponded to mapped flood zones. Those areas reporting flooding that are outside of mapped flood zones were few, but generally located near mapped flood zones and the Coachella Valley Stormwater Channel (refer to **Figure 15**). This finding supports local understanding that floods are common along flood zones and along the Stormwater Channel and that mapped flood hazard zones may not show the full extent of potential flood hazards.

## Drinking Water Findings

- More people in the eastern Coachella Valley believe their tap water quality is poor than compared to those in the western Coachella Valley
- Of all persons who responded to the survey, 33% believed their drinking water quality was poor, 53% believed that their drinking water quality was moderate, and 14% believed their drinking water quality was excellent (refer to **Figure 9**)
- The majority of respondents (69%) reported their source of drinking water as either disposable plastic bottles or self-filled large containers
- 65% of the respondents do not drink their tap water (refer to **Figure 10**)

**Figure 9: Opinion Survey: Perceived Water Quality Reported as Percentages**

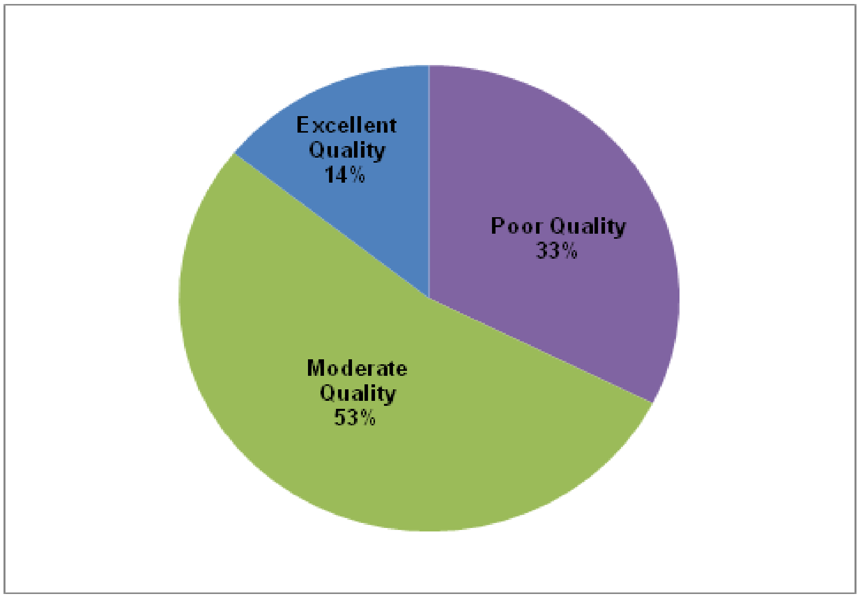
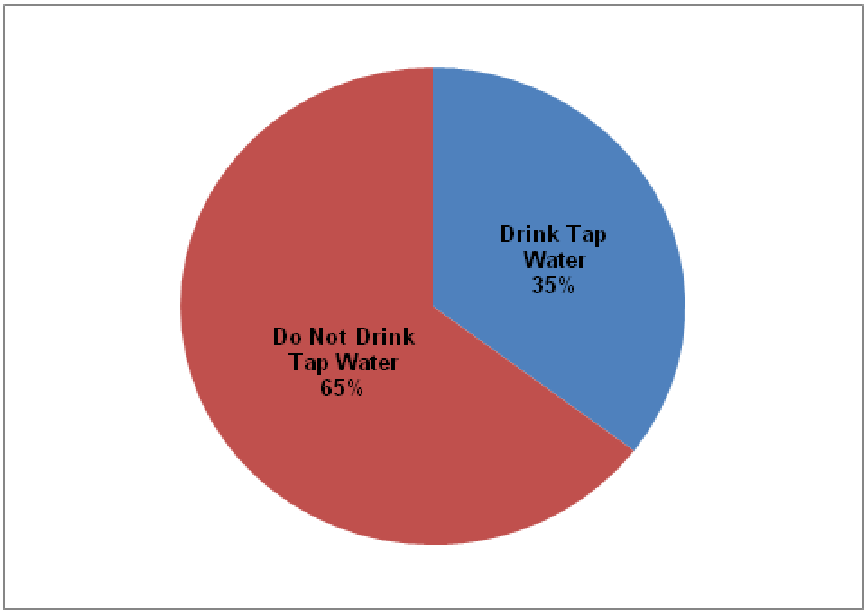



**Figure 10: Opinion Survey: Percentages of Respondents Who Reported Drinking Their Tap Water**



### Constituents and Treatments

From the assessment of publicly available water quality data, several constituents of concern were identified in groundwater wells in exceedances of water quality thresholds: arsenic, fluoride, nitrate, uranium, and potentially hexavalent chromium. While there is not yet a statewide standard for hexavalent chromium, due to the potential concern regarding this constituent and pending water quality regulations, this constituent was considered in the analysis. Sample points for arsenic were limited (8), but arsenic was found in DAC areas in excess of the regulatory limit of 10 µg/L (average concentration was 237 µg/L). This finding for arsenic is consistent with concerns expressed by DAC and tribal stakeholders in the East Valley, and supports IRWM funding of the Short Term Arsenic Treatment (STAT) project (refer to Section 4.1 above). Fluoride and nitrate had a considerably higher number of sample locations and on average were above the regulatory levels of 2 and 10 mg/L respectively. These levels were frequently found in DAC areas. Uranium was detected in some areas, especially in the West Valley, but the average concentration of 28.6 pCi/L in the 52 sample locations was below the regulatory limit of 30 pCi/L. Hexavalent chromium had an average concentration of 9.1 µg/L and the State of California has recently recommended a regulatory threshold of 10 µg/L, which indicates there may be portions of the Region that exceed future statewide regulatory limits for this constituent.

More than 20 treatment alternatives were evaluated for aforementioned constituents in the Areas of Concern. These treatment technologies were evaluated for effectiveness and economics in accordance with US Environmental Protection Agency (USEPA) best available technology assessment. The analysis indicated that only Ion Exchange and Membrane Separation/Reverse Osmosis (RO) were effective for all constituents. Each Area of Concern would have to be individually evaluated prior to implementation of any treatment method, but these two technologies could potentially treat all the significant constituents found in DAC areas of the Coachella Valley.

### Recommendations

The evaluation validated the initial Short Term Arsenic Treatment (STAT) project both in priority and in treatment. The project found that many of the water quality issues facing the DAC were in rural outlying areas. Membrane separation/RO was effective for all contaminants and the point of use and point of entry systems that were part of the STAT were cost effective and represented the best treatment alternative. Work to identify methods to expand these programs with help and support from non-governmental and local general government were recommended. Update this section once report is complete.

# Section 4 Identified DAC Issues

During the outreach activities discussed above, there was the opportunity to identify and discuss DAC needs in significant detail. The sub-sections below include information about the issues, needs, and concerns that were expressed by DAC stakeholders during outreach conducted. Three prominent issues were consistently raised by DAC stakeholders: water supply (drinking water), wastewater, and flooding. These issues, discussed in further detail below, may vary across the Coachella Valley in terms of priority and specifics, but are considered the three primary issues facing DACs in the Coachella Valley. Several of these issues were later prioritized and associated projects were developed to address the priority needs through planning and engineering project support (see Section 5).

## 4.1 Water Supply

DAC water supplies must be affordable, accessible, and in compliance with state and federal requirements in order to meet the needs of all Coachella Valley residents, including DACs. DAC and tribal groups in the East Valley have reported that arsenic levels and potentially other constituents exceed maximum containment levels (MCLs) set in statewide drinking water standards in localized groundwater wells. Despite these concerns, DAC groups have also noted that there is a need for public education on the safety of groundwater since many DAC residents may be unaware that the groundwater wells they utilize do not always meet drinking water standards. Information from the opinion survey (refer to Section 3.3.3) indicates that DAC water supply issues may not stem from lack of knowledge, as some members included within the opinion survey reported drinking their tap water even though they believe their water to be contaminated. **Figure 13** below shows the perceived tap water quality of DACs included within the opinion survey; this figure shows that respondents that perceive their tap water as contaminated (indicated by the green triangle) often also report drinking tap water (indicated by the small red dot).

Many DACs within the Coachella Valley are not within urban areas, making water supply even more difficult as connecting to the municipal water system may be cost-prohibitive. Furthermore, in the East Valley DACs may be relying upon groundwater from wells that are located in the shallow aquifer, and are not permitted to provide drinking water but rather were intended to provide water for irrigation purposes. A potential solution to such an issue would be to drill a deeper well so as to provide water from the Region’s deep water groundwater aquifer, which is of higher quality. However, drilling new groundwater wells can also be cost-prohibitive to DACs.

There is an identified need to address localized groundwater quality issues, particularly in groundwater wells that pump from the shallow aquifer in the eastern Coachella Valley. Identified constituents in groundwater wells include fluoride, arsenic, uranium, nitrate, and total dissolved solids (TDS). Although not currently considered a constituent of concern, it is possible that hexavalent chromium (chromium VI) will need to be treated from local groundwater wells due to pending water quality regulations.

Stakeholders have also noted that there may be conflicts between landowners and residents of DACs in instances when economic interests of landowners conflict with the interests of onsite DAC residents; this issue specifically pertains to the IRWM Program when such issues involve provision of adequate water supplies that meet drinking water standards.

of Environmental Health and the Regional Board to ensure that permitting and other components of the project were consistent with applicable regulatory requirements.

Collaboration with Pueblo Unido CDC, DACE, and the Rotary Club has identified two key aspects necessary for an effective water treatment program in the East Valley: technical needs (water treatment) and community organization. The technical component of such a program will evaluate and identify the appropriate point of entry and/or point of use water treatment facilities for mobile home parks in the East Valley setting. The community organization component will include distribution of O&M manuals and emergency procedures, and development of rental agreements with park tenants for a monthly user fee to cover O&M costs (such as filter replacement). The technical team has developed a regional program that includes both of these program components, for use in accelerating the existing STAT and Rotary Club-Pueblo Unido CDC-DACE efforts to install treatment systems in both permitted and unpermitted mobile home parks that have documented drinking water quality exceedances. The program focuses on installation of appropriate, commercially-available reverse-osmosis under-counter treatment units for tenants at the mobile home parks.

The technical components of this project are included as a formal Disadvantaged Community Water Quality Evaluation, which is included as **Appendix VII-C**. The organization component that includes a formal Work Plan, draft operating manuals, and other materials that would be necessary to implement the technical components are included as **Appendix VII-C** to this report.

# Section 6 Recommendations for DWR DAC Outreach Program

The information provided in the preceding sections of this report provides an overview of the experience and results of the efforts undertaken in 2012 and 2013 as part of the Coachella Valley DAC Outreach Program. The information gathered as part of the DAC Outreach Program is considered invaluable to the Coachella Valley IRWM Region in helping to better understand the nature and issues of DACs as well as ways to improve DAC involvement in the IRWM Program.

The following sections of this report are intended to summarize the findings from the DAC Outreach Program and recommend elements of a model program for DWR to potentially implement in other areas of California to improve DAC involvement in IRWM planning. Some of the recommendations included below were implemented as part of the DAC Outreach Program and are therefore considered validated recommendations in that they were found to be successful in the Coachella Valley; other recommendations are theoretical in that they have not yet been implemented or applied in the Coachella Valley. Similarly, some of the recommendations below are recommended for implementation by other regional water management groups (managers of regional IRWM Programs similar to the CVRWMG) and others are recommended for implementation by other parties such as DWR.

## 6.1 Utilize Assistance from Community Non-Profit Organizations

**Recommendation: The regional water management groups should partner with established and successful non-profit organizations to assist with community outreach and identify, develop, and implement DAC water-related projects.**

As discussed in detail in Section 3.2.7 and Section 3.3, part of the Coachella Valley DAC Outreach Program included contracting with local non-profit organizations to complete outreach and mapping (surveying work). Due to the success of the work completed by the non-profit organizations in the Coachella Valley, it is recommended that other IRWM regions work with local organizations on similar efforts.

Part of the CVRWMG's goal in utilizing the non-profit organizations for outreach efforts was to determine if working through established non-profit organizations with personal connections to DAC areas would increase DAC participation and involvement in the IRWM Program. Outreach efforts demonstrated that the non-profit organizations did impart this benefit, because prior to the DAC Outreach Program, few DAC community members (members of the public in DACs) attended IRWM Program meetings. As proof, the DAC Outreach Program workshops, held in June, 2013 and co-hosted/sponsored by the non-profit organizations, were attended by over 100 people, most of who were local residents of DACs. This outcome demonstrates that the existing trust and relationships the local non-profit organizations have with the DACs they serve contributed strongly to resident interest and participation in the DAC workshops. Furthermore, services provided by the non-profit organizations such as bilingual translation for meeting materials and meeting facilitation encouraged involvement in the DAC workshops. The IRWM Program developed working relationships with non-profits that had established relationships in most of the known regional DAC areas. The collaboration with the non-profit organizations – Loma Linda University, El Sol, and Pueblo Unido– later enabled the IRWM Region to identify and develop priority projects that were important to DACs and would address high-priority DAC issues. The non-profits also worked closely with the technical team to execute the projects, and continued to impart local knowledge and expertise throughout the development of project materials. Project 1 (see Section 5 or **Appendix VII-F** for more information) provided educational materials on water quality and wastewater management that were translated into Spanish by El Sol. Project 3 (see Section 5 or **Appendix VII-H**) conducted septic system replacement work with the facility design completed by Pueblo Unido CDC. It is hoped that planning and design work provided through the DAC Outreach Program has provided the foundation and project development materials necessary to develop projects that will qualify for additional Proposition 84 Implementation Grant funding and other grant funding opportunities.

The use of Loma Linda University, El Sol, and Pueblo Unido provided multiple benefits to the DAC Outreach Program through the in-person survey that was administered (refer to Section 4 for more information). The survey that was conducted by the three organizations throughout the Coachella Valley was conducted bilingually through teams that were comprised of students from Loma Linda University and either promoters (promotores in Spanish) from El Sol or staff/volunteers gathered by Pueblo Unido. The use of translation services and conducting outreach in both Spanish and English is thought to have provided additional benefits in reaching out to DAC stakeholders as this has allowed the CVRWMG to demonstrate that they understand some of the barriers to DAC participation, and are willing to implement solutions necessary to overcome barriers. The bilingual outreach efforts have also helped start building positive relationships between the CVRWMG and DAC residents by providing a means to have a meaningful conversation about the water needs and issues of DACs in the Region, and allowing DAC residents with the opportunity to express their concerns first-hand rather than through non-profit organizations.

Partnerships with the three non-profit organizations also enabled the CVRWMG to draw on the existing knowledge of how to work successfully with DACs in the Region. Given that the three organizations have extensive past working relationships with DACs, they were able to identify strategies that have worked for them in the past, and provide input on proposed outreach efforts. For example, the three non-profit organizations noted that outreach materials should advertise the availability of child care at meetings, and meetings should be held in the evenings in familiar locations to increase attendance by local residents. In addition, the non-profit organizations recommended that bilingual door knob hangers be developed to advertise the workshops and that the hangers should be placed on the doors of those residents who were not home when surveyors came by to conduct surveys and alert residences to the upcoming workshops. This recommended outreach mechanism, which was successfully implemented with translation assistance from the non-profit organizations, allowed for broad advertisement of the DAC workshops across the Coachella Valley (refer to Figure 4 for an example of the door knob hangers).

In collaboration with the partner non-profit organizations, the DAC Outreach Program has been able to implement some of the outreach techniques identified in the 2014 Coachella Valley IRWM Plan Volume I to improve DAC participation in the IRWM Program. These efforts have been quite successful in the Coachella Valley IRWM Region, as evidenced by the strong turnout at bilingual DAC outreach meetings, development of an expanded, detailed, and refined discussion of DACs and DAC issues and needs in the 2014 Coachella Valley IRWM Plan Volume I, and project development and design for four DAC projects that may be submitted for consideration during the next round of IRWM funding. As a result of these efforts, the Coachella Valley IRWM Program was able to build or strengthen trust and relationships between the CVRWMG and DAC residents.

Much to their credit, the non-profit organizations involved in the DAC Outreach Program were able to work very well together and support each other. Their contributions complemented one another, which further contributed to the success of the Coachella Valley DAC outreach approach. However, this may not always be the case for all geographic areas or for all non-profit organizations. Therefore, the existing relationships between potential organizations and the existing geographic coverage of the potential organizations should be considered if using this model for DAC outreach and participation in other IRWM regions or in other efforts in the Coachella Valley. This approach can provide a means of bringing non-profit organizations together and helping to exchange knowledge about successfully working with DACs (addressing the spatial coverage challenge), but may exacerbate existing conflicts between non-profit organizations in some regions. Those potential partnerships and potential conflicts need to be understood prior to initiating a successful non-profit partnership, because if a region has extreme conflict between non-profit organizations, this approach may not be appropriate.

## 6.2 Establish a “DAC Track” to Facilitate DAC IRWM Participation

DWR should seek Legislative or Executive approval to better support DAC NGO’s ability to apply for grant funding and financially manage projects by developing a “DAC Track” that would include specifically tailored project selection (e.g. technical feasibility and benefit-cost analysis requirements) and grant application requirements, payment of DAC pre-project costs, and expedited project expense reimbursements. In most areas, the program should defer to region’s local knowledge to select the most important locally-appropriate DAC projects.

It is not recommended that the DAC Track be a separate grant application or process from the standard IRWM Implementation Grant solicitations, but rather that through the Proposal Solicitation Packages (PSPs) that dictate Proposition 84 Implementation Grant requirements, DWR commit to reduced scoring and grant requirements for DAC projects. The DAC Track is not meant to marginalize or separate DAC issues, needs, and projects from the IRWM Program; but rather, it is meant to explain that DWR must make firm commitments to reducing technical feasibility for DAC projects. As explained in detail in *Chapter 9* of the 2014 Coachella Valley

# Technical Memorandum

## Coachella Valley IRWM Program

| | |
|---|---|
| **Subject:** | **DAC Onsite Plumbing Retrofit Program** |
| **Prepared For:** | Coachella Valley Regional Water Management Group (CVRWMG) |
| **Prepared by:** | Marina Mautner |
| **Reviewed by:** | Crystal Mohr |
| **Date:** | July 11th, 2014 |
| **Reference:** | 0574-002.002 |

# 1 Introduction and Background

During implementation of the Coachella Valley Disadvantaged Communities (DAC) Outreach Program, DAC residents noted that onsite plumbing leaks and faulty onsite plumbing systems may cause drinking water quality issues and water waste. For water quality issues, onsite plumbing systems may be compromised by structural damage or improper construction or design, which can allow water quality constituents to enter the potable water system. For onsite plumbing leaks, aging, damaged or improperly constructed or designed systems may leak and waste water.

The DAC Outreach Program included extensive outreach meetings and surveys of local DAC residents to refine the location of DACs within the Coachella Valley and also establish a comprehensive understanding of water-related issues and needs within the Region's DACs. The DAC survey had many findings, including that DAC residents are largely unaware of local resources that are available to address water and wastewater concerns and that further outreach and education would be beneficial in addressing pressing DAC water quality and water supply issues. Further, the DAC survey found that DAC residents that expressed concerns of poor tap water quality also reported drinking tap water, indicating that residents do not have many non-tap water options due to cost issues. As such, the survey concluded that water supply provisions to DACs must be cost-effective in order to be effective.

As a result of information gathered during the DAC Outreach Program, the Coachella Valley Regional Water Management Group (CVRWMG) developed a project that would include outreach and education to DACs and also provide a cost-effective mechanism for addressing DAC-reported water quality and water supply needs. The DAC Onsite Plumbing Retrofit Program was, therefore, developed to address both drinking water quality and water conservation issues by providing a cost-effective mechanism to repair faulty systems that leak and address potential sources of drinking water quality contamination. Program partners will include CVRWMG water agencies and community organizations Pueblo Unido Community Development Corporation (PUCDC) and Leadership Counsel for Justice and Accountability (Leadership Counsel).

## 1.1 Purpose and Outline

To develop a comprehensive DAC Onsite Plumbing Retrofit Program to address DAC water quality and conservation needs, the following activities were conducted:

- **Identification of Rehabilitation Potential** – Existing studies and reports regarding DACs in the Coachella Valley were reviewed to estimate an approximate number of eligible residents and housing units. Organizations and people implementing similar programs were also contacted to determine common onsite water system needs in and around homes.

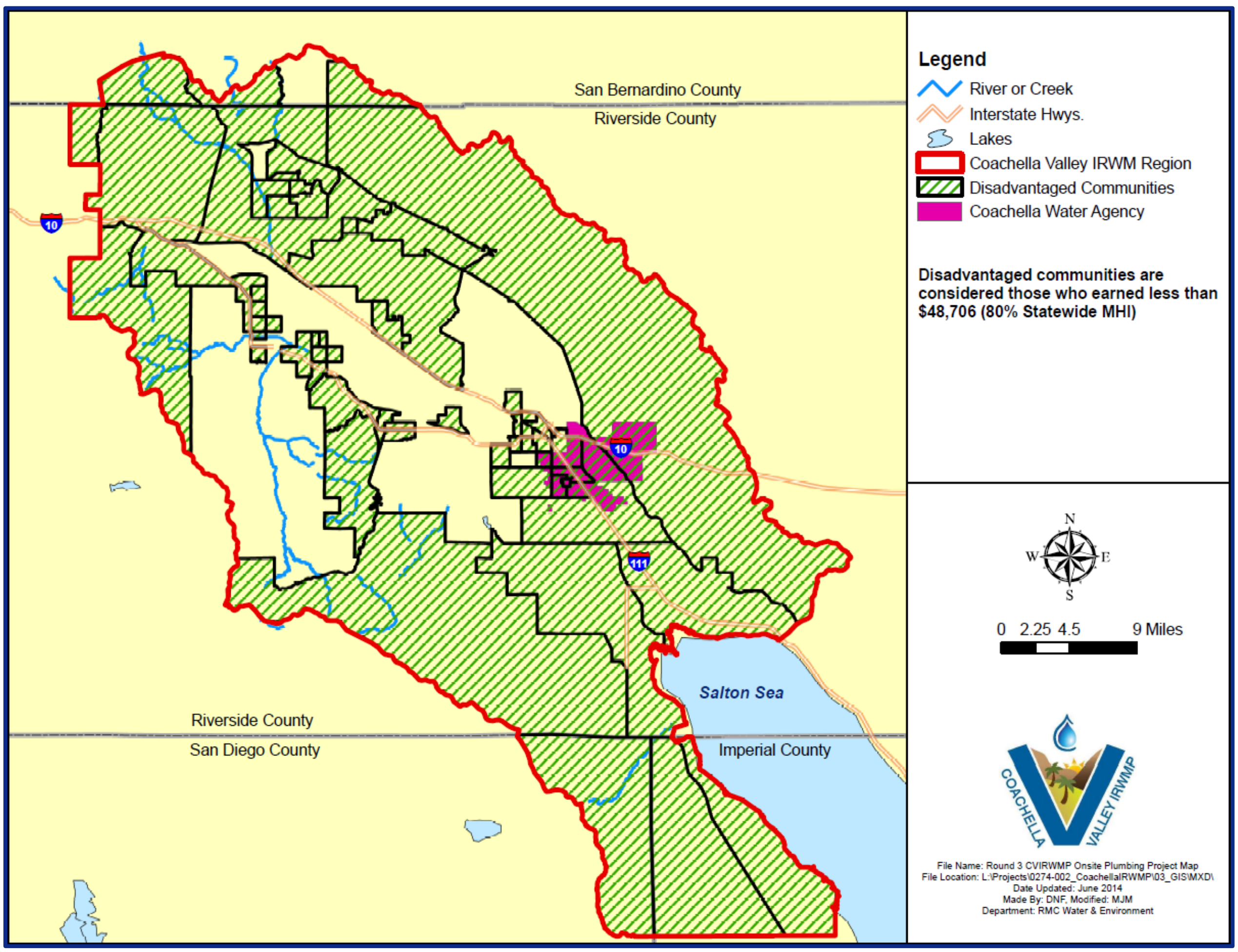
- **Determination of Water Savings** – Leak estimates based on national averages and similar programs were used to determine the approximate amount of water that could be saved by implementing the DAC Onsite Plumbing Retrofit Program.
- **Structural Development of the Retrofit Program** – Organizations and people involved in DAC issues in the Coachella Valley were contacted to obtain an understanding of programs already in place and potential tie-ins for the rebate program. Based on previous efforts and local estimates, costs per unit were determined to provide an appropriate total program cost.

## 1.2 Study Area and Background Information

### 1.2.1 Location

The Study Area evaluated for the DAC Onsite Plumbing Retrofit Program includes the Coachella Valley IRWM Region (Coachella Valley or Region), which is the same Study Area evaluated by the DAC Outreach Program. The distribution of DACs in Coachella Valley is represented in **Figure 1-1** below. While there are DACs located throughout the Coachella Valley, a majority of the DACs are located in the East Valley. As shown in **Figure 1-**1, the majority of the service area of the Coachella Water Authority (CWA) includes DACs. Because CWA provides services to a largely DAC area, water use data from CWA will be used for the basis of water savings calculations in this study.

**Figure 1-1: Disadvantaged Communities in Coachella Valley IRWM Region**



### 1.2.2 Population and Household Estimates for Study

The DAC Outreach Program included an analysis of the location of DACs in the Coachella Valley by analyzing statistics for separate Study Areas within the Coachella Valley (refer to **Table 1-1**). 2010 United States Census Data is the primary source of information for the data provided in **Table 1-1**, during which time the median household income (MHI) for California was $60,883. Disadvantaged communities are defined by the California Department of Water Resources (DWR) as those households earning 80% of the state MHI ($48,706); severely disadvantaged communities are those with a MHI that is less than 60% of the state MHI ($36,530). As shown in **Table 1-1**, there are fourteen Study Areas within the Coachella Valley that are classified as disadvantaged, and ten that are classified as severely disadvantaged.

All the Study Areas have a MHI less than 80% of the statewide MHI which indicates that at least half, usually more, of the households are disadvantaged; this is a total of 24,770 households or 83,332 persons. If it is assumed that within the areas that are considered disadvantaged, 50% of residents are disadvantaged (a conservative estimate) and that within areas that are considered severely disadvantaged, 100% of residents are disadvantaged, in the Coachella Valley approximately 34,936 households or 116,524 persons would be classified as DACs. For this study, a conservative estimate of 24,770 households was used to determine the amount of DAC households that could potentially qualify for the indoor portion of the rebate program.

The DAC Outreach Program found that on average, there are five residents per mobile home within Coachella Valley disadvantaged communities and that the average number of mobile home units per mobile home park (MHP) is 23.3. A study currently underway that is continuing these efforts has ground truth validated 123 mobile homes parks, or 2,861 mobile home units, in the Valley. Sergio Carranza from PUCDC, a local nonprofit organization that works to address DAC issues in the Coachella Valley, estimates that there are approximately 200 permitted and unpermitted mobile home parks in the Coachella Valley. Given the estimated number of mobile home parks (200), the average number of mobile homes per park (23.3), and the average number of residents per mobile home (5), this study estimates that there are approximately 4,600 DAC mobile home units with approximately 23,000 residents within the Coachella Valley. This number of mobile home units and residents will be used as the basis for the number of units qualifying for the plumbing system component of the DAC Onsite Plumbing Retrofit Program.

**Table 1-1: Focus Area Select Statistics**

| Study Area | Population | Households (HH) | HH Size | MHI | 80% of Statewide MHI ($48,706) | 60% of Statewide MHI ($36,529) |
|---|---|---|---|---|---|---|
| White Water | 859 | 312 | 2.8 | $39,375 | Y | N |
| Desert Hot Springs | 25,938 | 8,650 | 3.0 | $36,326 | Y | Y |
| Garnet | 7,543 | 2,174 | 3.5 | $32,132 | Y | Y |
| Desert Edge | 3,823 | 1,969 | 1.9 | $25,984 | Y | Y |
| Cathedral City | 51,000 | 17,047 | 3.0 | $45,693 | Y | N |
| Sky Valley | 2,406 | 1,064 | 2.3 | $31,771 | Y | Y |
| Thousand Palms | 7,715 | 2,849 | 2.7 | $42,656 | Y | N |
| Coachella | 40,704 | 8,998 | 4.5 | $43,012 | Y | N |
| Thermal | 2,864 | 684 | 4.2 | $33,998 | Y | Y |
| Mecca | 8,577 | 2,020 | 4.2 | $26,207 | Y | Y |
| Oasis | 6,890 | 1,474 | 4.7 | $25,469 | Y | Y |
| North Shore | 3,477 | 750 | 4.6 | $31,591 | Y | Y |
| Desert Shores | 1,104 | 344 | 3.2 | $18,958 | Y | Y |
| Salton City | 3,763 | 1,204 | 3.1 | $32,805 | Y | Y |

# 2 Determining Water Savings Potential

## 2.1 Indoor Water Use

Average base daily per capita water use in the CWA service area is 191 gallons per capita per day (gpcd); given that the CWA service are contains a large proportion of DAC residents, these water use values are used as a proxy to assess existing DAC water use. Using the Southern California average from a 2011 California Department of Water Resources (DWR) study, indoor water use is approximately 44% of total water use, which is 84 gpcd for a typical disadvantaged community in the Coachella Valley. Water savings calculations will assume weighted average from the study of 3.4 residents per non mobile home DAC residence. The program will offer 200 rebates for mobile home residences (discussed in submetering below), about 4.3% of MHP households, and 180 rebates for any DAC residence, a total of 380 DAC households or 1.5%. The calculation below only includes the 180 rebates for general DACs because the MHP DACs will be addressed in the submetering savings calculation.

Based on the Association of California Water Agencies' (ACWA) informational flyer for water conservation and the DWR 2011 study, the following savings would be made if the proposed 180 households received a rebate package. The rebate package would consist of two aerators for faucets, one low flow showerhead, and one high efficiency toilet.

**Table 2-1 Potential Indoor Water Savings Based**

| | Toilet Flush | Aerator | Showerhead |
|---|---|---|---|
| Average (gal) | 2.761[1] | | 2.14[1] |
| Low Flow (gal) | 1.28[2] | | 1.5[2] |
| Savings (gal) | 1.48 | 1.2[1] | 0.64 |
| Uses Per Person Per Day | 4.76[1] | 1 | 5.92[1] minutes |
| Loss Per Fixture Per Day (gal) | 30 | | |
| Savings Per Person Per Day (gal) | 15.9 | 1.2 | 3.8 |
| Total Savings Per Day (gal) | 9693 | 731 | 2307 |
| Total Savings Per Year (AF) | 10.9 | 0.8 | 2.6 |

[1] ACWA. *Infographics and Flyers*. http://saveourh2o.org/toolkit
[2] DWR 2011.

The most savings are found by replacing old toilets with High Efficiency Toilets (HET), which are required to have 1.28 gallons per flush based on the Water Sense guidelines of the EPA. The savings are potentially much more because the average gallons per flush in the study included HETs. Many rebate programs in California require that the toilet to be replaced must be at least 2 gallons per flush, this assumption would increase the average gallons per flush and create even more savings. Additionally, many toilets have leaks that go unnoticed or unattended which is assumed to be fixed with a toilet replacement.

The showerhead replacement had the second highest savings. For the program to be most effective, the rebate should only be for high efficiency showerheads that use 1.5 gallons per minute (gpm) or less water. The WaterSense product list has showerheads that use up to 2 gpm, however, this would yield less than 1/3 of the water savings and therefore would not be covered by the program.

While the aerators yield the least savings, they are also the least expensive fix as explained below in the Potential Retrofit Costs section.

The total program water savings with these three indoor fixes implemented in 180 residences, would be 14.3 acre feet per year (AFY). The savings per person per day is 20.9 gpcd or 24.9% savings on indoor water use.

## 2.2 Mobile Home Park Plumbing System Rehabilitation

Both in the DAC 2013 survey and communication with Sergio Carranza and Ryan Sinclair, the DAC survey contact at Loma Linda University, plumbing systems in the MHPs were described as substandard. In many cases the residents, with little to no professional plumbing experience, constructed the systems themselves out of PVC pipes and faulty joints. The systems leak often and are repaired in a haphazard fashion with improper supplies. These poor plumbing systems are claimed to be the cause of water quality issues for residents in addition to the water loss problems associated with the leaks.

One way of calculating distribution system leakage would be by subtracting the measured water consumption from the total water produced or purchased. In a mobile home park, the total water produced or purchased would be the water measured at the meter. Water consumption can then be calculated using sub-meter data, as a more direct method, or it can be calculated by using estimated amounts based on average usage amounts per person, which is less direct.

For both measurement methods, the amount of water used by each MHP is necessary to provide a baseline usage. The non-profit contact in the area, Mr. Carranza, communicated that it is uncommon for MHPs to have data on park usage if they use a community well. This is because community wells often lack a meter or recording apparatus (Carranza, pers.comm.). While it is possible to obtain data from those parks that receive water from municipal sources, Carranza stated that many MHPs are not connected to municipal water supplies and thus this data would not be representative of the MHPs in general.

With this information, it became clear that the first step in determining the amount of water lost to leaks and the potential savings would be to install meters and submeters in various MHPs. In addition to the ability to monitor water savings, there are various studies, one of which is described in the Similar Programs section below, that show that submetering can also serve as a water conservation tool.

A less accurate assumption for MHP distribution system leaks for the purposes of this TM will be calculated based on the generalized principal that municipal distribution systems have a 16% water loss (EPA 2013). Using a weighted average between a sample DAC Polanco Park, 1,071 gallons per day (gpd), and a sample medium sized DAC MHP, 735 gpd, gives an average household use of 767 gpd. Using the CWA estimate of 191 gpcd and multiplying by the average number of residents in mobile homes gives a total of 955 gpd per household. Assuming that the true number is closest to this estimate based on Polanco park agreement with this number, this study will use the 955 gpd per mobile home household estimate. The program proposes 200 unit rebates for distribution system fixes, which equates to 214 AFY of water use. Multiplying this by the 16% water loss factor gives a savings of 34.3 AFY. This number is expected to be very conservative because it represents municipal distribution systems, while the DAC MHP systems are often times of much lower quality workmanship and in greater disrepair.

### Submetering

As described in more detail in Section 3.3, submetering can reduce water usage by 22.5% on average. Using the average of 5 people per mobile home gives an average of 955 gallons per household per day (gphd). Water savings per household would be 215 gphd or 0.24 AFY. The program proposes an implementation of 200 rebates, which would yield 48.2 AFY in water savings.

**Table 2-2: Potential Water Savings from Submetering**

| Water Use per Person (gpcd) | Water Use per HH (gphd) | Submetering Savings of 22.5%[1] (gphd) | HH Annual Savings (AFY) | Total Annual Savings (AFY) |
|---|---|---|---|---|
| 191 | 955 | 215 | 0.24 | 48.2 |

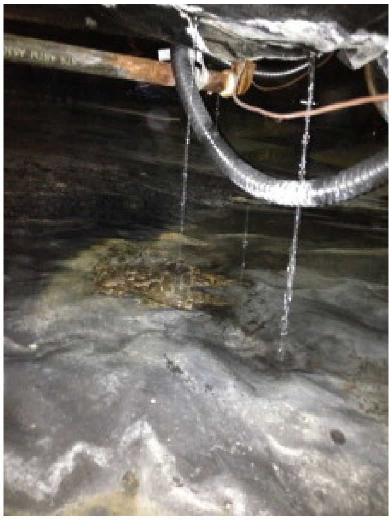
[1] SCVWD. 2008.

### Individual Unit Repairs

In addition to MHP distribution system rehabilitation, repairs on individual homes will be necessary for many units. One of the most common mobile home repairs is a trap leak under the mobile home or a water supply line leak underneath the mobile home (McKinnish 2013). Pictures of these types of problems are shown below. In communication with both Mr. Carranza and Mr. Sinclair, these types of conditions were confirmed to be a problem in the MHPs. Using a Drip Calculator and a 5 drip per second steady stream assumption (as seen in **Figure 2-1** water leaks in a steady stream in these cases), approximately 43.2 gallons are wasted per day from this type of faulty plumbing per mobile home (AWWA 2013). The program proposes 200 rebates, which would yield 9.7 AFY of water savings.

**Figure 2-1 Common Plumbing Issues in Mobile Homes**

Leak at bathroom trap under mobile home



Leak under mobile home laundry area

Source: McKinnish 2013

## 2.3 Total Program Savings

Overall, the total program savings would be approximately 106.5 AFY. This would be a weighted average of 24.4% reduction in water use and consequently costs for each household. This figure includes a very conservative figure for the potential savings from water distribution rehabilitation and therefore the savings are likely much higher than this estimate.

# 3 Supporting Information – Implementation of Successful Programs

## 3.1 Santa Clara Valley Water District (SCVWD) Mobile Home Submetering

As discussed in Section 2.2, one upgrade that can provide a variety of benefits is the installation of water meters on individual mobile home units or "submetering". In 2000 SCVWD began a study in Santa Clara County; 1,187 meters were installed in mobile homes in 5 mobile home parks (MHPs). The goal was to reduce water use and thus overall water costs.

SCVWD staff predicted a water savings of about 15% per submeter installed at mobile homes based on an American Water Work Association study from 1999. Submetering reduces water use by having residents pay directly for the amount of water they use, thereby encouraging conservation via both behavior and fixture changes. Savings would also occur through identifying high priority areas for rehabilitation through the Mobile Home Park Plumbing System Rehabilitation component of the Onsite Plumbing Retrofit Program. By installing meters on wells and individual units, a mass balance equation will determine where and how much water is being lost in the system.

The program included a water survey for residents and offers of rebates for fixture replacements. Over 10 years of water use data, the study found an overall reduction of 22.5% in water use. The total water use savings per year for 754 submeters installed was 43 AF. Savings were attributed to both installation of fixtures through the rebate program and behavioral changes based on awareness of actual water use.

## 3.2 Indio Water Authority (IWA)

IWA is one of the five agencies that make up the CVRWMG. In the IWA Urban Water Management Plan (UWMP) for 2010, IWA outlines the conservation programs that are being developed and implemented within their service area. As part of the IWA conservation program, the agency offers free Water Surveys for residents to help inform residents of ways to save water and identify necessary behavior and fixture changes in individual households. IWA estimates the cost for each residential survey to be $110/survey, which accounts for the time spent by IWA staff to perform surveys and track program implementation (IWA 2010).

IWA indicated that it may want to consider requiring in-home surveys for any residents interested in participating in its Smart Controller and/or Re-landscape Rebate programs. As of the 2010 UWMP the program was still in the planning phase, and had not yet been implemented. Implementation goals through 2015 were estimated in the conservation master plan. According to that plan, IWA should perform at least 1,400 residential surveys by 2015.

## 3.3 Coachella Valley Regional Water Conservation Program

The Coachella Valley Regional Water Conservation Program was implemented by the Coachella Valley Water District (CVWD) in partnership with the four other Coachella Valley Water Management Group agencies: IWA, CWA, Desert Water Agency, and Mission Springs Water District. The focus of the program was on concentrated outreach activities for water use efficiency, focus on the Water Wise program, water audits and workshops, turf replacement, and irrigation system retrofits.

# 4 Program Structure and Costs

## 4.1 Program Administration

This program will be submitted to the 2014 IRWM Drought Grant Solicitation of DWR for program funding; as such, the program will need to include measures to coordinate with DWR and report program status and results. This will include approximately 70 hours of CVWD Program Manager staff time to coordinate funding and requirements with DWR and 145 hours of staff time to complete all quarterly, final, and post-completion reports for the program. Assuming a CVWD staff billing rate of $85 per hour equates to $18,105 in administrative and reporting costs.

## 4.2 Indoor Water Savings Rebate

The EPA Water Sense website contains an online database for WaterSense approved replacement fixtures to improve water use efficiency in homes. Taking a random sampling of 4-5 fixtures in each category yielded the price range per unit shown in Table 4.1. Old toilets and showerheads must be recycled to be eligible for program, similar to the CVWD Toilet Replacement program. CVWD states that toilet recycling is $10 through Desert Recycling in Thousand Palms and thus a $10 recycling fee will be incorporated into the rebate. The rebate amount for each fixture was then determined to be within the range and low enough to reach more residents in a more cost effective manner.

**Table 4-1: Selected Price Range from WaterSense Fixture Database**

| | Toilet | Aerator (2 units) | Showerhead | Total |
|---|---|---|---|---|
| Per unit | $150 - $300 | $10 | $20 - $100 | $230 - $410 |
| Maximum Rebate | $200 | $10 | $30 | $240 |
| 380 Households | $76,000 | $3,795 | $11,400 | $91,195 |

The program proposes 380 rebates, approximately 1.5% of all households, are provided for each category: one toilet, two aerators, and one showerhead. Therefore total program costs for the indoor water savings rebate would be approximately $91,195 split between $43,195 for general DAC rebates and $48,000 for DACs in MHPs.

## 4.3 Water Distribution System Rehabilitation

Water distribution system rehabilitation costs were based on a combination of various studies due to the lack of previous studies that have been done on this type of program. A rough estimate was developed based on a study done by the Real Estate Center Texas A&M (REC) to determine base construction costs for new mobile home parks using data from California, Arizona, and Texas (REC 2000). The REC study determined costs per mobile home for new plumbing systems which are adapted to MHP type using various modifiers.

For the purposes of this study, all MHPs were assumed to be type “Low Cost” from the REC study which is defined by 3” mains, ¾” service lines, and a hydrant at each two spaces. The initial cost per mobile home for a water system for a “low cost” park was $365 per space. The following modifiers were provided for this MHP type:

**Table 4-2: Selected Price Range from WaterSense Fixture Database**

| Number of Spaces per Park | Modifier | Area per Space (sqft) | Modifier |
|---|---|---|---|
| 40 | 1.07 | 1200 | 0.83 |
| 80 | 1.00 | 2000 | 0.95 |
| 100 | 0.97 | 2400 | 1.00 |
| 120 | 0.95 | 2800 | 1.05 |
| 160 | 0.91 | 3600 | 1.12 |

Source: REC 2000.

Area per space for this study was based on site areas in the Oasis Mobile Home Park in Thermal, California as evaluated using the GoogleMaps polygon tool. At the Oasis Mobile Home Park, mobile home spaces range in size from about 1,300 to 4,500 square feet, with the majority at about 2,500 square feet. Therefore, the multiplier applied for area per space was 1.00. This mobile home park had over 200 mobile homes, though some in the area have closer to 80, there are other large parks. Thus, the Number of Space multiplier used was 0.95.

Once modified for the average space and number of spaces, which gave an approximate value of $347 per site for water main installation, the value was adjusted for inflation. Using the United States Department of Labor Consumer Price Index Inflation Calculator, the $347 per site installation cost from 2000, was adjusted to $478 in 2014 dollars.

While some systems may need a complete overhaul, it is likely that most systems will only need upgrades or repairs. Assuming that a third of the system will need replacement, a third of the system will only need repair, and the final third will not need plumbing system upgrades, the final cost was then multiplied by 0.5 to account for these three cases. Therefore the average plumbing retrofit cost per household in mobile home parks will be $240 according to this calculation.

Information was also collected from Carranza who confirmed a below ground plumbing system repair cost $3,240. The project replaced and rehabilitated asbestos insulated pipes that were below ground in a portion of a MHP with 88 mobile homes. Carranza confirmed that this was only a portion of the park, probably less than 1/5 of the total system. Using that fraction, the project cost about $185 per unit. This value is slightly less than the above estimated $240 and it was for one of the more difficult types of rehabilitation which would involve underground digging, complete pipe replacement, and management of hazardous materials.

This suggests that for the Coachella Valley area, a limit of $200 per unit for water distribution system rehabilitation is appropriate. The maximum program costs for water distribution system rehabilitation would therefore be $920,000 if water distribution systems were replaced for every mobile home. If the program begins with a target of system rehabilitation for 200 units, the costs would be approximately $40,000.

## Submetering

The Santa Clara Valley Water District (SCVWD) determined an average cost of $84 with installation for submetering on mobile home units in 2000. Using the CPI Inflation Calculator, this is equal to $115 in 2014. Using an upper limit of $120 rebate for each unit, total program costs for submetering for 200 units would be $24,000.

### Individual Unit Repairs

Jerry McKinnish provides a quote of approximately $250 for repairs to individual mobile homes with trap leaks and water supply line leaks. Providing for 200 homes, total program costs for individual unit repairs in MHPs would be $50,000.

## 4.4 Water Survey Program

The Water Survey program would be implemented for all rebates available in order for a household to be eligible for a rebate. The Water Survey may be conducted by a representative from one of the five agencies partnered in the program or by an alternative and previously approved program, including the DAC survey program being conducted through Loma Linda University. Based on the IWA program, the cost per Water Survey plus tracking costs is $110. The DAC program will also provide services to connect program participants with contractors and aid in filling out applications, the total costs of which are shown in Table 4-3 below. Using these activities as a basis for the water surveys, this study found that water survey costs will total about $60,000.

There will be 380 surveys available for DAC households in general and 200 available particularly for mobile home units. Assuming no overlap, 580 household surveys, each household would only have about 40 minutes of pre- and post-construction survey time with project partners and less than half an hour of application assistance. Alternatively, assuming complete overlap, all mobile home units also receive indoor plumbing retrofits, this would decrease the total surveys to only 380, but each household would then receive at least an hour of survey time with program partners and about 40 minutes of application assistance. The conservative figure of complete overlap will be used for this study in order to provide more attentive service and complete rehabilitation for those households that are in the program.

**Table 4-3: Water Survey Program Costs**

| Project Component | Implementing Organization | Hourly Wage | Hours | Total |
|---|---|---|---|---|
| Determine Final Program Structure | CVWD | $85 | 30 | $2,550 |
| Determine Final Program Structure | Partners | $60 | 40 | $2,400 |
| Determine DAC Status and Provide Application Assistance | Partners | $60 | 240 | $14,400 |
| Invoicing and Check Preparation | CVWD | $85 | 100 | $8,500 |
| Invoicing and Check Preparation | Partners | $60 | 50 | $3,000 |
| Pre- and Post-Construction Survey | Partners | $60 | 400 | $24,000 |
| Post-Program Reporting and Water Savings Calculation | CVWD | $85 | 10 | $850 |
| Post-Program Reporting and Water Savings Calculation | Partners | $60 | 60 | $3,600 |
| **Total** | | | | **$59,300** |

## 4.5 Outreach and Education

The Regional Water Conservation Program proposed in 2011 received $1,000,000, which included costs for thousands of sprinkler controllers, sprinkler upgrades, and square feet of turf replacement. Total outreach and education costs were estimated at $60 per hour for 1,000 hours of outreach or $60,000. The current program is 30% of the size of the Regional Water Conservation Program based on total program costs and therefore expects less than 300 hours of outreach and education costs.

Program outreach will be shared between partner organizations with Leadership Counsel providing the bulk of the outreach, about 270 hours, and PUCDC providing approximately 20 hours. At the base rate of $60 per hour, total outreach and education costs for the DAC Onsite Plumbing Retrofit Program will be $17,400.

## 4.6 Total Combined Program Costs

The total program cost would be $300,000. The total acre feet per year (AFY) saved is 106.5 AFY, which does not include the potentially very large savings made by fixing distribution system leaks. While the individual unit repairs have the highest cost per program element, they also have other intrinsic value that is not factored into the equation such as elimination of standing water below and around the units. Costs would be approximately $2,815 per AFY.

**Table 4.3 Costs per Program Element and Cost per Acre Feet per Year of Water Savings**

| | Cost | Element Percent of Program | AFY Saved | Cost per AFY |
|---|---|---|---|---|
| Project Administration | $18,105 | 6% | NA | - |
| Indoor (General) | $43,195 | 14% | 14.3 | $3,020 |
| Indoor (MHP) | $48,000 | 16% | See Submetering | - |
| Distribution System | $40,000 | 13% | 34.3 | $1,165 |
| Submetering | $24,000 | 8% | 48.2 | $1,495[1] |
| Individual Unit | $50,000 | 17% | 9.7 | $5,155 |
| Water Surveys | $59,300 | 20% | NA | - |
| Outreach | $17,400 | 6% | NA | - |
| Total | $300,000 | 100% | 106.5 | $2,815 |

[1]Includes costs for assumed fixture replacement.

## 4.7 Expected Length of Beneficial Use

Below, in Table 4.4, the expected length of the beneficial use is given in years for each component of the program.

**Table 4.4 Beneficial Use Life of Program Elements**

| | Toilet | Aerator | Showerhead | Piping |
|---|---|---|---|---|
| Beneficial Life (years) | 20[1] | 15[2] | 10[2] | 10-35[3] |

[1] EPA. 2014. [2] Homer, TLC. 2014. [3] REC. 2000.

Given that the lifetime of most of these fixes is between 10 and 35 years, the cost would lower to between $80 and $282 per AFY over the lifetime of the project. The expected life of the project will be set to 15 years based on an approximate weighted average of all the program elements.

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# Coachella Valley Water District

# 2010 Urban Water Management Plan

## Final Report

July 2011

# SECTION 2 SYSTEM DESCRIPTION

This section describes the CVWD service area as well as the historical and projected service area population. The applicable law governing the requirements for the UWMP in regards to system description is provided in the first subsection.

## 2.1 Law

**California Water Code Section 10631, Paragraph (a)**

*A plan shall be adopted in accordance with this chapter that shall do all of the following:*

*(a) Describe the service area of the supplier, including current and projected population, climate, and other demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available.*

## 2.2 Service Area Physical Description

The Coachella Valley lies in the northwestern portion of a great valley, the Salton Trough, which extends from the Gulf of California in Mexico northwesterly to the Cabazon area. This area lies primarily in Riverside County but also extends into northern San Diego County and northeastern Imperial County. The Colorado River enters this trough, and its delta has formed a barrier between the Gulf of California and the Coachella Valley. The Coachella Valley is ringed with mountains on three sides. On the west and north sides are the Santa Rosa, San Jacinto, and San Bernardino Mountains, which rise more than 10,000 feet above mean sea level (ft MSL). To the northeast and east are the Little San Bernardino Mountains, which attain elevations of 5,500 ft MSL.

The Coachella Valley is geographically divided into the West Valley and the East Valley. Generally, the West Valley, which includes the cities of Palm Springs, Cathedral City, Rancho Mirage, Indian Wells and Palm Desert, has a predominately resort/recreation-based economy that relies on groundwater as its principal water source. The East Valley, which includes the cities of Coachella, Indio and La Quinta and the communities of Bermuda Dunes, Mecca, and Thermal, has an agricultural-based economy utilizing groundwater and Colorado River water imported via the Coachella Canal. The East Valley lies southeast of a line extending from Washington Street and Point Happy northeast to the Indio Hills near Jefferson Street, and the West Valley is northwest of this line as shown in **Figure 2-1**. The CVWD service area also includes the western and eastern shores of the Salton Sea which relies on groundwater pumped from the Whitewater River Subbasin.

### 2.3.2 Future Population Projections

For population projections into the future, it is assumed that the annual growth rate of the CVWD service area population will be consistent with the annual growth rates provided in the 2010 Coachella Valley Water Management Plan (CVWMP) Update. The growth rates provided in the 2010 CVWMP Update are based on the Riverside County Center for Demographic Research (RRCDR) Riverside County Projections 2006 (RCP-06). The RCP-06 was approved by the Executive Committee of the Western Riverside Council of Governments (WRCOG) on December 4, 2006, the Executive Committee of the Coachella Valley Association of Governments (CVAG), and by the Riverside County Board of Supervisors on March 14, 2007.

The annual growth rates of the cities and unincorporated areas within the CVWD service area are proportionally averaged together to obtain the annual growth rate of the CVWD service area population. **Table 2-4** provides the projected service area population through 2035 and the annual growth rate for each 5-year increment.

***Table 2-4***
***Current and Projected Population***

| UWMP Guidebook Table 2 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Population — current and projected | | | | | | | |
| Year | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | Data source |
| Service area population | 202,660 | 244,700 | 314,000 | 386,300 | 442,100 | 512,200 | Projections based on 2010 CVWMP Update |

### 2.3.3 Effects of Recession on Growth Forecasts

There was a rapid population increase in the Coachella Valley in the early 2000s; the population in the Valley has increased by 35 percent since 2000. Since late 2007, Riverside County has been negatively affected by the current economic recession and has experienced some of the highest rates of foreclosures and unemployment in the country. Due to this economic downturn, growth in the County has significantly moderated over the last two years. The RCP-06 growth forecasts were developed and adopted in late 2006 and early 2007, before the onset of the widespread recession. Therefore, the slowdown in the housing market, which was one of the primary components of the recession, is not accounted for in the RCP-06 forecasts.

Some economists and real estate professionals who have been studying the effects of the recession on Riverside County predict that economic recovery in the County will be slow paced over the next five years (Beacon-UCR, 2010). This could result in lower than projected growth rate for the Valley in the near term. The timing and extent of this reduced growth rate cannot be accurately predicted at this time. Because the planning period extends through 2035, it is expected that the effect of the recession on growth in the Valley will attenuate over the long term. Changes in the growth forecast will be reflected in future UWMP reports. For the purpose of this report, it is assumed that the RCP-06 growth forecasts are applicable.

# SECTION 3 SYSTEM DEMANDS

Water resources planning requires reasonably accurate estimates of future water needs. This section presents CVWD's baseline and project urban water system demands. To provide an adequate long-range view of future water needs, this report uses a 25-year planning period from 2010 to 2035. The applicable laws governing the requirements for the UWMP in regards to system demands is provided below.

## 3.1 Law

**California Water Code Section 10608.20, Paragraph (e)**

*(e) An urban retail water supplier shall include in its urban water management plan due in 2010 pursuant to Part 2.6 (commencing with Section 10610) the baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use, along with the bases for determining those estimates, including references to supporting data.*

**California Water Code Section 10608.36**

*Urban wholesale water suppliers shall include in the urban water management plans required pursuant to Part 2.6 (commencing with Section 10610) an assessment of their present and proposed future measures, programs, and policies to help achieve the water use reductions required by this part.*

**California Water Code Section 10631, Paragraphs (a), (e), (k)**

*(a) The water use projections required by Section 10631 shall include projected water use for single-family and multi-family residential housing needed for lower income households, as defined in Section 50079.5 of the Health and Safety Code, as identified in the housing element of any city, county, or city and county in the service area of the supplier.*

*(e) Quantify, to the extent records are available, past and current water use, and projected water use (over the same five-year increments described in subdivision (a)), identifying the uses among water use sectors, including, but not necessarily limited to, all of the following uses: (A) single-family residential; (B) multifamily; (C) commercial; (D) industrial; (E) institutional and governmental; (F) landscape; (G) sales to other agencies; (H) saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof; (I) agricultural.*

*(k) Urban water suppliers that rely upon a wholesale agency for a source of water shall provide the wholesale agency with water use projections from that agency for that source of water in five-year increments to 20 years or as far as data is available. The wholesale agency shall provide information to the urban water supplier for inclusion in the urban water supplier's plan that identifies and quantifies, to the extent practicable, the existing and planned sources of water as required by subdivision (b), available from the wholesale agency to the urban water supplier over the same five-year increments, and during various water-year types in accordance with subdivision (c). An urban water supplier may rely upon water supply information provided by the wholesale agency in fulfilling the plan informational requirements of subdivisions (b) and (c).*

capita water use for each base period year. Taking the average daily per capita water use over the base period, the 5-year base daily per capita water use is 590 gpcd. Ninety-five percent of this base daily per capita water use is 561 gpcd. Since the 2020 urban water use target of 473 gpcd is less than this value, the urban water use target is confirmed.

In addition to the 2020 urban water use target, an interim 2015 urban water use target is also required per Water Code Section 1068.20. The 2015 interim urban water use target is calculated by adding the 10-year base daily per capita water use and the 2020 urban water use target and dividing by two. This value is 532 gpcd. **Table 3-7** provides the values for the 10-year base daily per capita water use, 2015 interim urban water use target, and 2020 urban water use target.

***Table 3-6***
***5-Year Base Daily Per Capita Water Use***

| UWMP Guidebook Table 15 | | | | |
|---|---|---|---|---|
| Base daily per capita water use — 5-year range | | | | |
| Base period year | | | | |
| Sequence Year | Calendar Year | Distribution System Population | Daily system gross water use (mgd) | Annual daily per capita water use (gpcd) |
| Year 1 | 2003 | 180,305 | 108 | 600 |
| Year 2 | 2004 | 188,358 | 111 | 588 |
| Year 3 | 2005 | 193,536 | 109 | 562 |
| Year 4 | 2006 | 195,570 | 121 | 616 |
| Year 5 | 2007 | 198,363 | 116 | 584 |
| Base Daily Per Capita Water Use | | | | 590 |

***Table 3-7***
***Urban Water Use Targets***

| | |
|---|---|
| Base Daily Per Capita Water Use (gpcd) | 591 |
| 2015 Interim Urban Water Use Target (gpcd) [1] | 532 |
| 2020 Urban Water Use Target (gpcd) [2] | 473 |

1 - Calculated by adding the base daily per capita water use and 2020 urban water use target and dividing by two.

2 - 80 percent of base daily per capita water use per Method 1

## 3.3 Water Demands

### 3.3.1 Potable Water Demand Projections

The following tables provide past, current, and projected urban water use for CVWD. **Table 3-8** and present water deliveries by water use sector for 2005 and 2010, respectively. The two biggest water use sectors are single family and landscaping. It is estimated that 80 percent of single family water use is for outdoor landscaping. Recognizing that the vast majority of urban water use is for landscaping purposes, CVWD has focused its conservation efforts to reduce landscape water use as described in Section 6.

# SECTION 4 SYSTEM SUPPLIES

This section describes the existing and future water supplies available to CVWD to meet its domestic and non-potable water demands. Water supply reliability is presented for normal, single dry and multiple dry years.

## 4.1 Law

**California Water Code Section 10631, Paragraph (b), (d), (h), (i)**

*(b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments described in subdivision (a). If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information shall be included in the plan:*

*(1) A copy of any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management.*

*(2) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater. For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition.*

*(3) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.*

*(4) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.*

*(d) Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.*

*(h) Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed description of expected future projects and programs, other than the demand management programs identified pursuant to paragraph (1) of subdivision (f), that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in average, single-dry, and multiple-dry water years. The description shall identify specific projects and include a description of the*

flexible storage at Castaic and Perris Reservoirs. Amendments to CVWD's SWP contract was executed in 2003 (DWR, 2003).

Metropolitan has the option to call back the water in years when needed. This option must be exercised no later than April 30 of each year. Metropolitan's callback options are to be exercised in two 50,000 AF blocks. To estimate the average supply from this transfer conservatively, the CVWMP assumes that Metropolitan would exercise its option to callback the 100,000 AFY in 4 wet years out of every 10 years. The actual frequency of callback would depend on the availability of Metropolitan's water supplies to meet its demands. Since 2003, Metropolitan has called back the water only in 2005.

#### 4.2.3.2 Other SWP Transfers

In 2004, CVWD purchased an additional 9,900 AFY of SWP Table A water from the Tulare Lake Basin Water Storage District (Tulare Lake Basin) in Kings County (DWR, 2004). In 2007, CVWD made a second purchase of Table A SWP water from Tulare Lake Basin for 5,250 AFY (DWR, 2007). Also in 2007, a transfer was completed for 12,000 AFY of Table A Amounts from the Berrenda Mesa Water District in Kern County (DWR, 2007a). DWA participated in these latter two transfers in amounts of 1,750 AFY and 4,000 AFY, respectively. With these additional transfers, CVWD's total SWP Table A Amount is 138,350 AFY. **Table 4-10** summarizes CVWD's and DWA's total allocations of Table A SWP water.

***Table 4-10***
***State Water Project Sources***

| Agency | Original SWP Table A | Tulare Lake Basin Transfer #1 | Tulare Lake Basin Transfer #2 | Metropolitan Transfer | Berrenda Mesa Transfer | Total |
|---|---|---|---|---|---|---|
| CVWD | 23,100 | 9,900 | 5,250 | 88,100 | 12,000 | 138,350 |
| DWA | 38,100 | 0 | 1,750 | 11,900 | 4,000 | 55,750 |
| Total | 61,200 | 9,900 | 7,000 | 100,000 | 16,000 | 194,100 |

All values expressed in AFY.

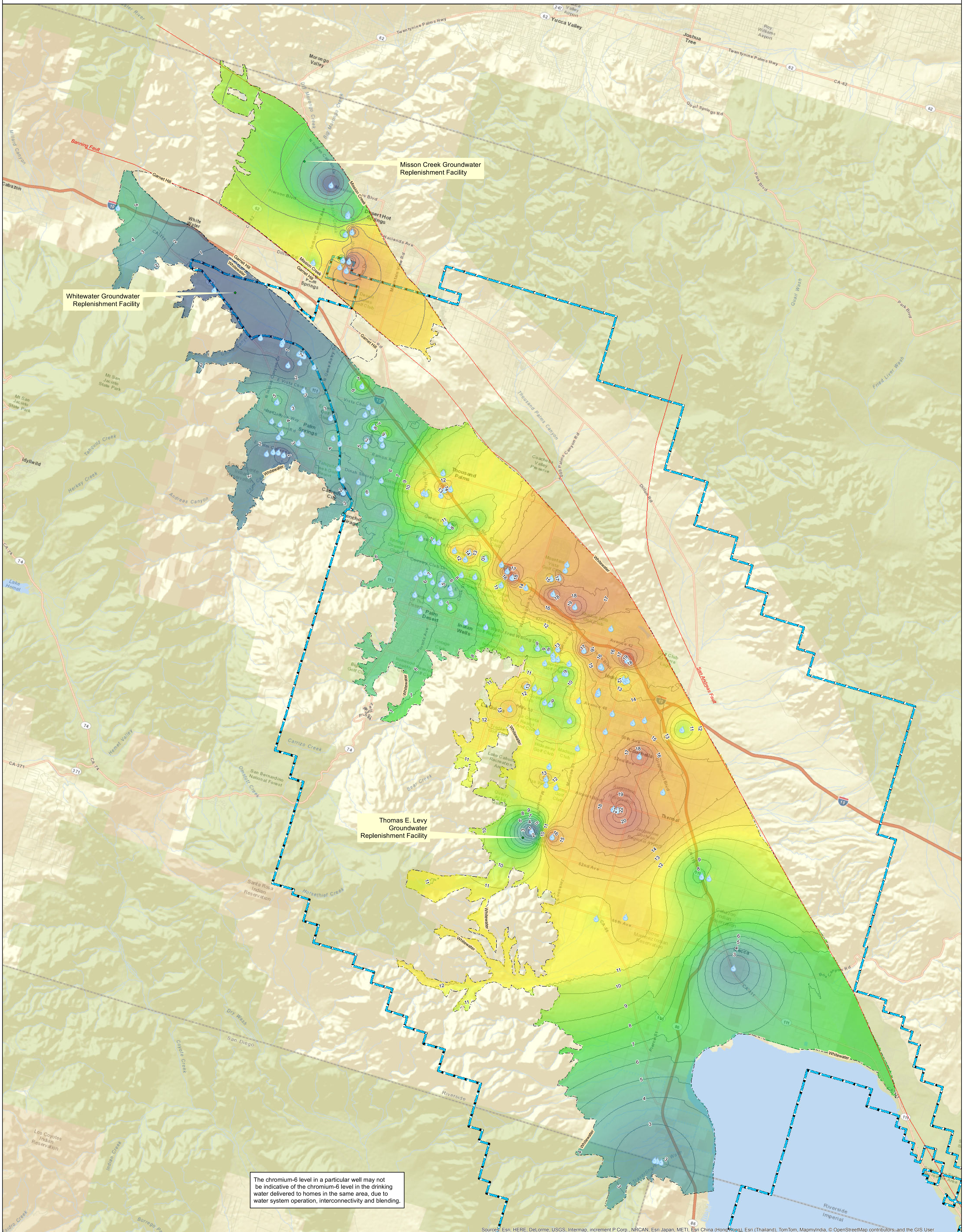
Although CVWD and DWA have contracts for water amounts as shown on **Table 4-10**, the amount of water they are actually allocated in any given year is based on the amount of SWP water available. For 2010, the allocation was 50% of the total contracted amount. A more detailed discussion on SWP reliability is provided in Section 5.

## 4.3 Transfer Opportunities

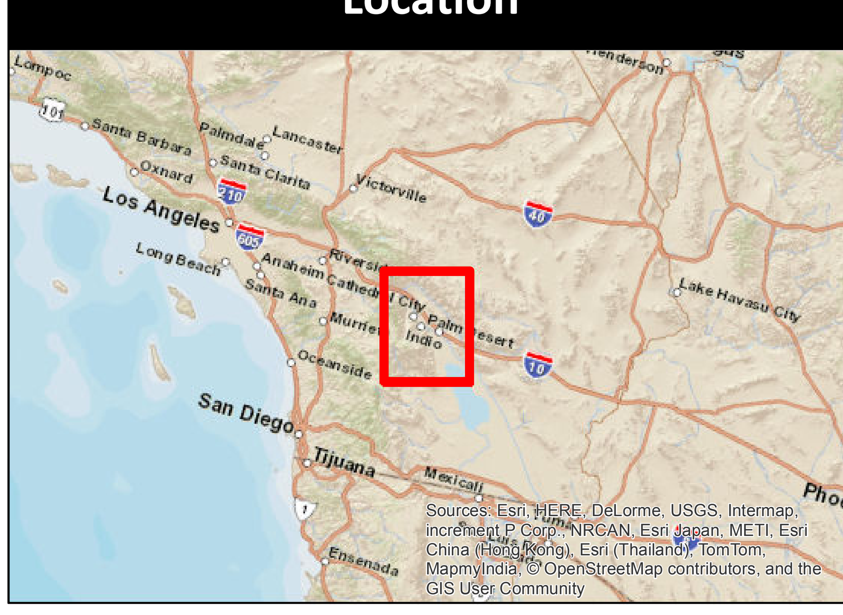
Water transfers involve the temporary or permanent sale or lease of a water right or contractual water supply between willing parties. Water can be made available for transfer from other parties through a variety of mechanisms:

- Transferring surface water from storage that would have otherwise carried over to the following years
- Pumping groundwater instead of surface water delivery and transferring the surface water

# Coachella Valley Groundwater Chromium-6 Occurrence




## Location




## Legend

**Chromium-6 Levels**

**Value**

High : 23.6675

Low : 0.0003776

Domestic Water Well

Contours

Fault Lines

CVWD Boundary

Subbasin Boundary

**Coachella Valley Water District**

*75515 Hovley Lane East*
*Palm Desert, CA 92211*
*www.cvwd.org*
*Ph. (760) 398-2661*
*Fx. (760) 568-1789*

Miles

0 0.75 1.5 3 4.5 6 7.5

File Name: GroundwaterChromium6Levels_24x36_June03_2014.mxd
File Location: N:\GIS\Projects\ChromiumMapping\Mxd\
Date Updated: Tuesday, June 03, 2014 @ 2:18:46 PM
Updated By: TH1209
Department: CVWD Engineering - GIS/CAD

*This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.*

*PREPARED FOR*
**COACHELLA VALLEY WATER DISTRICT**

# Coachella Valley Water Management Plan Update

**DRAFT REPORT**

December 2010

WATER DISTRICT

MWH® BUILDING A BETTER WORLD

Water Consult
Engineering and Planning Consultants

# COACHELLA VALLEY WATER MANAGEMENT PLAN 2010 UPDATE

## Draft Report

**Prepared by:**

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**Planning and Special Program Manager**

**December, 2010**

# Section 1
# Introduction

The Coachella Valley Water District (CVWD, District) initiated a planning process in the early 1990s to meet its responsibilities for securing and protecting Coachella Valley water supplies into the future. The process initially addressed the East Valley, but was expanded to include the entire Coachella Valley in 1995. In September, 2002, the CVWD Board of Directors adopted the "Coachella Valley Final Water Management Plan" (2002 WMP) (Water Consult and MWH, 2002) and certified the final program environmental impact report (PEIR) (MWH, 2002). The Board recognized the need to update the Plan periodically to respond to changing external and internal conditions. This 2010 WMP Update meets that need.

## 1.1 PURPOSE AND NEED FOR WATER MANAGEMENT PLAN UPDATE

The Coachella Valley groundwater basin has been the principal source of water for the Valley since the early 1900s. As land was developed for agricultural and urban uses, demand on the groundwater basin increased. Groundwater levels in the East Valley began to decline and artesian wells ceased flowing. Recognizing the need for a supplemental water source, CVWD contracted with the federal government for Colorado River water from the All-American and Coachella Canals in 1934. With the completion of the Coachella Canal in 1949, supplemental water deliveries began and the groundwater levels began to recover. Groundwater levels stabilized in the 1970s and early 1980s near historical levels. With increased growth, groundwater levels once again began to decline as demand exceeded the available supply. Groundwater levels have shown a steady decline since the mid 1980s.

In the West Valley, resort and urban development relied solely on groundwater. Recognizing the need for additional water supplies, Desert Water Agency (DWA) and CVWD entered separate agreements with the State of California to purchase water from the State Water Project (SWP) in 1962 and 1963, respectively. To avoid the estimated $150 million cost to construct a pipeline to the Valley at that time, CVWD and DWA signed a water exchange agreement with the Metropolitan Water District of Southern California (Metropolitan) to deliver an equivalent amount of Colorado River water from Metropolitan's aqueduct in exchange for the Valley's SWP water. Deliveries of SWP Exchange water to the Whitewater River Spreading Facility commenced in 1973. Groundwater levels near the recharge facility showed a response to the recharge. However, in the central portions of the Valley, a steady decline continued. CVWD and DWA also signed an advanced delivery agreement with Metropolitan to store excess Colorado River water in the West Valley basin. This stored water represents a pre-delivery of the Valley's SWP supply. In the mid-1980s Metropolitan stored up to 600,000 AF of water in the basin. Even with this additional water, groundwater levels in the West Valley declined.

In 1994, CVWD with DWA commenced preparation of a water management plan to eliminate groundwater overdraft. The goal of the 2002 WMP is to assure adequate quantities of safe, high-quality water at the lowest cost to Coachella Valley water users. To meet this goal, four objectives must be met:

1. Eliminate groundwater overdraft and its associated adverse impacts, including:
   - Groundwater storage reductions,
   - Declining groundwater levels,
   - Land subsidence, and
   - Water quality degradation.
2. Maximize conjunctive use opportunities,
3. Minimize adverse economic impacts to Coachella Valley water users, and
4. Minimize environmental impacts.

Since the adoption of the 2002 WMP, the Coachella Valley has experienced a number of changes affecting water demands in the Valley that are projected to continue for the foreseeable future. These changes include:

- rapid population growth,
- changes in land use from agricultural or vacant to urban and corresponding changes in water demand in terms of both quantity and quality,
- development on tribal lands and related water demands, and
- projected urban development outside the 2002 WMP study area and corresponding increases in water demands.

External factors have also affected or may affect Valley water supplies:

- SWP supplies fluctuate annually due to hydrology and environmental needs in the Sacramento-San Joaquin Delta (Delta).
- Recent environmental rulings have restricted the State's ability to move water through the Delta to the SWP decreasing supply reliability. The degree to which the long term supply of the SWP will be affected is uncertain.
- Efforts are underway to prepare the Bay-Delta Conservation Plan (BDCP), which is intended to restore the Delta's ecosystem and improve water supply reliability.
- The Quantification Settlement Agreement (QSA) has been overturned by the court, creating uncertainty in future Colorado River supplies.
- Climate change could affect the long term reliability of SWP and Colorado River supplies.

These changing conditions reinforce the need for a long term Plan and for updating the Plan in response to changing conditions. Consequently, the goal and objectives for the 2010 WMP Update have been refined to reflect the significant changes in projected water demands and water supplies that have occurred in recent years. The basic goal of the WMP remains essentially the same: "to reliably meet current and future water demands in a cost-effective and sustainable manner." However, the underlying objectives have been refined based on the uncertainties facing water resources managers throughout California. The programs and projects identified in the 2010 WMP Update are based on the following objectives:

1. Meet current and future water demands with a 10 percent supply buffer,
2. Eliminate long-term groundwater overdraft,
3. Manage water quality,
4. Comply with state and federal regulations,
5. Manage future costs, and
6. Minimize adverse environmental impacts.

These objectives are described in detail in Section 6.

## 1.2 STUDY AREA DESCRIPTION

The Coachella Valley lies in the northwestern portion of a great valley, the Salton Trough, which extends from the Gulf of California in Mexico northwesterly to the Cabazon area as shown in **Figure 1-1**. The Colorado River intersects this trough about midway, and its delta has formed a barrier between the Gulf of California and the Coachella and Imperial valleys. The Coachella Valley is ringed with mountains on three sides. On the north and west sides are the San Bernardino Mountains, San Jacinto, and Santa Rosa, which rise more than 10,000 feet above mean sea level (MSL). To the northeast and east are the Little San Bernardino Mountains, which attain elevations of 5,500 feet above MSL.

The Coachella Valley is geographically divided into the West Valley and the East Valley. Generally, the West Valley, which includes the cities of Palm Springs, Cathedral City, Rancho Mirage, Indian Wells and Palm Desert, has a predominately resort/recreation-based economy that relies on groundwater as its principal water source. The East Valley, which includes the cities of Coachella, Indio and La Quinta and the communities of Mecca and Thermal, has an agricultural-based economy utilizing groundwater and Colorado River water imported via the Coachella Canal. The East Valley is southeast of a line extending from Washington Street and Point Happy northeast to the Indio Hills near Jefferson Street, and the West Valley is northwest of this line as shown in **Figure 1-1**. The WMP study area also included CVWD's domestic water service area along the western and eastern shores of the Salton Sea which relies on groundwater pumped from the Whitewater River Subbasin. The 2010 WMP Update includes expanded areas of potential development located east of the San Andreas Fault along Dillon Road. This area falls within the spheres of influence of the cities of Coachella and Indio. Additional discussion of this expanded service area is presented in **Section 3**.

The Coachella Valley Groundwater Basin encompasses much of the Valley floor. Geologic faults and structures divide the basin into five subbasins: San Gorgonio Pass, Whitewater River (Indio), Garnet Hill, Mission Creek, and Desert Hot Springs subbasins. The largest of these is the Whitewater River Subbasin, which lies between the San Andreas Fault on northeast and the surrounding San Jacinto and Santa Rosa Mountains on the southwest. The subbasin extends from Whitewater in the northwest to the Salton Sea in southeast.

The California Department of Water Resources (DWR) refers to the Whitewater River subbasin as the Indio Subbasin which is designated Basin No. 7-21.01 in DWR's Bulletin 118 (DWR, 2003). The basin has a storage capacity of approximately 30 million acre-feet[1] (AF) (DWR, 1964). The geology of the basin varies with coarse-grained sediments located in the vicinity of Whitewater and Palm Springs, gradually transitioning to fine-grained sediments near the Salton Sea. Water placed on the ground surface in the West Valley will percolate through the sands and gravels directly into the groundwater aquifer. However, in the East Valley, several impervious clay layers lie between the ground surface and the main groundwater aquifer. Water applied to the surface in the East Valley does not easily reach the East groundwater aquifers due to these impervious clay layers. The only outlet for groundwater in the Whitewater River Subbasin is through natural subsurface outflow to the Salton Sea or through collection in drains and transport to the Salton Sea via the Coachella Valley Stormwater Channel (CVSC).

Although the study area of 2002 WMP and the 2010 WMP Update includes the Garnet Hill Subbasin, this subbasin is evaluated in detail the Mission Creek/Garnet Hill WMP which is under preparation (see **Section 1.4.3**.) The study area also includes the southeast portion of the Desert Hot Springs Subbasin; however, since little to no groundwater is produced from this subbasin.

The water users in the Coachella Valley receive water service from six water agencies: CVWD, DWA, Mission Springs Water District (MSWD), Indio Water Authority (IWA), Coachella Water Authority (CWA) and Myoma Dunes Mutual Water Company. Several isolated communities are supplied by small private water companies. The service area boundaries of Valley water purveyors along with city boundaries are presented in **Figure 1-2**. Wastewater service is provided by CVWD, DWA, the City of Palm Springs, Coachella Sanitary District and Valley Sanitary District (portions of Indio). Portions of the planning area which are not served by one of these agencies rely on individual septic systems for wastewater treatment and disposal.

[1] One acre-foot (AF) is the amount of water that would cover one acre of land (approximately the size of a football field), one foot deep, or about 326,000 gallons.

# Section 2
# The 2002 Water Management Plan

Adoption of the 2002 WMP represented a major change in water management for the Coachella Valley. While past water management practices had been vital for the economic growth of the Valley, the 2002 WMP provided a road map for meeting future water needs. CVWD, DWA and the other Coachella Valley agencies have been successful in implementing many of the recommendations and projects included in the 2002 WMP. The primary successes have been in the areas of urban water conservation, acquisition of additional State Water Project (SWP) supplies, construction of the initial phase of the Mid-Valley Pipeline (MVP) and construction of the Thomas E. Levy Groundwater Replenishment Facility (Levy facility). CVWD has worked cooperatively with Riverside County, the Coachella Valley cities and water agencies and the Coachella Valley Association of Governments (CVAG) to develop a Valley-wide landscape ordinance to conserve water. Many of the local governments in the Valley have adopted the ordinance. CVWD also implemented a replenishment assessment charge (RAC) on pumping for the lower Whitewater River subbasin which generates funds for groundwater replenishment activities. Although much remains to be done to eliminate groundwater overdraft, significant progress has been and continues to be made. This section describes the 2002 WMP and the status of implementation of that Plan.

## 2.1 ALTERNATIVES

The goal and objectives of the 2002 WMP are stated in Section 1. During preparation of the 2002 WMP, CVWD and its consultants identified a wide range of potential management elements that could potentially be included in a plan. These elements were organized in six categories: pumping restrictions, demand reduction (conservation), local water sources, imported water sources, water management actions, and water quality. Following evaluation for ability to reduce overdraft, technical feasibility, potential environmental impacts, costs, legal and regulatory factors and regional economic impacts, the elements were screened and combined into four management alternatives. A preferred alternative was selected that best met the 2002 WMP goal and objectives.

**Alternative 1 – No Project:** The No Project Alternative assumed continuation of water management actions at 2002 levels by CVWD including groundwater recharge in the West Valley; supplying Canal water to existing golf courses and agricultural users and to all new agricultural users and new golf courses within ID-1; supplying excess recycled wastewater effluent beyond percolation capacity to area golf courses; and domestic, golf course, and agricultural water conservation.

**Alternative 2 – Pumping Restriction by Adjudication:** Alternative 2 assumed court-ordered restrictions that allotted water to individual groundwater pumpers. The allocation would require groundwater pumping be drastically reduced throughout the Coachella Valley. West Valley pumping would be reduced by approximately 35 percent, while in the East Valley pumping would be reduced by approximately 75 percent.

**Alternative 3 – Management of Demand and Maximization of Local Resources:** Alternative 3 maximized the use of available local water resources and managed water demand while maintaining imported water usage at 2002 levels. Demand would be managed, to the extent practical, by maximizing water conservation for both urban and agricultural uses and by the increased use of recycled water.

**Alternative 4 – Combination Alternative:** Alternative 4 included conservation, groundwater recharge, and source substitution, including many new actions. The most feasible and cost effective management elements were combined to include:

- Urban, golf course, and agricultural conservation measures,
- Additional surface water supplies,
- Groundwater recharge in the West and East Valleys, and
- Numerous source substitution elements to reduce groundwater pumping, including:
  - Canal water to agricultural groundwater users within Improvement District 1 (ID-1),
  - Canal water for golf course irrigation within ID-1,
  - Additional recycled water to West Valley golf courses,
  - Desalted agricultural drain water for agricultural irrigation outside ID-1,
  - Recycled water for agricultural irrigation in East Valley,
  - Treated Canal water for urban uses within ID-1, and
  - Direct delivery of SWP exchange water for West Valley golf course irrigation.

Alternatives 1, 2, and 3 were found to have significant adverse social, economic, and environmental impacts to the Coachella Valley. Alternative 4 best met the 2002 WMP goal and objectives with the least adverse impacts and was selected as the preferred alternative.

## 2.2 RECOMMENDED PLAN

The 2002 WMP included water conservation, additional supply, source substitution, and groundwater recharge elements. These are described below.

### 2.2.1 Water Conservation

The primary focus of water conservation was on urban use, agricultural irrigation, and golf course irrigation. As shown in **Table 2-1**, water conservation measures were expected to decrease total water demand by approximately seven percent by 2015. Water conservation activities included in the Plan are described below.

**Urban Conservation:** Under the preferred alternative, the target was to reduce urban water demand by a minimum of 10 percent by 2010 and maintain this level of reduction through 2035, the 2002 WMP planning period. Existing and potential new water conservation measures to be evaluated included water efficient landscaping, water efficient plumbing, tiered or seasonal water pricing, public information and education programs, and policies to incorporate water conservation measures into future general plan updates and development policies adopted by Valley municipalities.

**Table 2-1**
**Minimum Water Conservation Assumptions for the 2002 Preferred Alternative**

| Water Use Category | Minimum Conservation Target (Reduction from No Project Demand) |
|---|---|
| Urban (municipal/residential) | 10 percent by 2010 |
| Golf Courses: | |
| Existing in 1999 | 5 percent by 2010 |
| Built after 1999 [1] | Case-by-Case |
| Industrial | Case-by-Case |
| Crop Irrigation | 7 percent by 2015 |
| Fish Farms | Case-by-Case |
| Duck Clubs | Case-by-Case |
| Greenhouses | Case-by-Case |
| Total Demand | 7 percent |

[1] Future golf courses were assumed to implement water conservation measures under No Project

**Agricultural Conservation:** Agricultural water conservation included evaluation of existing and new agricultural conservation measures, including efficient irrigation practices and on-farm water audits consisting of field-by-field review of practices with a confidential report to each irrigator on practices and recommendations for improving efficiency.

**Golf Course Conservation:** Proposed golf course water conservation included improved irrigation practices, golf course turf restrictions and establishing a maximum water allowance.

**District Operating Policies:** The 2002 WMP included an ongoing process to identify CVWD operating policies resulting in additional water savings or to make the use of Canal water more attractive to groundwater users.

**Evaluation of Water Conservation Programs:** CVWD's water conservation programs would be evaluated to determine the effectiveness of voluntary programs. Recommendations would be developed for improvement in specific areas, such as public education, ordinances, etc. Based on evaluation results, additional conservation measures would be considered by the CVWD Board.

### 2.2.2 Additional Water Supplies

The 2002 WMP proposed that CVWD and DWA obtain additional water supplies to help eliminate current and future overdraft. Sources of additional water included the Colorado River, the State Water Project, the Whitewater River, recycled water, water exchanges and transfers, dry year purchases, water development projects, and desalination.

**Colorado River Water:** CVWD, IID and Metropolitan, along with the State of California and the U. S. Department of the Interior (Interior), agreed on a formal Quantification Settlement Agreement (QSA) regarding their respective shares of Colorado River water. The QSA is described in more detail in **Section 4**.

The QSA was signed in October 2003, giving CVWD a total diversion of 459,000 AFY at Imperial Dam. After deducting conveyance losses, about 428,000 AFY was expected to be available for use in the Valley by 2026.

**SWP 100,000 AFY Transfer:** Prior to adoption of the 2002 WMP, CVWD and DWA had contracts with the State of California for a combined Table A Amount[1] of 61,200 AFY of SWP water. Under the SWP Transfer Project, CVWD and DWA would acquire 100,000 AFY of Metropolitan's SWP Table A Amount as a permanent transfer. Water obtained through this transfer would be exchanged for Colorado River water.

**Additional Water Purchases:** During wet years, CVWD and DWA would continue their current practice of purchasing Pool A, Pool B and interruptible water as available from other SWP contractors. In addition, CVWD and DWA would evaluate the purchase of water during dry years from programs like the Governor's Drought Water Bank based on supply availability and costs. The objective of these purchases and acquisitions along with the SWP Transfer was to achieve long-term average deliveries of 140,000 AFY from the SWP.

**Recycled Treated Municipal Wastewater Effluent:** Municipal effluent recycling would continue and increase by an additional 16,000 AFY by 2035.

**Desalinated agricultural drain water:** Agricultural drain water from the CVSC would be desalted to a quality equivalent to Canal water for irrigation use with an initial rate of 4,000 AFY by 2013, increasing to 11,000 AFY by 2023.

**Recycled fish farm effluent:** Recycling would continue at fish farms providing about 5,000 AFY for use by duck clubs and agriculture irrigation.

### 2.2.3 Source Substitution

Source substitution is the delivery of an alternate source of water to users pumping groundwater. Alternative sources of water in the Coachella Valley include recycled water from municipal wastewater treatment plants, Canal water, desalinated agricultural drain water, and SWP Exchange water delivered through the Coachella Canal.

Source substitution projects included conversion of existing and future golf courses from groundwater to Canal water, recycled water or SWP Exchange water, and conversion of agricultural irrigation and municipal use from groundwater to Canal water. A major project envisioned was the MVP that would convey SWP Exchange water from the Coachella Canal to golf courses in the Rancho Mirage-Palm Desert-Indian Wells area.

Approximately 30 percent of the municipal demand in the East Valley would receive treated Canal water from one or more water treatment plants. Total municipal usage of treated Canal water was projected to be about 32,000 AFY and would be phased in during the late 2020s and early 2030s.

[1] Each SWP contract contains a "Table A" exhibit which defines the maximum annual amount of water each contractor can receive, excluding certain interruptible deliveries. Table A Amounts are used by DWR to allocate available SWP supplies and some of the SWP project costs among the contractors.

**Table 2-2**
**Status of the 2002 Water Management Plan Implementation**

| 1. WATER CONSERVATION | |
|---|---|
| **A. Municipal Conservation** | |
| **Large Landscape Customers** | **Has This Program or Project Been Implemented?** |
| Low-Interest Loans to Implement Water Conservation Programs | No – A CVWD Board resolution was adopted but no applications received |
| Initiate Professional Landscaper Certification Program | Yes – Quarterly seminars |
| Water Audits for Large Water Users | Yes |
| Adoption of Water Efficient Landscape Ordinance by Valley Cities | Yes - Most cities adopted 2007 CVWD ordinance or something more stringent. Revised ordinance adopted by CVWD Board in 2009. All cities and the County are expected to adopt 2009 ordinance. |
| Large Landscape Weather-Based Irrigation Controller Rebate Program | Yes – 97 customers. This represents about 10% of CVWD customers. |
| Large Site Curbside Sprinkler Retrofit Rebate Program | Yes – Two pilot projects. New development complies with 2009 Landscape Ordinance. |
| Plan Check Compliance Inspections of All Approved Landscape Irrigation Plans | Yes |
| **Residential Customers** | **Has This Program or Project Been Implemented?** |
| Generate Residential ETo Zone Map | Yes – Used for tiered rates and maximum applied water allowance in Landscape Ordinance |
| Residential Weather-Based Irrigation Controller Rebate Program | Yes – Existing customers. Required for all new development via Landscape Ordinance |
| Residential Curbside Sprinkler Retrofit Rebate Program | Yes - A pilot project consisting of 10 houses on a cul-de-sac. Reduced street runoff by a total of 55 gpm when sprinklers were running. |
| Generic Landscape Irrigation Schedule Sticker Program | Yes |
| Website Turf Grass Irrigation Scheduling Program | Yes |
| Turf buyout partnership with cities of La Quinta and Palm Desert | Yes – new program not included in 2002 WMP. |
| **Water Efficient Plumbing** | **Has This Program or Project Been Implemented?** |
| Water efficient plumbing is installed in all new homes. | Yes – Implemented via building codes. |
| Retrofit of existing fixtures with water efficient fixtures | No – Emphasis has focused on reducing outdoor water use. |
| **Tiered or Seasonal Water Pricing** | **Has This Program or Project Been Implemented?** |
| Tiered water pricing will be reviewed as part of the 2008 Water Management Plan update. | Yes– Implemented in 2009 |

# Section 3
# Water Demand Projections

Water resources planning requires reasonably accurate estimates of future water needs. Many factors can affect the amount of water required in the future including climate, existing water use patterns, population growth, employment, economic trends, environmental needs and water conservation efforts, to name a few. To provide an adequate long-range view of future water needs, the 2010 WMP Update uses a 35-year planning period from 2010 through 2045. This section also describes the changes in the study area for this 2010 WMP Update since the adoption of the 2002 WMP and presents the projected water demands through 2045 for the Coachella Valley.

## 3.1 FACTORS AFFECTING FUTURE WATER DEMANDS

Since the adoption of the 2002 WMP, the Coachella Valley has experienced a number of changes that will affect future water demands. These changes include:

- Rapid population growth,
- Changes in land use,
- Development on Tribal land,
- Potential development outside the 2002 WMP Study Area, and
- Effects of the economic recession.

These changes are discussed below.

### 3.1.1 Revised Growth Forecasts

In 2005, Riverside County was experiencing rapid growth. Recognizing the need for more accurate growth forecasts, the Riverside County Center for Demographic Research (RCCDR) was established under the joint efforts of the County of Riverside, the Western Riverside Council of Governments (WRCOG), the Coachella Valley Association of Governments (CVAG), and the University of California Riverside for the development of demographic data and related support products to serve all of Riverside County. The RCCDR was tasked with developing the Riverside County Projections 2006 (RCP-06) growth forecasts.

The RCP-06 was developed to provide County agencies and departments, the councils of governments, the universities and other entities with a consistent and standard set of population, housing and employment forecasts. In addition, a major objective for developing RCP-06 was to provide the Southern California Association of Governments (SCAG) with a set of projections for inclusion in their regional growth forecasts. The RCP-06 was approved by the Executive Committee of WRCOG on December 4, 2006, the Executive Committee of CVAG on January 29, 2007, and by the Riverside County Board of Supervisors on March 14, 2007.

## 3.3 WATER DEMAND PROJECTIONS

Water demand projections form the basis for water supply planning in the Coachella Valley. This section describes the principal assumptions and the resulting water demand projections that are used for the 2010 WMP Update. These baseline water demands serve as a starting point for water supply and demand management planning in the Update.

### 3.3.1 Assumptions

A number of assumptions have been made in the development of the future baseline water demands, as described below.

#### 3.3.1.1. Water Conservation

Water conservation is a major component of future water management. A significant focus of urban water conservation activities is on landscape irrigation water use. Adoption of the Coachella Valley Landscape Ordinance[1] along with water budget-based rates is expected to have a significant impact on water use by both existing and future development. Consequently, the baseline urban water demands resulting from growth incorporate the reduced water use associated with the landscape ordinance. Similarly, water demands associated with future golf courses assume the turf restrictions contained in the landscape ordinance. Baseline agricultural water demands do not include additional water conservation. Instead, agricultural conservation is evaluated as part of the water management elements considered in the 2010 WMP Update.

#### 3.3.1.2. Urban Water Demand Assumptions

The average urban water use in the Coachella Valley by CVWD customers was 1,173 gallons per day per connection (gpd/conn) for all customer categories during the period 1995-2004. Water usage for all Valley urban customers for the same period was estimated to be about 1,400 gpd/conn, based on reported production data and CVAG population estimates.

The 2003 CVWD Landscape Ordinance required 25 percent reduction in outdoor water use for new development. Future urban water use is further reduced with the implementation of 2007 and 2009 Landscape Ordinances to an average of 800 gpd/conn. Consequently, the water demand factor used to calculate urban demands within the Whitewater River Subbasin boundary associated with growth is estimated to be 800 gpd/conn. The RCP-06 population projections and assumptions regarding the population densities per connection are used with the water demand factor to project future urban demands.

The following assumptions are made for demands outside the Whitewater River Subbasin boundary:

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[1] CVWD adopted a valley-wide model ordinance for water efficient landscaping in 2003. This ordinance established a maximum applied water allowance (MAWA) equal to 60 percent of the reference evapotranspiration (ETo). The ordinance was revised in 2007 to reduce the MAWA to 50 percent of ETo and established limits on the amount of turf at new gold courses. CVWD and CVAG revised the ordinance again in 2009 to meet new State requirements and provide a model ordinance for all Valley cities to adopt.

1. An average residential density of 4 dwelling units per acre is assumed, except for three sections (about 1,920 acres) previously subdivided as 5 acre lots where a density of 1 dwelling unit per 2 acres may be allowed.
2. Urban water use is based on an average of 5 water connections per acre (less golf acreage) and an average water use of 800 gpd/conn. This demand is an overall average of residential, commercial, institutional and irrigation use (excluding golf courses).
3. Build-out of vacant parcels is assumed to take place by 2050 with initial development beginning in 2020.

#### 3.3.1.3. Agricultural Water Demand Assumptions

The 2002 WMP assumed that agricultural land use would be displaced as growth occurs, but that vacant land would be developed for agricultural purposes, keeping agricultural demands more or less constant. The 2010 WMP Update assumes that agricultural demand will reduce in proportion to the increase in urban demands. The agricultural demands are based on the assumption that urban growth in the East Valley will occur equally (50 percent each) on agricultural and vacant parcels. A water usage factor of 6.27 AFY/acre of agricultural land is used for calculating agricultural demands through 2045 based on the 2005 demands adjusted for conservation and evapotranspiration (ET). This number accounts for increased water use on land which is double- or triple-cropped but excludes additional conservation.

#### 3.3.1.4. Golf Course Water Demand Assumptions

The golf industry represents a significant water demand sector in the Coachella Valley and is expected to remain so in the future. Estimates developed for the 2010 WMP Update indicate that up to 75 new golf courses could potentially be constructed within the Whitewater River Subbasin boundary area by 2045. Since most of the future growth is anticipated to occur in the East Valley, this estimate is based on a ratio of the total number of existing golf courses in the East Valley to the total East Valley population. This ratio is then applied to future population growth in the Valley. This method assumes that the existing pattern of development (golf course acres per acre of urban development) within the Valley will continue into the future.

Implementation of the Landscape Ordinance and improved irrigation efficiency (proposed as part of the 2002 WMP) will result in reduced demands at new golf courses. For the purpose of this Update, it is expected that water demand for new golf courses or for any rehabilitation of existing golf courses will be 700 AFY per 18 holes (reduced from 900 AFY in 2002 WMP) based on the ordinance.

Water demand for new golf courses located outside the Whitewater River Subbasin is also assumed to be 700 AFY per course based on a typical 125-acre course. The ratio of golf courses per developed acre is similar to that of the six major identified developments. Based on this ratio, up to 14 golf courses are assumed for area outside the Whitewater River Subbasin.

# Section 4
# Existing Water Supplies

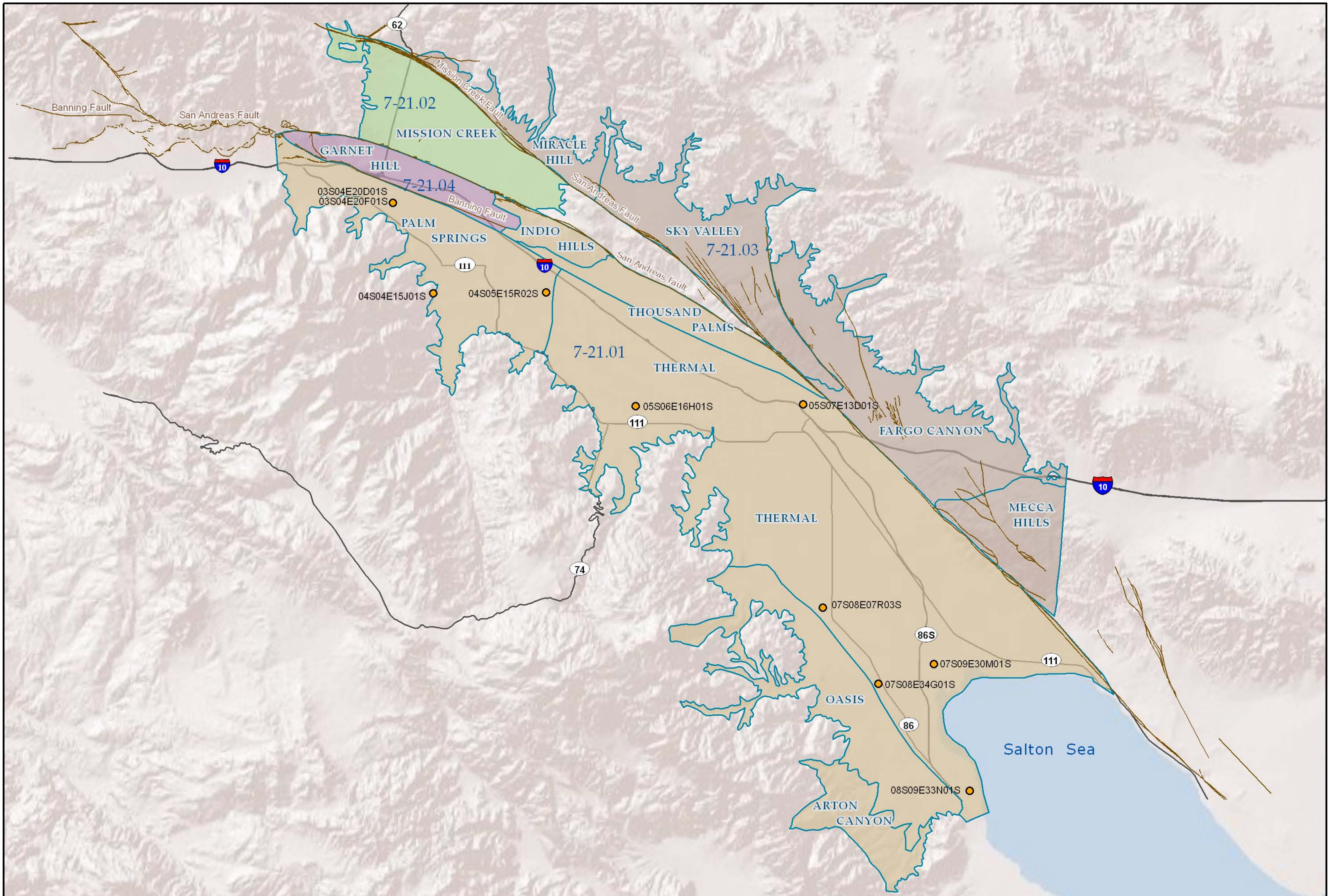
The Coachella Valley relies on a combination of local groundwater, Colorado River water, State Water Project (SWP) water, surface water and recycled water to meet water demands. This section describes the existing water supplies available to the Coachella Valley. A detailed discussion of amounts, risks and reliability associated with each supply source is also presented in the section. The section concludes with a discussion of the "No-Project" condition, which essentially evaluates what would happen if the 2002 Water Management Plan (WMP) was not updated to reflect new demands and changing supplies.

## 4.1 LOCAL GROUNDWATER

Groundwater has been the principal source of urban water supply in the Coachella Valley since the early part of the 20th century. Groundwater also supplies water for crop irrigation, fish farms, duck clubs, golf courses, greenhouses and industrial uses in the Valley. The Coachella Valley Groundwater Basin (DWR Basin No. 7-21) encompasses the entire floor of the Coachella Valley and consists of five subbasins as shown on **Figure 4-1**. These subbasins are the San Gorgonio Pass, Whitewater (Indio), Garnet Hill, Mission Creek and Desert Hot Springs subbasins. The 2010 WMP Update study area as described in **Section 1** consists of the Whitewater River (Indio) Subbasin, Garnet Hill and portions of Desert Hot Springs subbasins, which are described below. The Mission Creek Subbasin is described briefly because it relies on imported SWP supplies for replenishment.

### 4.1.1 Whitewater River Subbasin

The Whitewater River Subbasin, designated the Indio Subbasin (Basin No. 7-21.01) in DWR Bulletin No. 118 (2003), underlies the major portion of the Valley floor and encompasses approximately 400 square miles. Beginning approximately one mile west of the junction of State Highway 111 and Interstate Highway 10, the Whitewater River Subbasin extends southeast approximately 70 miles to the Salton Sea. The Subbasin is bordered on the southwest by the Santa Rosa and San Jacinto Mountains and is separated from Garnet Hill, Mission Creek and Desert Hot Springs Subbasins to the north and east by the Garnet Hill and San Andreas faults (CVWD, 2010a, DWR, 1964). The Garnet Hill fault, which extends southeastward from the north side of San Gorgonio Pass to the Indio Hills, is a relatively effective barrier to groundwater movement from the Garnet Hill Subbasin into the Whitewater River Subbasin, with some portions in the shallower zones more permeable. The San Andreas fault, extending southeastward from the junction of the Mission Creek and Banning faults in the Indio Hills and continuing out of the basin on the east flank of the Salton Sea, is also an effective barrier to groundwater movement from the northeast.




**Key to Features**

Fault

Highway

Groundwater Subbasins

Desert Hot Springs

Garnet Hill

Mission Creek

Whitewater

Groundwater Well

Groundwater Subareas

Source: DWR, ESRI, USGS, County of Riverside. Note: DWR Subbasin 7-21.04 was modified based on latest information.

N 0 2 4 8 Miles

**Document:** \Coachella Valley WD\WMP Update\14 Electronic Files - Modeling\GIS\Projects\CVWDSubbasins.mxd

**Date: December 2010**

**Coachella Valley Groundwater Subbasins**

**Figure 4-1**

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The subbasin underlies the cities of Palm Springs, Cathedral City, Rancho Mirage, Palm Desert, Indian Wells, La Quinta, Indio and Coachella, and the unincorporated communities of Thousand Palms, Thermal, Bermuda Dunes, Oasis and Mecca. From about Indio southeasterly to the Salton Sea, the subbasin contains increasingly thick layers of silt and clay, especially in the shallower portions of the subbasin. These silt and clay layers, which are remnants of ancient lake beds, impede the percolation of water applied for irrigation and limit groundwater recharge opportunities to the westerly fringe of the subbasin.

In 1964, the DWR estimated that the five subbasins that make up the Coachella Valley groundwater basin contained a total of approximately 39.2 million acre-feet (AF) of water in the first 1,000 feet below the ground surface; much of this water originated as runoff from the adjacent mountains. Of this amount, approximately 28.8 million AF of water was stored in the Whitewater River Subbasin. However, the amount of water in the Whitewater River Subbasin has decreased over the years due to pumping to serve urban, rural and agricultural development in the Coachella Valley has withdrawn water at a rate faster than its rate of recharge.

The Whitewater River Subbasin is not adjudicated. From a management perspective, the subbasin is divided into two management areas designated the Upper Whitewater River Subbasin Area of Benefit (AOB) and the Lower Whitewater River Subbasin AOB. The dividing line between these two areas is an irregular trending northeast to southwest between the Indio Hills north of the City of Indio and Point Happy in La Quinta. The Upper Whitewater River Subbaisn AOB is jointly managed by CVWD and DWA under the terms of the 1976 Water Management Agreement. The Lower Whitewater River Subbasin AOB is managed by CVWD. DWA and CVWD jointly operate a groundwater replenishment program whereby groundwater pumpers (other than minimal pumpers[1]) within designated areas of benefit pay a per acre-foot charge that is used to pay the cost of importing water and recharging the aquifer.

The Whitewater River Subbasin is divided into four subareas: Palm Springs, Thermal, Thousand Palms and Oasis. The Palm Springs Subarea is the forebay or main area of recharge to the Subbasin and the Thermal Subarea comprises the pressure or confined area within the basin. The other two subareas are peripheral areas having unconfined groundwater conditions (CVWD, 2009b).

#### 4.1.1.1 Palm Springs Subarea

The triangular area between the Garnet Hill Fault and the east slope of the San Jacinto Mountains southeast to Cathedral City is designated the Palm Springs Subarea, and is an area in which groundwater is unconfined. The Valley fill materials within the Palm Springs Subarea are essentially heterogeneous alluvial fan deposits with little sorting and little fine grained material content. The thickness of these water bearing materials is not known; however, it exceeds 1,000 feet (CVWD, 2010a). Although no lithologic distinction is apparent from well drillers' logs, the probable thickness of Recent deposits suggests that Ocotillo conglomerate underlies Recent fanglomerate in the Subarea at depths ranging from 300 to 400 feet.

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[1] CVWD's enabling legislation defines a minimal pumper as any producer who produces 25 or fewer AF in any year. DWA's legislation defines a minimal pumper as any producer who produces 10 or fewer AF in any year.

Natural recharge to the aquifers in the Whitewater River and Garnet Hill subbasins occurs primarily in the Palm Springs Subarea. The major natural sources include infiltration of stream runoff from the San Jacinto Mountains and the Whitewater River, and subsurface inflow from the San Gorgonio Pass and Mission Creek Subbasins. Deep percolation of direct precipitation on the Palm Springs Subarea is considered negligible as it is consumed by evapotranspiration.

#### 4.1.1.2 Thermal Subarea

Groundwater of the Palm Springs Subarea moves southeastward into the interbedded sands, silts and clays underlying the central portion of the Valley. The division between the Palm Springs Subarea and the Thermal Subarea is near Cathedral City. The permeabilities parallel to the bedding of the deposits in the Thermal Subarea are several times the permeabilities normal to the bedding and, therefore, movement of groundwater parallel to the bedding predominates. Confined or semi-confined groundwater conditions are present in the major portion of the Thermal Subarea. Movement of groundwater under these conditions is present in the major portion of the Thermal Subarea and is caused by differences in piezometric (pressure) level or head. Unconfined or free water conditions are present in the alluvial fans at the base of the Santa Rosa Mountains, as in the fans at the mouth of Deep Canyon and in the La Quinta area.

Sand and gravel lenses underlying this Subarea are discontinuous and clay beds are not extensive. However, two aquifer zones separated by a zone of finer-grained materials were identified from well logs. The fine grained materials within the intervening horizontal plane are not tight enough or persistent enough to restrict completely the vertical interflow of water, or to assign the term “aquiclude” to it. Therefore, the term “aquitard” is used for this zone of less permeable material that separates the Upper and Lower aquifer zones in the southeastern part of the Valley. Capping the Upper aquifer at the surface are tight clays and silts with minor amounts of sands. Semiperched groundwater occurs in this capping zone, which is up to 100 feet thick.

The Lower aquifer zone, composed of part of the Ocotillo conglomerate, consists of silty sands and gravels with interbeds of silt and clay. It is the most important source of groundwater in the Valley Groundwater Basin, but serves only that portion of the Valley east of Washington Street. The top of the Lower aquifer zone is present at depths ranging from 300 to 600 feet below the surface. The thickness of the zone is undetermined, as the deepest wells present in the Valley have not penetrated it in its entirety. The available data indicate that the zone is at least 500 feet thick and may be in excess of 1,000 feet thick.

The aquitard overlying the Lower aquifer zone is generally 100 to 200 feet thick, although in small areas on the periphery of the Salton Sea it is in excess of 500 feet in thickness. North and west of Indio, in an curving zone approximately one mile wide, the aquitard is apparently lacking and no distinction is made between the Upper and Lower aquifer zones.

Capping the Upper aquifer zone in the Thermal Subarea is a shallow fine-grained zone in which semi-perched groundwater is present. This zone consists of Recent silts, clays, and fine sands and is relatively persistent southeast of Indio. It ranges from zero to 100 feet thick and is generally an effective barrier to deep percolation. However, north and west of Indio, the zone is composed mainly of clayey sands and silts and its effect in retarding deep percolation is limited. The low permeability of the materials southeast of Indio has contributed to the irrigation drainage problems of the area. Semiperched groundwater has been maintained by irrigation water applied to agricultural lands south of Point Happy. This condition causes waterlogged soils and the accumulation of salts in the root zone in agricultural areas. Surface drains were constructed in the 1930s to alleviate this condition. Subsurface tile drainage systems were installed in the 1950s to control the high water table conditions and to intercept poor quality return flows. The District operates and maintains a collector system of 166 miles of pipe, ranging in diameter from 18 inches to 72 inches, along with 21 miles of open ditches, to serve as a drainage network for irrigated lands. All agricultural drains empty into the Coachella Valley Stormwater Channel (CVSC) except those at the southern end of the Valley, which flow directly to the Salton Sea. This system serves nearly 38,000 acres and receives water from more than 2,293 miles of on-farm drain lines (CVWMP, 2002).

The Thermal Subarea contains the division between the upper and lower portions of the Whitewater River Subbasin and their respective groundwater tables. Primarily due to the application of imported water from the Coachella Canal, and an attendant reduction in groundwater pumpage, the water table in the area southerly from Point Happy (in La Quinta) rose until the early 1970s, while the water table in the area northerly of Point Happy was dropping. This division forms the lower (southern) boundary of the management area of the Management Agreement between CVWD and DWA. Water table measurements have shown no distinction between the Palm Springs Subarea and the Thermal Subarea. The only distinction is that in the Thermal Subarea at Point Happy the groundwater levels until recently were stabilized, neither rising nor falling significantly. As discussed elsewhere, this is changing, as increased pumpage is again lowering the groundwater levels in the lower portion of the Whitewater River Subbasin. CVWD recently completed a study to evaluate the entire groundwater basin. This led to the development and adoption of the Valley-wide Coachella Valley WMP in 2002.

#### 4.1.1.3 Thousand Palms Subarea

The small area along the southwest flank of the Indio Hills is designated the Thousand Palms Subarea. The southwest boundary of the Subarea was determined by tracing the limit of distinctive groundwater chemical characteristics (CVWD, 2009b). Whereas calcium bicarbonate water is characteristic of the major aquifers of the Whitewater River Subbasin, water in the Thousand Palms Subarea is sodium sulfate in character.

These quality differences suggest that recharge to the Thousand Palms Subarea comes primarily from the Indio Hills and is limited in supply. The relatively sharp boundary between chemical characteristics of water derived from the Indio Hills and groundwater in the Thermal Subarea suggests there is little intermixing of the two waters.

The configuration of the water table north of the community of Thousand Palms is such that the generally uniform, southeast gradient in the Palm Springs Subarea diverges and steepens to the east along the base of Edom Hill. This steepened gradient suggests a barrier to the movement of groundwater, or a reduction in permeability of the water bearing materials. A southeast extension of the Garnet Hill Fault would also coincide with this anomaly. However, there is no surface expression of such a fault, and the gravity measurements taken during the 1964 DWR investigation do not suggest a subsurface fault. The residual gravity profile across this area supports these observations. The sharp increase in gradient is therefore attributed to lower permeability of the materials to the east. Most of the Thousand Palms Subarea is located within the upper portion of the Whitewater River Subbasin. Groundwater levels in this area show similar patterns to those of the adjacent Thermal Subarea, suggesting a hydraulic connectivity.

#### 4.1.1.4 Oasis Subarea

Another peripheral zone of unconfined groundwater that differs in chemical characteristics from water in the major aquifers of the Whitewater River Subbasin is found underlying the Oasis Piedmont slope. This zone, named the Oasis Subarea, extends along the base of the Santa Rosa Mountains. Water bearing materials underlying the Subarea consist of highly permeable alluvial fan deposits. Although groundwater data suggest that the boundary between the Oasis and Thermal Subareas may be a buried fault extending from Travertine Rock to the community of Oasis, the remainder of the boundary is a change from the coarse fan deposits of the Oasis Subarea to the interbedded sands, gravel and silts of the Thermal Subarea. Little information is available as to the thickness of water bearing materials, but it is estimated to be in excess of 1,000 feet. Groundwater levels in the Oasis Subarea have exhibited similar declines as elsewhere in the Subbasin due to increased groundwater pumping to meet agricultural demands on the Oasis slope.

### 4.1.2 Mission Creek Subbasin

Water-bearing materials underlying the Mission Creek upland comprise the Mission Creek Subbasin. This subbasin is designated number 7-21.02 in DWR’s Bulletin 118 (2003). The subbasin is bounded on the south by the Banning fault and on the north and east by the Mission Creek fault. The subbasin is bordered on the west by non-waterbearing rocks of the San Bernardino Mountains. To the southeast of the subbasin are the Indio Hills, which consist of the semiwater-bearing Palm Springs Formation. The area within this boundary reflects the estimated geographic limit of effective storage within the subbasin. This subbasin is outside of the study area of the 2010 WMP Update; however, it relies on the same imported SWP Exchange water source for replenishment as does the Whitewater River Subbasin.

CVWD, DWA and MSWD jointly manage this subbasin under the terms of the Mission Creek Settlement Agreement (CVWD-DWA-MSWD, 2004). This agreement and the 2003 Mission Creek Groundwater Replenishment Agreement between CVWD and DWA specify that the available SWP will be allocated between the Mission Creek and Whitewater River Subbasins in proportion to the amount of water produced or diverted from each subbasin during the preceding year (CVWD-DWA, 2003). In 2009, production from the Mission Creek Subbasin was about 7 percent of the combined production from these two subbasins.

More information on water supply within this subbasin can be found in “Engineer’s Report on Water Supply and Replenishment Assessment for the Mission Creek Subbasin Area of Benefit” (CVWD, 2008). CVWD, MSWD and DWA are jointly developing a water management plan for this subbasin.

### 4.1.3 Garnet Hill Subbasin

The area between the Garnet Hill fault and the Banning fault, named the Garnet Hill Subarea by DWR (DWR, 1964), was considered a distinct subbasin by the USGS (Tyley, 1974) because of the effectiveness of the Banning and Garnet Hill faults as barriers to groundwater movement. This is illustrated by a difference of 170 feet in groundwater level elevation in a horizontal distance of 3,200 feet across the Garnet Hill fault, as measured in the spring of 1961. The fault does not reach the surface and is probably effective as a barrier to groundwater movement only below a depth of about 100 feet. Although some recharge to this subbasin may come from Mission Creek and other streams that pass through during periods of high flood flows, the chemical character of the groundwater plus its direction of movement indicate that the main source of recharge to the subbasin comes from the Whitewater River through the permeable deposits which underlie Whitewater Hill. Based on groundwater level measurements, this area is partially influenced by artificial recharge activities at the Whitewater Spreading Facilities at Windy Point. This subbasin is considered part of the Whitewater River (Indio) in DWR's Bulletin 118 (2003).

### 4.1.4 Desert Hot Springs Subbasin

The Desert Hot Springs subbasin is bounded on the north by the Little San Bernardino Mountains and to the southeast by the Mission Creek and San Andreas faults. The San Andreas fault separates the Desert Hot Springs subbasin from the Whitewater River subbasin and serves as an effective barrier to groundwater flow. The subbasin has been divided into three subareas: Miracle Hill, Sky Valley and Fargo Canyon. This subbasin is designated number 7-21.03 in DWR's Bulletin 118 (2003).

The Desert Hot Springs subbasin is not extensively developed except in the area of Desert Hot Springs. Relatively poor groundwater quality has limited the use of this subbasin for groundwater supply. The Miracle Hill subarea underlies portions of the City of Desert Hot Springs and is characterized by hot mineralized groundwater, which supplies a number of spas in that area. The Fargo Canyon subarea underlies a portion of the planning area along Dillon Road north of Interstate 10. This area is characterized by coarse alluvial fans and stream channels flowing out of Joshua Tree National Park. Based on limited groundwater data for this area, flow is generally to the southeast. Water quality is relatively poor with salinities in the range of 700 to over 1,000 mg/L (CVWD, 2009c).

### 4.1.5 Historical Groundwater Use

CVWD and other public water suppliers, including DWA, MSWD, the City of Coachella, the City of Indio and the Myoma Dunes Mutual Water Company, share a common groundwater source – the Whitewater River Subbasin. Other groundwater users of this source include tribes, individual residents, farmers, golf courses, businesses and commercial facilities.

The 2002 WMP and CVWD's and DWA's annual Engineer's Report on Water Supply and Replenishment Assessment for each of the groundwater basins review the historical use of groundwater in the Coachella Valley. In 1936, groundwater use was estimated to be 92,400 acre-ft/yr (AFY) and it increased steadily to about 376,000 AFY in 1999 (Water Consult and

### 4.1.6 Overdraft Status

The groundwater supply of the Whitewater River Subbasin consists of a combination of natural runoff and returns from groundwater and imported water use. The supply is supplemented with artificial recharge with imported SWP and Colorado River water. The long-term average of natural inflow is about 57,000 AFY and varies from about 8,000 AFY in very dry years to over 200,000 AFY in extremely wet years. From 2000 to 2009, natural inflows were below normal averaging about 40,000 AFY. Returns from use vary with water demands. From 2000 to 2009, returns from use are estimated to average about 240,000 AFY. During this same period, about 51,000 AFY of imported water was recharged in the basin. Total inflows are estimated to be about 331,000 AFY.

Outflows from the basin consist of pumping, flows to the agricultural drainage system, evapotranspiration by native vegetation and subsurface outflow to the Salton Sea. For the 2000-2009 period, groundwater pumping averaged about 389,000 AFY. Drain flows are estimated be about 48,000 AFY while evapotranspiration and subsurface outflow averaged about 4,000 AFY. Total basin outflows for this period averaged 441,000 AFY.

Bulletin 108 (1964) and Bulletin 118 (2003) are the most DWR recent bulletins that characterize the condition of the Coachella Valley aquifer as a whole. In Bulletin 108, DWR noted that the amount of usable supply in the overdrafted aquifer was decreasing. CVWD estimates the annual overdraft annually in its Engineer's Reports on Water Supply and Replenishment Assessment. The annual loss in storage (overdraft) for the Coachella Valley continued; in 2009, it was estimated to be 72,051 AFY. The 2009 loss in storage was lower than historical loss due to increased SWP Exchange water deliveries at Whitewater River Recharge Facility and increased Canal water recharge at the Thomas E. Levy Groundwater Replenishment Facility (Levy facility) in the East Valley beginning in 2009.

The overdraft condition of the Coachella Valley has caused groundwater levels to decline in many portions of the East Valley from La Quinta to the Salton Sea, and has raised concerns about water quality degradation and land subsidence. As indicated on **Figure 4-2**, groundwater levels in the West Valley from Palm Springs to La Quinta have also decreased substantially, except in areas adjacent to and down gradient of the Whitewater River Recharge Facility, where artificial recharge has successfully raised water levels. In 2009, the annual loss in storage in the Lower Whitewater River Subbasin was 23,912 AF (CVWD, 2010b). The annual loss in storage in the Upper Whitewater River Subbasin was 48,139 AF in 2009 (CVWD, 2010a). For the ten-year period of 2000 to 2009, an average of 110,000 AFY was removed from storage.

## 4.2 COLORADO RIVER

Colorado River water has been a major source of supply for the Coachella Valley since 1949 with the completion of the Coachella Canal. The Colorado River is managed and operated in accordance with the *Law of the River*, the collection of interstate compacts, federal and state legislation, various agreements and contracts, an international treaty, a U.S. Supreme Court decree, and federal administrative actions that govern the rights to use of Colorado River water within the seven Colorado River Basin states. The *Colorado River Compact*, signed in 1922, apportioned the waters of the Colorado River Basin between the Upper Colorado River Basin

(Colorado, Wyoming, Utah, and New Mexico) and the Lower Basin (Nevada, Arizona, and California). The Colorado River Compact allocates 15 million AFY of Colorado River water: 7.5 million AFY to the Upper Basin and 7.5 million AFY to the Lower Basin, plus up to 1 million AFY of surplus supplies. The Lower Basin's water was further apportioned among the three Lower Basin states by the *Boulder Canyon Project Act* in 1928 and the 1964 U.S. Supreme Court decree in *Arizona v. California*. Arizona's basic annual apportionment is 2.8 million AFY, California's is 4.4 million AFY, and Nevada's is 0.3 million AFY. California has been diverting up to 5.3 million AFY in recent years, using the unused portions of the Arizona and Nevada entitlements. Mexico is entitled to 1.5 million AFY of the Colorado River under the *1944 United States-Mexico Treaty for Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande*. However, this treaty did not specify a required quality for water entering Mexico. In 1973, the United States and Mexico signed Minute No. 242 of the International Boundary and Water Commission requiring certain water quality standards for water entering Mexico.

California's apportionment of Colorado River water is allocated by the 1931 *Seven Party Agreement* among Palo Verde Irrigation District (PVID), Imperial Irrigation District (IID), CVWD and Metropolitan. The three remaining parties - the City and the County of San Diego and the City of Los Angeles - are now part of Metropolitan. The allocations defined in the *Seven Party Agreement* are shown in **Table 4-1**. In its 1979 supplemental decree in the *Arizona v. California* case, the United States Supreme Court also assigned "present perfected rights" to the use of river water to a number of individuals, water districts, towns and Indian tribes along the river. These rights, which total approximately 2,875,000 AFY, are charged against California's 4.4 million AFY allocation and must be satisfied first in times of shortage. Under the 1970 *Criteria for Coordinated Long-Range Operation of the Colorado River Reservoirs* (Operating Criteria), the Secretary of the Interior determines how much water is to be allocated for use in Arizona, California and Nevada and whether a surplus, normal or shortage condition exists. The Secretary may allocate additional water if surplus conditions exist on the River (see **Section 4.7.1.2**).

**Table 4-1**
**Priorities and Water Delivery Contracts**
**California Seven-Party Agreement of 1931**

| Priority | Description | AFY |
|---|---|---|
| 1 | Palo Verde Irrigation District gross area of 104,500 acres of valley lands | 3,850,000 |
| 2 | Yuma Project (Reservation Division) not exceeding a gross area of 25,000 acres within California | |
| 3(a) | Imperial Irrigation District, Coachella Valley Water District, and lands in Imperial and Coachella Valleys to be served by the All American Canal | |
| 3(b) | Palo Verde Irrigation District - 16,000 acres of mesa lands | |
| 4 | Metropolitan Water District of Southern California for use on coastal plain | 550,000 |
| | **Subtotal – California's Basic Apportionment** | **4,400,000** |
| 5(a) | Metropolitan Water District of Southern California for use on coastal plain | 550,000 |
| 5(b) | Metropolitan Water District of Southern California for use on coastal plain | 112,000 |
| 6(a) | Imperial Irrigation District and lands in the Imperial and Coachella Valleys to be served by the All American Canal | 300,000 |
| 6(b) | Palo Verde Irrigation District - 16,000 acres of mesa lands | |
| | **Total** | **5,362,000**[1] |

1 – Priorities 5-6 would only receive water if there is water available in excess of the 7.5 MAFY available to the Lower Basin States or unused water within the Lower Basin.

California's Colorado River supply is protected by the 1968 Colorado River Basin Project Act, which provides that in years of insufficient supply on the main stream of the Colorado River, supplies to the Central Arizona Project shall be reduced to zero before California will be reduced below 4.4 million AF in any year. This assures full supplies to the Coachella Valley except in periods of extreme drought. As described further in **Section 4.7.1.2**, delivery analyses performed for the Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lakes Powell and Mead indicated that that California would only experience shortages if the total shortage in the Lower Basin exceeds 1.7 million AFY.

The Coachella Canal (Canal) is a branch of the All-American Canal that brings Colorado River water into the Imperial and Coachella Valleys. Historically, CVWD received approximately 330,000 AFY of Priority 3A Colorado River water delivered via the Coachella Canal. The Canal originates at Drop 1 on the All-American Canal and extends approximately 122 miles, terminating in CVWD's Lake Cahuilla. The service area for Colorado River water delivery under CVWD's contract with Reclamation is defined as Improvement District No. 1 (ID-1) which encompasses most of the East Valley and a portion of the West Valley north of Interstate

10. Under the 1931 California Seven Party Agreement, CVWD has water rights to Colorado River water as part of the first 3.85 million AFY allocated to California. CVWD is in the third priority position along with IID.

### 4.2.1 Quantification Settlement Agreement

In 2003, CVWD, IID and Metropolitan successfully completed negotiation of the Quantification Settlement Agreement (QSA). The QSA quantifies the Colorado River water allocations of California's agricultural water contractors for the next 75 years and provides for the transfer of water between agencies. Under the QSA, CVWD has a base allotment of 330,000 AFY. In accordance with the QSA, CVWD has entered into water transfer agreements with Metropolitan and IID that increase CVWD supplies by an additional 129,000 AFY as shown in **Table 4-2** and **Figure 4-3**.

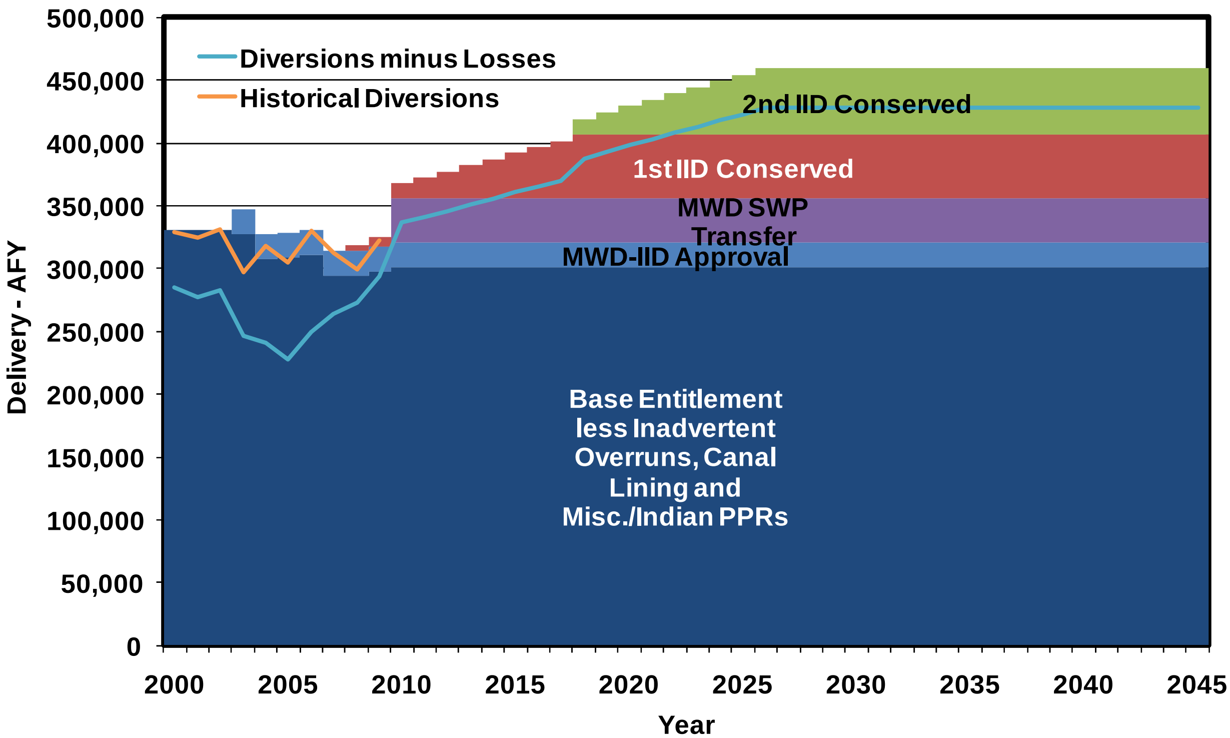
**Table 4-2**
**CVWD Deliveries under the Quantification Settlement Agreement**

| Component | 2010 Amount (AFY) | 2045 Amount (AFY) |
|---|---|---|
| Base Entitlement | 330,000 | 330,000 |
| 1988 Metropolitan/IID Approval Agreement | 20,000 | 20,000 |
| Coachella Canal Lining (to SDCWA) | -26,000 | -26,000 |
| To Miscellaneous/Indian PPRs | -3,000 | -3,000 |
| IID/CVWD First Transfer | 12,000 | 50,000 |
| IID/CVWD Second Transfer | 0 | 53,000 |
| Metropolitan/SWP Transfer | 35,000 | 35,000 |
| **Total Diversion at Imperial Dam** | **368,000** | **459,000** |
| Less Conveyance Losses [1] | -31,000 | -31,000 |
| **Total Deliveries to CVWD** | **337,000** | **428,000** |

1 – Assumed total losses after completion of canal lining projects.

As of 2010, CVWD receives 368,000 AFY of Colorado River water deliveries under the QSA (**Table 4-2**). This includes the base entitlement of 330,000 AFY, Metropolitan/IID Approval of 20,000 AFY, 12,000 AFY of IID/CVWD First transfer, and 35,000 AFY of Metropolitan/SWP transfer. It also includes the 26,000 AFY transferred to San Diego County Water Authority (SDCWA) as part of the Coachella Canal lining project and the 3,000 AFY transfer to Indian Present Perfected Rights (PPRs). CVWD's allocation will increase to 459,000 ac-ft/yr of Colorado River water by 2026 and remain at that level for the 75 year term of the QSA. After deducting conveyance and distribution losses, approximately 428,000 AFY will be available for CVWD use.

**Figure 4-3**
**CVWD Colorado River Water Allocation Chart**




The Valley's Colorado River supply faces problems that could impact long-term reliability. Issues affecting Colorado River supply are the extended Colorado River Basin drought, Colorado River shortage sharing agreement, endangered species and habitat protection, climate change and lawsuits challenging the validity of the QSA. Due to both California's and CVWD's high priority position regarding Colorado River allocations, this supply is expected to be relatively reliable. However, in January 2010, the QSA was rendered invalid in a state court decision along with eleven related agreements (Superior Court of California, 2010). CVWD and the other parties have appealed the judgment. On March 9, 2010, the California Court of Appeal, Third Appellate District, issued a temporary stay of the judgment pending further briefing and order of the court regarding appellants' request for a stay during the pendency of the appeal. An appellate decision is expected in early 2011. A detailed discussion of these issues is presented in **Section 4.7.1**.

## 4.3 STATE WATER PROJECT (SWP)

The SWP is managed by DWR and includes 660 miles of aqueduct and conveyance facilities extending from Lake Oroville in northern California to Lake Perris in the south. The SWP has contracts to deliver 4.172 million AFY to 29 contracting agencies. DWA and CVWD initially contracted for water from the SWP in 1962 and 1963, respectively. CVWD's original SWP water allocation (Table A Amount) was 23,100 AFY and DWA's original SWP Table A

Amount[2] was 38,100 AFY for a combined Table A Amount of 61,200 AFY. Each year, DWR determines the amount of water available for delivery to SWP contractors based on hydrology, reservoir storage, the requirements of water rights licenses and permits, water quality and environmental requirements for protected species in the Sacramento-San Joaquin Delta. The available supply is then allocated according to each SWP contractor's Table A Amount.

There are no physical facilities to deliver SWP water to the Valley. CVWD's and DWA's Table A water is exchanged with Metropolitan for a like amount of Colorado River water from Metropolitan's Colorado River Aqueduct (CRA), that extends from Lake Havasu, through the Coachella Valley to Metropolitan's Lake Mathews. SWP Exchange water has been used to recharge the Whitewater River Subbasin at the Whitewater River Recharge Facility since 1973. Metropolitan, DWA and CVWD executed an advanced delivery agreement in 1985 that allowed Metropolitan to pre-deliver up to 600,000 AF of SWP water into the Coachella Valley. Metropolitan then has the option to deliver CVWD's and DWA's SWP allocation either from the CRA or from water previously stored in the basin. This agreement was subsequently amended to increase the pre-delivery amount to a maximum of 800,000 AF. The 2002 WMP established a goal of maintaining an average amount of SWP exchange water recharge at 140,000 AFY in the Whitewater River Subbasin.

### 4.3.1 Metropolitan 100,000 AFY Transfer

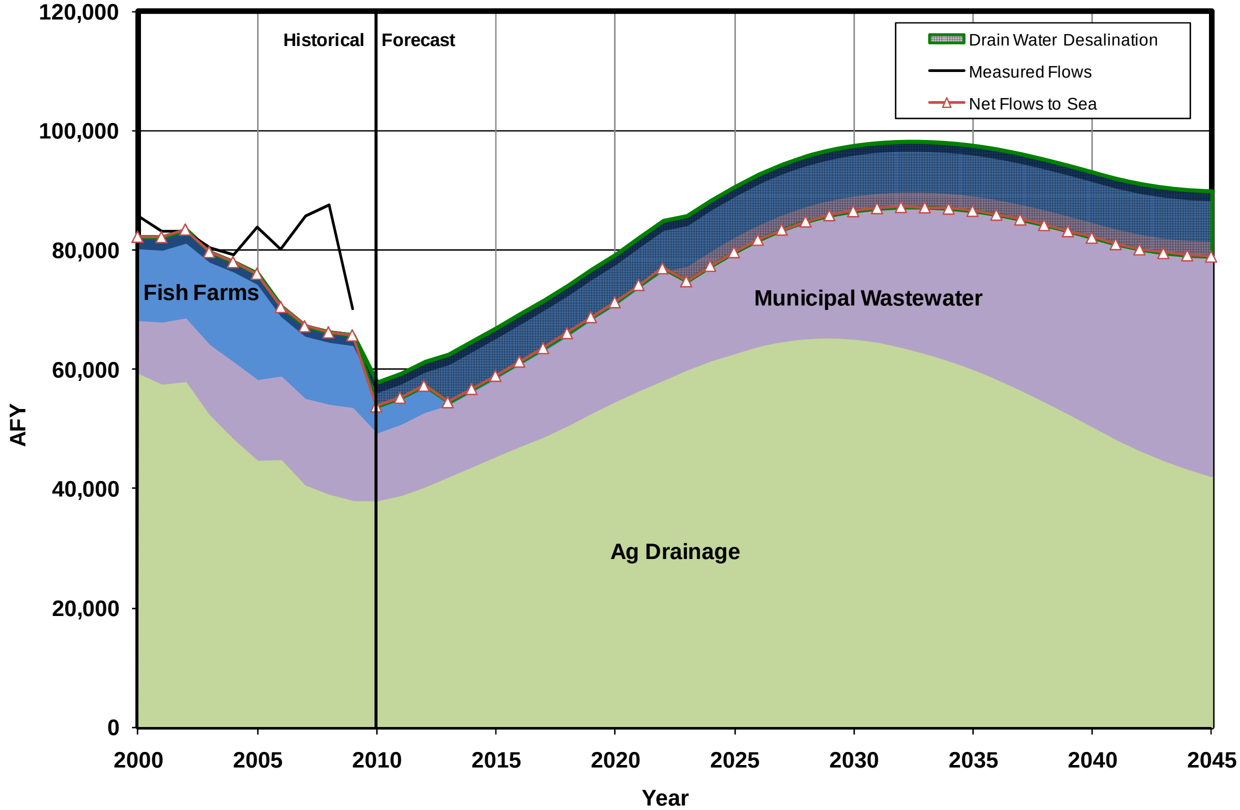
Metropolitan historically has not made full use of its SWP Table A Amounts in normal and wet years. Under the 2003 Exchange Agreement, CVWD and DWA acquired 100,000 AFY of Metropolitan's SWP Table A water as a permanent transfer (CVWD-DWA, 2003). The water would be exchanged for Colorado River water and either recharged at the existing Whitewater Spreading Facility or delivered via the Coachella Canal for golf course irrigation purposes in the Palm Desert-Rancho Mirage area of the West Valley. The transferred water may also be delivered from Metropolitan's Advance Storage account. CVWD and DWA would assume all SWP costs associated with this water except as described below.

The terms of the agreement provide that CVWD receives 88,100 AFY and DWA receives 11,900 AFY of Metropolitan's SWP Table A water. CVWD and DWA assume all capital costs associated with capacity in the California Aqueduct to transport this water and variable costs to deliver the water to Lake Perris. Metropolitan retains other rights associated with the transferred water including interruptible water service, carryover storage in San Luis Reservoir and flexible storage at Castaic and Perris Reservoirs. Amendments to CVWD's and DWA's SWP contracts were executed in 2003 (DWR, 2003b and 2003c).

Metropolitan has the option to call back the water in years when needed. This option must be exercised no later than April 30 of each year. Metropolitan's callback options are to be exercised in two 50,000 AF blocks. To estimate the average supply from this transfer conservatively, the 2010 WMP Update assumes that Metropolitan would exercise its option to callback the 100,000 AFY in 4 wet years out of every 10 years. The actual frequency of callback would depend on the

[2] Each SWP contract contains a "Table A" exhibit which defines the maximum annual amount of water each contractor can receive excluding certain interruptible deliveries. Table A Amounts are used by DWR to allocate available SWP supplies and some of the SWP project costs among the contractors.

**Figure 4-6**
**Estimated Annual Flow to Salton Sea – No Project Alternative**

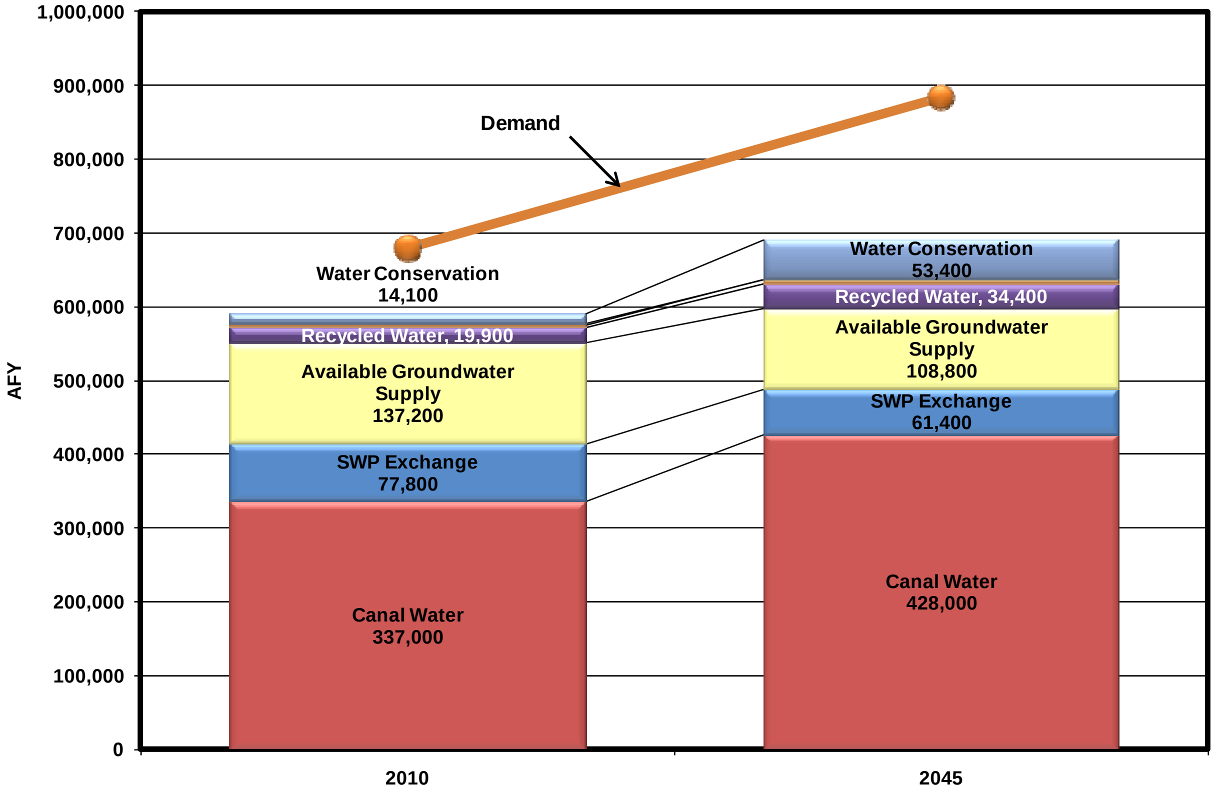



The issues discussed above point out the need to modify the 2002 WMP to adapt to changing conditions. This will require measures to decrease water demands, increase use of Canal water, recycled water and other local resources, acquire additional supplies and manage the groundwater basin. Without these changes, the Valley's water management goal and objectives will not be achieved. Options to accomplish these changes are described in detail in **Section 6**.

## 4.9 SUMMARY

As described in this section, the Coachella Valley has both imported water and local water sources in its current water supply portfolio. A comparison of the projected water demands (**Table 3-2**) with the currently available supplies is presented in **Figure 4-7**. The figure shows that currently available supplies as planned in the 2002 WMP are not adequate to meet the current demand (2010) or the projected demands in 2045. The Colorado River supply increases significantly due to the QSA. Recycled water use and water conservation also increase due to planned water management activities. Extended drought, climate change, and the recent QSA litigation further increase the uncertainties associated with Colorado River water. Recent and pending water litigation surrounding the endangered species in the Delta, risks associated with levee failure in the Delta, as well as potential variability associated with climate change pose a threat to the reliability of SWP water.

**Figure 4-7**
**Supply and Demand Comparison under Existing Supply Conditions**




Notes: 1. See Table 4-2 for Canal water availability in 2010 and 2045.
2. See Table 4-5 for SWP availability.
3. Available groundwater supply is calculated based on the total pumping less recharge and adjusted for change in storage in the East and West Valleys (i.e. overdraft).

The overdraft condition in the East Valley and West Valley groundwater aquifers presents a challenge to both the quantity and the quality of groundwater in the Valley. Future growth and water quality regulations will affect the amount of recycled water available in the Coachella Valley.

Projected growth in the Valley, coupled with uncertain and less reliable future water supplies, is expected to create a supply deficit (gap) as shown in **Figure 4-7** unless new supply sources are developed. The uncertainties surrounding both imported and local water supplies within the Valley make it imperative that the 2010 WMP Update provide a plan to develop new supply sources for the Valley including a contingency factor to assure adequate supplies. A detailed discussion of the future supplies is provided in **Section 6** of this report.

# Section 5
# Emerging Issues

This section describes emerging issues that may affect the 2010 WMP Update. Some issues that present potential challenges to water management planning in the Coachella Valley have been identified but have not been fully developed. Actions on higher priority issues needing further investigation are included in this Update. However, solutions will be addressed in subsequent planning efforts. A list of issues discussed in this section is presented below:

- Water Quality
  - Basin Plan
  - Salinity Management
  - Groundwater Quality
- Climate Change
- Invasive Species – Quagga Mussels
- State Water Conservation Guidelines
- Subsidence
- Salton Sea Restoration
- Seismic Response

## 5.1 WATER QUALITY

There are a number of historical, current and future water quality issues that warrant discussion in the 2010 WMP Update. The major issues described below are associated with the Water Quality Control Plan for the Colorado River Basin Region (Region 7, Basin Plan), salinity management in the Valley, and other groundwater quality issues. These issues and recommended future actions for these issues are described below.

### 5.1.1 Basin Plan

The Water Quality Control Plan for the Colorado River Basin Region (Region 7) (Basin Plan) was prepared and adopted by the Colorado River Basin Regional Water Quality Control Board (Regional Board) in 1993. The planning area includes the Coachella Valley. The Basin Plan was updated with subsequent amendments and was readopted by the Regional Board in June 2006. The Basin Plan was prepared in accordance with the California Porter-Cologne Water Quality Control Act (California Water Code §13000 *et seq.*), the Federal Clean Water Act, and other state and federal rules and regulations. The Plan provides guidelines for optimizing use of state waters within the Colorado River Basin Region by preserving and protecting the quality of these waters. The plan is reviewed periodically by the State Water Resources Control Board (SWRCB) and the U. S. Environmental Protection Agency (USEPA) and updated as necessary.

One of the country's largest uranium deposits was found in Moab, Utah, located along the Colorado River, in 1952. A uranium reduction mill was operated at this site until 1984. Waste slurry from the uranium reduction process was stored in unlined ponds near the river. These ponds were capped after the mill was shut down. It is believed that waste was leaching from the ponds and contaminating the river with radioactive material (USDOE, 2009).

The site is currently under the control of the U.S. Department of Energy (DOE). The DOE is undertaking a project to move 10.8 million tons of radioactive tailings by rail to a lined pit in Crescent Junction, Utah, about 30 miles from the Colorado River. The removal is expected to take approximately 20 years.

Trace uranium levels have been observed in the groundwater in the Cove communities and Indio Hills system in the Valley. These traces are believed to be naturally occurring and there is no evidence linking the uranium found in the Valley groundwater to Colorado River water. CVWD conducts annual testing of the Colorado River water in the Canal for uranium. Based on sampling in the Canal, uranium concentrations over the last four years have varied from 3.5 pCi/L to 6.1 pCi/L, with the most recent reading of 3.5 pCi/L (May 2010), which is well below the California MCL of 20 pCi/L.

CVWD and other Valley agencies (MSWD, DWA, City of Indio, City of Coachella) will continue to monitor for radioactive materials in the Colorado River water used for recharge.

#### 5.1.3.5 Nitrate

Nitrate is a nitrogen compound that is a nutrient and can also have public health implications in drinking water, especially for babies. The primary drinking water standard for nitrate is 10 mg/L as nitrogen (45 mg/L as nitrate). Higher concentrations of nitrate (as high as 40 mg/L as N in Cove Communities based on CVWD's 2008-09 Annual Review and Water Quality Report) exist in some of the shallower portions of the Coachella Valley groundwater basin. Sources of nitrate include nitrogen-based fertilizers used for agriculture, golf courses and landscaping; septic tank discharges; wastewater disposal through percolation; natural sources like mesquite hummocks; and alluvial fan formations. Generally, nitrates are found in the unsaturated and shallow aquifer zones above 300 to 400 feet, and have not been observed in the deeper aquifer zones below 500 feet. Activities in the basin that could cause nitrate to leach into higher quality groundwater include recharge, pumping, and overdraft reduction.

Nitrate does not adsorb to aquifer sediments and readily migrates in groundwater. Steps that can be taken to reduce the risk of nitrate migration include:

- Locating recharge activities away from areas known or expected to have higher nitrate contamination in shallow aquifer zones.

- Avoid pumping in areas known to have nitrate concentrations that can be leached downward by pumping into lower aquifer zones

- Monitor areas of high nitrate concentration to ensure that they do not become oversaturated as overdraft reduction occurs.

- In areas where shallow pumping can prevent nitrate concentrations from leaching into the deeper aquifer, consider implementing ion exchange treatment or similar approach to remove the nitrate from the pumped groundwater.

#### 5.1.3.6 Carcinogens

The USEPA is considering a new strategy to tighten restrictions on four waterborne compounds that can cause cancer. The four compounds to be addressed as a group are tetrachloroethylene (PCE), an organic compound used in dry cleaning; trichloroethylene (TCE), an organic compound used as an industrial solvent; acrylamide, a compound used in manufacturing; and epichlorohydrin, an organic compound used in plastic manufacturing. Under the new strategy being explored by USEPA, the agency would address chemical contaminants as a group for more expeditious and cost-effective enforcement. This strategy would also foster development of new water-treatment technologies, and partnerships with states to better monitor public water systems. CVWD should continue to monitor for the above constituents and track the development of the new USEPA strategy. Any action that would be required to address the issue of carcinogens in the Coachella Valley, as the new strategy evolves, might be developed in future updates of this Plan Update.

#### 5.1.3.7 Endocrine Disrupting Compounds

There is growing interest by regulatory agencies in possible effects of endocrine disrupting compounds (EDCs) in drinking water and groundwater. EDCs are a class of chemicals that interfere with the natural action of hormones in the body, and are thought to interfere with the reproductive systems of both wildlife and humans. EDCs encompass a wide range of contaminants that include some pesticides and a number of chemicals that may be used in residential, commercial and industrial applications. Some pharmaceuticals and personal care products such as antibiotics, prescription drugs, shampoos and cleansers have also been implicated as potential EDCs.

To date, the documented levels of these compounds in drinking water are generally low, at the low end of the parts per trillion range. Most drinking water standards are set in the mg/L or µg/L range, which are 1,000 to 10,000 times higher than the levels at which EDCs are typically detected in water supplies. What is not presently known is the importance of detection at such low levels, since these compounds may have the potential for impact at low concentrations. Sex abnormalities in aquatic organisms in relation to wastewater discharge and other possible influences in the Potomac River and other rivers are consistent with hormonal imbalances in which EDCs may play a role (USFWS, 2003). The mode of exposure of these populations is quite different and more intense than human exposure by drinking water, making extrapolation questionable. The issue of importance to drinking water is not presently resolved.

Several water treatment technologies can remove EDCs, including nanofiltration and reverse osmosis. Coachella Valley water purveyors should continue to monitor this issue along with the associated regulations and take appropriate action in the future.

The average SWP reliability factor of 50 percent of Table A Amount used in the 2010 WMP Update is believed to account for potential climate change impacts on supply through 2045.

### 5.2.3 Coachella Valley Supplies and Demands

Projected potential changes in temperature or evapotranspiration for the Coachella Valley due to climate change are not currently available. However, based on larger scale studies, it can be inferred that increased temperatures in the Coachella Valley would increase water demands for crop and landscape irrigation, municipal water use, and evaporative losses from canals and open reservoirs. It has been suggested that increased summer temperatures could draw increased monsoonal flow resulting in more frequent summer thunderstorms. However, no formal studies have been conducted.

### 5.2.4 Conclusion

The current projections regarding global warming and climate change increase the uncertainty regarding Coachella Valley water supplies. Consequently, to account for such uncertainty, the 2010 WMP Update has adopted a more flexible approach by assigning book-end targets (ranges) for each of the major project categories. The book-ends represent reasonable minimum and maximum amounts for potential project development. In addition, inclusion of a water supply contingency over and above the supplies required to meet projected demands provides an additional buffer in the event that water supplies do not produce the expected amounts. Implementing the elements of the 2010 WMP Update is expected to be a good means of dealing with this additional uncertainty. Water conservation and development of alternative supplies such as recycled water and desalinated drain water increase the reliability of supplies to the Coachella Valley.

## 5.3 INVASIVE SPECIES – QUAGGA MUSSELS

The non-native mollusk, *Dreissena bugensis*, also known as Quagga mussel, has been found in the Colorado River system. A Quagga mussel invasion could significantly affect the Coachella Valley's water quality, aquatic ecosystems, and water delivery systems.

**Figure 5-2**
**Quagga Mussels in a Pipe**

# Section 6
# Management Plan Elements

The water management plan elements included in the 2002 WMP were water conservation, development of additional water sources, source substitution and groundwater recharge. These elements were combined into a preferred plan to meet current and future demands while eliminating groundwater overdraft in the Valley. Since the 2002 WMP was adopted, changed planning conditions require modification of the elements included in the 2002 WMP. In addition to the elements considered in the 2002 WMP, the 2010 WMP Update considers and evaluates additional management options as well as potential water quality improvements.

This section discusses the need for changes to the 2002 WMP and presents the water management elements that are considered in the 2010 WMP Update. Evaluation of these elements is presented in Section 7.

## 6.1 NEED FOR FLEXIBILITY

The preceding sections of this report describe the need for changes to the Coachella Valley's water management strategy. Expectations for population growth have increased significantly, and result in a corresponding increase in the projected urban development of agricultural and vacant land in the Valley. Areas that were previously expected to have little growth are now expected to develop within the next 35 years. At the same time, the reliability of imported water supply from the SWP has declined due to a combination of extended drought, climate change, legal and environmental restrictions and risk of levee failure in the Sacramento-San Joaquin Delta (Delta). Increasing demands coupled with reduced imported water supply reliability have increased the potential for future supply deficits that must be addressed in the 2010 WMP Update. In addition, a number of other emerging issues may affect water management in the future including more stringent water quality regulations, the need for salt and nutrient management plans, land subsidence, infrastructure needs, control of invasive species, integrated regional water management planning, Salton Sea Restoration plans and climate change. To address these uncertainties, the 2010 WMP Update incorporates a more flexible and adaptive approach to water resources management. Such an approach will allow the Valley's water agencies to adjust the implementation strategy when future changes occur.

Sections 3, 4 and 5 of the 2010 WMP Update have identified some of the uncertainties that affect water resources planning and management in the Coachella Valley. However, it is not possible to quantify all of the uncertainties affecting the Valley's water resources. Consequently, the 2010 WMP Update has adopted a more flexible approach by assigning book-end targets (ranges) for each of the major project elements. The book-ends represent reasonable minimum and maximum amounts of supplies provided by the projects included in the Plan elements. This allows Valley water managers to plan more pragmatically in the near term and adjust those plans in the future as more information becomes available and the level of uncertainty is reduced.

Each of these "building blocks" represents increased investment and potential for agricultural water use reductions. Evaluation of grower practices and crop requirements indicates that a savings of up to 14 percent of current water use can be achieved through incremental implementation of these measures. Assuming no change in cropping patterns and average ET conditions, agricultural water use is expected to decrease from 6.2 AFY per acre to about 5.33 AFY per acre. As agricultural land is removed from production in response to urban development, it is expected that the amount of water saved through agricultural conservation will decrease from almost 39,500 AFY in 2020 to 23,000 AFY in 2045. In general, CVWD program experience indicates the cost of agricultural conservation is in the range of $30 to $60/AF of water conserved, making it a very cost-effective method for extending the water supply.

Continued investment in agricultural conservation programs is needed to meet the higher levels discussed in this report.

### 6.3.3 Golf Course Conservation

The CVWD Landscape Ordinance established maximum allowable turf area and associated water demands for new golf courses by limiting turf to 4 acres per hole plus 10 acres for associated practice areas (driving ranges and putting greens). Other landscaping must use low water-using plant materials. Based on a typical 18-hole course encompassing about 125 acres of landscaped area, the expected water use would be about 700 AFY, which is an additional 22 percent reduction compared with the 2002 WMP goal for new courses.

New golf courses incorporate desert landscaping to reduce water use

CVWD continues to work with new and existing golf courses to reduce water demands through programs such irrigation system audits, soil moisture monitoring, plan checking, inspecting new golf courses for plan check compliance, and monitoring maximum water allowance compliance.

Existing golf courses could achieve enhanced water savings by the following methods:

- Scientific irrigation scheduling
- Water audits - each course is audited every five years
- Monitoring of maximum water allowance compliance

As described earlier, the water demand for future golf courses is expected to be 22 percent less than the amount used in the 2002 WMP for new courses. This reduction can be achieved by the following methods:

- Full implementation of turf limitations specified in the Landscape Ordinance

- Plan checking for all new golf courses
- Inspection of all new courses after construction
- Water audits every five years

Implementation of conservation measures could reduce golf course demands by 11,600 AFY by 2045. The cost per AF of water saved to implement golf course conservation is expected to be comparable to that of agriculture ($30 to $60/AF), making golf course conservation a cost-effective source of water.

### 6.3.4 Potential Savings from Water Conservation Programs

Based upon the water conservation measures described above, the ranges of potential savings used in this plan are shown in **Table 6-2**. Total water savings would range from 60,000 to 145,000 AFY by 2045. Urban conservation in excess of 100,000 AFY is considered if cost-effective compared to other water supply options.

**Table 6-2**
**Range of Water Conservation Savings – 2045**

| Type of Conservation | Low Range (AFY) | High Range (AFY) |
|---|---|---|
| Urban [1] | 43,000 | 100,000 |
| Agriculture [2] | 11,000 | 23,000 |
| Golf Courses | 6,000 | 22,000 |
| Total | 60,000 | 145,000 |

Notes:
1. Low range for domestic conservation represents the amount of additional water saved as a result of currently adopted conservation programs.
2. Agricultural savings declines over time as agricultural land is developed for urban uses.

## 6.4 ADDITIONAL WATER SOURCES

CVWD and DWA should continue their efforts to obtain additional water supplies to meet projected water demands and help eliminate overdraft. Sources of additional water include Colorado River water, SWP water, recycled water, exchanges, entitlements and transfers, dry year purchases, water development projects, other groundwater supplies, and desalination.

delivery operation at Whitewater where Metropolitan stores surplus water for future exchange with CVWD and DWA. This program has allowed the Valley to benefit from higher groundwater levels while water is stored and allowed Metropolitan to essentially discontinue Exchange water deliveries during dry periods, drawing upon its stored water. CVWD and DWA also purchase and store available surplus water for groundwater storage.

With the increased variability of SWP deliveries and uncertainty regarding the QSA, increased emphasis will be placed on conjunctive use. Since the Valley has a large groundwater basin, it can provide groundwater storage opportunities for other water agencies in the State. As part of the QSA, CVWD and IID have signed an agreement that allows IID to store surplus Colorado River water in the Coachella Valley. Under the agreement, CVWD would store water for IID subject to availability of storage space, delivery and recharge capacity and the prior storage rights of CVWD, DWA and Metropolitan. Stored water would incur a 5 percent recharge loss and a 5 percent annual storage loss. IID may also request CVWD to investigate and construct additional locations for direct or in-lieu recharge facilities. CVWD would return stored water to IID by reducing its consumptive use of Colorado River water. This could be accomplished by temporarily reducing or eliminating groundwater recharge. If reduced recharge were not sufficient to produce the required delivery reduction, CVWD or its customers could pump groundwater and reduce Colorado River water deliveries to source substitution projects. This program would benefit Coachella Valley by providing higher levels of groundwater storage while IID water is stored in the Valley.

The 2002 WMP did not identify specific conjunctive use projects, but instead recommended that flexibility be provided for conjunctive use. For the 2010 WMP Update, it is recommended that recharge facilities have sufficient capacity to allow capture of surplus water deliveries during future wet periods. This could be accomplished by providing additional recharge basins or by changing the operations of existing facilities to recharge water on a more continuous basis. The ability to recharge additional water may be limited by water delivery system capacity and the need to meet existing customers' demands.

In addition to providing sufficient recharge capacity, additional pumping capacity may be required to maximize the potential for conjunctive use. Under the Advanced Delivery and Exchange Agreements, the mechanism for returning stored water to entities outside the basin is through a reduction in SWP deliveries. If stored water is to be returned through reductions in Canal water deliveries, then deliveries for recharge would need to be reduced during the payback period. If recharge reductions are insufficient, then reductions in direct deliveries would need to be offset through increased groundwater pumping.

## 6.5 SOURCE SUBSTITUTION

Source substitution is the delivery of an alternate source of water to users that currently pump groundwater. The substitution of an alternate water source reduces groundwater extraction and allows the groundwater to remain in storage, thus reducing overdraft. Source substitution projects include:

- Conversion of existing and future golf courses in the West Valley from groundwater to recycled water

- Conversion of existing and future golf courses in the East Valley from groundwater to Colorado River water
- Conversion of existing and future golf courses in the West Valley from groundwater to Colorado River water via the Mid-Valley Pipeline
- Conversion of agricultural irrigation from groundwater to Colorado River water, primarily in the Oasis area
- Conversion of urban use from groundwater to treated Colorado River water in the East Valley
- Conversion of outdoor urban use to non-potable water including Colorado River water or recycled water in the East Valley

The following discussion of source substitution projects is presented by water source and by location within the Valley.

### 6.5.1 Recycled Water Uses

Recycled water is a significant potential local resource that could be used to help reduce overdraft. Wastewater that has been highly treated and disinfected can be reused for landscape irrigation and other purposes; treated wastewater is not suitable for potable use. Recycled wastewater has historically been used for irrigation of golf courses and urban landscaping in the Coachella Valley. Future recycled water uses could also include indirect potable reuse (IPR), which is the planned use of highly treated wastewater to directly augment water supplies via direct or indirect groundwater recharge, or blending with other potable sources.

#### 6.5.1.1 Non-potable Uses

The principal non-potable uses for recycled water in the Coachella Valley are:

- Agricultural irrigation
- Golf course irrigation
- Urban landscape irrigation

Each of these recycled water uses could be implemented through: 1) direct blending with Coachella Canal water and delivery through the existing Canal water distribution system or the MVP system, 2) construction of an isolated distribution system that delivers recycled water only, 3) expansion of existing dedicated recycled water systems to serve new customers, and 4) a combination of these options. Each approach has advantages and disadvantages.

The first option has a significant potential cost advantage in that the distribution system is in place; little additional capital expenditures would be needed to deliver recycled water to a wide range of non-potable water users. Recycled water (even blended with Canal water) may not be acceptable to certain agricultural users; however, the California Department of Public Health (DPH) regulations allow the use of tertiary treated municipal effluent to irrigate "food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop" (CCR Title 22, 2010). However, the introduction of recycled water into the Canal system could pose significant permitting issues for the future potable use of Canal water.

significant increase in the amount of Canal water that would be treated for urban use compared to the 2002 WMP. Treatment strategies are discussed further in **Section 6.7.1**.

#### 6.5.2.4 Non-potable Urban Water Systems in the East Valley

One approach for reducing future groundwater use and overdraft while increasing Canal water use is the installation of dual source water systems, which refers to the operation of separate but parallel potable and non-potable systems to serve urban development.

An urban non-potable distribution system may be achieved by the following methods:

- Developer installation of on-site non-potable irrigation system (treatment if needed, storage, pumping and piping) which connects to Canal water distribution system or recycled water systems as available and feasible.
- Rehabilitation and extension of the existing Canal delivery system, as needed
- Separate potable water system that meets indoor and other uses requiring a potable supply.

A separate non-potable system could reduce the amount of groundwater that would have to be treated for arsenic removal, minimize the number of new wells required to serve growth and could be designed to meet fire protection needs, thus reducing the size of the potable water system. In addition, delivery of non-potable water for urban use would reduce the amount of Canal water treatment need for potable use. The non-potable system would need to be distinguishable from the potable water system to prevent cross-contamination and backflow issues. In California, non-potable systems are installed using “purple pipe” in compliance with the California Health and Safety Code §116815, to clearly indicate that the water is not for drinking purposes.

For this 2010 WMP Update, it is estimated that distribution systems could be installed for at least two-thirds to as much as 80 percent of the new development in the East Valley by 2045. This estimate is based on the following:

- Growth will create about 190,000 AFY of new demand in the East Valley with conservation. Of this amount, about 75 percent or 143,000 AFY is expected to be outdoor demand.
- Larger developments must mitigate for their incremental demand on the basin.
- Large developments are more likely to have the financial capability to distribute the costs of infrastructure among more housing units, thereby lowering the individual unit’s cost.

Based on these premises, about 95,000 to 115,000 AFY of non-potable use with Canal water and desalinated drain water could potentially be implemented by 2045. Additional investigations should be conducted into the feasibility of delivering non-potable water on this scale over the next five years.

# Section 7
# Plan Evaluation

This section presents an evaluation of the water management elements that are considered as part of the 2010 WMP Update as presented in **Section 6**. These elements consist of water conservation, additional water sources, source substitution, groundwater recharge and water quality improvements. Next, this section discusses the important factors that are considered in developing a balanced plan – basin management considerations and costs – and how these factors are used to revise the recommendations of the 2002 WMP. Finally, the section describes the approach for the development of the elements that are included in the 2010 WMP Update.

## 7.1 EVALUATION APPROACH

The 2010 WMP Update evaluates the need for changes in direction and strategies to meet changing conditions. Consequently, the 2010 WMP Update revisits decisions made in the 2002 WMP to the extent that changed conditions necessitate a change in strategy. The evaluation of future plan elements considers the goals of the Plan and criteria needed to measure the effectiveness of the updated Plan.

### 7.1.1 Evaluation Factors

To evaluate the effectiveness of water management elements, evaluation factors have been developed. Each factor is described along with how the factor is considered in the evaluation process.

#### 7.1.1.1 Potential Supply

The initial consideration of a management action or project within an element is the amount of water it can produce in the case of conservation and water supply elements, or the amount of overdraft reduction that can be accomplished in the case of source substitution and recharge elements. The amount of water is expressed in terms of average supplies or deliveries considering the range of hydrology or the potential magnitude of the potential element.

#### 7.1.1.2 Water Quality

Water quality is an important factor for maintaining the long-term salt-balance and use of the basin. In the case of water sources, water quality is identified principally in terms of total dissolved solids (TDS) expressed in milligrams per liter (mg/L) or other critical water quality components.

#### 7.1.1.3 Cost

A major consideration in updating the plan is minimizing the future cost to Valley water customers to the extent practicable. Costs are expressed in dollars per acre-foot ($/AF). Where program costs have not been well defined a range of potential costs are identified.

#### 7.1.1.4 Reliability

The reliability of water source is important for determining its availability during a range of wet and dry cycles. A supply is considered to have high reliability if it can provide water on a more-or-less continuous basis; that is, average supply is greater than 90 percent of the maximum supply. In the case of source substitution and groundwater recharge, reliability is judged on the basis of the option's ability to reduce overdraft on a continuous basis over the planning period.

#### 7.1.1.5 Technical Feasibility

Many factors can affect the technical feasibility of a management element. For example, an element that is well defined and/or uses a proven technology would be rated higher than one that is very conceptual. Where possible, technical issues are identified that may affect feasibility.

#### 7.1.1.6 Environmental Impacts

Many water management elements can have impacts on the environment. Ideally, a management element that has no environmental impacts or whose impacts can be fully mitigated would be rated much higher than one that has significant adverse impacts that cannot be mitigated.

#### 7.1.1.7 Permitting

Many management elements require some level of permit approval by regulatory agencies prior to construction. The level of difficulty to obtain permit approval or the number of permits required for the option being evaluated is considered in this evaluation factor.

#### 7.1.1.8 Public Acceptance

Management elements that are acceptable to the public have a much higher chance of being successfully implemented than are those which are opposed by the public. In some cases, the level of public acceptance is not well known.

## 7.2 WATER SUPPLY EVALUATION

Prudent water supply planning dictates the need to include a supply buffer due to the uncertainties associated with water demand projections and the risks in developing and implementing new water supplies. The 2010 WMP Update differs from the 2002 WMP in that a 10 percent supply buffer is applied to the projected water demands while eliminating overdraft. This buffer compensates for uncertainties such as demands higher than forecast or supplies that cannot be implemented or do not deliver as much water as planned.

Future water demand for the Valley is presented in **Section 3** along with possible ranges of growth. Water demands could range from 793,600 AFY to 971,500 AFY with a planning value of 885,400 AFY. Consequently, the WMP seeks to identify sufficient water supplies and conservation to provide 974,000 AFY by 2045 (supply with 10% buffer as discussed earlier).

With this supply buffer, the Valley would be better able to adapt to higher water demands that anticipated or further supply reductions.

From a water supply planning point of view, conservation activities are viewed on par with water supply measures. Water conservation efforts, mandated through state law, plumbing codes and landscaping ordinances and voluntary efforts help meet future demands in the same way that additional supplies meet those demands.

### 7.2.1 Water Supply Scenarios

Water supply planning scenarios are identified that describe a range of possible future outcomes for the 2010 WMP Update. The scenarios are based on existing local water supplies and differing levels of imported water supply availability. For each scenario, the amount of additional water supply required is estimated by subtracting the existing supply from the water demand including the 10 percent buffer.

**Local Water Supplies:** The existing local water supplies in the Valley consist of surface water diversions, local mountain-front runoff that recharges the groundwater basin, recycled water and return flows from use that replenish the basin, minus any groundwater consumed by native vegetation, drain flows discharged to the Salton Sea and subsurface outflow from the basin. The local supply available in 2045 is estimated to be about 176,200 AFY as shown in **Table 7-1** without implementation of the 2010 WMP Update.

**Table 7-1**
**Summary of Local Supplies**

| Source | Amount in 2045 (AFY) |
|---|---|
| Natural Inflow | 60,600 |
| Surface Water (direct use) | 3,400 |
| West Valley Recycled Water | 34,500 |
| Returns from Use | 183,300 |
| Less | |
| Drain flows to Salton Sea | (96,800) |
| Phreatophyte Evapotranspiration [1] | (7,800) |
| Subsurface Outflow to Salton Sea | (1,000) |
| **Total** | **176,200** |

1 Phreatophytes are native vegetation located near the Salton Sea that utilize groundwater.

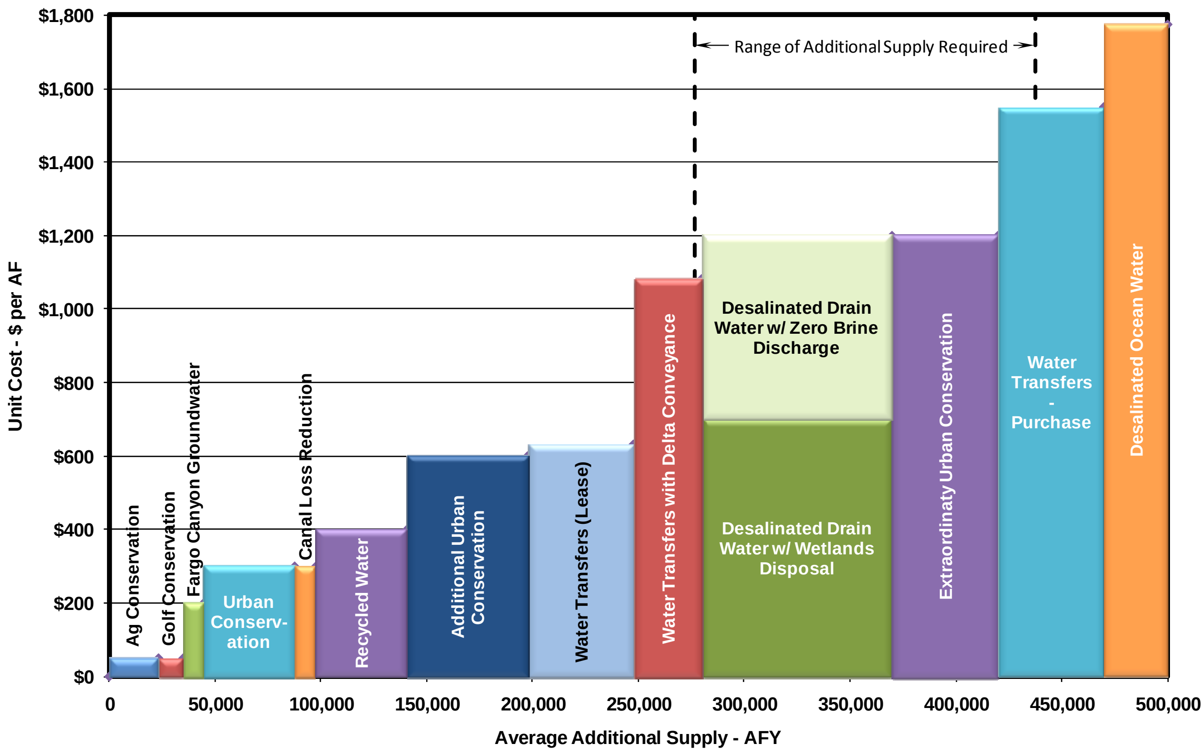
**Coachella Canal Supply – Colorado River:** Two scenarios are considered for the Coachella Canal supply – with and without the QSA. Under a "with QSA" scenario, no changes are made to the delivery schedule prescribed in the QSA and CVWD would receive 459,000 AFY of supply by 2027 less 31,000 AFY of conveyance losses. Reclamation has stated that it views the QSA and the federal Water Delivery Agreement as binding and it intends to honor and implement the provisions of these agreements (Reclamation, 2010).

If the QSA invalidation is upheld on appeal, CVWD management believes that revisions to the existing agreements involving the State of California and the other QSA parties would be

### 7.2.2.3 Costs

The 2010 WMP Update considered the potential sources of additional water supply and ranked those supplies based on anticipated cost and yield. The results of the cost ranking are shown on **Figure 7-1**. Costs of new supplies range from about $40/AF to nearly $1,800/AF.

**Figure 7-1**
**Cost Rank of Water Sources**




As indicated in this figure, the most cost-effective supply augmentation approaches involve water conservation. Additional Canal water loss recovery may potentially be cost-effective, but requires a feasibility study to verify the amount of savings and evaluate the feasibility of recovering the water. Development of recycled water for non-potable uses may also be cost-effective; however, the cost of a separate non-potable distribution system can add significant costs depending on the distance from the source to the user. Additional urban water conservation totaling up to about 100,000 AFY and water transfers acquired through long-term lease are the next most cost-effective options. Leased transfers with the additional yield created by a Delta conveyance facility would be similar in cost to desalinated drain water costs, which are significantly affected by the brine disposal approach. If acceptable to the regulatory agencies, wetlands disposal of brine (and ultimately to the Salton Sea) is more cost-effective than zero liquid discharge approaches which could increase the cost of desalinated drain water by about 70 percent. Under Supply Scenario 1 with Delta conveyance and the QSA, no additional supplies are needed.

Under the less favorable supply scenarios, additional higher cost water would be required to meet demands and provide the desired supply buffer. These higher cost waters include the purchase of additional Table A and extreme urban conservation. Desalination of ocean water would not likely be required given the current demand projections and supply options. It should be noted that for the purpose of determining cost of the 2010 WMP Update implementation, Delta Fix costs are accounted to establish the higher end of the costs.

Because the feasibility of some water supply strategies have not yet been evaluated, additional supplies may be needed to meet the supply targets may be required. For example, the yield and feasibility of developing Fargo Canyon groundwater and Canal water loss reduction require additional study. Should these potential supplies prove infeasible, then additional, more costly supply options must be considered. While additional urban water conservation may be more cost-effective than desalination of drain water, it is uncertain how much additional conservation can be implemented without dramatic life-style and economic changes in the Valley. If the desired level of conservation cannot be achieved, additional high cost supplies might be required. Alternatively, growth restrictions might be needed to reduce future demands.

Similarly, the feasibility of certain options is affected by actions outside the control of Valley water agencies. If the BDCP and Delta conveyance are not successful in increasing the average SWP reliability, options for enhancing the yield from water transfers may not be as viable.

#### 7.2.2.4 Reliability

Supply reliability is evaluated based on the anticipated long-term variability of each supply option. Water recycling and drain water desalination are highly dependable and reliable local sources of water. Water conservation measures can also be reasonably reliable but depend upon the level of participation and the commitment of the customers. Imported supplies that originate from other parts of California are affected by hydrologic variability and regulatory restrictions on exports from the Delta. Some supply options such as Fargo Canyon groundwater and Canal loss recovery require additional study to evaluate their reliability.

#### 7.2.2.5 Technical Feasibility

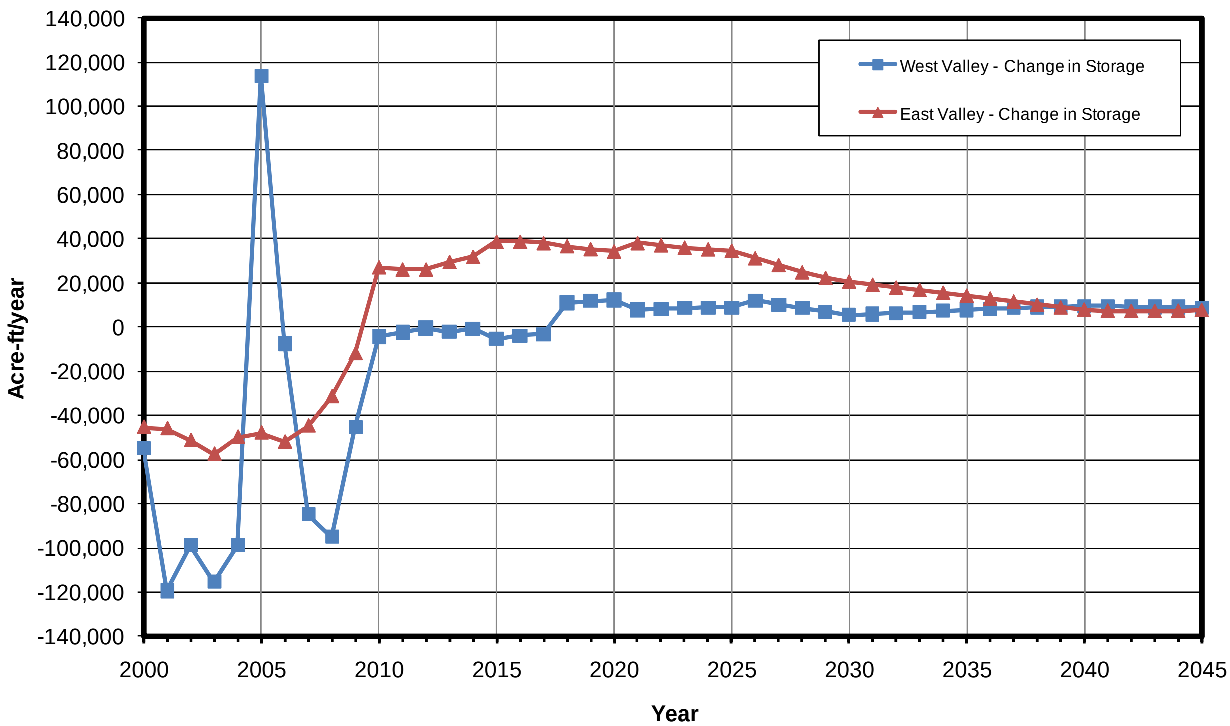
Many of the water supply options under consideration utilize proven technologies. While recycled water and desalinated drain water require significant treatment infrastructure, the technologies that would be used have been implemented in the Valley and elsewhere in California. Options involving Delta exports may have technical issues if a politically and publically acceptable solution to the Delta conveyance and habitat restoration issues cannot be found. High levels of water conservation can be implemented but may require significant customer investment in re-landscaping.

#### 7.2.2.6 Environmental Impact

Some of the supply options could have potentially significant environmental impacts while others would have no or less than significant impacts. While water conservation measures generally have little environmental impact, higher levels of conservation would reduce the return flow to the groundwater basin, potentially decreasing the groundwater supply. Use of recycled increase in basin storage and restoration of groundwater levels, especially in the East Valley. Over time, as storage volumes are restored, the positive change in storage in the East Valley gradually declines to control excessive drain flows and minimize water level increases. In the West Valley, change in storage is maintained at a slightly positive level. This preserves operational storage for buffering SWP supply variations and Metropolitan's periodic needs to store water under the Advanced Delivery Agreement.

One challenge in attaining this increase in storage is the variability of SWP Exchange supplies. During periods when SWP deliveries are reduced, groundwater is removed from storage. When SWP deliveries are relatively high, groundwater storage is gained, as occurred in 2005. The groundwater basin balance and groundwater modeling is performed under long-term average hydrologic conditions. As the WMP is implemented, it is important to recognize these variations when evaluating plan performance.

**Figure 7-4**
**Projected Change in Storage**




### 7.4.1.1 Drain Flows

Throughout much of the East Valley, agricultural tile drains were installed to drain shallow groundwater perched on fine-grained, high-salinity, ancient lakebed soils. Most of the drains empty into the CVSC; however, 25 smaller open channel drains at the southern end of the Coachella Valley discharge directly to the Salton Sea. Adequate drain flows are needed to export salt from the basin and to maintain habitat in the CVSC, drains and Salton Sea.

The quantity of flow in the drains, and therefore in the CVSC, depends upon water levels in the underlying aquifers and the quantities of applied irrigation water. Historically, the highest drain flows occurred from the 1960s to the early 1980s when groundwater levels were at their highest. Groundwater levels in some areas of the confined Lower aquifer were above ground surface or at least above those in the Upper aquifer, creating an upward hydraulic gradient. This upward gradient tended to flush the more saline water in the Upper and Semi-perched aquifers into the drain system.

Since that time, both water levels and drain flows have declined. However, as overdraft has increased, deep groundwater levels have declined and a downward vertical gradient has been created. This has allowed more irrigation return flow to recharge the groundwater basin rather than flow to the drains. Because the quality of the return flows is generally poor (~2,000 mg/L TDS), an increasing amount of poor quality water recharges the basin when drain flows are low, leading to water quality degradation. While this degradation may initially occur in the shallower aquifers, it may eventually contribute to degradation in the Lower aquifer. In the absence of higher groundwater levels and drain flows, this recharge of poor quality water will continue.

Increased drain flows are beneficial through the export of salt from the groundwater basin; however, changes in drain flows may potentially have adverse effects on biological resources of the Valley. Some resource agencies view any change in drain flows (increase or decrease) from current conditions as detrimental relative to their effect on endangered species such as desert pupfish. In addition, increased drain flows could be viewed as wasting water because additional water must be put into the basin through recharge activities to offset the amount of water lost to the drains. Although a portion of the higher drain flows could be recovered and reused through treatment, this would require added cost and energy consumption.

Groundwater modeling results indicate that drain flows in 2045 can range from a low of about 66,000 AFY for continued implementation of the 2002 WMP strategies with the revised water demands to a high of about 119,000 AFY with restoration of historical groundwater levels. Consequently, drain flows are sensitive to the management approach. It appears that somewhat lower drain flows can be maintained by reducing recharge near the Oasis area and increasing recharge in the Indio area where there is more pumping. This would allow better use of the basin storage capacity. However, the amount of recharge feasible in the Indio area has not been demonstrated by field testing.

**Figure 7-5** shows the projected flows to the drain system with implementation of the 2010 WMP Update. This chart indicates that flows will decline until about 2015 and then increase as water levels in the East Valley recover as a result of management activities. The net amount of flow reaching the Salton Sea is a function of total drain flows (water flowing from subsurface drains), wastewater discharges to the CVSC less any flow recovered through drain water desalination and recycled water use. **Figure 7-5** also shows the potential flow to the Sea in the event that desalination of drain water is maximized and all recycled water generated by new growth is used to meet future demands. The actual flow to the Sea could be higher than shown if alternate sources of water are implemented (such as water transfers) that could offset a portion of the drain water desalination. Consequently, the net flows to the Sea represent a minimum level with

# Section 8
# Implementation Plan

The Coachella Valley Water Management Plan (WMP) is a dynamic document. The WMP must be periodically updated to reflect changing conditions in development and water demand, water supply availability, and other internal and external factors affecting the water resources of the Valley. As discussed in the previous sections, the 2010 WMP Update has been prepared to reflect the changes in expected development within the Valley based on conversion of agricultural land to urban land uses and the reductions in water supply reliability estimates that have taken place as a result of environmental and legal restrictions in the California Delta. Additional factors such as climate change, changing water quality requirements and the potential for other emerging issues have also been considered. This section presents the proposed implementation plan for water supply development and control of groundwater overdraft.

## 8.1 PLAN COMPONENTS

The goal of the Coachella Valley WMP is to reliably meet current and future water demands in a cost-effective and sustainable manner. This will be accomplished by achieving the following objectives:

- Meet current and future water demands with a 10 percent supply buffer
- Manage groundwater overdraft
- Manage water quality
- Comply with state and federal regulations
- Manage future costs
- Minimize adverse environmental impacts

As described in **Section 6**, the principal components of the WMP include water conservation and water supply development to meet water demands coupled with groundwater recharge and source substitution to reduce groundwater overdraft. Water quality improvements incorporated into the plan will ensure that the water delivered for urban use meets State and Federal drinking water requirements.

Key underlying themes of this update are balance and flexibility. Consequently, the approach with the 2010 WMP Update is to maximize flexibility in implementing plan elements while minimizing costs. In addition, the recommended Implementation Plan avoids excessive reliance on any one supply source while meeting projected water demands with a 10 percent supply buffer. In 2011, the supply buffer should ideally be about 68,000 AFY. The supply buffer should gradually increase with demand to about 89,000 AFY by 2045. The supply buffer serves as a contingency in the event that demands are higher than expected or supplies cannot be implemented at the levels expected. This supply buffer is achieved by establishing increased planning targets for urban water conservation, desalinated drain water, recycled water and water transfers and taking the actions to implement these higher targets if and when needed. Currently, due to groundwater overdraft and full use of existing developed supplies, there is no supply

**Golf Course Conservation:** Golf course conservation continues to be an important component of water management in the Valley. Valley water agencies will do the following:

- Implement a water conservation program to achieve a ten percent reduction in water use by existing golf courses (built prior to 2007) by 2020. This would be accomplished through golf course irrigation system audits and soil moisture monitoring services.
- Encourage existing golf courses to reduce water use by reducing their acreage of turf.
- Implement the 2009 CVWD/CVAG Landscape Ordinance objectives for all new golf courses (built in 2007 and later). Conduct landscaping and irrigation system plan checks to verify compliance.
- Develop and implement methods to evaluate the effectiveness of golf course water conservation such as measuring water use per irrigated acre.

These measures are expected to achieve a savings of 11,600 AFY by 2045. Progress toward meeting golf course conservation goals will be evaluated and reported annually. Additional golf course conservation could contribute to the supply buffer; however, no specific target is included in the 2010 WMP Update.

#### 8.1.1.2 Supply Development

As described in **Section 6**, the strategy for water supply development consists of a balanced portfolio which retains flexibility to adapt to future changes in supply reliability. Sufficient water supplies will be planned to provide a 10 percent buffer on an average basis to meet unanticipated reductions in existing supplies or difficulties in developing new supplies. The additional supplies needed to provide the buffer would be implemented when required based on an on-going analysis of projected demands and supplies.

**Acquisition of Additional Imported Supplies:** Additional water supplies will be required to eliminate groundwater overdraft and meet the future demands of the Valley. The 2010 WMP Update retains the 103,000 AFY target for recharge at Whitewater but the MVP will be supplied with 35,000 AFY of SWP water transferred from Metropolitan to CVWD under the QSA. Given the uncertainty in the California water supply picture, the average amount of additional imported supply required is in the range of 45,000 to 80,000 AFY. The lower value assumes successful implementation of the BDCP and Delta conveyance facilities while the upper value is based on reduced future SWP reliability (50 percent). To provide the water supply buffer, additional transfers and acquisitions of up to 20,000 AFY are required.

Additional supplies will be obtained through the following actions:

- Acquire additional imported water supplies through long-term lease or purchase where cost-effective.
- Continue to purchase SWP Turnback Pool, SWP Article 21 (Interruptible) and supplemental SWP water under the Yuba River Accord Dry Year Water Purchase Program as available.
- Work with Metropolitan to define the frequency and magnitude for SWP Table A call-back under the 2003 Water Transfer Agreement.

# COACHELLA VALLEY WATER MANAGEMENT PLAN
# 2010 UPDATE

## Administrative Draft
## Subsequent Program Environmental Impact Report
### SCH No. 2007091099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# Section 8
# The Human or Built Environment

This section presents the human or built environment potentially affected by the 2010 Water Management Plan (WMP) Update within the Coachella Valley study area. Elements discussed are population/housing/employment, land use, agriculture and forest resources, consistency with regional planning, public services and utilities, energy resources and conservation, and Indian Trust Assets. See also Section 8 of the 2002 Program Environmental Impact Report (PEIR) for the Coachella Valley Water Management Plan and State Water Project Entitlement Transfer (MWH, 2002).

## 8.1 POPULATION, HOUSING AND EMPLOYMENT – REGIONAL PLANNING

### 8.1.1 Environmental Setting

Section 8.2 of the 2002 PEIR discussed population, housing and employment based on adopted projections current at that time. The PEIR found that since the WMP would not control land use decisions, or the distribution, density or nature of growth and was developed to respond to demand created by others, the Valley-wide project was not growth inducing, nor would it remove an obstacle to growth. The Project was found to require no new housing nor displace any existing housing, and to have only a minor, temporary, beneficial effect on employment for facilities construction. Therefore, the effect was found to be less than significant. Potential growth inducing impacts of the WMP were also discussed in Section 11.3 of the PEIR, which concluded that the Proposed Project would not foster economic or population growth or construction in the Valley. The PEIR also found that sufficient water was available in the Coachella Valley groundwater basins to meet the demands of projected growth through at least 2035 with or without the Proposed Project.

This situation has changed in the intervening years. The Coachella Valley Association of Governments (CVAG)/Riverside County population projections adopted by those agencies in early 2007 and by the Southern California Association of Governments (SCAG) in 2008 show far higher populations throughout the Coachella Valley by 2035 than the Riverside County projections that formed the basis of planning in 2002. The County of Riverside has not yet developed land use projections to accompany the population projections, and will not until after 2011 when the updated county General Plan is adopted. The County's California Environmental Quality Act (CEQA) compliance document for the General Plan will evaluate the impacts of these projections at that time. Therefore, the Coachella Valley Water District (CVWD) has been required to make assumptions for the 2010 WMP Update about the land use changes that could result from these projections and their potential subsequent effects on projected water demands and supplies.

The County anticipates that the projected population would displace a substantial fraction of existing agriculture in the East Valley, which together with anticipated reductions in imported water supplies to the Coachella Valley from the State Water Project (SWP) and possibly the

### 8.5.3 Impacts

The 2002 PEIR stated that the Proposed Project was expected to change energy use within and outside the Coachella Valley. Total energy usage was expected to increase due to pumping and treatment. Baseline energy usage for water and wastewater operations (1999 conditions) totaled 541,664,000 kilowatts per year (kWh/yr). With implementation of the 2002 WMP, energy use was projected to increase to 648,443,000 kWh/yr by 2015, an increase of 106,779,000 kWh/yr, and to 700,824,000 kWh/yr by 2035, an increase of 159,160,000 kWh/yr over 1999 conditions.

Implementation of the present Proposed Project is similarly expected to change energy use both within and outside the Coachella Valley. The overall Proposed Project energy demand is projected to increase from 390,356,000 kWh/yr in 2009 to approximately 462,783,000 kWh/yr by 2020, an increase of 72,427,000 kWh/yr or 18.6 percent, and to approximately 663,079,000 kWh/yr by 2045, an increase of approximately 272,723,000 kWh/yr or 69.9 percent over 2009 levels.

Energy use is discussed in terms of energy to operate in-Valley Proposed Project elements and reduction in pumping energy with reduction in overdraft and also in terms of energy to import water to the Valley from the SWP and CRA.

#### 8.5.3.1 In Valley Energy Use

Under the Proposed Project, energy usage within the Valley for facilities is expected to increase due to increased water conveyance to and from treatment plants, tanks, pumping stations and to recharge basins, but overwhelmingly for desalination treatment. At the same time, energy usage for groundwater pumping is expected to decrease under the Proposed Project with reduced pump lifts as groundwater levels rise with the reduction in overdraft.

Existing and projected future energy usage for groundwater pumping has been estimated based upon the following assumptions:

- Total pump lift is based on the sum of depth to water, drawdown and pump discharge head (pressure above ground).
- Depth to water is computed from groundwater model results as the difference between the ground surface and the groundwater table elevations.
- Drawdown is also computed from groundwater model results using estimates of specific capacity and assuming continuous pumping.
- Discharge heads are assumed to average 60 pounds per square inch (psi) for agricultural uses, 70 psi for urban uses and 90 psi for golf courses. Regional weighted averages are computed using the proportion of pumping for the various uses. Thus discharge heads vary over time as usage changes.
- The assumed average wire-to-water energy efficiency is 63 percent (the overall or "wire-to-water" efficiency of a pumping plant is the ratio of work done by a pumping plant to the energy put into the pump, expressed as a percentage).

**Table 8-6** summarizes estimated energy requirements of the various components of the Proposed Project. The proposed treatment facilities and pumping stations required to deliver water would be electrically powered, possibly with standby diesel generators in case of outages. The amount of energy required will depend on the specific design of the facilities. Energy will also be required to convey imported water to the study area from the SWP over the Tehachapi Mountains for Metropolitan, as Exchange water in the Metropolitan CRA, and from the Colorado River via the Coachella Canal. The additional energy usage presented in **Table 8-6** is based on the concepts developed for the Proposed Project.

Based on this analysis, the existing (2009) electrical energy demand for water management in the Coachella Valley is approximately 211,130,000 kWh/yr of which groundwater pumping is approximately 196,265,000 kWh/yr, or 93 percent. With implementation of the Proposed Project (water conservation and increased groundwater levels as overdraft is addressed), electrical energy consumption for groundwater pumping is projected to decrease to approximately 139,355,000 kWh/yr by 2020 and to 128,608,000 kWh/yr by 2045, a saving of 56,910,000 kWh/yr (29 percent of pumping energy) by 2020 and 67,657,000 kWh/yr (35 percent of pumping energy) by 2045, compared to 2009 conditions. This is a beneficial effect of the Proposed Project. Total Coachella Valley energy use is projected to decrease from 211,130,000 kWh/yr in 2009 to 196,772,000 kWh/yr by 2020 and then to increase to 345,238,000 kWh/yr by 2045 with implementation of maximum desalination. At the same time, energy use for groundwater pumping would decrease from 196,265,000 kWh/yr to 128,608,000 kWh/yr of which 102,414,000 kWh/yr would be in the West Valley supplied by SCE, and 26,194,000 kWh/yr would be in the East Valley supplied by IID. The net increase in Valley energy use from 2009 to 2045 would be approximately 134,108,000 kWh/yr by 2045.

Operation of Proposed Project components within the Valley represents 52 percent of the total overall anticipated increase in energy use from Proposed Project implementation (as opposed to energy to importation of water from outside the Valley). The projections also reflect that the greatest increase in energy use would occur after 2020, as Proposed Project elements with the highest energy requirements are implemented. These elements are agricultural drainage desalination, treatment of Canal water, treatment of recycled water, and pumping to the completed MVP distribution system for golf course irrigation (**Table 8-6**). Desalination of agricultural drainage would require 101,150,000 kWh/yr.

Energy for WMP projects in the Valley would be supplied by SCE and IID from their own facilities and from the grid. In general, SCE would supply energy for proposed West Valley facilities and IID would supply East Valley facilities. Since the majority of the Proposed Project facilities would be in the East Valley, more of the additional energy would be required from IID. The Proposed Project facilities would contribute to base period demand, and some would contribute to peak demand as well (e.g., pumping for MVP, East Valley Oasis Canal system, and Canal water treatment). Energy for water importation on the Colorado River and SWP Exchange is and would be supplied by a complex of entities.

The proposed in-Valley elements would minimize energy use, avoiding the inefficient, wasteful and unnecessary consumption of energy. The amount of energy required for powering these facilities, 7 MW by 2045, would have less than significant effects on local and regional energy supplies and on requirements for additional capacity. Total energy supplied by SCE is 5,000 MW (SCE, 2010), and by IID is 1100 MW (IID, 2011). Therefore, a demand of 7 MW is considered to have a less than significant potential impact on local and regional energy supplies and would not require the development of new supplies.

Therefore the energy impacts of in-Valley WMP elements are considered to be less than significant. Mitigation Measures to further reduce these effects are discussed below.

#### 8.5.3.2 Water Importation Energy Use

Water importation to the Valley from the SWP requires energy to pump CVWD and DWA's water over the Tehachapi Mountains into southern California (where Metropolitan takes it) and also energy to pump the SWP Exchange water from the Colorado River to the Whitewater Turnout on the CRA. Energy is also required to move Colorado River water from the All-American Canal into the Coachella Canal, thence into the study area. In 2009, water importation to the Coachella Valley required approximately 179,226,000 kWh/yr. However, energy use in 2009 for water importation on the SWP was lower than average because of ongoing drought and Delta issues – i.e., the amount of water imported was less than usual. Therefore, the projected 2020 and 2045 energy demand increments for SWP Exchange water may be somewhat lower than shown in **Table 8-6**.

Total 2009 energy use estimated for Coachella Valley water importation is approximately 179,226,000 kWh/yr. Under the Proposed Project, water importation will substantially increase total Proposed Project energy use. Energy use for water importation will increase from approximately 179,226,000 kWh/yr to 266,011,000 kWh/yr by 2020 and to approximately 317,841,000 kWh/yr by 2045, increments of 86,785,000 kWh/yr and 138,613,000 kWh/yr, respectively. Additional energy for water importation is estimated to bed 16 MW of electricity on the SWP and CRA by 2045.

The SWP is actively pursuing measures to improve energy efficiency of major equipment, is procuring renewable energy through a progressive procurement plan and is using best management practices for its existing facilities to minimize energy use. Metropolitan and suppliers of energy to the CRA, particularly SCE, are similarly pursuing measures to reduce energy consumption and increase renewables.

Energy for water importation to the Coachella Valley, which can be minimized but not eliminated, would not result in the inefficient, wasteful and unnecessary consumption of energy. The anticipated energy requirement for water importation by 2045 under the WMP is estimated to be 16 MW, which is a minor fraction of total energy provided by the power suppliers. Annual net energy use on the SWP is 5.1 GWh (California DWR, 2011) and energy use on the CRA is 325 to 2600 GWh depending on the number of pumps operating (Metropolitan, 2006). Therefore, the energy required for the Proposed Project is considered to be less than significant.

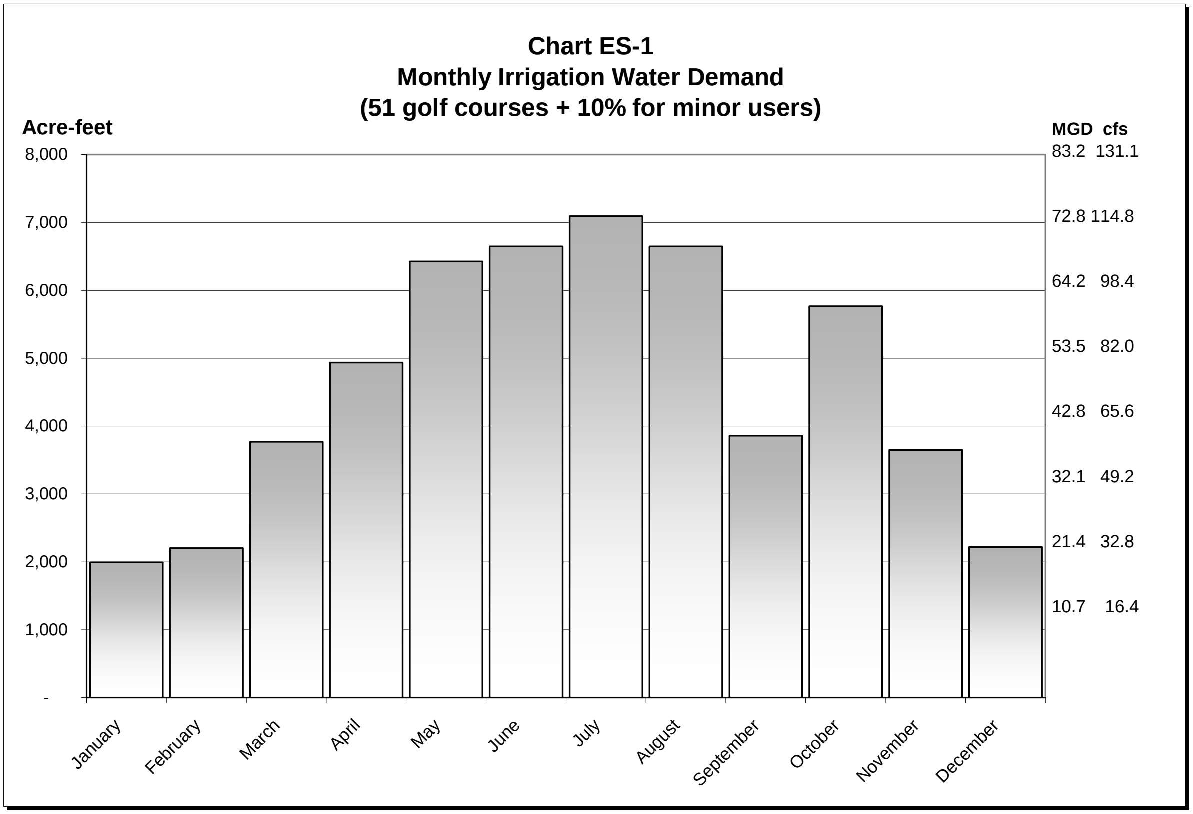
Final Concept Paper

# Mid-Valley Pipeline

**Coachella Valley, California**

**Submitted to:**
**Coachella Valley Water District**

**October 2005**
**Project No: 042720**




## Impacts on Golf Course Operations

While the golf courses recognize the necessity of reducing groundwater pumping they operate in a highly competitive market and are concerned with equity among all golf courses. If the project is implemented in a manner that puts one golf course at a disadvantage to another, there may be severe financial impacts. Golf courses have a number of concerns with the projects impact on their operations and costs. These concerns include water quality, capital costs of converting their irrigation systems and increased maintenance and operations costs.

The District has set in place a collaborative effort with the golf courses in the Mid-Valley area to address issues related to use of Canal water, recycled water and groundwater on the courses.

## WRP 10 Recycled Water Facilities

WRP 10 is located within the Mid-Valley area on the south side of Hovley Lane east of Cook Street. An existing recycled water system serves golf courses and other users with tertiary treated water from WRP 10. Since 1987, WRP 10 has been providing recycled water to golf courses, homeowners associations, and the Palm Desert High School.

# 2 Irrigation Water Use in Mid-Valley Area

The Mid-Valley Pipeline area (Mid-Valley area) is generally bounded by Interstate 10 on the northeast, Washington Street on the east, Highway 111 on the south, and Date Palm Drive on the west. In addition, several golf courses along Deep Canyon Channel, south of Highway 111, are included. The area includes a large concentration of golf courses that currently obtain most of their water from groundwater and the remainder from the District's recycled water program. **Sketch 2-1** (all sketches are in **Appendix B**) shows the Mid-Valley area. The limits of the area were established based on the engineering and economic feasibility of delivering water from the Coachella Canal (Canal).

This section updates the water demand projections of the Conjunctive Use/Surplus Water Storage Study (Bookman-Edmonston, 2002). The primary changes have been to reflect the construction of additional golf courses and to include golf courses that use recycled water. While the prior study treated recycled water as a separate system, this concept paper proposes close integration of the recycled water and Canal water systems.

## 2.1 Irrigation Water Demand

There are 51 golf courses within Mid-Valley area (A 27-hole golf course is counted as 1.5 golf courses), including several proposed courses. **Table 2-1** lists these golf courses and their projected water use in 2015. Water use by minor users in the area (including homeowners associations, parks and the Palm Desert High School) is assumed to use ten percent of golf course use.

**Chart 2-1** shows the monthly pattern of irrigation in the area. **Chart 2-2** combines the data in Table 2-1 and Chart 2-1 to show the anticipated monthly Mid-Valley area demand. Combining the information from Table 2-1 and Chart 2-1, the average 18-hole golf course uses approximately 975 acre-feet per year (0.87 million gallons per day (MGD)). The highest demand occurs in July, when each golf course uses an average of 3.88 acre-feet per day (1.26 MGD).

**Table 2-1**
**Projected Mid-Valley Use of Irrigation Water (2015)**

| Golf Course | Holes/18-Hole Equivalents | 2015 Projected Water Use[1] (acre-feet per year) |
|---|---|---|
| Desert Willow[2] | 36 | 1800 |
| Portola Country Club[2] | 18 | 900 |
| The Golf Center, Palm Desert[2] | 9 | 450 |
| Woodhaven Country Club | 18 | 994 |
| Palm Desert Country Club | 27 | 1,999 |
| Palm Desert Resort Country Club | 18 | 1,157 |
| Indian Ridge Country Club[2] | 36 | 923 |
| Palm Valley Country Club | 36 | 1,664 |
| Avondale | 18 | 793 |
| Emerald Desert Country Club | 9 | 333 |
| Desert Falls Country Club | 18 | 1,522 |
| The Lakes Country Club | 27 | 2,308 |
| The Oasis | 18 | 931 |
| The Golf Resort at Indian Wells | 36 | 1,845 |
| Indian Wells Country Club | 27 | 885 |
| El Dorado Country Club | 18 | 307 |
| Desert Horizons Country Club | 18 | 867 |
| Marriott's Shadow Ridge[3] (built since 2000) | 18 | 923 |
| Santa Rosa Country Club[2] | 18 | 746 |
| Suncrest Country Club | 9 | 714 |
| Chaparral Country Club | 18 | 951 |
| Monterey Country Club | 27 | 1,628 |
| Date Palm Country Club | 18 | 619 |
| Marriott's Desert Springs Resort | 36 | 1587 |
| Palm Desert Greens Country Club[2] | 18 | 884 |
| Toscana Country Club[4] | 36 | 1800 |
| Rancho Portola, future course at T4S/R6E Sec 33 | 18 | 923 |
| The Eagle, future course at T4S/R6E Sec 31 | 36 | 1,845 |
| Rancho Las Palmas Resort Country Club, Marriott's | 27 | 1,236 |
| Date Palm Country Club | 18 | 619 |
| Sunrise Country Club | 18 | 961 |
| Thunderbird Country Club | 18 | 574 |
| The Springs Club | 18 | 1,289 |
| Desert Island Golf and Country Club | 18 | 852 |
| Rancho Mirage Country Club | 18 | 1,236 |
| Tamarisk Country Club | 18 | 692 |
| The Club at Morningside Heights | 18 | 1,205 |
| Westin Mission Hills Resort | 36 | 1,854 |
| Mission Hills Country Club | 54 | 5,747 |
| Private at NW corner Hope and Sinatra[5] | 9 | 450 |
| Private at top of Magnesia Canyon[5] | 18 | 900 |
| **Total golf course irrigation** | **51** | **50,194** |
| **Average demand per golf course (18 hole equivalent)** | | **975** |
| **Minor irrigation (assumed to equal 10% of golf course use)** | | **5,019** |
| **Total irrigation demand in Mid-Valley area** | | **55,213** |

[1] Unless otherwise noted, projected 2015 usage is from the District's Water Management Plan. Projections for 2105 assume implementation of water conservation measures.
[2] Golf courses currently receiving recycled water. Use assumed to be 900 acre-feet per year.
[3] Marriott's Shadow Ridge was constructed to facilitate later conversion to recycled water (low pressure system). It is currently using groundwater.
[4] Toscana Country Club signed agreements with the District in August 2004 to use recycled water. Construction is underway.
[5] These are closely-held private courses. The Magnesia Canyon course obtains water from a private well located below the cove. Use assumed to be 900 acre-feet per year.

**Recycled Water Program**

# Guidelines for the Use of Recycled Water

# SECTION J TIPS FOR SUCCESSFUL USAGE

The recycled water that is delivered for beneficial reuse has been "manufactured" at a water reclamation plant, resulting in a quality that meets very strict CDPH standards for safety. Even though it is virtually impossible to distinguish the recycled water, as described in this Manual, from potable water supplies. However, there are general chemical differences that may require Customers to make changes in their landscaping practices. The following few pages is not meant to be a comprehensive discussion of issues that might arise when irrigating with recycled water; but only the most common areas of concern.

## SALT LEVELS

Salt is a difficult and expensive constituent to remove from water; consequently, it and other minerals that are not often removed by conventional treatment processes. The salinity, or salt levels in recycled water can vary from treatment plant to treatment plant, but are generally higher than the local domestic water supply. Therefore, Customers may want to carefully consider their selection of plants, soil composition and irrigation practices.

### Type of plants

For the most part, turf grass is very tolerant of higher salt levels, as are many ornamental trees and shrubs. Additionally, experience has shown that most flowering plants thrive with the use of recycled water. However, not all landscape plants are suitable for irrigation with recycled water. Most notable of these are azaleas, which are very salt **intolerant** and should be avoided when using recycled water.

### Soil types

The type of soil present at a Customer's site strongly influences how the salt in the recycled (or any) water affects plant growth and health. Well draining soil is preferable; however, any areas have a clay component in their soil. Clay tends to hold on to salt, and can actually cause the soil to stop draining altogether. This particular phenomenon is the direct result of elevated levels of sodium and is measured by its ratio to calcium and magnesium (Sodium Adsorption Ratio, or SAR). The presence of self-regenerating water softeners that discharge sodium-laden brine into the sewer system are big contributors to elevated sodium levels in the recycled water.

Problems with soil drainage due to clay soils and an elevated SAR can be rectified by the application of gypsum (calcium), which loosens the bound up clay and allows for water to drain through the soil. However, when dealing with clay soil drainage issues, some recycled water Customers have rejected gypsum as it increases the salinity and instead opted for an acid injection system. Buffered acid can be added to break up the bicarbonate binding and salt buildup at the surface level in clay soils and allow improved penetration to the root zone.

### Irrigation schedule

Depending on the levels of salt in the recycled water and the soil type (sand vs. clay), a switch to longer irrigation run times done on a less frequent basis may be called for. Short irrigation runs have the potential to deposit more salt in the root zone, with possible adverse impacts on plant health and growth. Clay soil is more susceptible to this phenomenon than better-draining soils. Heavier watering done less frequently leaches the accumulating salts out of the root zone. This is particularly important in regions of the state that don't experience sufficient precipitation during the rainy season. Rainfall can have the same effect as longer watering periods, if the rainstorms are heavy enough. Periods of drought can exacerbate the build-up of salts further but can be answered with a modified irrigation schedule.

## NUTRIENTS

Recycled water may also contain higher nutrient levels such as nitrogen, phosphorous and potassium, which are essential components for plant growth. Some treatment processes may reduce the levels of these chemicals, although they are not totally removed.

### Fertilizer Value

While nutrient levels vary among treatment plants, there are sufficient levels of nitrogen, phosphorous and potassium in the recycled water to provide fertilizer value to the landscaping each and every time irrigation takes place. Based on nutrient levels in the recycled water being supplied, an On-site Supervisor can readily calculate the number of pounds of each constituent being delivered. He or she can then determine how much, if any, and what kind of additional fertilizer needs to be applied. A common mistake is to continue the same fertilizer application schedule that was in place when domestic water was being used for irrigation. The addition of applied fertilizer, on top of the extra nutrients in the recycled water, can cause problems with plant health, groundwater quality problems and avoidable costs to the site in buying and using unnecessary fertilizer.

### Ornamental Lakes

Some reuse sites have ornamental lakes as part of the landscaping. Care must be exercised if recycled water is used to supply these lakes. The nutrient value in the recycled water readily promotes the growth of algae, which can impair the aesthetics of these lakes. This is especially a problem in lakes that are less than 10 feet deep, due to sunlight penetration. Several different strategies have been employed at such lakes, with the greatest level of success in algae control coming from combinations of two or more of the following methods:

- Pumping the recycled water from the lake into the irrigation system reduces the amount of time the water (and the nutrients it contains) spends in the lake, consequently reducing algae production.

- Re-circulating the water by means of fountains or waterfalls or installing more extensive aeration systems.

- Preventing the introduction of organic material (such as grass clippings) from entering the lake.

- Stocking the lake with algae eating fish, such as Tilapia. However, some fish, like koi, react unfavorably to the higher ammonia levels that may be in the recycled water.

- Using a chemical product to prevent sunlight from penetrating the water column.

**Increased Mowing**

Reports from many turf sites using recycled water have reported the need to mow their grass more often. This may be the direct result of additional nutrients in the recycled water being available for uptake by the grass. This information should be used by the On-site Supervisor to reduce fertilizer application to avoid using unnecessary fertilizer and optimize mowing frequencies.

# News Releases

## April 18, 2014

# State Increases State Water Project Allocation from 0 to 5%

## Good News, but Remains Lowest Allocation in History

The California Department of Water Resources today announced that State Water Project (SWP) contractors will begin receiving five percent of their allotted water supplies from the state. The department had previously forecasted that contractors would not receive any of their supplies in 2014 due to a multi-year drought.

"When looking at our imported water supply, even a small increase is good news for the Coachella Valley. A five percent allocation is important to our long-term efforts to reduce overdraft of the aquifer," said Coachella Valley Water District (CVWD) General Manager Jim Barrett.

CVWD and Desert Water Agency (DWA) are both SWP contractors with a combined allotment of 194,100 acre-feet per year. To date, the Agencies have replenished more than 3.2 million acre-feet of imported water into the Coachella Valley's aquifer.

While this increase from zero to five percent is good news for SWP contractors, it remains the lowest overall SWP allocation in history.

"Managing the groundwater in the Coachella Valley is of utmost importance to the Desert Water community, and the key to that is our State Water allocation," said DWA board president Craig Ewing. "In the future, the challenges of managing the State Water Project will grow unless we join with other agencies and all Californians to bring the SWP up to date. In the meantime, I am sure that today agencies across the state are breathing a sigh of relief."

The SWP supplies water for 25 million Californians, 750 thousand acres of farmland and business throughout California, including the Bay Area, Central Valley, Southern California and the desert region. DWA and CVWD exchange the water they receive from the SWP for water from the Colorado River Aqueduct because there is not a direct pipeline from the SWP to the Coachella Valley. DWA and CVWD use this water to recharge the groundwater basin, ultimately providing water to Coachella Valley residents and businesses.

**About DWA**
Desert Water Agency is a public, non-profit agency and a State Water Contractor, serving a 325-square-mile area, including parts of Cathedral City, outlying county areas, Desert Hot Springs and Palm Springs. An elected five-member board sets policy and represents the ratepayers. For more information, please visit www.dwa.org.

**About CVWD**
The Coachella Valley Water District is a public agency governed by a five-member board of directors. The district provides domestic and irrigation water, agricultural drainage, wastewater treatment and reclamation services, regional storm water protection, groundwater management and water conservation. It serves approximately 108,000 residential

and business customers across 1,000 square miles, located primarily in Riverside County, but also in portions of Imperial and San Diego counties. For more information, please visit www.cvwd.org.

For more information, please contact:
DWA Public Information Officer Katie Ruark at (760) 323-4971 ext. 184, kruark@dwa.org.
CVWD Director, Communication & Conservation Heather Engel at (760) 398-2651 ext. 2353, hengel@cvwd.org.

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**CVWD News Releases**
www.cvwd.org/news/news.php

# 2010 URBAN WATER MANAGEMENT PLAN

# City of Coachella

**Prepared By:**

TKE Engineering and Planning
2305 Chicago Avenue
Riverside, CA 92507
(951) 680-0440

**July 13, 2011**

**Table 2.1.2-1**
**City of Coachella Area Climate**

| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total or Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly Average ETo[1] | | 1.59 | 2.54 | 4.03 | 5.67 | 7.81 | 8.74 | 9.28 | 8.42 | 6.26 | 4.39 | 2.36 | 1.59 | 62.68 |
| Average Temperature (Fahrenheit)[2] | Max | 71 | 76 | 80 | 86 | 94 | 102 | 107 | 106 | 101 | 92 | 80 | 72 | 88.9 |
| | Min | 40 | 45 | 50 | 57 | 64 | 71 | 77 | 77 | 70 | 60 | 47 | 38 | 58.0 |
| Average Rainfall (inches)[3] | | 0.60 | 0.50 | 0.40 | 0.10 | 0.10 | 0.00 | 0.30 | 0.50 | 0.40 | 0.30 | 0.40 | 0.40 | 4.00 |

[1] California Irrigation Management Information System, Department of Water Resources, Office of Water Use Efficiency, Monthly Average ETo Report for Station 200, Indio 2, Imperial/Coachella Valley – all other nearby stations are inactive or too new; [on-line] http://www.cimis.water.ca.gov/cimis/frontMonthlyEToReport.do

[2] [3] [on-line] http://countrystudies.us/united-states/weather/California/indio.htm (closest to Coachella and similar to CIMIS Station 200 Indio 2 report)

## 2.2 Service Area Population

The City of Coachella service area population is expected to increase substantially in the future. Based on the California Department of Finance, the City's population grew from 30,879 to 42,591 between 2005 and 2010 or by 37.8 percent. This equates to an average annual growth rate of approximately 7.6 percent.

The City Development Services Department has plans for several proposed development projects, ranging in size from 10 residential units to mixed-use developments with over 8,000 residential units. The total number of proposed residential units associated with these projects is documented as 30,142 in the City of Coachella 2006 Water Master Plan Update. These units are included in the City's SOI, which is not anticipated for full build out until after 2050. Therefore, population projections remain in the City's current service area through the year 2030, which is consistent with the location of water demand through 2030. However, since development has slowed significantly since 2007, development plans are expected to stay in the planning stages until local economies begin to show recovery, see Section 2.2.3 for further discussion.

Table 2.2-1 shows the City's service area population since 2005 and projects the population through the year 2035 in five-year increments based on the assumed buildout of the proposed projects by the year 2027 (the midpoint of the 15 to 30 year buildout range projected in the Water Master Plan).

**Table 2.2-1**
**City of Coachella**
**Population Projections**

| | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|---|
| **Service Area Population** | 30,879 | 42,591 | 60,759 | 76,540 | 90,121 | 104,703 | 119,383 |

Sources: California Department of Finance, http://www.dof.ca.gov/; Riverside County Center for Demographic Research, http://www.rctlma.org/default.aspx

## *2.2.1 Demographics*

The City of Coachella experienced a substantial increase in both housing units and employment from 2005 through 2010 with an increase of 50% and 41%, respectively. Table 2.2.1-1 shows housing units and employment since 2005 and projects these demographics through the year 2035 in five-year increments.

**Table 2.2.1-1**
**City of Coachella**
**Housing and Employment Projections**

| | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|---|
| **Housing Units** | 6,624 | 9,903 | 14,132 | 17,632 | 21,132 | 24,632 | 28,132 |
| **Employment** | 6,971 | 9,800 | 10,920 | 12,878 | 14,831 | 16,793 | 19,014 |

Sources: California Department of Finance, http://www.dof.ca.gov/; Riverside County Center for Demographic Research, http://www.rctlma.org/default.aspx

## *2.2.2 Recession Affects*

Population and demographic projections above are all based on 2000 US Census data and California Department of Finance data that was published before the economic recession hit the Coachella Valley region. The City of Coachella has experienced moderate growth since late 2007. As such, declines in population, employment, and housing are not reflected in the projections.

According to a 2010 Economic Forecast authored by Beacon Economics, the unemployment rate in Riverside and San Bernardino Counties was higher than Statewide and it is expected to fall faster than that of California as a whole. It is expected that the housing market will get worse before it gets better, as the housing market continues to bring uncertainty to the local economy, limiting growth in the short term. Beacon Economics projected that substantial job growth won't occur until sometime in the second half of 2011 and the unemployment rate in Riverside and San Bernardino counties will remain above 8 percent through 2015.

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD**
**COLORADO RIVER BASIN REGION**

ORDER NO. 97-700

GENERAL WASTE DISCHARGE REQUIREMENTS
FOR
DISCHARGE OF RECYCLED WATER
FOR GOLF COURSE AND LANDSCAPE IRRIGATION

The California Regional Water Quality Control Board, Colorado River Basin Region, finds that:

1. Section 13260 (a) of the California Water Code requires that any person discharging waste or proposing to discharge waste within any region, other than to a community sewer system, that could affect the quality of waters of the state, shall file a report of waste discharge (ROWD).

2. Section 13512 of the California Water Code states, it is the intention of the Legislature that the state undertake all possible steps to encourage development of recycled water facilities, so recycled water may be made available to meet the growing water requirements of the state.

3. This Order serve as a region-wide General Permit for discharge of tertiary treated municipal wastewater (hereinafter recycled water) for use in golf course and landscape irrigation. Adoption of this General Permit will streamline the permitting process and should encourage recycled water usage.

4. Each discharger of recycled water covered by this General Order shall submit an annual fee, and an application fee equal to the first annual fee, pursuant to Section 13260, California Water Code. The amount of the fee is currently determined by the type of Order issued the threat to water quality and the complexity of the discharge as detailed in Section 2200, Chapter 9, Division 3, Title 23, California Code of Regulations. Recycled water use projects would generally be rated as Non-Chapter 15 waste discharge requirements with a "III" threat to water quality, and a "C" complexity rating. Individual ratings may differ, based on the characteristics of the project.

5. To obtain coverage under this General Order, a complete Notice of Intent (NOI) (Attachment "A" incorporated herein and made a part of this Order) must be submitted with an appropriate fee. Users who submit a duly filled NOI, an appropriate filing fee, and meet the requirements of this permit, will be conditionally authorized to use tertiary reclaimed water for landscaping and golf course irrigation. A separate NOI must be filed for each facility.

6. The Regional Board may at its discretion issue individual waste discharge requirements, or prohibit discharge of recycled water when such actions are deemed appropriate. Upon issuance of individual waste discharge requirements or prohibition orders, discharge of recycled water under this General Order is not applicable.

7. This General Order is not applicable to producers (or producers/dischargers) of secondary or tertiary recycled water, who are currently required to obtain individual waste discharge requirements for discharge of recycled water. This General Order does not apply to persons engaged solely in distribution of recycled water.

D. Health Based Provisions

1. There shall be no-cross connection between potable water supply and piping containing recycled water. Supplementing recycled water with water used for domestic supply shall not be allowed except with an air-gap separation. An air-gap or reduced pressure principle device shall be provided at all domestic water service connections to recycled water use areas.

2. The discharger shall provide documentation to ensure that there is no interconnection between the potable and recycled water systems. Dischargers with both potable and irrigation water delivered to the site shall ensure that a cross-connection test is completed prior to delivery of recycled water to the site. A cross-connection control test, mutually agreeable to the permittee and DHS shall be conducted at least once every four years. Existing users shall conduct a cross-connection test within a time frame acceptable to DHS. The tests shall be conducted by an American Waterworks Association (AWWA) certified cross-connection control program specialist or equivalent. Prior to conducting the test the user shall notify the DHS and County Department of Health Services. Results of the cross-connection test shall be submitted to the Regional Board, DHS and County Department of Health Services within 30 days of completion.

3. The user shall submit the "as built" plans and specifications showing the domestic and irrigation systems; the location of all potable and recycled water connections; and locations of all on-site and nearby wells to DHS. These plans shall be submitted within a time frame acceptable to DHS. Within 30 days of the issuance of this permit, existing facilities without "as built" plans shall contact DHS for guidance.

4. Adequate measures shall be taken to minimize public contact with recycled water. Clearly visible, adequately sized warning signs shall be posted in sufficient numbers around the application and storage areas. The size and number of warning signs shall be mutually determined by the discharger and DHS.

5. Prior to construction of new facilities planning to discharge recycled water, the discharger shall submit the design drawings to the DHS, field operations branch, for approval. The discharger shall, at a maximum, allow the State Department of Health Services a 30-day comment period for completed designs submitted. If comments are not received by the discharger from the State Department of Heath Services within that 30-day period, then no response will be deemed as "no comment" and the discharger will be able to begin construction.

6. Golf course pump houses utilizing recycled water shall be appropriately tagged with warning signs with proper wording of sufficient size to warn the public that recycled water is not safe for drinking. All new and replacement at grade valve boxes shall be purple or appropriately tagged for water reuse purposes.

7. The use of recycled water shall be in conformance with the reclamation criteria contained in Title 22 of the California Code of Regulations, or amendments thereto.

8. Recycled water shall not be applied in a manner or at a location where it could come in contact with drinking water fountains, food handling, food storage or dining areas.

9. There shall be at least a 4-foot horizontal and 1-foot vertical separation (with domestic water above the recycled water pipeline) between all newly installed constant pressure pipelines transporting domestic water and those transporting recycled water. All newly installed recycled water distribution lines shall be colored purple or labeled with purple tape. Existing pipelines are excluded from this requirement.

10. Irrigated areas shall be properly managed to minimize ponding.

11. Recycled water shall not be used as domestic supply water or intentionally used as animal water supply.

I, Philip A. Gruenberg, Executive Officer, do hereby certify the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, Colorado River Basin Region, on June 25, 1997.

Philip A Gruenberg
Executive Officer

# March 2007

# Natural Environment Study

### Bacterial Indicators Total Maximum Daily Load (TMDL)
### Coachella Valley Storm Water Channel
### Riverside County, California

The purpose of the Natural Environment Study (NES) is to provide biological studies and biologically related information necessary for the environmental review process regarding land use decisions. Full disclosure of environmental impacts of proposed projects is required to satisfy legal mandates of various California and federal statutes and regulations. The NES includes documentation of project area biological resources and an impact assessment of project alternatives on those resources.

## PROJECT DESCRIPTION

The proposed project is an amendment to the Water Quality Control Plan for the Colorado River Basin Region (Basin Plan) that will establish the **Bacterial Indicators Total Maximum Daily Load (TMDL), Coachella Valley Storm Water Channel (CVSC), Riverside County, California**. A TMDL is the maximum amount of a pollutant that a water body can receive while still meeting water quality objectives (narrative or numerical) designed to protect beneficial uses [Clean Water Act Section 303(d); 40 Code of Federal Regulations (CFR) Sections 130.2(d), (i), 130.7].

*E. coli*, enterococci, and fecal coliform are specific indicator organisms that apply to bacteria conditions. Indicator bacteria do not cause illness directly, but high concentrations of these indicators that exceed WQOs indicate the high likelihood of infectious diseases. The United States Environmental Protection Agency (USEPA) recommends using either E. coli or enterococci water quality objectives (WQOs) for protection of bathers from gastrointestinal illness in fresh recreational waters such as CVSC, and only enterococci WQOs for marine (USEPA 2002).

Quantitative water quality objectives for these three bacteria indicator organisms were established by the Regional Board and incorporated into the Basin Plan to protect beneficial uses of waterways in the Region. Violation of these objectives indicates impairment of beneficial uses and degraded water quality conditions. The Basin Plan states that beneficial uses of the Coachella Valley Storm Water Channel[a] include: freshwater replenishment (FRSH); water contact recreation (REC I)[b]; water non-contact recreation (REC II)[b]; warm freshwater habitat (WARM); wildlife habitat (WILD); and preservation of rare, threatened, or endangered species (RARE)[c] (Basin Plan as amended to date).

[a] Section of perennial flow from approximately the City of Indio to the Salton Sea

[b] Unauthorized use

[c] Rare, threatened, or endangered wildlife exists in or utilizes some of this waterway

The CVSC is located in Riverside County, California. The CVSC is unlined and extends about 17 miles from the City of Indio to the northern end of the Salton Sea. The CVSC is an engineered extension of the Whitewater River and serves as a depository and conveyance channel for irrigation return water, treated wastewater, storm water runoff, and urban runoff. The CVSC is maintained by the Coachella Valley Water District for flood protection in the Coachella Valley and serves as a master drain for the area from the City of Indio to the Salton Sea.

The Coachella Valley has been heavily agricultural since the early 1900s. Agricultural fields are irrigated by groundwater and Colorado River water from the All-American Canal. Agricultural return water dominates the channel's flow to the Salton Sea. However, the CVSC also receives discharges from four National Pollutant Discharge Elimination System (NPDES) permitted facilities: three municipal wastewater treatment plants and an aquaculture facility (Kent Seatech Corporation Fish Farm (KSCFF). Average annual flows in the CVSC are decreasing due to changes in agriculture practices and suburban development.

The CVSC's main sources of pathogens (represented by *E. coli*) are avian (40%), human (25%), rodents plus other wild mammals (25%), and livestock (<3%). Human sources include sewage, wastewater effluent, and wastewater treatment plants. Agricultural, stormwater and urban runoff appears to play a significant role, but the actual contribution is not well understood and therefore requires more study.

The Basin Plan Amendment to incorporate the TMDL:

- Summarizes TMDL elements, including the Project Definition, Watershed Description, Data Analysis, Source Analysis, Critical Conditions and Seasonal Variations, Linkage Analysis, TMDL Calculation and Allocations, Public Participation, Implementation Plan, and Monitoring Plan.

- Establishes numeric targets that are consistent with Basin Plan water quality objectives, and applicable throughout the year and in the entire stretch of the Coachella Valley Storm Water Channel:

| Indicator Parameter | 30-Day Geometric Mean[a] | Or | Single Sample |
|---|---|---|---|
| *E. coli* | 126 MPN[b]/100 ml | | 400 MPN/100 ml |

a. Based on a minimum of no less than 5 samples equally spaced over a 30-day period.
b. Most probable number.

- Incorporates a TMDL Implementation Plan, as required by Section 13242 of the Porter-Cologne Water Quality Control Act, that includes designation of responsible parties and cooperating agencies/organizations, a description of required and recommended actions, time schedules, and Regional Board compliance monitoring.

- Describes TMDL enforcement.

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# DESERT WATER AGENCY
# 2010 URBAN WATER MANAGEMENT PLAN

**MARCH 2011**

Prepared by

KRIEGER & STEWART, INCORPORATED
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REGISTERED PROFESSIONAL ENGINEER
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Exp. 03/31/2012
CIVIL
STATE OF CALIFORNIA

Signature ______

Date 6/30/11

101-26.6
KJL/jcb
101-26P6-UWMP2010

**DESERT WATER AGENCY**
**Palm Springs, California**

2010 URBAN WATER MANAGEMENT PLAN
CONTACT SHEET

| | |
|---|---|
| Date plan submitted to the Department of Water Resources: | **June 30, 2011** |
| Names of plan preparers: | **Charles A. Krieger**<br>**David F. Scriven**<br>**Krieger & Stewart, Incorporated**<br>**DWA Consulting Engineer** |
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| E-mail addresses: | **ckrieger@kriegerandstewart.com**<br>**dscriven@kriegerandstewart.com** |
| The Water supplier is a: | **Public Agency** |
| The Water supplier is a: | **Retailer** |
| Utility services provided by the water supplier include: | **Domestic and municipal water (for residential and commercial development), recycled water (for municipal park and landscape irrigation), sanitary sewage (for Cathedral City area), hydroelectric power (for energy delivery to Southern California Edison Company), solar energy power (for energy delivery to Desert Water Agency Operations Center with excess to Southern California Edison Company), and groundwater basin management (for groundwater replenishment and assessment therefor)** |
| Is This Agency a Bureau of Reclamation Contractor? | **No** |
| Is This Agency a State Water Project Contractor? | **Yes** |

# SECTION I

# DESERT WATER AGENCY

does not include the MSWD service area, which is generally northerly of Interstate 10 and includes DHS and its surroundings. MSWD provides municipal water service throughout its service area, and is preparing its own 2010 Urban Water Management Plan.

DWA's Service Area is generally bounded on the north (from west to east) by Interstate 10 to Highway 111, to Chino Canyon and the Whitewater River, on the east by the Whitewater River and the CVWD, on the south by the rugged Santa Rosa Mountains, and on the west by the rugged San Jacinto Mountains.

DWA provides municipal and recycled water service through two separate systems within its Service Area, which is generally southerly of Interstate 10. DWA's current Institutional Boundary and Service Area are shown on **Figure 1** in **Appendix G**.

## 2. Population

Population within DWA's Service Area (CPS, the southwest portion of CCC, and several small unincorporated areas along the western boundary) has increased from approximately 18,000 persons in 1961, when DWA was formed, to around 60,600 persons in 2010, based on data from the Southern California Association of Governments (SCAG).

CPS contains the largest population within DWA's Service Area, with a current population around 47,000. The Palm Springs area has experienced tremendous growth since its beginnings during the late 1800s, in particular, the period from 1970 to the present, during which time the population more than doubled. The golf and tourist industries remain paramount to the area's economy, with future growth in these areas expected; however, due to the current economic climate, growth has slowed substantially over the past three years.

Existing development within the Upper Coachella Valley primarily occupies the valley floor and is situated in Palm Springs, Cathedral City, Palm Springs Oasis (commonly known as Palm Oasis), and Snow Creek Village. Future development is expected to consist of infill within the local communities and expansion into canyons, coves, and mountainous areas.

**Table 2** shows population projections within DWA's Service Area as well as population projections within DWA's Institutional Boundary (refer to **Figure 1** in **Appendix G**). Population within DWA's Institutional Boundary includes the entire DWA Service Area, essentially all of MSWD's service area (including CDHS), and certain adjacent unincorporated areas within Riverside County.

The population estimates within DWA's Institutional Boundary were developed based on historic population data within DWA's Service Area, as well as population projections provided by the Southern California Association of Governments (SCAG). **Figure 2** in **Appendix G** depicts historic and projected population within DWA's Service Area, 1970 through 2035. **Figure 3** in **Appendix G** shows a comparison of DWA's projected population with Riverside County's projected population, 2010 through 2035.

Table 2
Population - Current and Projected

| | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|
| Population within DWA's Service Area | 60,600 | 64,700 | 70,100 | 74,900 | 80,600 | 86,500 |
| Population within DWA's Institutional Boundary | 111,400 | 128,900 | 141,300 | 152,800 | 165,200 | 177,500 |

# San Diego's Water Sources: Assessing the Options

Sponsored and published by the **Equinox Center**
Researched and produced by the **Fermanian Business & Economic Institute**

July 2010

**Healthy Environment**

**Strong Economy**

**Vibrant Communities**

Equinox Center is pleased to partner with the Fermanian Business and Economic Institute (FBEI) to present groundbreaking, independent research on San Diego County's water supply options. Our region's imported water supply is increasingly vulnerable due to structural, environmental and legal issues and is rapidly escalating in cost. This is creating a sense of urgency to develop more local, reliable and sustainable sources of water.

"San Diego's Water Sources: Assessing the Options" is the initial publication of Equinox Center's H2Overview Project, which will provide balanced, easy-to-understand research on San Diego County's water supply to help inform the decision-making process. The Fermanian Business and Economic Institute provides a sharp and thorough economic analysis and offers a new lens with which to view our different water sources.

As the region adds 750,000 more people in the next 20 years, it is important to prepare today for the difficult decisions our region faces to properly steward our water resources well into the future. We thank the many experts that were consulted during this process for their assistance in producing this research.

About Equinox Center

To ensure a healthy environment, vibrant communities and a strong economy for the San Diego Region, Equinox Center researches and advances innovative solutions to balance regional growth with our finite natural resources. We are proponents for our region's responsible growth and we support the conscientious care-taking of the natural and economic assets that we have inherited.

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# INTRODUCTION

Water is the world's most valuable commodity (*The Economist*, May 22nd-28th, 2010). As the pressures of a growing population clash with a limited resource and concerns about energy usage and the environment, it is vital that San Diego County plan strategically for its water future. Considering economic costs, energy intensity, legal, technical, social and other factors, what options should the region pursue to meet its future water demands? This report presents an analytical framework to address those questions and provides its conclusions on the optimal approach.

# REPORT STRUCTURE AND METHODOLOGY

The first part of this report examines the current marginal costs of the different present or possible water sources for San Diego County. Projections for 2020 and 2030 are provided to shed light on how the relative costs of the various energy sources may change during the next ten and twenty years.

The second section analyzes the energy intensity of the different sources both to capture the impact on energy supplies and the magnitude of the "carbon footprint." The third section follows a less quantitative approach but analyzes the feasibility of the different water solutions based on legal, technical, safety, social, environmental, and other factors. The report ends with a section summarizing the rankings of the various water supply options according to these various criteria and concludes with recommendations for San Diego's water policy.

Estimates of marginal costs, energy intensity, and other factors were based on inputs from a number of different studies and water authorities from within San Diego County and elsewhere. (See Sources and References at the end of this report.) These estimates vary widely; the authors of this report used their best judgment based on the current state of knowledge in the field and projections of various economic and financial factors. Attention was paid to ensure that definitions of various concepts, such as marginal cost and energy intensity, were treated consistently across the different water source options. In most cases, estimates and forecasts are presented as ranges to portray the considerable uncertainty surrounding these issues and the different conditions that exist in the various local jurisdictions of San Diego County.

# SAN DIEGO COUNTY'S WATER SUPPLY OPTIONS

Seven solutions to meet the water demands of San Diego County are examined.

**Imported Water**: Water from other areas can be imported into the region if available. Currently, San Diego County receives about 80% of its water supply from this source. (See Chart 1.) In 1991, 95% of the region's water was imported. About two-thirds of San Diego County's current imports come from the Sacramento-San Joaquin River Delta; the remainder comes from the Colorado River.

**Surface Water**: Surface water refers to water accumulated in local streams, rivers, and lakes from precipitation in various watersheds throughout San Diego County. It will represent about 3% of the region's total water supply in 2010. Drought conditions in recent years have reduced the contribution of surface water from a more typical 5% share. Two percent of this year's total water consumption will represent "dry-year transfers," refering to water brought in from substitute sources outside the region.

**Groundwater**: Groundwater is water located beneath the ground surface in soil pore spaces and in the fractures of rock formations. Some of it only requires that certain minerals be extracted to obtain potable water of desired standards, while other is brackish, requiring desalination. Groundwater currently accounts for about 2% of San Diego County's water supply.

**Imported Water**: Imported water currently carries a marginal cost with a range of $875 to $975 per acre foot. This reflects a marginal cost of about $535 per acre foot for untreated water from different sources, $215 for treatment, and $175 for other expenses, including transportation, storage, customer service, and the amortized costs of expanding conveyance capacity. The total represents primarily the wholesale cost the Metropolitan Water District charges the San Diego County Water Authority, which in turn is passed on to the 24 water districts in the San Diego region.

Table 1a

**Marginal Costs and Energy Intensity of San Diego County's Water Alternatives, 2010e**

| | | Imported | Surface Water | Groundwater | Desalinated | Recycled Non-potable | Recycled Potable | Conservation |
|---|---|---|---|---|---|---|---|---|
| Marginal Cost | low | 875 | 400 | 375 | 1,800 | 1,600 | 1,200 | 150 |
| ($/acre foot) | high | 975 | 800 | 1,100 | 2,800 | 2,600 | 1,800 | 1,000 |
| Energy Intensity | low | 2,000 | 500 | 400 | 4,100 | 600 | 1,500 | negligible |
| (kWh/acre foot) | high | 3,300 | 1,000 | 1,200 | 5,100 | 1,000 | 2,000 | |

e=estimated range

Source: FBEI

**Surface Water**: Surface water has a marginal cost estimated to range between $400 and $800 per acre foot. This represents treatment, pumping, distribution, and reservoir costs. Reservoir expenses encompass payments to the state for river usage rights and dam safety, brush clearance, habitat restoration, dikes to prevent contamination from diesel fuel and other elements, and dam improvements over time. The low and high ends of the range represent primarily the differences between reservoir water levels in any given year, with pumping costs per unit considerably higher when reservoir levels are low.

**Groundwater**: Groundwater has a marginal cost that generally ranges from about $375 to $1,100 per acre foot. Much of the cost and variation reflect differences in required treatment methods to bring the water to potable standards. Fresh water may only need to be disinfected (usually with chloramines) and can have a lower cost than surface water which may require more treatment. This is the case for some of the less expensive water supply available, for example, from the Sweetwater Authority. Demineralization, however, may be required to remove iron and manganese. Where water is brackish, reverse osmosis is necessary along with disposal costs of the brine. Distribution and transportation expense of the water to and from the treatment facility also adds both to the total cost and its variability across the region.

**Desalinated Sea Water**: Desalinated sea water has a marginal cost ranging from about $1,800 to $2,800 per acre foot. Although advances in technology have helped reduce the cost of desalination over the past 15 years, the high energy requirements of this source make it the most expensive of the seven energy alternatives investigated in this report. A significant part of the cost and variability in costs of this option reflects the distances that sea water and potable water must be moved. For example, if a desalination plant is connected with a power plant, it can use the outflow from the once-through cooling system of the power plant to dilute the salty brine from the desalination plant before it is discharged back to the ocean. Where dilutants for the brine need to be brought to the plant, costs are substantially higher. It should be noted that California's State Water Resources Control Board voted in May 2010 to phase out once-through cooling systems, where ocean water is cycled through the plant and then returned to the sea, because of envirnomental concerns.

The choice of intake systems is also significant in terms of both the potential environmental impact and marginal cost. Large sea water desalination plants have typically used open sea, surface water intake systems, which can trap marine organisms in the intake screens. Subsurface intake systems, involving horizontal or vertical beach wells, infiltration galleries, or seabed filtration, can eliminate much of the impact on marine

# SmartScape Design Provides Improved Avian Habitat

Andrea D. Haller, M.S.
Stivers & Associates, Inc.
June 2012

## INTRODUCTION

Conventional landscaping primarily consists of monoculture non-**native** grasses as cover, and large trees and /or shrubs as focus, or highlight plants. While these classic, simplistic landscapes are aesthetically pleasing, they provide little vegetation variation and complexity to attract and support **native** wildlife, primarily birds (Roth, R., 1976). Not only do these standard landscapes lack the variability to offer adequate year-round resources for birds, such as food and shelter, they are extremely high maintenance in regards to irrigation, electricity and labor needs (Stivers & Associates, 2010). Many plants in conventional landscapes are ornamental plants not **native** to the area, and so an artificial environment must be created in order for the plants to get the type of soil nutrients and water they need to thrive. This creates a demand for irrigation and fertilizers, and consequently, a demand for associated labor and electricity. Financial costs increase, as well as detrimental effects on the natural environment. **Native** vegetation is suppressed by these forced landscapes, leaving the resident wildlife denied of its natural ecosystem (Hostetler, M.E., and Main, M.B., 2010).

In an effort to design a more natural landscape and decrease the water, electricity and costs associated with conventional landscapes, SmartScape was created by Orange County Coastkeeper and Southern California Edison (SCE) to develop SCE's Villa Park (VP) Substation in the City of Orange. SmartScape will also serve as a model for a sustainable landscape that can be utilized to retrofit both residential and business areas. By planting **native** Southern Californian and other Mediterranean vegetation that is already naturally drought-resistant, irrigation needs are lessened dramatically. It is also hoped that by increasing the **native** vegetation, more avian species will return to utilize the area for resources (Burghardt, K.T., Tallamy, D.W., and Shriver, G.W., 2009). This **native** vegetation is a diverse mix of evergreen and flowering trees, shrubs, succulents and grasses, offering birds a wide range of textures and

**Page 2**

vertical variation for shelter and nesting opportunities. Additionally, varied food resources are provided, such as nectar, seeds, and the insects that will be attracted.

The objectives of this paper are to (1) compare a base site with the SmartScape site for avian species diversity and abundance: (2) and to identify opportunities for avian habitat improvement for SmartScape.

## BACKGROUND

*Villa Park Substation*

Originally designed as a conventional landscape in 1973, this approximately three-acre area on the corner of Taft Avenue and Tustin Street surrounding SCE's VP substation was planted with 272 trees and large areas of non-**native** kikuyu grass. By the time this area was surveyed prior to the SmartScape restoration, only 65 trees remained, all in decline, either dead or dying from disease or structural defects.

In 2010, the SmartScape design was implemented and finally unveiled to the public. The dying trees and **turf** grass had been removed, and the "California-friendly" vegetation planted. On-site composting and vermiculture will provide rich, naturally enhanced soils. Systems of bio-swales, detention basins, and percolation trenches are in place to enhance irrigation and help eliminate dry weather **runoff**. The project was completed in April of 2011 and is now on a two-year management and monitoring program.

## METHODOLOGY

*Base Site Description*

A quarter of a mile east of the SmartScape landscape site on Taft Avenue is an SCE easement, which will serve as a comparison site. Since this area is an unimproved site, it represents what the SmartScape area looked like before the restoration.

*Methods*

Both sites were observed several times during the spring of 2012. With the use of binoculars, detailed observations were taken on avian species sighted, how many, and what (if any) resources at the site were being utilized. Each site was also described by its existing vegetation and location.



## OBSERVATIONS AND RESULTS

*BASE SITE*

*Vegetation and Site Description*

The Base Site, while usually requiring irrigation to keep the grass green, appears to have gone fallow. The **turf** grass covering the easement is dried out and largely dead. The area is completely flat and there are no other plants growing on the main portion of the site. The southern border of the site connects to a residential development. The western and eastern borders are fenced off from concrete areas. The northern border, which runs along Taft Avenue, is a sidewalk, lined with planted ornamental trees, shrubs, and grasses. *Photinia* and Indian Hawthorne bushes are both non-**native**, popular ornamentals originating from Asia. They are widely cultivated and grown for their showy flowers. Along with Crape Myrtles trees, originating from China, these are the dominant tall plant forms along the northern border. *Gazania* is the primary ground cover plant, **native** to South Africa.

The northern side of Taft Avenue is a residential neighborhood. Traffic on Taft Avenue is light and relatively quiet due to it being more residential, less busy than on Tustin Street.

*Avian Life*

A pair of Mourning Doves was observed foraging on the western portion of the easement, on the pavement. An individual Anna's Hummingbird was observed perched and singing on the Crape Myrtle trees, as well as on the power lines above the trees, several separate times. A Red-tailed Hawk was observed perched for several minutes on the top of the tower on the eastern end of the easement. Several House Finches were observed foraging in the shrubs along the sidewalk and flying over the area. Many Tree Swallows were observed flying over the main area of the easement above the fallow grass. It appeared that the swallows were feeding on insects in the grass. There were no other bird **species** observed using this site for resources.

*SMARTSCAPE SITE*

*Vegetation and Site Description*

The SmartScape site, located on the corner of Tustin Street and Taft Avenue, is visually much more heterogeneous plant-wise, than the Base Site. Instead of a monoculture **turf** grass



for cover, there is a variety of **native** grasses, such as *Muhlenbergia rigens*, or deer grass, and wild ryes, rushes and sedges. These grasses were planted as cover and also in the drainage areas to help slow and filter excess rainwater. Many **native**, drought-resistant evergreen shrubs such as toyon (*Heteromeles arbutifolia*) and lemonade berry (*Rhus integrifolia*), as well as the Mediterranean rosemary (*Rosmarinus officinalis*), serve as mid and foreground plants. Lemonade berry (*Rhus integrifolia*), **California** buckwheat (*Erigonum fasciculatum*), Manzanita (*Arctostaphylos* **species**) and coffee berry (*Rhamnus californica*) are other **native** shrubs. **Native** trees have also been planted including Western Redbud (*Cercis occidentalis*) and Hollyleaf Cherry (*Prunus ilicifolia spp. ilicifolia*). "**California**-friendly" accent plants have also been added to bring focus to southern **California's** distinctive vegetation and diversity. These include succulents like aloe and agave, and colorful, flowering plants like bird-of-paradise.

Both Tustin Street and Taft Avenue that surround this location on the west and north borders are busy with regular auto and pedestrian traffic, busier and noisier than the base site. The neighborhood is primarily businesses.

*Avian Life*

An individual Red-tailed Hawk was observed perched on a tower within the substation for several minutes. Several Bushtits were observed feeding on the purple sage (*Salvia*), which offers seeds and nectar through its flowers. A Black Phoebe was observed for several minutes feeding on the insects attracted to the purple sage in the same area. An Anna's Hummingbird was observed foraging around the site often, visiting the red flowers of the dwarf bottlebrush (*Callistemon citrinus*) for nectar. Common Ravens were observed regularly in and around the substation and towers, a popular visitor to urban and rural areas for scavenging. Lesser Goldfinches were observed several times along Taft Avenue and Tustin Street, perched on the power lines and singing. A pair of Mourning Doves was observed for several minutes within the substation, resting together on the constructs. House Finches and House Sparrows were also observed many times foraging in the site. Tree Swallows were also observed flying over the site, foraging on the insects attracted to the plants.

| Species | Base Site | SmartScape Site |
|---|---|---|
| Mourning Dove | X | X |
| Anna’s Hummingbird | X | X |
| Red-tailed Hawk | X | X |
| House Finch | X | X |
| Tree Swallow | X | X |
| Bushtit | | X |
| Black Phoebe | | X |
| Common Raven | | X |
| Lesser Goldfinch | | X |
| House Sparrow | | X |
| **TOTAL (*n*)** | **5** | **10** |

DISCUSSION

While all of the ornamental, non-**native** plants in the Base Site easement are relatively drought-tolerant (excluding the **turf** grass cover), thus may requiring less irrigation, none are **native** to California. In a study by Burghardt, Tallamy, and Shriver (2009), landscape properties that were planted entirely with **native** plants supported higher avian diversity, abundance, and species richness, as well as supporting more caterpillars and caterpillar species, as opposed to traditional landscaped properties with non-**native** groundcover and shrubs. This study suggests that **native** landscaping can help to offset biodiversity losses in urban settings, in addition to saving water and electricity (Stivers & Associates, 2010).

Avian diversity and species richness was greater at the SmartScape Villa Park substation than the Base Site. Both sites had five species in common, suggesting that those species are common visitors to the greater area, probably year-round residents, and visit both sites regularly since they are in close proximity. The additional five **species** that were observed in the VP substation were largely observed utilizing the resources provided from the SmartScape

Page 6

retrofit, like the purple sage, for example. Indirect benefits, such as the **native** flowering plants attracting insects, will then attract flycatchers like the **native** Black Phoebe.

RECOMMENDATIONS FOR SMARTSCAPE LANDSCAPING

Trees not only complete the canopy and increase aesthetic value, they provide an important shelter resource for birds to use for nesting, roosting and protection. Trees also intercept more rain water and can increase the amount of available moisture for plants and wildlife to utilize, in addition to slowing down surface **runoff**. Over time, the **native** trees and shrubs planted at the Villa Park substation will grow larger, but will not create a great enough canopy to interfere with the overhead power lines or impede the integrity of the security walls. Therefore, more **native** trees and shrubs that can grow densely and to a safe maximum height for the area are recommended for additional planting, either at the Villa Park substation or at future SmartScape sites. This will increase the safe spaces available to attract **native** bird populations.

Although noise levels were not studied on this project, noise from traffic, businesses, and pedestrians was observed to be consistently greater at the VP Site compared to the Base Site. Increased noise in avian habitat can mask alarm calls to other birds, predatory sounds, and mating calls and songs. Many recent studies have shown that urban noise has a negative effect on avian life (Slabbekoorn, H. and Ripmeester, E. A. P., 2008; Fernández-Juricic, E., Poston, R., De Collibus, K., Morgan, T., Bastain, B., Martin, C., Jones, K., and Treminio, R., 2005). In the study by Fernandez-Juricis, et. al, 2005, **native** male House Finch songs were found to be different in many different parks based on different factors including habitat structure and ambient noise. One result was that male House Finches decreased the number of notes in their songs as ambient noise increased. This could be detrimental for successful breeding since females prefer males with long songs (Nolan and Hill, 2004). In order to attract and support successful **native** avian populations, an attempt to decrease the noise created by urbanization needs to be addressed in future projects. Planting larger, denser vegetation when possible will help, but further research into other possibilities is necessary.

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SUMMARY

SmartScape's **native** landscaping design is well on its way to success in many ways. It already is incredibly beneficial to the environment by reducing storm water **runoff** and preventing excess pollution. Traditional fertilizers and chemicals are not used, since vegetation is **native** and already suited to and comfortable in the climate. Also, composting and vermiculture on site creates rich, nutritious soils and reduces waste.

SmartScape is still, if not a more, beautiful design than conventional landscape, since it implements complex and colorful **native** plants. It is clear from this study that even in the early stages of this SmartScape retrofit, it is already attracting greater avian diversity. As the plants and trees develop over the years and become more established, more resources for birds will be available and will hopefully be able to sustain diverse and abundant avian populations.

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**CITY OF INDIO**
**INDIO WATER AUTHORITY**

**WATER RECLAMATION FACILITIES FOR REUSE AND GROUNDWATER RECHARGE – PHASE 1 ENVIRONMENTAL PROGRAM**

# TECHNICAL MEMORANDUM NO. 4
# RECYCLED WATER TREATMENT ALTERNATIVES AND DELIVERY CORRIDOR OPTIONS

January 2010

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# RECYCLED WATER TREATMENT ALTERNATIVES

## 1.0 INTRODUCTION

This technical memorandum (TM) is prepared for the Indio Water Authority (IWA) in partial fulfillment of the agreement between the IWA and Carollo Engineers; P.C. (Carollo) entitled "Water Reclamation Facilities for Reuse and Groundwater Recharge – Phase I Environmental Program." This TM describes the different treatment alternatives to produce recycled water, candidates for using recycled water, and potential corridors for delivering recycled water. This TM is intended to provide the essential information to compile the project description for a program environmental document that will be prepared and processed by the IWA for compliance with the California Environmental Quality Act (CEQA), and National Environmental Policy Act (NEPA).

## 2.0 TREATMENT ALTERNATIVES

Several treatment alternatives have been identified for the production of recycled water that meets California Title 22 requirements. Specifically, treatment alternatives to produce recycled water for irrigation and groundwater recharge were identified. For a detailed summary of California Title 22 requirements for irrigation and groundwater recharge, see Appendix A. The Title 22 treatment alternatives for irrigation include tertiary filtration (DynaSand®, Cloth Disk) and membrane bioreactors (MBR), while the groundwater recharge alternative will investigate microfiltration/reverse osmosis (MF/RO) combination. All alternatives will require disinfection as the final treatment step. The alternatives were developed based on conventional Title 22 treatment requirements and potential future treatment plant effluent requirements. The proposed alternatives are described in the following sections.

### 2.1 Tertiary Filtration

Tertiary filters are designed to remove total suspended solids (TSS) from secondary effluent by passing it through a filter media. There are several filter media options available including fine sand, dual media (anthracite/sand), and cloth. The filter options that will be evaluated for this project are continuous backwash, upflow, sand filters (DynaSand®) and cloth disk filters. Both of these filter technologies are approved for Title 22 treatment and are installed at numerous facilities producing Title 22 water.

Tertiary filtration is a proven lower cost option for the production of Title 22 irrigation water. If this option is selected, tertiary filters will be installed at the Valley Sanitary District (VSD) treatment plant. The facility could include a secondary effluent pump station, flocculation, tertiary filters, disinfection, irrigation water storage, and an irrigation water pump station. A process flow diagram (PFD) of the treatment train is shown on Figure 1. Because the tertiary filter only remove suspended solids, any requirement for nutrient removal need to be accomplished in the secondary treatment process.

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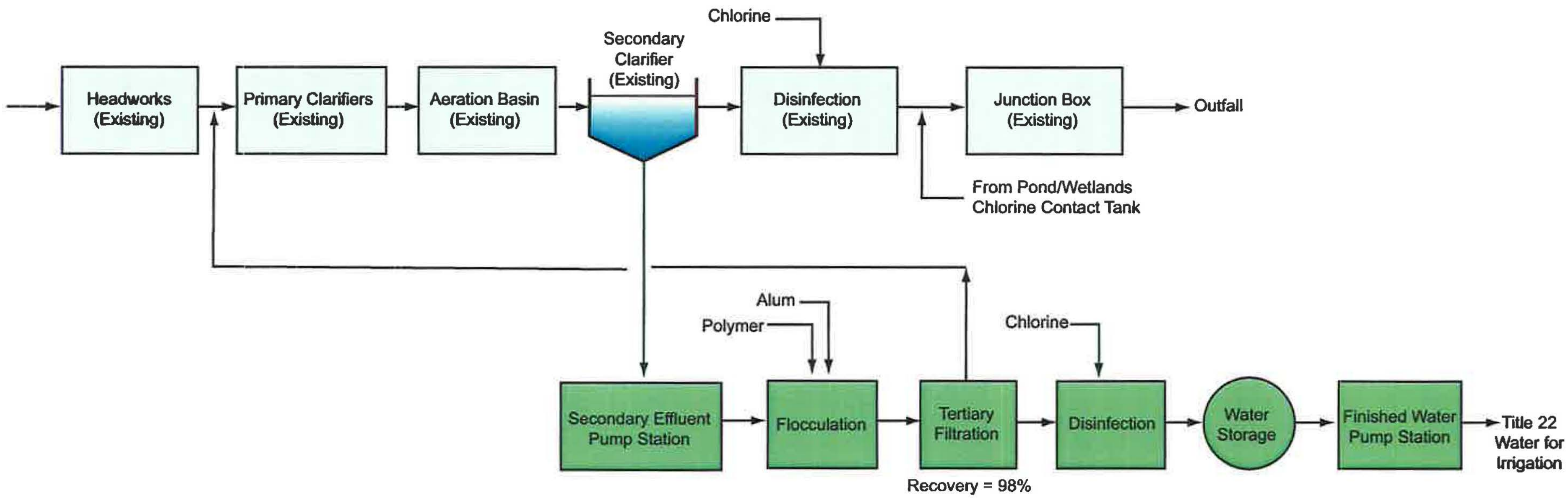


# TERTIARY FILTRATION PFD

FIGURE 1

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### 2.1.1 DynaSand® Filters

The DynaSand® filter is available either as standalone package units or in a modular concrete design. The continuous backwash filter operates with an upflow, counter-current flow pattern and provides initial contact of unfiltered water with the dirtiest sand in the filter. The dirty sand moves downward away from the water's flow path to the air scour tube. The water's upward flow path passes through progressively cleaner filter media until it exits from the surface of the cleanest media. A typical filter cell includes the components of four filter modules within a reinforced concrete filter chamber. The filter's deep media bed allows it to handle high levels of suspended solids.

### 2.1.2 Cloth Filters

Cloth media filters are also available as standalone package units or in a modular concrete design. They are low-head systems and are designed to backwash automatically based upon water differential while maintaining continuous filtration during backwash. The typical backwash volume represents approximately 2 to 3 percent of the feed flow with a recovery time of less than 3 minutes, compared to other typical filters, which can take up to 20 minutes. The disks can be provided in tanks with various numbers of disks depending on the design flow.

### 2.1.3 Tertiary Filtration Title 22 Effluent Requirements

The Title 22 effluent requirements are similar for both filter technologies. In accordance with Title 22, the filter effluent turbidity must average less than or equal to 2 NTU for any 24-hour period, must not exceed 5 NTU longer than 15 minutes, and must never exceed 10 NTU. In the event the effluent turbidity exceeds 5 NTU for more than 15 minutes, automatic chemical addition must be implemented, or else the filter feed pumps must be shut down. Alum and polymer can be added to the filter influent and mixed using inline mixing or flocculation basins.

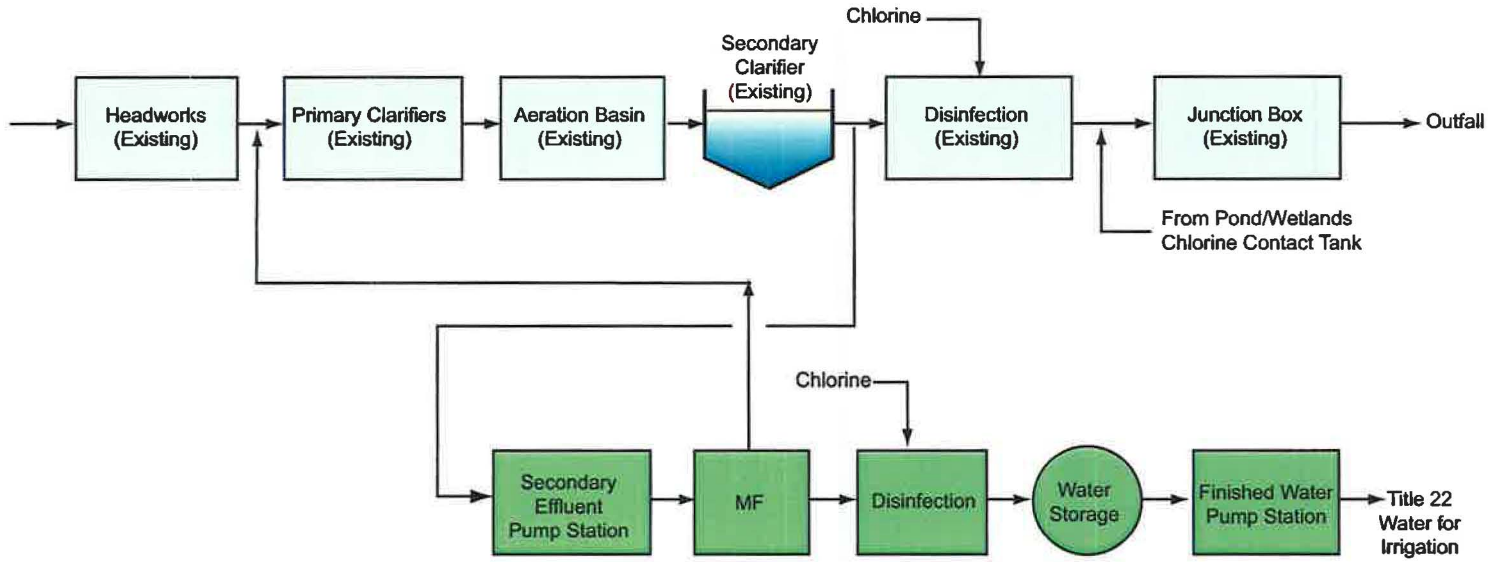
### 2.1.4 Tertiary Microfiltration

MF membranes are an efficient technology for particle removal and pathogen control. These technologies yield finished water turbidities consistently below 0.1 NTU, independent of feed water quality. Membrane filtration is a pressure-driven process that provides a near absolute barrier to suspended solids and microorganisms. MF membranes have a pore size ranging from 0.1 to 0.5 microns.

The MF process would provide greater flexibility for future groundwater recharge. If this option is selected, existing Chlorine Contact Tank No. 1 (abandoned) could be converted into a membrane tank. The Title 22 facility would include MF, disinfection, water storage, and an effluent water pump station. A PFD of the treatment train is shown on Figure 2.

### 2.1.5 Tertiary Microfiltration Title 22 Effluent Requirements

Title 22 requirements state that membrane treated effluent must have a turbidity that does not exceed 0.2 NTU more than 5 percent of the time in a given 24-hour period, and cannot exceed 0.5 NTU at any time.




# TERTIARY MICROFILTRATION PFD

FIGURE 2

## 2.2 Membrane Bioreactor

The MBR process is a biological process that uses MF or ultrafiltration (UF) membranes installed in membrane tanks to separate solids and produce a high-quality effluent. The MBR process is capable of achieving the nutrient removal requirements for effluent ammonia and nitrate to be compatible with future treatment requirements for groundwater recharge. Membranes used in MBR applications are typically polymeric (but may be ceramic) media with pore sizes in the range of 0.04 microns to 0.4 microns. The physical separation barrier provided by the membranes is the most effective and reliable treatment mechanism to meet recycled water requirements, and is less susceptible to process upsets. The MBR process is required by Title 22 to produce effluent with turbidity that does not exceed 0.2 NTU more than 5 percent of the time and not more than 0.5 NTU at any time.

The MBR process is a higher cost alternative, but has advantages over tertiary filtration. The MBR process will provide more flexibility for future groundwater recharge and increase plant capacity. If this option is selected, the existing Chlorine Contact Tank No. 1 (abandoned) could be converted into a membrane tank and fine screens could be installed upstream of the aeration basins. The Title 22 facility would include fine screens, MBR, disinfection, water storage, and an effluent water pump station. A PFD of the treatment train is shown on Figure 3.

### 2.2.1 <u>MBR Title 22 Effluent Requirements</u>

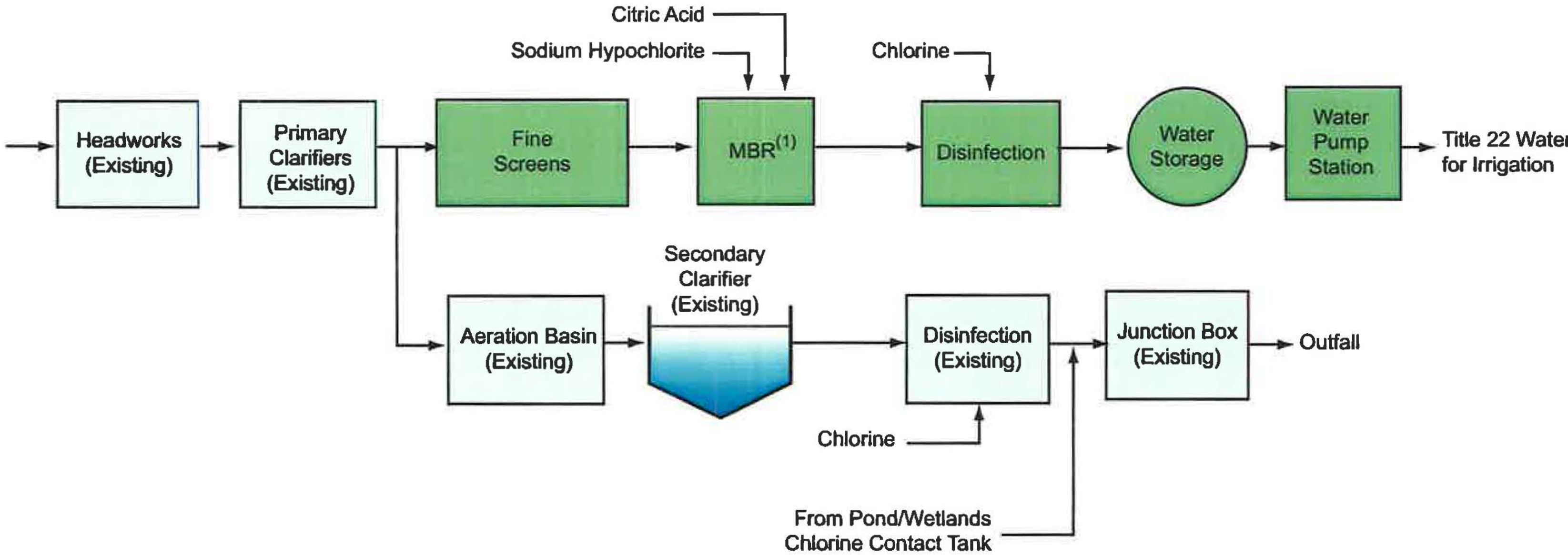
As previously mentioned, Title 22 requirements stipulate that membrane treated effluent must have a turbidity that does not exceed 0.2 NTU for more than 5 percent of the time in a given 24-hour period, and cannot exceed 0.5 NTU at any time.

## 2.3 Advanced Treatment for Ground Water Recharge

This section discusses the MF/RO membrane treatment process to provide demineralization for the production of recycled water for groundwater recharge. The MF process (this process could also be UF, MF has been used here for simplicity) is required as pretreatment for the RO, and the RO is responsible for demineralization and removal of dissolved organic compounds in the recycled water. The groundwater recharge treatment facility would also include an ultraviolet (UV) advanced oxidation process (AOP) using hydrogen peroxide to provide disinfection and oxidation of microconstituents. This process would be followed by a stabilization step to protect the distribution pipeline, finished water storage, and a finished water pump station. A PFD of this treatment train is shown on Figure 4.

### 2.3.1 <u>Microfiltration</u>

The MF process for advanced treatment would be similar to the tertiary MF previously described in this TM. As shown on Figure 2, the MF process requires a backwash that flows back to the headworks. As the satellite advanced treatment facility, this backwash flow would be discharged to the sewer to flow back to the treatment plant. MF can provide consistent pretreatment for RO systems and would be included in the design of a groundwater recharge treatment system if tertiary filters are chosen for Title 22 treatment.




Notes:
(1) Modify existing aeration basins and retrofit abandoned chlorine contact tank 1.

# MBR PFD

FIGURE 3

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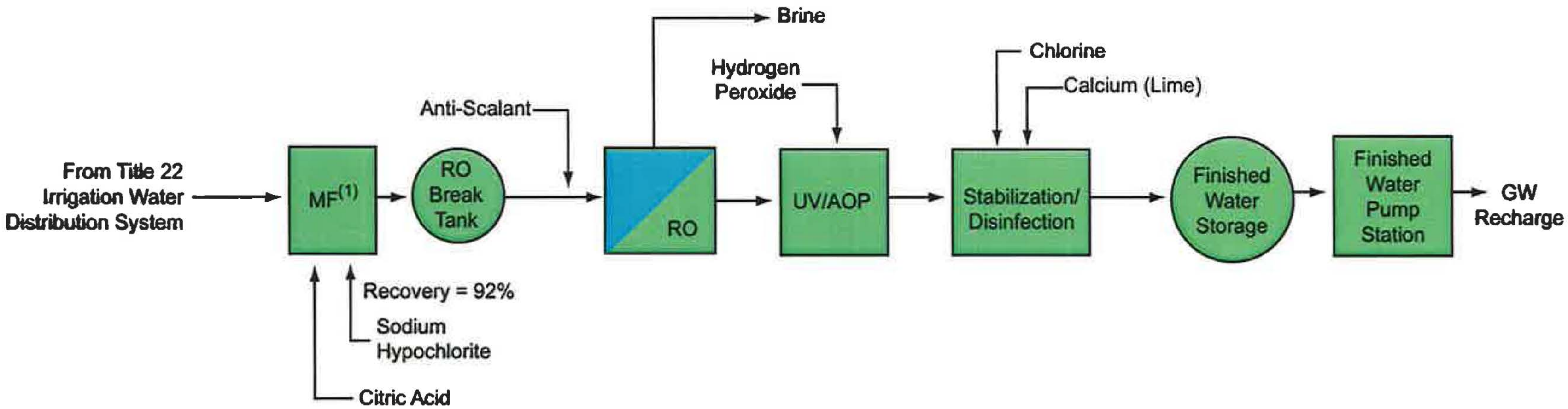


Notes:

(1) MF system is required if tertiary filtration is used for title 22 irrigation water.
(2) MF/RO system would be built near point of injection.

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**ADVANCED TREATMENT SYSTEM PFD(2)**

FIGURE 4

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### 2.3.2 Reverse Osmosis

High-pressure membrane processes such as RO are typically used for the removal of dissolved constituents including both inorganic and organic compounds. RO is a process in which the mass-transfer of ions through membranes is diffusion controlled. The feed water is pressurized, forcing water through the membranes concentrating the dissolved solids that cannot travel through the membrane. Consequently, these processes can remove salts, hardness, synthetic organic compounds, disinfection-by-product precursors, etc. However, dissolved gases such as $H_2S$ and carbon dioxide, and some pesticides pass through RO membranes.

RO is considered a "high-pressure" process because it operates from 75 to 1,200 psig, depending upon the total dissolved solids (TDS) concentration of the feed water. Typical recoveries for RO plants operating on domestic wastewater are around 85 percent depending on the type and concentrations of sparingly soluble salts (calcium sulfate, calcium carbonate, silica, etc.) in the feed water.

One of the issues with the RO process is the discharge of the concentrated brine stream. For this site there are a few options: The brine from the RO unit could be sent to a large system of evaporation ponds, the brine could be further treated to increase finished water production and decrease brine volume reducing the size of the evaporation ponds, or there may be potential for a regional brine management plan consisting of large evaporation ponds. (Note: As of 2011, a regional brine line seems to be the preferred option).

### 2.3.3 Ultraviolet Advanced Oxidation Process

UV disinfection is a physical process that uses no toxic chemicals and produces no known toxic residuals or byproducts. The disinfection mechanism of UV light involves damage or destruction of an organism's genetic material due to the transference of electromagnetic energy (i.e., wavelength of 254 nanometers, or 254-nm) from a UV lamp to the genetic material. The lethal effects of this energy result primarily from the organism's inability to replicate. When coupling this system with a small dose of hydrogen peroxide, an advanced oxidation system results, in which hydroxyl radicals are produced which can attack and destroy many microconstituents.

## 3.0 SITE LAYOUT

Conceptual site layouts have been developed for the three Title 22 irrigation water treatment facilities and the groundwater recharge treatment facility. The site layouts are preliminary and show the general footprints of each unit operation on the project site. The footprints were developed for each unit operation based on an assumed ultimate system capacity of 12 mgd. The three alternatives for Title 22 irrigation water treatment are shown on the VSD treatment facility and the groundwater recharge facility is shown near the potential injection points at Posse Park. An aerial photograph of the existing site and facilities is presented on Figure 5.

Indio Water Authority
Your Water. Our Responsibility.

# 2010 Urban Water Management Plan

**September 2011**

BLACK & VEATCH
building a world of difference™

# CHAPTER 1 – INTRODUCTION

## 1.1 Overview

This report presents the Urban Water Management Plan 2010 (Plan) for the Indio Water Authority (IWA) service area. This chapter describes the general purpose of the Plan, discusses Plan implementation, and provides general information about IWA and service area characteristics.

## 1.2 Purpose

An Urban Water Management Plan (UWMP) is a planning tool that generally guides the actions of water management agencies to support long-term resources planning and ensure adequate water supplies are available to meet existing and future water demands. While the conservation and efficient use of urban water supplies are statewide and global concerns, developing and implementing plans for efficient use can best be accomplished at the local level. Thus, an UWMP provides both managers and the public with a broad perspective of the water supply issues that may affect their service area.

Furthermore, while a UWMP may specify a strategic agenda for reliable water supplies, it is not to be substituted for project-specific planning documents. For example, as mandated by the State Legislature, a plan shall "describe the opportunities for exchanges or transfers of water on a short-term or long-term basis" (California Urban Water Management Planning Act 2010, Article 2, Section 10631(d)). The identification of such opportunities within a UWMP is non-binding such that it neither commits a water management agency to pursue a particular water exchange/transfer opportunity, nor precludes a water management agency from exploring exchange/transfer opportunities that were not identified in the plan. Additionally, should a project be approved for implementation within a service area, the appropriate detailed project plans and analyses must be prepared separate from the UWMP.

In short, this UWMP is a planning tool, providing a framework for action, but not requiring specific project development or action. Water resources management in California is not a matter of certainty and planning projections may change in response to a number of factors. Thus, it is important that this Plan be viewed as a long-term, general planning document, rather than as an exact blueprint for supply and demand management. Development of this Plan is an effort to generally answer a series of planning questions including:

- What are the potential sources of water supply and what are their probable yields?
- What is the probable demand, given a reasonable set of assumptions about growth and implementation of good water management practices?
- How comparable are the supply and demand figures, assuming that the various probable supplies will be pursued by the implementing agency?

The IWA will address these questions by identifying feasible and cost-effective opportunities to meet existing and future demands. IWA will explore enhancements to supplies from traditional

The notifications sent to the public regarding the scheduled meeting to adopt this Plan are available in Appendix C, along with the actual adoption resolution.

### 1.3.3 Resource Maximization

Due to the already strained groundwater resources and water availability in California, it is important that IWA diversifies its water supply portfolio to meet growing needs. Receiving water supplies from a variety of resources will allow IWA to establish a sustainable water supply that will foster development without further depleting the resources available. This diversification includes not only developing new resources or reusing existing resources, but also conserving available resources. IWA's multi-faceted approach to future water management include: regional cooperation, source substitution, groundwater recharge, and water efficiency measures.

Regional cooperation and development of partnerships are crucial for ensuring the sustainable management of water resources in the Valley. Appropriate source substitution, such as groundwater of seawater desalination, will continue to diversify IWA's water supply source portfolio. Groundwater recharge, using State Water Project and Colorado River water, provides safe storage and natural treatment for the future use of these supplies. Lastly, water efficiency measures, whether through voluntary practices or mandatory regulations, will ensure that a limited supply will meet the most pressing demands and increase public awareness of the value of water.

The following seven alternatives have been identified through a Water Resources Development Plan (WRDP) (IWA, 2008b) as having a high priority for implementation in order to diversify water supply options and reduce reliance on groundwater:

- Agricultural conservation
- Urban water conservation
- Use recycled water from Valley Sanitary District's wastewater treatment plant
- Use recycled water from remote recycling plants
- Treatment of Coachella Canal water for urban use
- Agricultural use of Coachella Canal water in-lieu of groundwater
- Groundwater recharge via spreading basins

## 1.4 Water Agencies of the Coachella Valley

There are predominantly five water supply agencies in the Coachella Valley. These include:

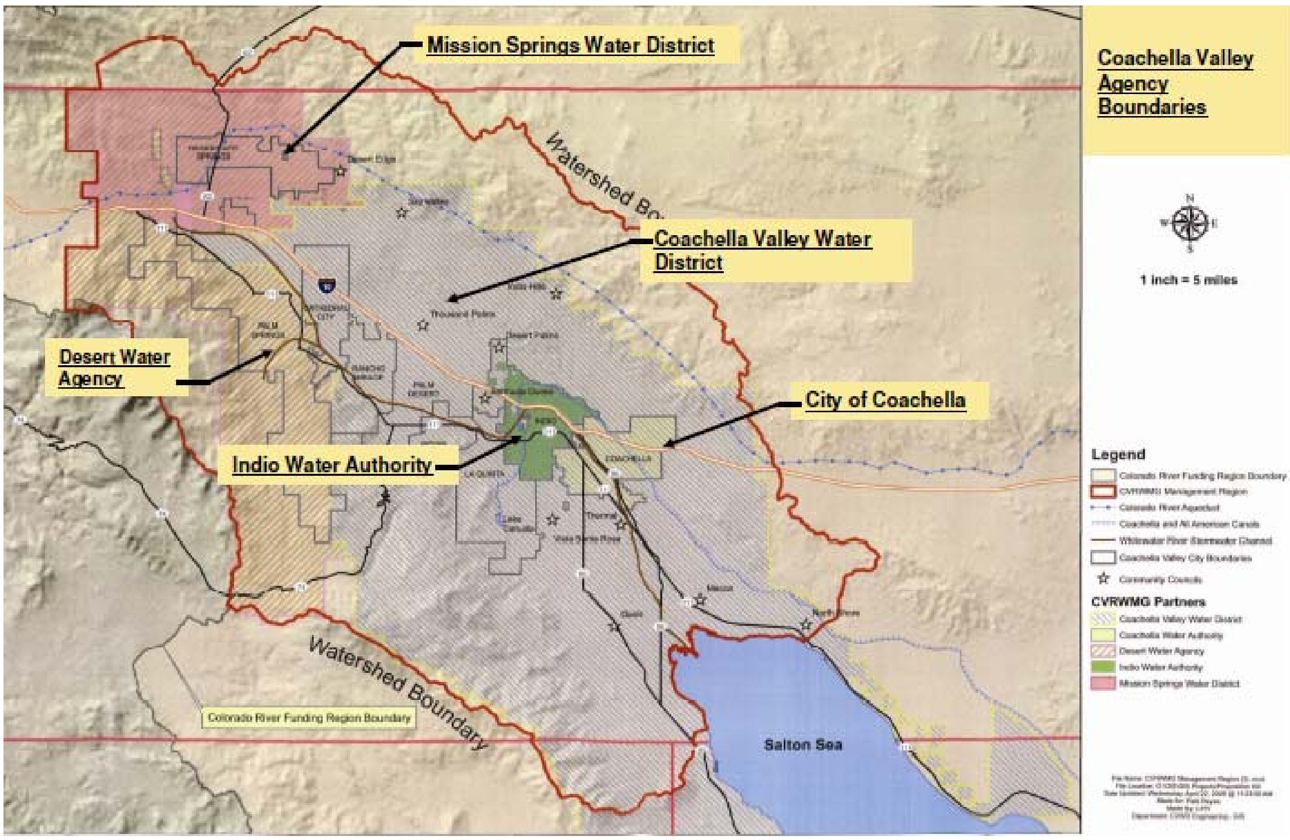
- Indio Water Authority (IWA)
- Coachella Valley Water District (CVWD)
- Desert Water Agency (DWA)
- Mission Springs Water District (MSWD)

- City of Coachella

In addition to providing background information on IWA, this section also presents background information on the other agencies in the Valley, as all of the agencies are working together towards the development of a regional water management plan. These issues are further discussed in subsequent chapters.

Figure 1-1 illustrates the location of the water supply agencies in the Coachella Valley.

**Figure 1-1: Coachella Valley Agency Boundaries**




## 1.4.1 Indio Water Authority

Incorporated in 1930, the City of Indio (City) was the first city in the Coachella Valley. The City encompasses approximately 38 square miles with a sphere of influence that adds approximately 21.5 square miles north of Interstate 10. The existing land uses include commercial, limited industrial, and residential. The majority of land use can be classified as residential, varying in density from equestrian and country estates to high-density multi-family dwellings. The proposed future land uses within the sphere of influence include open space, residential, resource recovery, specific plans (assumed mixed use), business park, and a small amount of community commercial.

The Indio Water Authority (IWA) was formed as a Joint Powers Authority in 2000, wholly owned by the City and Indio Redevelopment Agency, to be the legislative and policy entity responsible for delivering water to residents of the City for all municipal water programs and services. The five elected members of the Commission appoint four members of the community to serve on the Board. The IWA mission is to:

> "Provide the highest quality most reliable source of water, in an effective and fiscally responsible manner while promoting the highest standard to our customers, and maintaining excellent customer service through highly motivated customer oriented employees. To achieve this mission, the Indio Water Authority will provide leadership in managing and developing water resources in the Coachella Valley region."

Since the establishment of the IWA, service connections have increased from approximately 12,100 to 20,575 active meter accounts in 2009, with the majority of the new growth occurring north of Interstate 10. In 2009, the IWA supplied 7,576 million gallons (23,251 AF) of water to approximately 75,000 businesses and residents. As one of the fastest growing municipal utilities in the Coachella Valley, the IWA is committed to maintaining a sustainable water supply for its residential and commercial customers.

IWA extracts groundwater to meet the needs of its current customer population. The groundwater is drawn from the Whitewater River Subbasin and is delivered to the service area via a pressurized distribution system supplied by 21 wells and 6 pumping plants. The IWA also has emergency intertie connections with Coachella Valley Water District (CVWD) and the City of Coachella.

Since 2005, IWA has established active water conservation, water reuse, and groundwater recharge planning efforts to ensure adequate water availability and system capacity to meet the growing needs of the City. These planning efforts include: residential and commercial landscape rebate and irrigation programs, water misuse program, and a Memorandum of Understanding between IWA and Valley Sanitation District (VSD) to collaborate in the construction of capital improvement projects that support water reuse and groundwater recharge efforts.

The City is a co-permitee with Riverside County Flood Control and Water Conservation District, the County of Riverside, Coachella Valley Water District, and the cities of Banning, Cathedral City, Coachella, Desert Hot Springs, Indian Wells, La Quinta, Palm Desert, Palm Springs, and Rancho Mirage for implementing the National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharge.

### 1.4.2 Coachella Valley Water District

The Coachella Valley Water District (CVWD) was formed in 1918 under the County Water District Act provisions of the California Water Code. In 1937, CVWD absorbed the responsibilities of the Coachella Valley Stormwater District which had formed in 1915. CVWD now encompasses approximately 640,000 acres, mostly within Riverside County, but also

- Annual runoff concentrated more in winter months with more variability and greater extremes.
- Sea level rise of up to 55 in. with the potential for higher rises if ice sheets collapse.
- Ecosystem challenges, such as forest fires, increased due to exacerbation of existing threats from above changes.

The implications of climate change regionally and nationally may adversely impact the following Valley water resources:

State Water Project (SWP) "Table A" entitlements – Reductions to the Sierra snowpack would reduce the availability of water during late spring and early summer and may make it more difficult to fill reservoirs, while increased sea levels would increase salinity intrusion, which could degrade available freshwater supplies. This would require the State to further reduce SWP "Table A" entitlements, including allocations to the Valley.

Coachella Valley Colorado River water supplies are protected from impacts of climate change and corresponding shortages by 1) California's first priority for Colorado River supplies in the lower Colorado River basin, and 2) Coachella's high priority for Colorado River supplies among California users of Colorado River water. Climate change impacts were evaluated in the Environmental Impact Study (EIS) on the "Colorado River Interim Guidelines for East Basin Shortages and Coordinated Operations for Lakes Powell and Mead", (USBR, 2007) These shortage sharing guidelines are crafted to include operational elements that would respond if potential impacts of climate change and increased hydrologic variability occur. The guidelines include coordinated operation elements that allow for adjustment of Lake Powell releases to respond to low average storage conditions in Lake Powell or Lake Mead. In addition, the guidelines enhance conservation opportunities in the lower Colorado River basin and retention of water in Lake Mead. While impacts from climate change cannot be quantified at this time, the interim guidelines provide additional protection against impacts of shortage sharing.

Computer models have been developed to show water planners how California water management might be affected by climate change. The Department of Water Resources (DWR) has committed to continue to update and refine these models based on ongoing scientific data collection and to incorporate this information into future California Water Plans. In the future IWA should update their water management plan to be in-step with DWR updates on SWP delivery reliability and water demands..

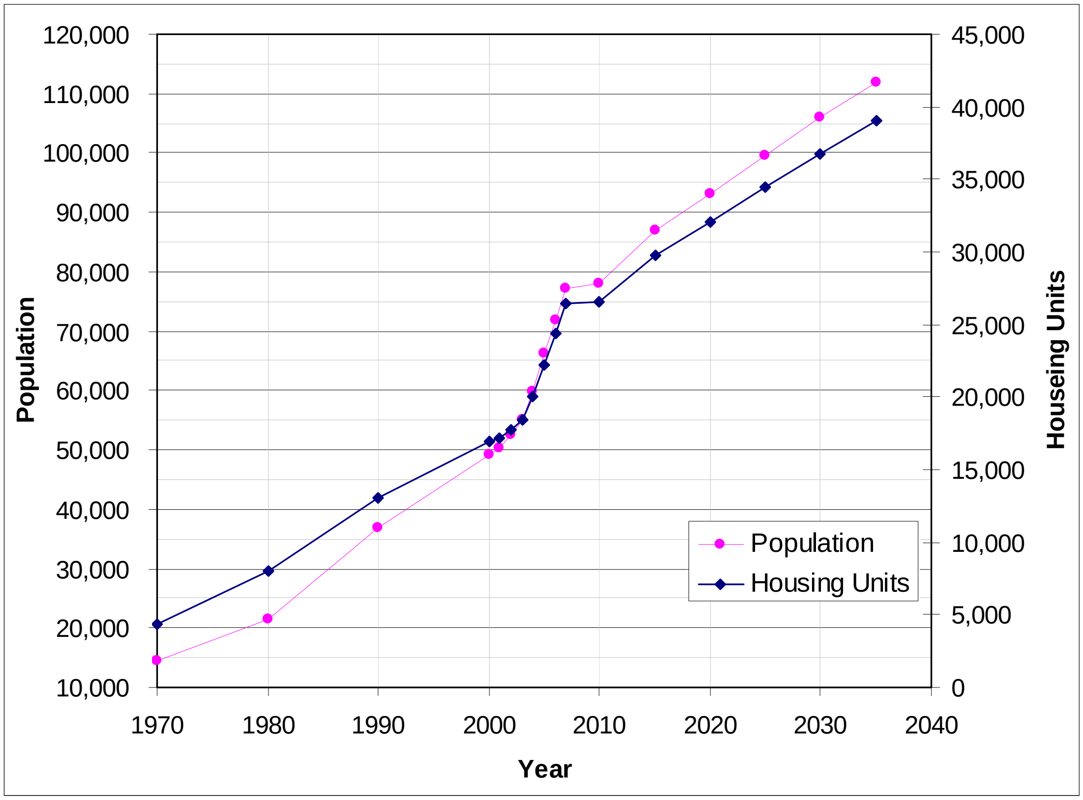
## 1.7 Demographic Features

Like much of Southern California, the City of Indio experienced rapid growth in recent years until the economy slowed in 2008. Current and projected populations for the IWA service area are listed in Table 1-3. Figure 1-3 presents historical and projected populations as developed by Riverside County's Center for Demographic Research (2008). Projections for housing units within Indio's current city boundaries are also presented along the right axis.

**Table 1-3: Population Current and Projected (DWR Table 2)**

| | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|
| Service Area Population | 66,284 | 76,036 | 86,889 | 93,115 | 99,476 | 105,873 |

**Figure 1-3: Population and Housing Projections for the City of Indio (Riverside County, 2008)**




The Riverside County Study (2008) has also provided projections for employment/jobs within the City boundary. These are presented in Table 1-4.

**Table 1-4: Employment/Job Projections (DWR Table 2)**

| | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|
| Employment/Jobs | 25,275 | 27,896 | 30,501 | 33,153 |

Additional demographic statistics of the Riverside County study (2008) are presented below.

- Median Age (2007) = 29
- Median Household Income (2007) = $43,001

# CHAPTER 2 – WATER USE

## 2.1 Overview

This chapter describes historic and current water usage and presents projected future demands within IWA's service area. Water usage is presented by customer class such as residential, industrial, institutional, landscape, agricultural, and other purposes.

Demand projections contain an inherent level of uncertainty and are intended to provide a general sense as to water supply requirements for the future. Demand projections are dynamic, often changing as a result of economic, political, and environmental pressures. Several factors can affect demand projections, including:

- Land use revisions
- New regulations
- Consumer choice
- Economic conditions
- Transportation needs
- Highway construction
- Environmental factors
- Conservation programs
- Plumbing codes

These factors can impact not only the amount of water needed, but also the timing and location of when and where it is needed. Past experience in the Coachella Valley has indicated that population growth is the most influential factor in determining water demand projections. During the current economic recession, there has been a major downturn in development and new construction, thus reducing projected demands for water.

The projections presented in this Plan do not attempt to forecast extreme economic or climatic changes. Likewise, no speculation was made regarding future plumbing codes or other regulatory changes. The projections do account for IWA's current water conservation efforts, which are projected to reduce overall water demand by 20 percent by 2020.

## 2.2 Background

Since the early 1900s, the Coachella Valley (Valley) has been dependent on groundwater as the primary source of drinking water. Groundwater from the Coachella Valley Basin, and predominantly its Whitewater River Subbasin, has also been used to supply irrigation for crops, fish farms and duck clubs, golf courses, greenhouses, industrial uses, and municipalities throughout the Valley. Historically, 100 percent of water supplies for the City of Indio have come from the underlying groundwater aquifer, which also serves the other water purveyors

**Table 2-4: Base Daily per Capita Water Use – 10-Year Range (DWR Table 14)**

| Base Years | Service Area Population* | Gross Water Use (gal. per day) | Daily Per Capita Water Use (3) ÷ (2) |
|---|---|---|---|
| 2001 | 50,435 | 18,660,129 | 370 |
| 2002 | 52,463 | 17,349,581 | 331 |
| 2003 | 55,078 | 16,596,998 | 301 |
| 2004 | 60,035 | 18,680,662 | 311 |
| 2005 | 66,358 | 18,584,246 | 280 |
| 2006 | 71,949 | 21,283,903 | 296 |
| 2007 | 77,046 | 22,207,000 | 288 |
| 2008 | 80,962 | 22,081,123 | 273 |
| 2009 | 82,230 | 20,757,184 | 252 |
| 2010 | 76,036 | 19,276,122 | 254 |
| | | Total of Column: | 2956 |
| | | Divide Total by Number of Base Years(10): | 296 |
| *2001 through 2009 CA DOF; 2010 US Census | | | |

**Table 2-5: Base Daily per Capita Water Use – 5 Year Range (DWR Table 15)**

| Base Years | Service Area Population* | Gross Water Use (gal. per day) | Daily Per Capita Water Use (3) ÷ (2) |
|---|---|---|---|
| 2003 | 55,078 | 16,596,998 | 301 |
| 2004 | 60,035 | 18,680,662 | 311 |
| 2005 | 66,358 | 18,584,246 | 280 |
| 2006 | 71,949 | 21,283,903 | 296 |
| 2007 | 77,046 | 22,207,000 | 288 |
| | | Total of Column: | 1477 |
| | | Divide Total by 5: | 295 |
| *2001 through 2009 CA DOF; 2010 US Census | | | |

### 2.6.2 Target Water Use

An urban retail water supplier must set a 2020 water use target and a 2015 interim target using one of four methods.

- Method 1: Eighty percent of the water supplier's baseline per capita water use
- Method 2: Per capita daily water use estimated using the sum of performance standards applied to indoor residential use; landscaped area water use; and Commercial, Industrial and Institutional (CII) uses
- Method 3: Ninety-five percent of the applicable state hydrologic region target as shown in Figure D-3 of the DWR 2010 UWMP Guidebook.
- Method 4: Baseline per capita water use minus savings from achieving water conservation measures in three water sectors (CII, Residential Indoor, and Landscape water use along with losses).

In accordance with Water Code Section 10608.22, the 2020 urban water use target also must be less than the Minimum Water Use Reduction Requirement, which is calculated as 95% of the 5-year base daily per capita water use. For Indio, this is 281 gpcd. Thus, the 2020 Water Use Target cannot exceed 281 gpcd. Table 2-6 presents potential 2020 Water Use Targets for IWA.

**Table 2-6: Potential Urban Water Use Targets for 2020**

| Approach/Method | Description | Target (gpcd) |
|---|---|---|
| | Baseline per capita daily use (10-year) | 296 |
| | Baseline per capita daily use (5-year) | 295 |
| 1 | 80% of water supplier's baseline per capita water use for the 10-year period. | 236 |
| 2 | Per capita daily water use estimated using the sum of performance standards applied to indoor residential, landscaped area water use; and CII uses | Not Calculated |
| 3 | 95% of the applicable state hydrologic region target | 200 |
| 4 | Baseline per capita water use less savings from achieving water conservation measures in three water sectors (CII, Residential Indoor, and Landscape water use along with losses). | Not Calculated |
| Minimum Reduction Requirement | 95% of Baseline per capita daily use for the 5-year period. | 281 |

The interim 2015 urban water use target is calculated as the average of the 10-year base per capita water use and the 2020 urban water use target. Table 2-7 presents IWA's 2015 and 2020 Water Use Targets.

**Table 2-7: Urban Water Use Targets**

| | |
|---|---|
| Base Daily Per Capita Water Use (gpcd) | 296 |
| 2015 Interim Urban Water Use Target (gpcd) | 266 |
| 2020 Urban Water Use Target (gpcd)* | 236 |
| *80 percent of the Base Daily Per Capita Water Use per Method 1 | |

# CHAPTER 3 – WATER RESOURCES

## 3.1 Overview

This section describes the water resources currently available to IWA and those planned for the 20-year period covered by the 2010 UWMP. Throughout the Valley, the only direct water source employed for potable urban water uses is local groundwater. Although both CVWD and DWA have (SWP) and Colorado River water rights, these waters are currently used only to either replenish the groundwater basin via recharge or for agricultural irrigation and other non-urban purposes. Colorado River water is delivered to the Coachella Valley via the Coachella Canal, while SWP is exchanged for Colorado River water.

Currently, groundwater is the sole supply source for IWA. The 2005 and 2010 reported values for total water supply are the volumes of water that were actually pumped from groundwater basins to meet IWA needs. Water supply totals for 2015-2030 are projected demands including the savings projected from implementing a moderate conservation program (IWA, 2008 IWA is actively pursuing several agreements that would enable it to exchange purchased water for Colorado River Water. IWA plans to invest in infrastructure that would enable it to treat and serve Colorado River Water from the Coachella Canal to its urban water customers, while any excess water would be sent to recharge basins for aquifer recharge.

Assumptions to develop the projected water supply values include:

- Delivery of surface water supplies will begin in 2013 at 5,000 AFY up to a maximum of 20,000 AFY.
- Potable supply from a 10 MGD Surface Water Treatment Plant (SWTP) for Colorado River Water from the Coachella Canal is online by 2015, with an expanded capacity of 14 MGD by the year 2030 (BV, 2010)
- Surface water will be treated at the SWTP for potable use with any excess water utilized for aquifer recharge through spreading basins.
- Supplies from recycled water are available by 2015.
- Any recycled water that is not reused or treated canal water that is not required to meet direct use demands will be used for aquifer recharge.

Both currently available and planned water supplies sources are summarized in Table 3-1.

**Table 3-1: Current and Planned Water Supplies – AFY (DWR Table 16)**

| Water Supply Sources | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|
| Surface Water[1] | 0 | 0 | 5,000 | 10,000 | 20,000 | 20,000 |
| Wholesale Water | 0 | 0 | 0 | 0 | 0 | 0 |
| Supplier Produced Groundwater | 20,800 | 21,600 | 20,000 | 20,000 | 20,000 | 20,000 |
| Transfers In or Out | 0 | 0 | 0 | 0 | 0 | 0 |
| Recycled Water (Projected Use) | 0 | 0 | 1,700 | 5,800 | 6,500 | 6,500 |
| Total | 20,800 | 21,600 | 26,700 | 35,800 | 46,500 | 46,500 |

[1] Unspecified water deals totaling up to 20,000 AFY

reducing its consumptive use of Colorado River water by an amount requested by IID not exceeding the amount previously put into storage.

## 3.4 Transfers, Exchanges, and Groundwater Banking Programs

### 3.4.1 Valley-wide Program – State Water Project

Both CVWD and DWA are among the 29 State Water Contractors holding contracts for State Water Project (SWP) Table A water. Through various agreements and purchases, both CVWD and DWA have been able to increase their total allocations of Table A SWP water. Their original allocations were 23,100 AFY and 38,100 AFY, respectively. Today, CVWD's total allocation of Table A water is 138,350 AFY and DWA's allocation is 55,750 AFY for a total of 194,100 AFY to the Valley. However, the amount of water that they are actually allocated in any give year is based on the amount of SWP hydrologically available in that year. For example, in 2010, the allocation was only 50 percent of the total amount contracted.

Neither agency has a direct physical connection to the SWP by which they can receive SWP water. Rather, their SWP water is delivered to Metropolitan Water District of Southern California (MWD) and in exchange, MWD transfers an equal amount of water to the Coachella Valley via its Colorado River Aqueduct, which traverses the Valley near Whitewater.

Since 1973, SWP Exchange water has been used to recharge the Upper Whitewater River Subbasin at the Whitewater Recharge Facility. Under the Advance Delivery Agreement, MWD can pre-deliver up to 800,000 AF of Colorado River water into the Valley. This agreement gives MWD the flexibility to deliver CVWD SWP allocations either from their Colorado River Aqueduct or from water previously stored in the basin.

### 3.4.2 IWA Program

IWA would like to acquire as much as 20,000 AFY of new surface water supplies. Specific details of a water acquisition deal are not available, but it is desirous that deliveries from any deal would commence in 2013. This new supply would reach IWA via existing SWP and Colorado River water exchange agreements coordinated by CVWD and Metropolitan Water District. For the purpose of this Plan, it is assumed that deliveries of a new surface water supply would commence in 2013 at 5,000 AFY, with 10,000 AFY by 2020 and 20,000 AFY by 2030.

The surface water supply will be treated and served in-lieu of pumping groundwater to meet local domestic, industrial, and commercial demands. Excesses in this supply could be recharged and/or reserved for future storage and recovery program negotiations (i.e., providing a water source to outside agencies in exchange for developing a local storage account and financing capital facilities). This supply source would increase IWA's flexibility in serving its clients and, as a result, would help to reduce the groundwater overdraft in the area. The Coachella Canal is readily accessible to IWA, making this a potentially feasible option.

The selection of an efficient and capable water treatment process train will ultimately provide a water supply that is compatible with the existing system water supplies and minimize corrosion issues associated with blending two source waters. IWA is currently developing a feasibility report to evaluate the construction of a 10 MGD water treatment plant that could be expanded in the future. One of the concerns with the Canal water is total dissolved solids (TDS) levels. TDS levels in the Coachella Canal range from 650-800 mg/L. However, groundwater TDS levels are approximately 200 mg/L and IWA intends to blend the two supplies to meet target water quality objectives.

A summary of the transfer/exchange opportunity to IWA is presented in Table 3-5.

**Table 3-5: Transfer and Exchange Opportunities – AFY (DWR Table 20)**

| Transfer Agency | Transfer or Exchange | Short Term | Proposed Quantities | Long Term | Proposed Quantities |
|---|---|---|---|---|---|
| IWA Transfers & Exchanges | | | | | |
| MWD/CVWD – SWP/CRW | Transfer/ Exchange | N/A | N/A | X | 20,000 |

### 3.4.3 Groundwater Banking Programs

Groundwater banking opportunities have been provided to MWD by CVWD and DWA through an advanced delivery agreement. CVWD and DWA entered into the Advanced Delivery Agreement in 1984, wherein Colorado River supplies are percolated into the Whitewater aquifer during periods of surplus water availability, with the understanding that MWD will utilize the banked supplies during periods of future water shortages in Southern California. As of 1999, MWD had stored 290,300 AF of Colorado River water in the groundwater basin (CVWD, 2002). The storage amount varies significantly from year to year and was at approximately 44,000 AF at the close of 2009. Under the terms of the Advanced Delivery Agreement, MWD's balance cannot fall below zero. (CVWD, 2010 comment on IWA draft UWMP)

## 3.5 IWA Planned Water Supply Projects and Programs

IWA has initiated planning processes to develop a more reliable water supply for the City of Indio while reducing the groundwater overdraft. Viable water management alternatives were identified and screened. A Water Resources Development Plan was developed, identifying preferred alternatives to be given a high priority for implementation. These preferred alternatives will help to diversify IWA's supply and reduce groundwater production. These projects include:

- Urban Conservation Program
    - Public outreach
    - Implementation of California Urban Water Conservation Council (CUWCC) DMMs
    - Water use ordinances
    - Savings of 9,500 to 17,300 AFY

# CHAPTER 4 – RECYCLED WATER

## 4.1 Overview

This section of the Plan describes the existing and future recycled water opportunities available to IWA's service area. Recycled water currently plays a limited role in the water supply throughout the Coachella Valley.

## 4.2 Recycled Water Master Plan

Wastewater treatment services for the City of Indio are predominantly provided by Valley Sanitary District (VSD). IWA and VSD are working together to develop recycled water program to augment the local water supply and will be releasing an Environmental Impact Report in anticipation of new facilities. The IWA is also in the process of developing a Recycle Water Master Plan.

## 4.3 Potential Sources of Recycled Wastewater

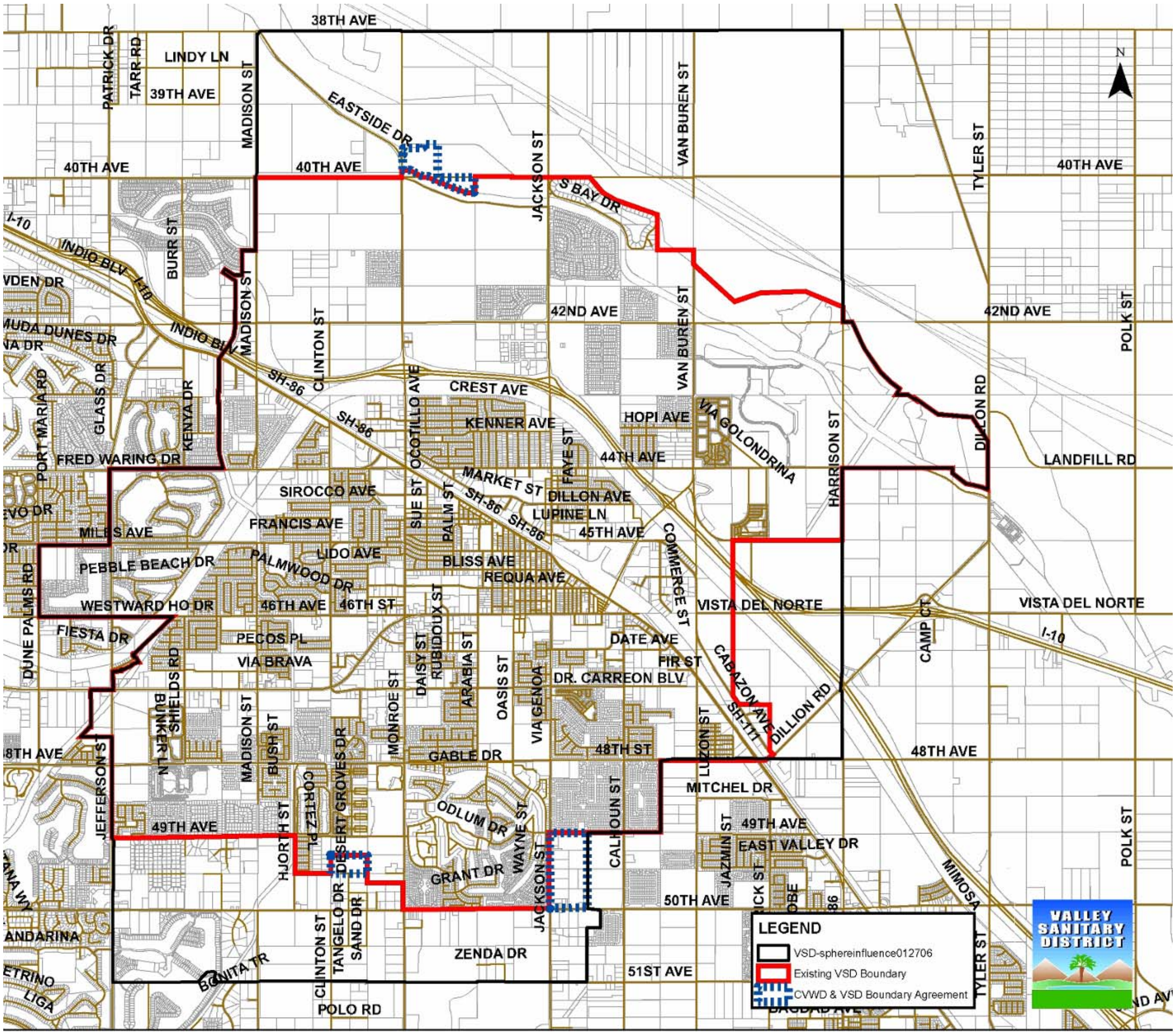
### 4.3.1 Existing Wastewater Treatment Facilities

The City of Indio is served by two wastewater treatment plants (WWTPs): one is owned by VSD and the other by CVWD. The CVWD WWTP treats a small percentage of the City's wastewater. The plant is located at Avenue 38 and Madison Street (WRP-7) in the City of Indio. The CVWD WWTP is a tertiary treatment facility and the effluent produced is recycled for non-potable uses for CVWD customers.

The VSD WWTP is located on Van Buren Street in the City of Indio and provides services to 98 percent of the City's population. Currently, the majority of the effluent from the VSD WWTP is discharged to the Coachella Valley Stormwater Channel (CVSC) while a small percentage is sent to tribal lands for irrigation.

While the current capacity of VSD's WWTP is approximately 11.0 MGD, the facility will ultimately expand to accommodate a capacity of 17.0 MGD (Dudek, 2003) by 2020. Average wastewater flows at the VSD WWTP in 2009 were 6.3 MGD (7,050 AFY) (Black & Veatch, 2009). Figure 4-1 was provided by VSD and illustrates their service boundary, sphere of influence (SOI), and sewer network. The figure also delineates the areas shared with CVWD. Furthermore, current and projected volumes of wastewater collected and treated at VSD WWTP are listed in Table 4-1.

**Figure 4-1: VSD's Sewer Network and Service Boundary**




The VSD WWTP operates three parallel treatment processes: an activated sludge treatment process; an oxidation pond treatment process; and a constructed wetlands treatment process. In 2009, VSD delivered 272 AF of secondary effluent for irrigation use. Any effluent that is not reused is discharged to the CVSC which flows directly to the Salton Sea.

The Wetlands Treatment Project was developed to expand the VSD wastewater treatment process. This site has become a home for the Coachella Valley Wild Bird Center and provides a migratory and resident waterfowl and shorebird habitat as well as community education and recreational benefits. The 15-acre natural system treats up to 1 MGD of primary effluent (VSD, 2003). Flows from the wetland discharge into the CVSC.

**Table 4-1: Wastewater Collection & Treatment by VSD – AFY (DWR Table 21)**

| Type of Wastewater | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|
| Wastewater collected & treated in service area [1] | 7,150 | 8,170 | 13,600 | 19,040 | 19,040 | 19,040 |
| Volume that meets recycled water standard | 0 | 0 | 1,700 | 5,800 | 6,500 | 6,500 |

[1] Values developed via linear interpolation based on recent flows to VSD and estimated flow at build-out (Dudek, 2003).

At the present time, approximately 96 percent of the plant effluent is sent to the CVSC, and the remaining effluent is provided to adjacent tribal lands for irrigation (spray). Of the effluent sent to the CVSC, 1.0 MGD comes from the Wetland Treatment Project just south of the WWTP (BV, 2008b).

NPDES permit limits for discharge to the CVSC include: CBOD < 25 mg/L, TSS < 30 mg/L, 6.0 < pH < 9.0, fecal coliform < 200 MPN/100ml, and Cl < 0.01 mg/L.

Sludge build up in the ponds is dewatered and sludge disposed as fertilizer, soil conditioner or compost and hauled to farming operations in the Coachella Valley.

**Table 4-2: Disposal of Wastewater (non-recycled) - AFY (DWR Table 22)**

| Method of Disposal | Treatment Level | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|
| Wetlands | Primary | 1,120 | 1,120 | 1,120 | 1,120 | 1,120 | 1,120 |
| CVSC | Secondary | 5,193 | 6,778 | 10,508 | 11,848 | 11,148 | 11,148 |
| | Total | 6,313 | 7,898 | 11,628 | 12,968 | 12,268 | 12,268 |

See subsequent sections for the amount to be used in a recycled water system.

### 4.3.2 Planned Improvements and Expansions

Existing VSD WWTP facilities consist of primary and secondary treatment facilities which discharge to the CVSC and neighboring wetlands and tribal lands. Development of a new recycled water supply would require the addition of tertiary treatment facilities, and potentially advanced treatment, depending on the ultimate use of the recycled water.

It is anticipated that the primary uses of recycled water by IWA would be for direct non-potable reuse. Direct non-potable reuse includes irrigation at golf courses and landscaping on roadway medians and new home and commercial developments. A secondary use of recycled water would be groundwater recharge.

IWA is currently planning a 4 MGD, first-phase recycled water project. This project would include required treatment facilities and core infrastructure, such as construction of a new recycled water pump station and major conveyance pipeline(s). This initial phase is expected to

INDIO Water Authority

# Recycled Water Master Plan

December 2011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**CITY OF INDIO**
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**RECYCLED WATER MASTER PLAN**

**FINAL**
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# 1.0 INTRODUCTION

This chapter describes the project background and goals of this Recycled Water Master Plan (RWMP), followed by a description of the study area, data review, and report organization.

## 1.1 Project Background

The Indio Water Authority (IWA) is exploring the feasibility of utilizing recycled water as a new source of water for landscape irrigation within and near its existing and future City of Indio (City) limits. The use of recycled water would supplement the groundwater and canal water that is currently used for these demands. The purpose of this RWMP is to identify the cost and feasibility of developing a recycled water system to diversify IWA's water supply mix in the future.

## 1.2 Goals and Objectives

The purpose of this study is to present information to help the IWA plan for the implementation of a recycled water system. A recycled water system will reduce the demands on the potable water distribution system and offset withdrawals from the groundwater aquifer and canal water supply. The ultimate goal of this project is to present a capital improvement program (CIP) that IWA can use to make decisions on the implementation of a recycled water system and to provide a phasing plan that prioritizes the various projects.

## 1.3 Study Area

The IWA service area boundary and City limits forms the basis of the study area boundary for this RWMP. The IWA's service area includes approximately 38 square miles and supplied 8,100 million gallons (MG) (24,873 acre-feet) of water to approximately 75,000 businesses and residents in the City of Indio in 2008[1]. Some areas outside the IWA service area and City limits were also considered in this study due to their high potential for recycled water use.

The City is located along Interstate 10 (I-10) in Southern California's Coachella Valley, between the cities of Palm Springs and Coachella, and near the Salton Sea Recreation Area. Figure 1 presents a location map showing the City and IWA service area relative to neighboring cities, while Figure 2 shows the study area boundary, IWA service area boundaries, and the current City limits.

[1] Source: www.indio.org (Indio Water Authority)

# 2.0 RECYCLED WATER DEMANDS

This section details the process and results of the recycled water market assessment that was performed by Carollo Engineers (Carollo) and presented in the Market and Demand Assessment Technical Memorandum Number 1 (TM No.1) dated January 2010. TM No.1 is also included in Appendix A. This section includes summaries of the customer market assessment, demand projection methodology, peaking factors, and a demand summary for various demand conditions.

## 2.1 Customer Market Assessment

The potential recycled water customers listed in TM No.1 were identified using a variety of sources. These sources include aerial photos, digital maps, General Plan (GP) land use maps, and potable water consumption data. This information was examined to locate parks, schools, golf courses, and other potential irrigation customers.

Potential customers with very low recycled water demand potential were considered only if they were located in close proximity to a large potential recycled water user or a logical alignment of a recycled water pipeline to service another user.

The customer market assessment evaluated three (3) potential customer categories: landscape irrigation, industrial, and agricultural customers. In addition, opportunities for indirect potable reuse (IPR) were explored.

### 2.1.1 Landscape Irrigation Customers

For potential irrigation customers, the available irrigable acreage was estimated using aerial photographs and Geographic Information System (GIS) techniques. The estimated available irrigation acreage formed the primary basis for the development of potential recycled water demands. Water supply and irrigation demand information was obtained from interviews and from discussions with golf course and other staff where possible. These potential customers and associated irrigation demands were identified in TM No.1.

A total of 39 potential landscape irrigation customers were identified consisting of golf courses, parks, schools, and homeowners associations (HOA's) within IWA's existing service area. In addition, the Bermuda Dunes Golf Course (outside the IWA boundary), as well as the Indian Springs Golf Courses (with a portion of the course located just outside the IWA boundary) were included as potential users.

### 2.1.2 Industrial Customers

There are no potential recycled water industrial customers identified.

### 2.1.3 Agricultural Customers

Due to the long distance required to supply recycled water to local agricultural customers, these customers were not considered in this study.

### 2.1.4 Potential for Indirect Potable Reuse

Indirect potable reuse (IPR) can be accomplished by recharging the groundwater aquifer with recycled water from Valley Sanitation District (VSD) wastewater reclamation plant. Recharge can occur either by surface spreading or by installing Aquifer Storage Recovery (ASR) wells. Based on discussions with IWA staff, Posse Park and Indio Municipal Golf Course were identified as the most promising location for IPR with ASR wells. These wells could recharge the remaining wastewater flow during low demand periods (e.g. winter) with a number of gravity feed ASR wells.

## 2.2 Demand Projection Methodology

The following sections provide summaries of the methodology used to prepare demand estimates for the potential recycled water customers under various seasonal conditions. These demand conditions are as follows and defined below:

- Average Annual Demand (AAD)
- Average Day Demand (ADD)
- Minimum Month Demand (MinMD)
- Maximum Month Demand (MMD)
- Maximum Day Demand (MDD)
- Peak Hour Demand (PHD)

### 2.2.1 Average Annual Demand

The AAD is the total annual recycled water demand developed for each potential user as determined in TM No. 1. This water use will be the basis for the water demands associated with each user.

### 2.2.2 Average Day Demand

The ADD is the total annual recycled water demand divided by the number of days in that year.

Average Day Demand= AAD/365 days

### 2.2.3 Minimum Month Demand

The MinMD is the average demand for the month with the lowest recycled water demand. The MinMD reduction factor was estimated using monthly landscape irrigation requirements and shown in Table 3 of TM No. 1. This table shows the month of December as the lowest recycled water demand with 0.26 times the average day demand.

Minimum Month Demand = 0.26 x ADD

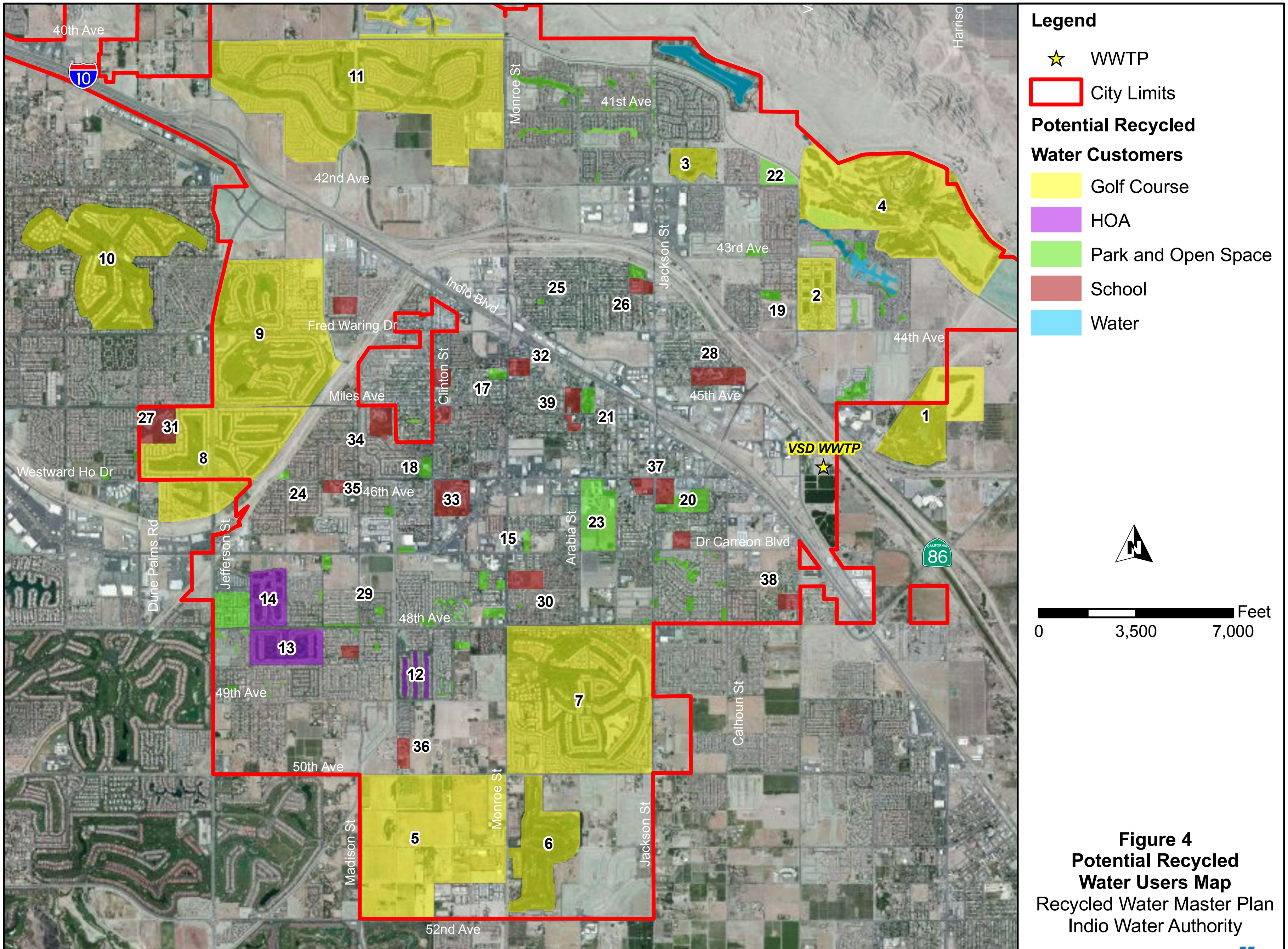


**Figure 4**
**Potential Recycled Water Users Map**
Recycled Water Master Plan
Indio Water Authority

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## 2.3 Hourly Demand Variation

For this study, most landscape irrigation using recycled water is assumed to occur during non-operational times at a constant rate between the hours of 7:00 p.m. and 7:00 a.m. Irrigation times from TM No. 1 were used to develop individual diurnal patterns for each individual user. This includes diurnal patterns based on 5-hour, 7-hour, 8-hour, 10-hour and 12-hour irrigation periods. One potential customer has an estimated irrigation window outside of the 7:00 p.m to 7:00 am window for typical turf irrigation and therefore a separate pattern was created. The daily diurnal pattern for each customer is expressed through a series of hourly multipliers applied to the MDD. This diurnal pattern was developed using the assumptions developed in TM No. 1 from discussions with the potential customers. An example of 10-hour irrigation period based diurnal pattern is shown on Figure 5.

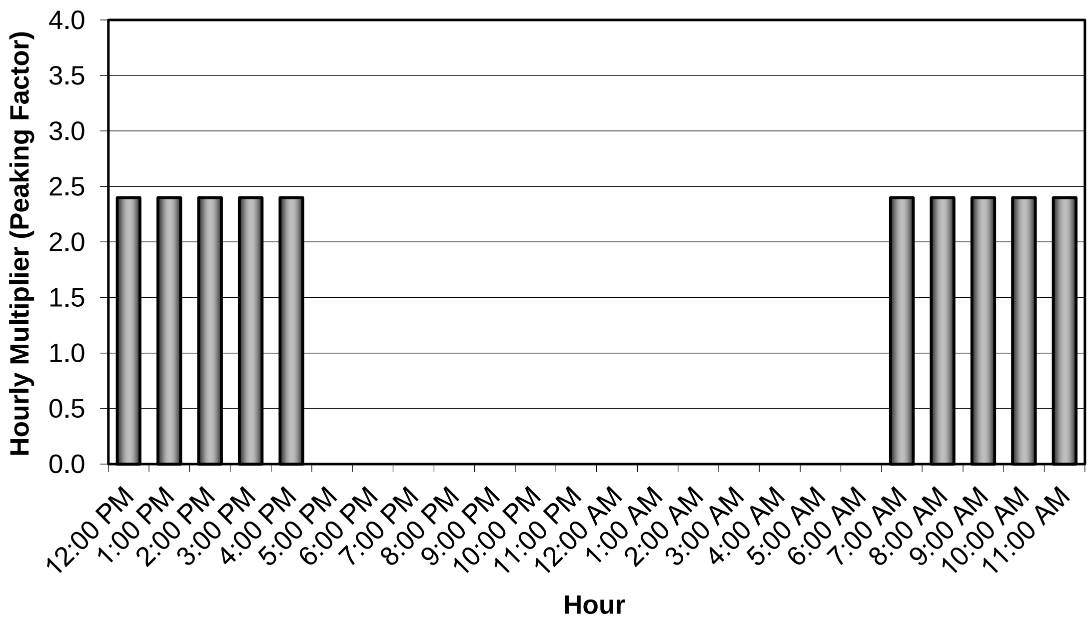


**Figure 5 Example of 10-Hour Irrigation Diurnal Pattern**

As shown on Figure 5, the hourly peaking factor for the 10-hour diurnal is 2.4. This hourly peaking factors varies from 2.0 for customers with a 12-hour irrigation pattern to 3.4 for customers with a 7-hour irrigation pattern. These hourly peaking factors are applied to the MDD estimates for each customer to estimate the peak hour demand for each customer.

## 2.4 Potential Recycled Water Demand Summary

The potential recycled water customers and their AAD, ADD, MMD, MDD, and PHD are summarized in Table 2. As shown in this table, the total potential demand of all 39 customers is estimated at 15,974 acre-feet per year (afy). The vast majority of this demand is from the 11 golf courses (14,467 afy or 91 percent), while the remaining nine percent is for irrigation at appropriate HOAs, parks, and schools.

**Table 2 Recycled Water Demand Estimates**
Recycled Water Maste Plan
Indio Water Authority

| Figure ID. | Customer Name | Irrigable Area (acres) | Average Day Demand(1) (mgd) | Average Annual Demand(2) (afy) | Max. Month Demand(3) (mgd) | Max. Day Demand(4) (mgd) | Irrigation Period (hrs) | Peak Hour Demand(5) (gpm) |
|---|---|---|---|---|---|---|---|---|
| **Golf Courses** | | | | | | | | |
| 1 | Eagle Falls Golf Course | 123 | 0.99 | 1,107 | 1.85 | 1.98 | 10 | 3,293 |
| 2 | Rancho Casa Blanco Country Club and HOA | 14 | 0.10 | 117 | 0.20 | 0.21 | 8 | 435 |
| 3 | Indio Municipal Golf Course | 40 | 0.32 | 358 | 0.60 | 0.64 | 8 | 1,331 |
| 4 | Terra Lago Golf Club | 192 | 1.54 | 1,728 | 2.89 | 3.09 | 12 | 4,284 |
| 5 | Empire and Eldorado Polo Clubs | 420 | 2.63 | 2,950 | 4.93 | 5.27 | 10 | 8,776 |
| 6 | Plantation Golf Club | 167 | 0.87 | 972 | 1.62 | 1.74 | 7 | 4,131 |
| 7 | Indian Palms Country Club | 174 | 1.67 | 1,865 | 3.11 | 3.33 | 10 | 5,548 |
| 8 | Indian Springs Country Club | 121 | 0.67 | 750 | 1.25 | 1.34 | 5 | 4,462 |
| 9 | Heritage Palms Golf Course | 170 | 1.43 | 1,600 | 2.67 | 2.86 | 12 | 3,966 |
| 10 | Bermuda Dunes Golf Course | 198 | 1.13 | 1,260 | 2.10 | 2.25 | 10 | 3,748 |
| 11 | Shadow Hills Golf Course | 191 | 1.57 | 1,760 | 2.94 | 3.14 | 10 | 5,236 |
| | **Golf Courses Subtotal** | 1,810 | 12.92 | 14,467 | 24.16 | 25.84 | - | 45,209 |
| **HOA's** | | | | | | | | |
| 12 | Motorcoach Country Club HOA | 16 | 0.10 | 112 | 0.19 | 0.20 | 10 | 333 |
| 13 | Outdoor Resort Indio HOA | 24 | 0.15 | 168 | 0.28 | 0.30 | 10 | 500 |
| 14 | Desert Shores Resales HOA | 20 | 0.13 | 140 | 0.23 | 0.25 | 10 | 416 |
| | **HOA's Subtotal** | 61 | 0.38 | 420 | 0.70 | 0.75 | - | 1,249 |
| **Parks** | | | | | | | | |
| 15 | Carreon Park | 2 | 0.01 | 9 | 0.01 | 0.02 | 10 | 26 |
| 17 | Dominguez Park | 3 | 0.01 | 14 | 0.02 | 0.03 | 10 | 43 |
| 18 | Indio Community Park | 3 | 0.02 | 18 | 0.03 | 0.03 | 10 | 55 |
| 19 | Indio Terrace Park | 5 | 0.02 | 25 | 0.04 | 0.04 | 10 | 74 |
| 20 | Jackson Park | 7 | 0.03 | 38 | 0.06 | 0.07 | 10 | 112 |
| 21 | Miles Avenue Park | 7 | 0.03 | 38 | 0.06 | 0.07 | 10 | 112 |
| 22 | Posse Park | 4 | 0.02 | 22 | 0.04 | 0.04 | 10 | 64 |
| 23 | Riverside CountY Fairgrounds | 10 | 0.05 | 54 | 0.09 | 0.10 | 10 | 160 |
| 24 | Shields Park | 1 | 0.00 | 5 | 0.01 | 0.01 | 10 | 14 |
| 25 | Yucca Park | 1 | 0.00 | 5 | 0.01 | 0.01 | 10 | 13 |
| | **Parks Subtotal** | 42 | 0.20 | 226 | 0.38 | 0.40 | - | 673 |
| **Schools** | | | | | | | | |
| 26 | Andrew Jackson Elementary School | 5 | 0.02 | 25 | 0.04 | 0.04 | 10 | 73 |
| 27 | Amelia Earhart Elementary School | 7 | 0.04 | 40 | 0.07 | 0.07 | 10 | 118 |
| 28 | Amistad Continuation School | 7 | 0.03 | 37 | 0.06 | 0.07 | 10 | 110 |
| 29 | Carrillo Ranch Elementary School | 1 | 0.00 | 3 | 0.01 | 0.01 | 10 | 9 |
| 30 | Dr. Reynoldo J. Carreon Jr. Acadamy | 4 | 0.02 | 23 | 0.04 | 0.04 | 10 | 70 |
| 31 | Glenn John Middle School | 9 | 0.04 | 46 | 0.08 | 0.08 | 10 | 137 |
| 32 | Herbert Hoover Elementary School | 6 | 0.03 | 31 | 0.05 | 0.06 | 10 | 92 |
| 33 | Indio High School | 17 | 0.08 | 90 | 0.15 | 0.16 | 10 | 267 |
| 34 | Indio Middle School | 18 | 0.08 | 95 | 0.16 | 0.17 | 11 | 257 |
| 35 | James Madison Elementary School | 19 | 0.09 | 100 | 0.17 | 0.18 | 12 | 249 |
| 36 | Mountain View Elementary School | 20 | 0.09 | 106 | 0.18 | 0.19 | 13 | 242 |
| 37 | Thomas Jefferson Middle School | 21 | 0.10 | 111 | 0.19 | 0.20 | 14 | 236 |
| 38 | Van Buren Elementary School | 22 | 0.10 | 116 | 0.19 | 0.21 | 15 | 231 |
| 39 | River Springs Charter School | 7 | 0.03 | 38 | 0.06 | 0.07 | 10 | 112 |
| | **Schools Subtotal** | 160 | 0.77 | 861 | 1.44 | 1.54 | - | 2,203 |
| | **Total** | **2,073** | **14.26** | **15,974** | **26.68** | **28.53** | **-** | **49,335** |

Notes:

(1) Average Day Demand = Average Annual Demand / 365 for golf courses and Hoa's from TM1 or 5.4 feet per irrigable acreage.

(2) Average Seasonal Demand for golf courses and HOA's developed from TM1. Others estimated using required irrigation of 5.4 feet per acre.

(3) Maximum Month Demand to Average Seasonal Demand Peaking Factor = 1.87, or Maximum Month Demand = Seasonal Demand x 1.87

(4) Maximum Day Demand to Average Seasonal Demand Peaking Factor = 2.0, or Maximum Day Demand = Seasonal Demand x 2.0

(5) Peak Hour Demand to Average Seasonal Demand Peaking Factor varies, Peak Hour Demand = Seasonal Demand x 24-hours/ Irrigation Window

# 3.0 RECYCLED WATER REGULATIONS AND SUPPLIES

This section starts with a description of current and anticipated water quality regulations regarding recycled water. Subsequently, the water supply sources are described. This section is concluded with the recycled water supply balance, which compares the projected recycled water demands and supplies on a seasonal basis.

## 3.1 Recycled Water Quality Regulations

This section identifies the major existing and proposed state and regional regulatory requirements governing the use of recycled water in the City.

### 3.1.1 <u>Existing Regulatory Considerations</u>

The California Water Code Regulations, Title 22 dictates the primary regulations governing recycled water use. The wastewater treatment and disposal is regulated by the Colorado River Regional Water Quality Control Board (RWQCB) Region 7. The State Water Resources Control Board (SWRCB) and the RWQCB have regulatory authority along with the California Department of Public Health (CDPH) over projects using recycled water. The interagency involvement between the SWRCB, RWQCB, and CDPH is further discussed in the following sections.

### 3.1.2 <u>Title 22</u>

The existing water recycling regulations, which dictate wastewater treatment processes and effluent quality criteria, are contained in the California Code of Regulations, Title 22, Division 4, Chapter 3, Sections 60301 through 60355. A compilation of the water recycling regulations can be found in "The Purple Book[3]." The regulations are intended "...to establish acceptable levels of constituents of recycled water and to prescribe means for assurance of reliability in the production of recycled water in order to ensure that the use of recycled water for the specified purposes does not impose undue risks to health..." The most recent revision to these regulations came into effect in 2001.

The CDPH regulations define four types of recycled water determined by the treatment process and total coliform, bacteria, and turbidity levels. The four treatment types of recycled water that are currently permitted by the CDPH are summarized in Table 3.

[3] http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Recharge/Purplebookupdate6-01.PDF

### 3.2.2 Recycled Water from CVWD

The Shadow Hills Golf Course is the only known user of recycled water within the study limits at this time. The golf course receives recycled water from the Coachella Valley Water Districts (CVWD) water reclamation plant located north of the golf course.

### 3.2.3 Recycled Water from VSD

The VSD does not currently provide Title 22 treated recycled water. However, it does divert approximately 1 million gallons per day (mgd) of flow through a wetlands area before being discharged to the Whitewater storm channel. Several treatment alternatives for the production of recycled water that meets the California Title 22 requirements have been identified in the Recycled Water Treatment Alternatives and Delivery Corridor Options-Technical Memorandum Number 4 (TM No. 4) dated January 2010 and the Draft Recycled Water Environmental Impact Report (EIR) prepared for the expansion of VSD's wastewater treatment plant (WWTP). TM No. 4 is included in Appendix B.

With the addition of tertiary level treatment, the VSD would be able to provide recycled water to customers. Different treatment alternatives were identified for the production of recycled water for irrigation and for groundwater recharge.

Treatment to Title 22 standards for landscape irrigation include tertiary filtration, membrane bioreactors, and disinfection. Groundwater recharge with recycled water would require advanced treatment with microfiltration (MF) and reverse osmosis (RO). MF is required as pretreatment for RO, and RO is responsible for demineralization and removal of dissolved organic compounds in recycled water. This advanced treatment would also include ultraviolet advanced oxidation process, using hydrogen peroxide to provide disinfection and oxidation of microconstituents. Advanced treatment would allow recycled water to be used with indirect potable using ASR wells. These wells could be used at the Posse Park and Indio Municipal Golf Course during the low-demand winter months to maximize recycled water-use year round.

VSD's existing WWTP currently treats approximately 6.5 mgd as stated in the EIR and summarized in Table 4.

**Table 4 Recycled Water Supply Compared with Potential Demand**
Recycled Water Master Plan
Indio Water Authority

| Flow Condition | Current Capacity (mgd) | Current Capacity (afy) | Ultimate Capacity (mgd) | Ultimate Capacity (afy) |
|---|---|---|---|---|
| Average Annual WWTP Flow | 6.5 | 7,282 | 16.0 | 17,925 |
| Wetlands Treatment[(1)] | 1.0 | - | 0.0 | - |
| Minimum Discharge to Channel | 0.5 | - | 0.5 | - |
| Available Ave. Recycled Water Flow | 6.0 | 6,722 | 15.5 | 17,365 |
| Potential Average Annual RW Demand | - | 15,387 | - | 15,387 |

Notes:
(1) The existing wetlands treatment facility could be eliminated after adding tertiary treatment facilities to the VSD WWTP.
Source: Draft Indio Water Authority Recycled Water Environmental Impact Report.

As shown in Table 4, approximately 1 mgd of the existing 6.5 mgd plant flow is currently diverted to a wetlands project. This project can be eliminated once the tertiary treatment process is in place. However, a minimum discharge to the Coachella Valley Canal of 0.5 mgd remains to maintain existing habitat in the discharge channel. Hence, the existing plant could provide approximately 6.0 mgd of recycled water supply under average day flow conditions.

At build-out, the WWTP is expected to reach a total capacity of 17.2 mgd as stated in the VSD Wastewater Treatment Plant Master Plan. As shown in Table 4 above, this amounts to approximately 16 mgd of average annual flow rate from VSD WWTP and approximately 15.5 mgd of available average recycled water irrigation flow rate.

## 3.3 Seasonal Demand Availability

The demands for the service area change with the seasonal weather fluctuations. These weather fluctuations directly affect irrigation practices. Figure 6 shows the potential monthly demands under build out conditions, which reflect fluctuations in weather conditions and irrigation rates. October has a higher demand due to the amount of irrigation required to support overseeding at golf courses and large turf areas. Winter months have lower demands due to rainfall and lower evaporation rates.

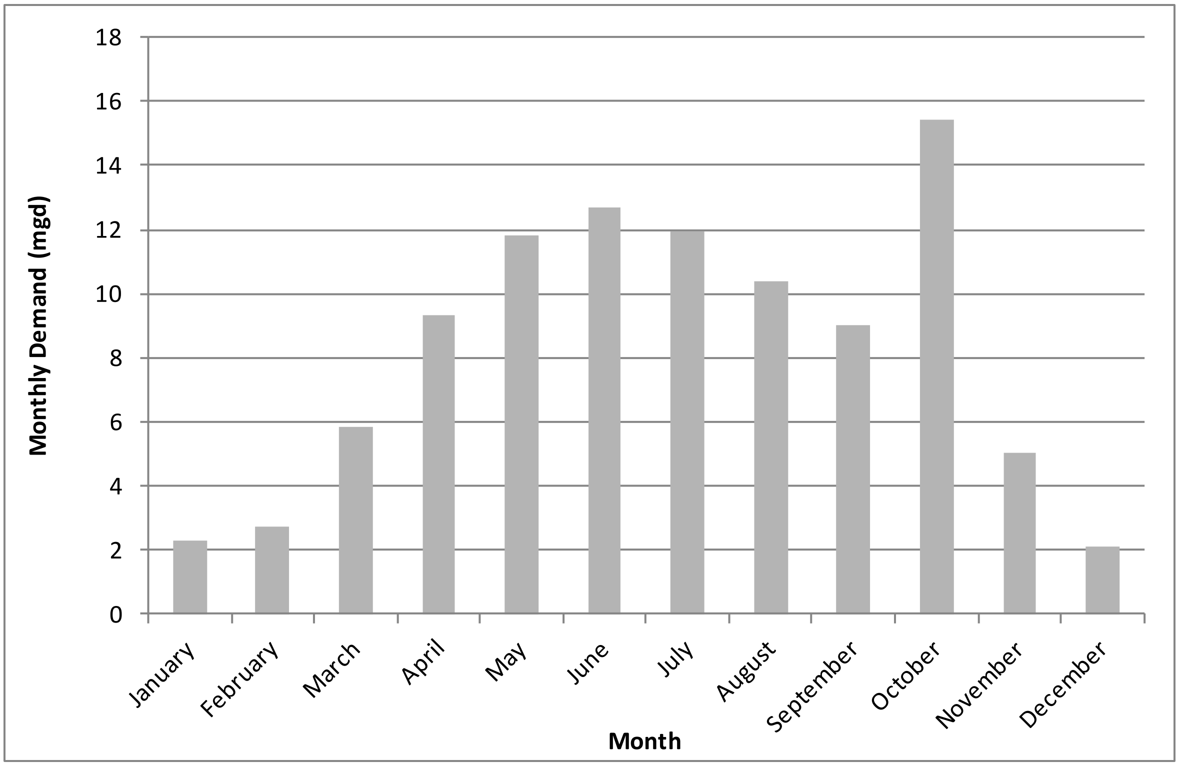


**Figure 6 Potential Seasonal Demand Variation**

## 3.4 Supply and Demand Balance

As shown in Table 2, the estimated MDD of all potential customers is 28.5 mgd. It is evident that this is substantially higher than the available average recycled water flow of 15.5 mgd under build-out conditions (see Table 4). Hence, approximately 13 mgd of potential customers will not have recycled water available under MDD conditions. Because the WWTP does not have adequate supply to accommodate all potential demands, the system was oriented to supply water to the most feasible customers based on location relative to the WWTP and amount of recycled water available.

The supply and demand balance for the WWTP under build-out conditions is shown in Figure 7. Customers were added to the system such that the MMD during October match the available recycled water supply after meeting the minimum discharge requirement of 0.5 mgd to the Coachella Canal. To maximize the use of recycled water year-round, the monthly difference between the available WWTP supply and the demands could be used for groundwater recharge using ASR wells. Based on the demand balance presented in Figure 7, it is estimated that approximately 8,150 afy of recycled water can be recharged into the groundwater basin.

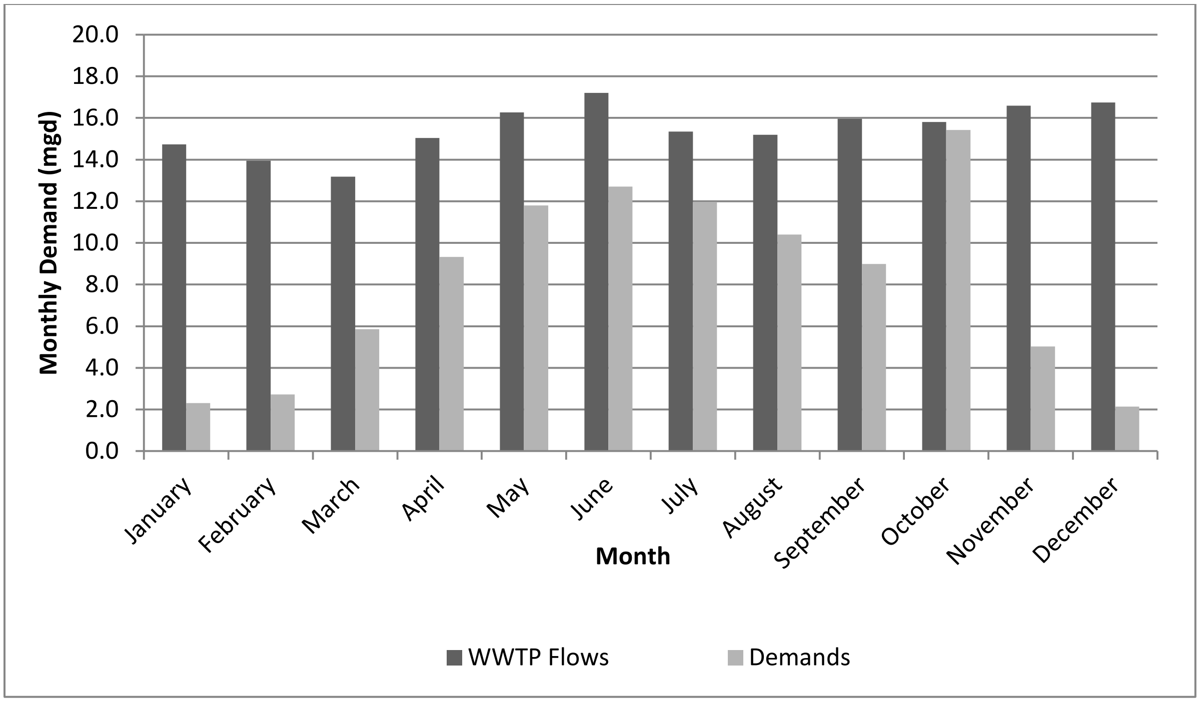


**Figure 7 Build-out Supply and Demand Balance**

# 5.0 SYSTEM ANALYSIS

## 5.1 Evaluation Criteria

The recycled water supply, storage, and distribution facilities for the conceptual distribution system were sized based on the planning criteria defined in this section. The criteria include standards from the IWA's Water Distribution System Master Plan and other planning criteria recommended by Carollo. The criteria address the recycled water supply capacity, storage capacity, acceptable service pressures, distribution main velocity, headloss, and daily and hourly peaking factors.

### 5.1.1 Recycled Water Supply Capacity

Recycled water supply capacity is the total capacity of the recycled water supplied by the WWTP. In determining the adequacy of the recycled water supply facilities, the source must be large enough to meet varying demand conditions.

In accordance with the criteria defined herein, the recycled water system's supply source from the WWTP should have the capacity to meet the system's MDD. For reliability purposes, it is desirable to maintain a firm pump station capacity equal to the MDD. Firm capacity is equal to the total capacity of the pump station at the WWTP, minus the capacity of the largest pump. Supply in excess of MDD required for PHD could come from ground level storage tanks with pump stations.

### 5.1.2 Storage

The principal function of storage in a recycled water system is to provide a reserve water supply for operational and emergency storage. Temporary interruptions are typically acceptable for irrigation sites because potable water can be used to supplement recycled water. Therefore, emergency storage is not required. Fire flow storage is not required either, as potable water will be used for fire protection within IWA's service area. Hence, the only type of storage required for IWA's recycled water system is operational storage.

Operational storage is the amount of water needed to buffer the difference between the demand and supply in a 24-hour period. For the purpose of this study, it is assumed that the wastewater treatment plant expansion will also include the installation of equalization basins to provide a constant recycled water supply for IWA's recycled water system.

Based on the assumption of a constant recycled water supply and the aggregate diurnal curve of all potential customers, the required amount of operational storage can be calculated. The calculation using the customers connected to the proposed build out system is presented in Figure 9. As shown in this figure, the minimum amount of operational storage is 58 percent of MDD.

### 5.2.2 Energy Analysis

Two options for delivery of recycled water to customers were investigated. The first option is to supply recycled water that will provide adequate pressures to the customers for large irrigation sprinklers. As discussed in the criteria section, the distribution system was sized to adequately supply water at 60 psi at each customer. The study area is relatively flat with customer elevations ranging from -30 feet to 20 feet above MSL. The WWTP pump station is adding approximately 280 feet of head into the distribution system.

The second option is to supply water to customers at a lower service pressure of 5 psi. Due to the abundance of golf courses with lakes and ponds, a higher service pressure is not needed because irrigation water is pumped out of the lakes. This option will allow an energy savings for the WWTP pump station because the system will not need to operate at an elevated hydraulic grade line to supply the higher 60 psi pressure. This would require the end customer to boost water pressures to the desired service pressure. The lower pressure system would require the WWTP to supply at least 80 feet of head into the distribution system to maintain a minimum of 5 psi.

The estimated cost savings for the lower pressure system is approximately $38,000 per month based on the WWTP pumping MMD during the summer months. The energy cost was estimated using $0.12/ per kilowatt-hour. Pump stations were sized according to the required horsepower to support the MDD at the two different hydraulic grade lines.

### 5.2.3 Feasibility Summary

The results of the feasibility analysis are summarized in Table 6. This table shows the cost per acre-foot of recycled water used for each of the three key system expansion segments that were analyzed.

**Table 6 Feasibility Analysis Summary**
Recycled Water Master Plan
Indio Water Authority

| Pipeline Segment | ADD (afy)(3) | Capital Cost ($ million) | Unit Cost(2) ($/afy) |
|---|---|---|---|
| Northern Section | 3,356 | $12.6 | $146 |
| Southern Section | 5,887 | $20.4 | $134 |
| Western Section | 4,031 | $18.2 | $220 |
| IPR with ASR Wells(1) | 8,000 | $41.2 | $200 |

Notes:
(1) Includes 4 ASR wells of 2,000 gpm ($1 million/well), $1 million for pipeline upgrades, and RO treatment.
(2) Based on a 50-year depreciation period for pipelines and 3 percent interest.

Based on the results presented in Table 6, it can be concluded that the southern section would provide the highest demand in afy for the lowest unit cost. It can also be seen that the western portion has a much higher unit cost than the northern and southern segments. These higher cost were due to extended length of pipe from the WWTP required to reach the potential customers and the need for a pump station. As the amount of recycled water supply is limited, the western segment was not included in the build out system configuration.

The northern segment includes the Indio Municipal Golf Course, a city-owned property that could be converted first to recycled water and serve as a model customer and to build experience and trust with other potential customers. For this reason, it is recommended that the northern section of the distribution system be developed first. This segment is therefore also referred to as Phase 1, while the southern segment is referred to as Phase 2.

Table 6 also shows that the addition of ASR wells at Posse Park makes the northern segment more expensive on a unit cost basis; however, groundwater recharge provides additional benefits from a water supply reliability perspective. Ultimately, the decision on implementing ASR wells with the required treatment needs to be compared to other water supply alternatives. This comparison is beyond the scope of this study.

## 5.3 Recycled Water System Layout

This section gives recommendations for the proper sizing and operation of the recycled water system. The following sections summarize the findings of the system analysis.

### 5.3.1 Recycled Water Supply Capacity

The recycled water supply requirements to meet the MDD are presented in Table 7.

**Table 7 Recycled Water Supply Capacity Requirements**
Recycled Water Master Plan
Indio Water Authority

| Phase | WWTP MDD (mgd) | Environmental Obligations (mgd)(1) | Available Recycled Water Supply (mgd)(2) | MDD (mgd) | Supply Balance(3) (mgd) |
|---|---|---|---|---|---|
| 1 | 6.5 | 0.5 | 6.0 | 6.0 | 0 |
| 2 | 9.5 | - | 9.5 | 9.5 | 0 |
| **Total** | **16.0** | **-** | **15.5** | **15.5** | **0** |

Notes:
(1) The existing wetlands treatment facility could be eliminated with the addition of tertiary treatment facilities to the VSD WWTP, and minimum discharge to the channel= 0.5 mgd.
(2) Available recycled water supply is WWTP Flow – Environmental Obligations.
(3) Supply Balance = WWTP Flow- Environmental obligations- Demands.

# 6.0 CAPITAL IMPROVEMENTS PROGRAM

The cost estimates presented in this study are opinions developed from bid tabulations, cost curves, information obtained from previous studies, and Carollo's experience on other projects. The costs are based on an Engineering News Record Construction Cost Index (ENR CCI) 20-City Average of 9,035 (September 2011).

## 6.1 Cost Estimating Accuracy

The cost estimates presented in the CIP have been prepared for general planning purposes and for guidance in project evaluation and implementation. Final costs of a project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors such as: preliminary alignment generation, investigation of alternative routings, and detailed utility and topography surveys.

The Association for the Advancement of Cost Engineering (AACE) defines an Order of Magnitude Estimate, deemed appropriate for master plan studies, as an approximate estimate made without detailed engineering data. It is normally expected that an estimate of this type would be accurate within plus 50 percent to minus 30 percent. This section presents the assumptions used in developing order of magnitude cost estimates for recommended facilities.

## 6.2 Construction Unit Costs

The construction costs are representative of recycled water system facilities under normal construction conditions and schedules. Costs have been estimated for public works construction, either as new construction in existing developed areas, or new construction in undeveloped areas.

Recycled water system pipeline projects range in size from 12-inches to 30-inches in diameter. Pipe casings up to 30-inches in diameter are included for major crossings (e.g. creeks, canals, highways, railroad) of the transmission mains. Pipeline unit costs are shown in Table 11. The construction cost estimates are based upon these unit costs. The unit costs are for "typical" field conditions with construction in stable soil.

Construction of pipelines in undeveloped areas is anticipated to cost less than those constructed in developed areas, such as downtown. The unit costs in Table 11 are discounted by 30 percent for pipelines that will be built in undeveloped areas. This discount is based on review of bid tabulations from recent projects that were constructed in developed and undeveloped areas. Pipelines built in undeveloped areas ranged from 30 to 50 percent less than pipelines built in developed areas.

**Table 12 Capital Improvement Program Summary**
Recycled Water Master Plan
Indio Water Authority

| Category | System Improvements ($ million)(1) | | |
|---|---|---|---|
| | Phase 1 | Phase 2 | Total |
| Distribution Pipes | 5.5 | 8.8 | 14.3 |
| WWTP Booster PSs | 2.0 | 3.3 | 5.2 |
| Storage and Booster PSs | 5.1 | 8.3 | 13.4 |
| Optional ASR Pipes(2) | 1.0 | 0.0 | 1.0 |
| Optional ASR Wells(3) | 3.3 | 3.3 | 6.5 |
| Optional RO treatment | 16.8 | 16.8 | 33.7 |
| **Totals without ASR** | **12.6** | **20.4** | **32.9** |
| **Total with ASR** | **33.7** | **40.5** | **74.1** |

Notes:
(1) All capital cost estimates were based on the unit construction costs listed in Table 10.
(2) Differential cost for upsizing pipelines between WWTP and Posse Park from 24”, 20”, and 18” to 30” in diameter.
(3) Cost for the construction of 2 and 2 ASR wells in Phase 1 and 2, respectively.

Table 13 correlates the planning level costs to the incremental increase in recycled water demand per phase. The purpose of this is to assist the IWA in quantifying the unit cost per acre-foot per year of water for implementation and expansion of a recycled water distribution system.

**Table 13 Capital Cost Analysis**
Recycled Water Master Plan
Indio Water Authority

| Implementation Phase | Demand (afy) | Capital Cost/Phase ($ million) | Capital Cost(1) ($/afy) |
|---|---|---|---|
| 1 (2011 - 2025) | 3,356 | $12.6 | $146 |
| 2 (2026 – 2040) | 5,887 | $20.4 | $134 |
| Optional ASR | 8,000 | $41.2 | $200 |
| **Total wo/ASR** | **9,243** | **$32.9** | - |
| **Total w/ ASR** | **17,243** | **$74.1** | - |

Notes:
(1) Based on amortized capital cost using 3 percent interest and a 50-year depreciation period. Unit costs do not include operation and maintenance cost.

## 6.4 Project Prioritization

Future development of a recycled water distribution system will require the construction of transmission system to serve potential existing and future customers. The implementation of these improvements will depend on the proximity to the WWTP, feasibility of chosen segments, as well as the City's growth patterns. The phasing of the improvements identified in this study was developed based on the phasing of improvements in the Valley Sanitation District Wastewater Treatment Plant Master Plan and proximity to the WWTP, as appropriate. Table 14 and associated Figure 11 show the proposed recycled water CIP. The improvements are broken down into two phases:

- Phase 1 Near-Term (Years 2011 through 2025)
- Phase 2 Build-Out (Years 2026 through 2040)

In general, improvements to service existing customers in the northern area of the City were given a higher priority than improvements to service existing customers in the southern end of the City based on the location of the City owned Indio Municipal Golf Course. The Indio Municipal Golf Course is considered an essential location to supply recycled water due to the possible construction of injection wells for recycled water recharge.

### 6.4.1 Phase 1 Existing Projects (2010-2025)

The Phase 1 projects form the backbone of the recycled water distribution system and are intended to service the majority of the existing potential recycled water customers north of the WWTP. These projects include a transmission main ranging from 30-inches down to 18-inches in diameter (P-1 through P-11) that extends from the WWTP north on Van Buren Street to Avenue 42. Then down Avenue 42 to the Indio Municipal Golf Course. Other smaller, 8-inch diameter distribution system mains (P-6) were targeted for implementation in Phase 1 to service potential customers in the vicinity of the transmission main (ie: Indio Terrace Park, Posse Park).

Other projects targeted for the first implementation phase include:

**WWTP Recycled Water Pump Station (WWTP-1).** This pump station serves as the sole source of supply to the recycled water system through build-out. It is assumed that the pump station will be designed to accommodate build-out demands, although the installation of individual pumps may be staged based on the incremental increase in recycled water demand.

**Indio Municipal Golf Course Pump Station and Tank (T-1 and P-1)**. This pump station supplies flows to meet the difference between MDD and PHD for the northern portion of the City. This pump station should be constructed on City-owned property at the Indio Municipal Golf Course.

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# Technical Memorandum

## Indio Water Authority Recycled Water Project

**Subject:** **Phase 1A Project Definition**

**Prepared For:** Indio Water Authority

**Prepared by:** Marc Nakamoto, P.E.

**Reviewed by:** Rosalyn Prickett and Rich Bichette, P.E.

**Date:** July 9, 2014

**Reference:** 0574-002

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## List of Abbreviations

| | |
|---|---|
| AACE | Association for the Advancement of Cost Engineering |
| AF | Acre-Feet |
| AFY | Acre-Feet per Year |
| ASR | Aquifer Storage and Recovery |
| DPH | Department of Public Health |
| CEQA | California Environmental Quality Act |
| CUP | Conditional Use Permit |
| CVRWMG | Coachella Valley Regional Water Management Group |
| CVWD | Coachella Valley Water District |
| DAC | Disadvantaged Community |
| DWR | California Department of Water Resources |
| EA | Each |
| EIR | Environmental Impact Report |
| ENR CCI | Engineering News Record Construction Cost Index |
| FPS | Feet per Second |
| FT | Feet |
| GPD | Gallons per Day |
| GPM | Gallons per Minute |
| HOA | Home Owners Association |
| HP | Horsepower |
| IN | Inch |
| IRWM | Integrated Regional Water Management |
| IWA | Indio Water Authority |
| JPA | Joint Powers Authority |
| LF | Lineal Feet |
| MG | Million Gallons |
| MGD | Million Gallons per Day |
| MSL | Mean Sea Level |
| OWTS | On-Site Wastewater Treatment Systems |
| PSI | Pounds per Square Inch |
| RFP | Request for Proposals |
| RFQ | Request for Qualifications |
| RWMP | Recycled Water Master Plan (Indio Water Authority) |
| RWQCB | Regional Water Quality Control Board |
| SRF | State Revolving Fund |
| SWRCB | State Water Resource Control Board |
| TM | Technical Memorandum |
| VSD | Valley Sanitation District |
| WWTP | Wastewater Treatment Plant |

# 1 Introduction and Background

This chapter presents the project background and purpose, and the scope of this study.

## 1.1 Project Background and Purpose

Indio Water Authority (IWA), in collaboration with Valley Sanitary District (VSD), has developed a strategic goal of reclaiming wastewater for use as recycled water to reduce demand for potable water resources and to recharge the groundwater aquifer beneath IWA's service area. Tertiary treated recycled water can be distributed to large landscape irrigation customers. Construction of a recycled water distribution system will offset potable water demand currently served by the over-drafted groundwater basin and prepare for groundwater recharge. IWA is currently seeking IRWM Proposition 84 Drought Relief Funding to assist in funding construction of the project.

Development of a recycled water distribution system will require construction of a distribution system to deliver the water to existing and future customers. The improvements will be phased as identified in the *2011 Recycled Water Master Plan*, which was based on the phasing plan identified in VSD's *Wastewater Treatment Plant Master Plan*. Figure 1-1 shows the proposed recycled water capital improvement program (CIP) from the *2011 Recycled Water Master Plan*. The improvements are broken down into two phases:

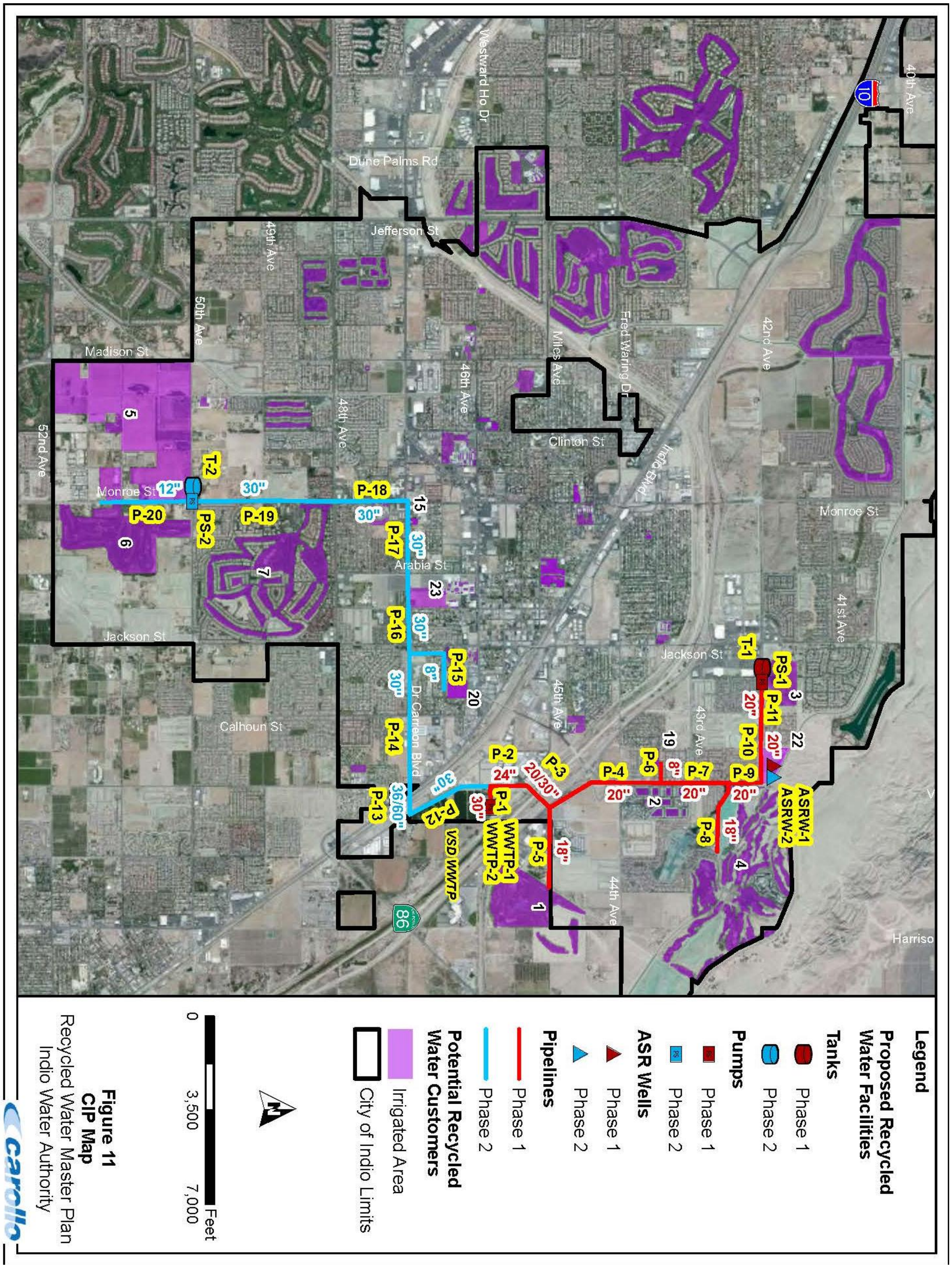
- Phase 1 Near-Term (Years 2011 through 2025)
- Phase 2 Build-Out (Years 2026 through 2040)

This technical memorandum (TM) presents a smaller "Phase 1A" project to deliver recycled water to existing customers in the vicinity of the VSD wastewater treatment plant (WWTP). The Phase 1A project includes recycled water treatment facilities and the backbone of the recycled water distribution system, including an essential pipeline that would deliver recycled water to future injection wells for groundwater recharge. The Phase 1A project would serve an estimated 1,930 acre-feet per year (AFY) of recycled water to roadway medians, home owners associations (HOAs), golf courses, and park facilities. Future phases will include branches off of the backbone distribution system to connect the remainder of customers and facilitate groundwater replenishment.

## 1.2 Scope of Study

The scope of this study includes definition of the Phase 1A project, including identifying recycled water demands and distribution pipelines, and identifying recycled water treatment, storage and pumping needs to serve a reduced customer base than the *2011 Recycled Water Master Plan* Phase 1 project. Cost estimates for the Phase 1A project were developed and a detailed implementation plan was established.

**Figure 1-1: Capital Improvement Plan (CIP) Map from *2011 Recycled Water Master Plan***



## 1.3 Study Area and Setting

This chapter provides a description of the Study Area and conditions within the Study Area that have an impact on the recycled water project, primarily as an alternative supply to local groundwater.

## 1.4 Study Area Location

The proposed recycled water project is located within the Indio Water Authority (IWA) service area (Study Area), shown in Figure 1-2. IWA's service area is 38 square miles and IWA supplies approximately 24,900 AFY of water to an estimated 75,000 businesses and residents in the City of Indio in 2010 (CVRWMG 2014). Valley Sanitary District (VSD) operates an 11.0-million gallon per day (MGD) capacity WWTP that services the majority of IWA customers and discharges approximately 6.3 MGD of effluent to the Coachella Valley Stormwater Channel.

The Coachella Valley is geologically divided into the West Valley and the East Valley. The boundary between the East Valley and West Valley extends from Washington Street and Point Happy northeast to the Indio Hills near Jefferson Street. Generally, the West Valley, which includes the cities of Palm Springs, Cathedral City, Rancho Mirage, Indian Wells and Palm Desert, is contained within the service areas of Mission Springs Water District, Desert Water Agency, or Coachella Valley Water District, and residents within this area receive municipal water and wastewater services. The East Valley, which includes the cities of Coachella, Indio, and La Quinta and the communities of Mecca, Oasis and Thermal (located within unincorporated Riverside County), is lower in population density. Portions of the East Valley are provided water and wastewater services by IWA, Coachella Valley Water District, Coachella Water Authority, and VSD.

## 1.5 Groundwater Conditions

The Coachella Valley Groundwater Basin encompasses much of the Coachella Valley floor. Geologic faults and structures divide the basin into five sub-basins. Two of the sub-basins, Whitewater River (also referred to as Indio) and Desert Hot Springs, fall within the project Study Area. The locations of these groundwater sub-basins are shown in Figure 1-3.

The Indio/Whitewater River Subbasin is the largest groundwater sub-basin in the Coachella Valley, and is the sub-basin that IWA pumps from for potable water supply. The sub-basin has a storage capacity of approximately 40 million acre-feet (AF) (DWR, 1964). The geology of the basin varies with coarse-grained sediments located in the vicinity of Whitewater and Palm Springs (West Valley), gradually transitioning to fine-grained sediments near the Salton Sea (East Valley). Development of the proposed recycled water project would offset pumping of groundwater supply to serve multiple large irrigators within the Study Area. In accordance with the *2010 Coachella Valley Water Management Plan* and the *2011 Recycled Water Master Plan,* implementation of recycled water will reduce continued overdraft of the Indio/Whitewater River Subbasin.

**Figure 1-2: Project Study Area**

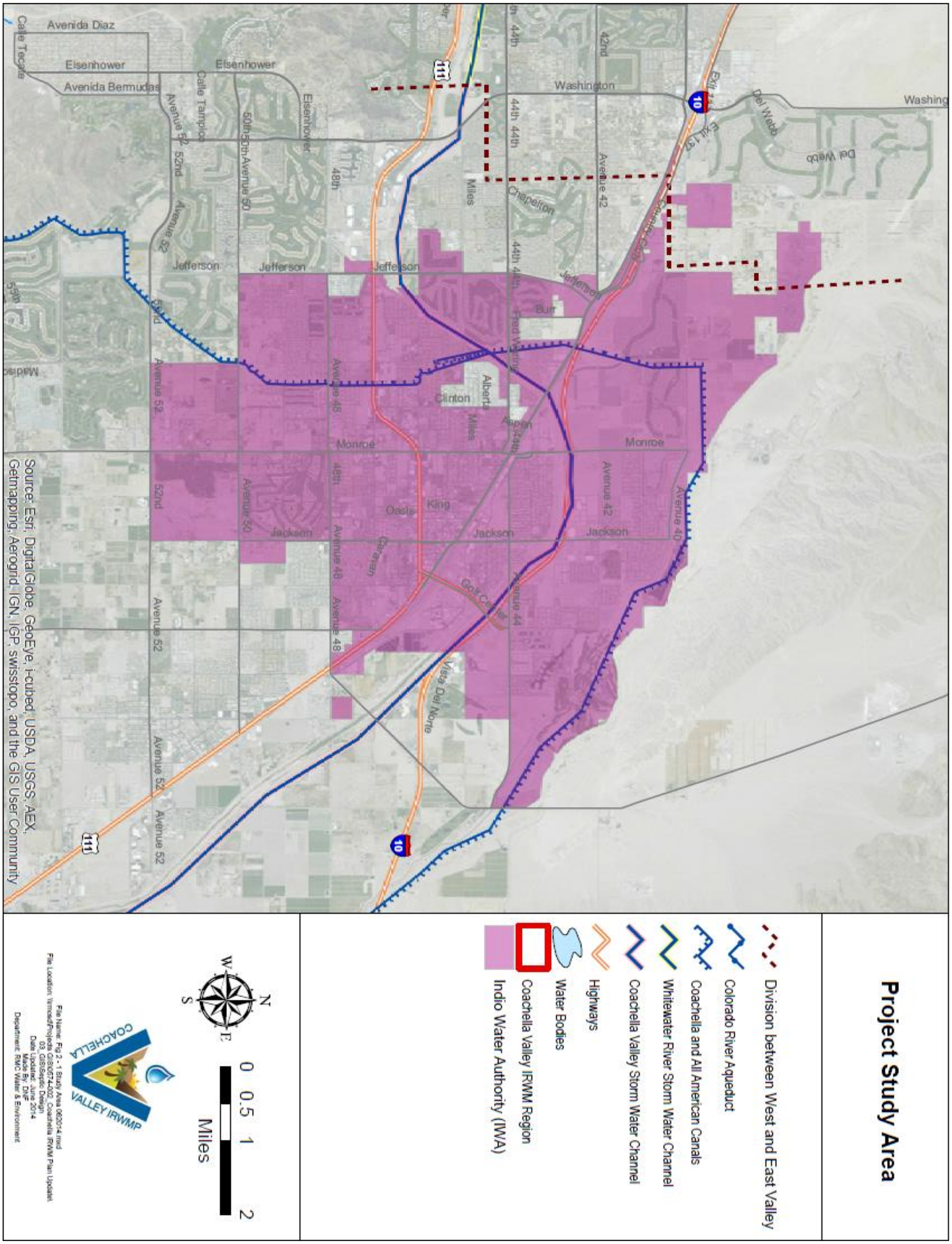
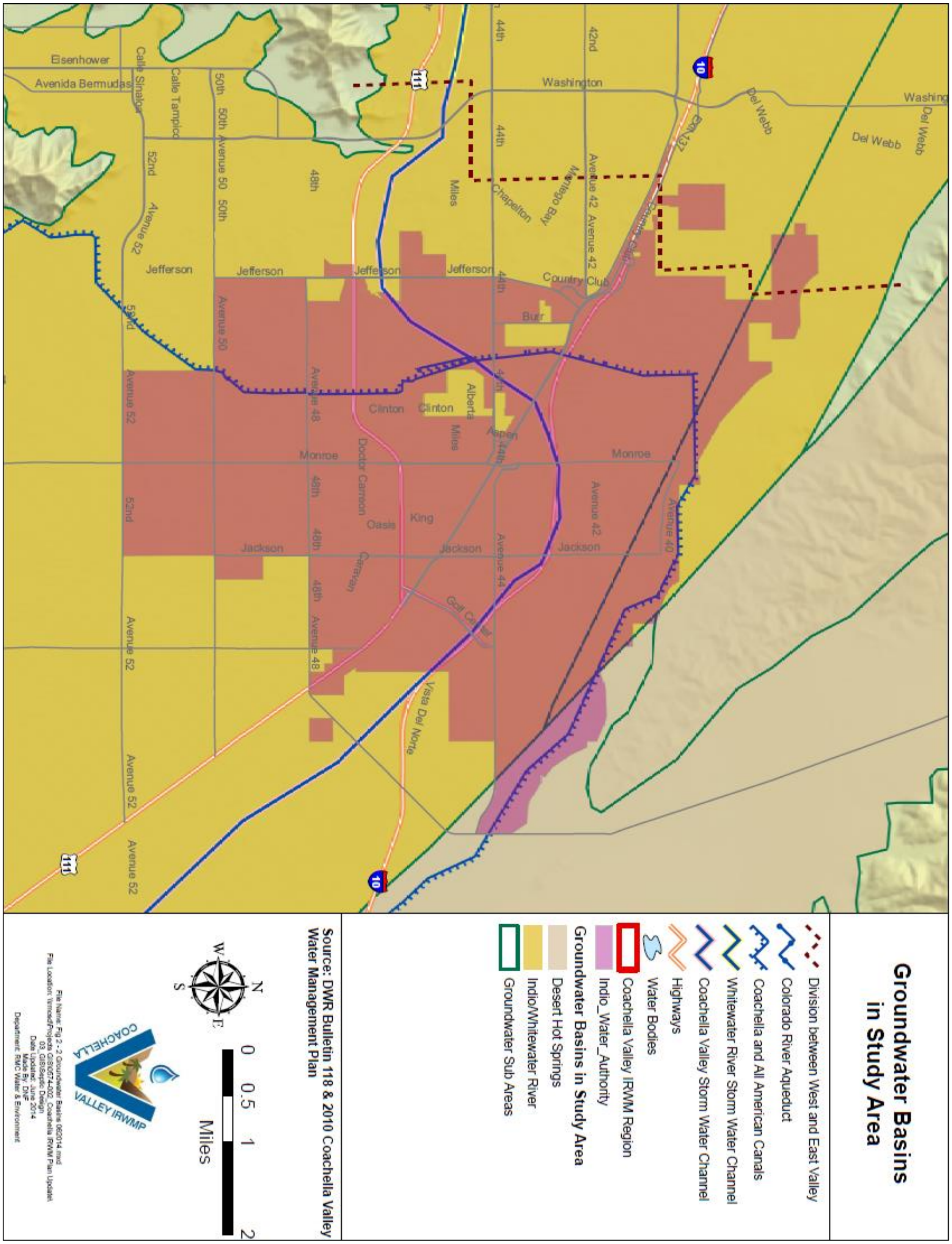


**Figure** 1-3**: Groundwater Basins in Coachella Valley**



# 2 Phase 1A Project Definition

IWA's *2011 Recycled Water Master Plan* (RWMP) identified the cost and feasibility of developing a recycled water system to diversity IWA's water supply. The use of recycled water would supplement groundwater that is currently used to meet water demand. Due to the substantial construction cost estimated for the full Phase 1 project identified in the RWMP, IWA chose to develop a smaller Phase 1A project that could be constructed with available funding. This study defines the recommended Phase 1A customers and infrastructure required to deliver recycled water to those customers.

The Phase 1A Recycled Water Project includes construction of recycled water treatment facilities with a capacity of 3.4 MGD complying with Department of Public Health Title 22 Standards for landscape irrigation water , storage, pump stations, and 15,200 feet (ft) of recycled water conveyance ranging in size from 18-inch to 30-inch.

The Phase 1A project will serve the Terra Lago Golf Club, Posse Park, and Rancho Casa Blanca Country Club and HOA, delivering approximately 1,930 AFY of recycled water. Phase 1A also paves the way for future expansions (remaining portions of Phase 1 and Phase 2), which includes expanded irrigation use of recycled water and indirect potable reuse (through groundwater recharge) as defined in the RWMP and Environmental Impact Report (EIR).

## 2.1 Demands and Design Sizing Criteria

Table 2-1 summarizes the Phase 1 customers identified in the RWMP and identifies the demands for the three Phase 1A customers. Terra Lago Golf Course was the largest water user identified in Phase 1 of the RWMP with an estimated annual demand of 1,730 AFY. Targeting of large customers typically results in favorable unit cost metrics for recycled water programs. With the proposed transmission line in Golf Center Parkway, short pipeline connections will facilitate recycled water service to Posse Park and Rancho Casa Blanca County Club and HOA in Phase 1A.

**Table 2-1: Phase 1 Recycled Water Customers**

| Customer | Phase 1A | Irrigable Area (acres) | Average Day Demand (mgd) | Average Annual Demand (AFY) | Max Day Demand (mgd) | Irrigation Window (hrs) | Peak Hour Demand (gpm) |
|---|---|---|---|---|---|---|---|
| Eagle Falls Golf Course | | 123 | 0.99 | 1,107 | 1.98 | 10 | 3,294 |
| Rancho Casa Blanca Country Club and HOA | ✓ | 14 | 0.10 | 117 | 0.21 | 8 | 435 |
| Indio Municipal Golf Course | | 40 | 0.32 | 358 | 0.64 | 8 | 1,332 |
| Terra Lago Golf Club | ✓ | 192 | 1.54 | 1,728 | 3.1 | 12 | 4,285 |
| Posse Park[2] | ✓ | 15 | 0.07 | 81 | 0.14 | 10 | 241 |
| Indio Terrace Park | | 5 | 0.02 | 25 | 0.04 | 10 | 74 |
| **Phase 1 Total** | | **389** | **3.0** | **3,416** | **6.1** | | **9,662** |
| **Phase 1A Total** | | **221** | **1.72** | **1,926** | **3.44** | | **4,962** |

Notes:

1. Reference: *Indio Water Authority Recycled Water Master Plan*, December 2011.
2. Posse Park irrigated acreage was increase from 4 acres shown in the RWMP to 15 acres based on revised estimates of the park area. Annual demand estimated at 5.4 acre-feet/acre of irrigated area per RWMP.

Table 2-2 summarizes the demand and distribution system criteria from the IWA RWMP that was used to size infrastructure.

**Table 2-2: Demand and Distribution System Criteria**

| | Units | Criteria |
|---|---|---|
| Irrigation Demand | Acre feet/acre | 5.4 |
| Max Month to Average Demand Factor | - | 1.87 |
| Max Day to Average Demand Factor | - | 2.0 |
| Required Operational Storage | % of Max Day Demand | 58% |
| Minimum Delivery Pressure | Pounds per Square Inch (PSI) | 60 |
| Maximum Velocity | Feet per Second (FPS) | 5 |

Notes:

1. Reference: *Indio Water Authority Recycled Water Master Plan*, December 2011.

## 2.2 Recycled Water Treatment, Storage and Pump Station

New recycled water treatment facilities will be required to meet California of Public Health Title 22 Disinfected Tertiary Recycled Water Requirements. At a minimum, recycled water treatment capacity is typically designed to meet maximum daily demand. Additional capacity may be provided to enhance reliability depending on customer needs. Treatment facilities will include filtration and disinfection.

Assuming treatment capacity equals to maximum daily demand, operational storage is necessary to capture recycled water flows during non-irrigation (low use) periods. The RWMP identified a need for 3.5 million gallons (MG) of operational storage capacity for the full Phase 1, while the required storage capacity for Phase 1A is approximately 2.0 MG based on 58% of max day demand per the RWMP sizing criteria. In Phase 1A, a portion of the storage should be incorporated into the distribution pump station clearwell to provide operational flexibility for treatment and distribution (i.e. allows shutdown of treatment without shutdown of distribution pump station).

A raw water pump station will convey secondary effluent to the recycled water treatment facilities. The Phase 1A raw water pump station was sized with pumps that will meet the full Phase 1 maximum daily demand. The distribution pump station is sized to meet the Phase 1A peak hour demand. Multiple pumps are envisioned to achieve minimum flow and provide unit redundancy.

Phase 1A treatment and storage capacity will be further optimized during the design of facilities as it may make sense to increase treatment capacity and reduce storage recognizing future Phase 1 demand. As Phase 1 storage of 3.5 MG will ultimately be needed, IWA will need to decide if the storage volume is met with multiple tanks or if one storage tank should be implemented.

Table 2-3 summarizes the baseline design treatment capacity needed for both Phase 1A and Phase 1 assuming sizing for max day demand and applicable storage to capture recycled water during non-irrigation periods during the day.

**Table 2-3: Phase 1A Design Criteria**

| | Units | Phase 1A | Phase 1 |
|---|---|---|---|
| Filter Design Capacity | MGD | 3.4 | 6.1 |
| Disinfection Design Capacity | MGD | 3.4 | 6.1 |
| Storage Volume | MG | 2.0 | 3.5 |
| Raw Water Pump Station | | | |
| Duty Capacity | MGD | 6.0 | 6.0 |
| No. of Pumps | | 2 duty and 0 standby[1] | 2 duty and 1 standby |
| Capacity Each Pump | MGD | 3.0 | 3.0 |
| Capacity Each Pump | GPM | 2,080 GPM | 2,080 GPM |
| Motor HP, Each | HP | 30 | 30 |
| Distribution Pump Station | | | |
| Duty Capacity | MGD | 7.2 | 7.2 |
| No. of Pumps | | 4 duty and 1 standby | 4 duty and 1 standby |
| Capacity Each Pump | MGD | 1.8 | 1.8 |
| Capacity Each Pump | GPM | 1,250 GPM | 1,250 GPM |
| Motor HP, Each | HP | 125 | 125 |

Notes:

1. Raw water pump station sizing for Phase 1A were based on Phase 1 needs. Assuming 3.0 MGD pumps would be implemented for Phase 1, two pumps are needed to deliver the 3.4 MGD Phase 1A flow. In Phase 1A, the duration of two pump operation will be minimal; therefore, typical operation will be with one pump with the second available as a backup. An additional standby pump was not included in Phase 1A to minimize project capital costs.

## 2.3 Distribution System

The Phase 1A Recycled Water Project includes the main distribution pipeline from the VSD WWTP to the Posse Park and Terra Lago Golf Course. The pipeline would be tunneled under the Coachella Valley Storm Water Channel and Highway 10 or could potentially be attached to existing roadway bridges that cross the channel and highway. The transmission line will generally travel north on Golf Course Parkway and then west along Avenue 42 to Posse Park. Service to Terra Lago Golf Course will be provided by a distribution pipeline along Terra Lago Parkway (See Figure 2-1 for the Phase 1A pipeline).

Table 2-4 summarizes the Phase 1A pipeline segment sizes and lengths. The pipelines are sized to meet the full Phase 1 demands identified in the RWMP. The pipeline sizes assume that storage is located at Indio Municipal Golf Course as identified in the RWMP.

**Figure 2-1: Phase 1A Distribution System**

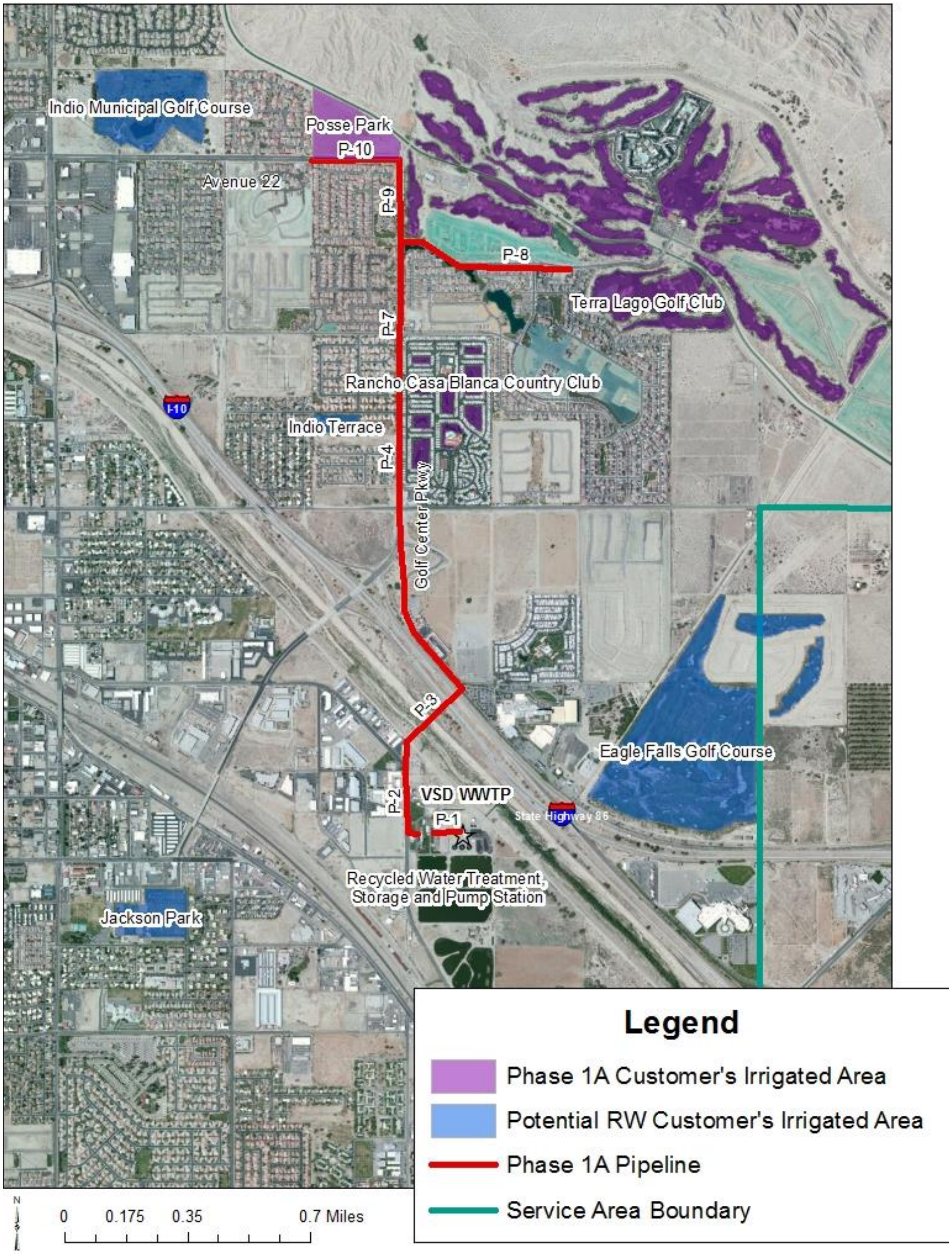


**Table 2-4: Phase 1A Pipeline Segments**

| Pipeline | Type | Description/Street | Description/Limits | New Size/Dia (IN) | Length (FT) |
|---|---|---|---|---|---|
| P-1 | Pipe | WWTP | From WWTP to Van Buren Street | 30 | 400 |
| P-2 | Pipe | Van Buren Street, Avenue 45 | From WWTP Connection to Commerce Street | 24 | 1,400 |
| P-3 | Pipe/ Casing | State Highway 10 Crossing | From Avenue 45 to Indio Springs Drive | 20 (pipe)<br>30 (casing) | 1,100 |
| P-4 | Pipe | Indio Springs Drive, Golf Center | From Indio Springs Drive to Avenue 44 | 20 | 3,100 |
| P-7 | Pipe | Golf Center Parkway | From Avenue 44 to Avenue 42 | 20 | 4,000 |
| P-8 | Pipe | Terra Lago Parkway | From Golf Center Parkway to Terra Lago Golf Course | 18 | 2,700 |
| P-9 | Pipe | Avenue 42 | From Terra Lago Parkway to Avenue 42 | 20 | 1,300 |
| P-10 | Pipe | Avenue 42 | From Golf Center Parkway to Posse Park | 20 | 1,300 |

Notes:

1. Reference: Based on Table 10 from the *Indio Water Authority Recycled Water Master Plan*, December 2011.

# 3 Estimated Cost

Conceptual level cost estimates for the Phase 1A project are based on unit costs in Table 3-1. The benchmark Engineering News Record Construction Cost Index (ENR CCI) for this estimate (June 2014) 20-Cities average is 9800.38. The cost estimate was developed for budgetary purposes for Phase 1A Project implementation and is based on available information The cost estimate includes a 20% construction contingency, a 16% allowance for engineering and construction management. Other implementation costs (i.e. administration, legal, etc.) are assumed to be covered by in-house personnel and were not included in the project estimate. The costs presented are based on conceptual-level engineering. The cost estimate is a Class 4 estimate and is expected to be within a +50% to -30% level of accuracy, as defined by the Association for the Advancement of Cost Engineering (AACE). Final costs will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, and other variable factors.

**Table 3-1: Cost Estimate Basis**

| Element | Value |
|---|---|
| Cost Estimate Date Reference | June 2014 |
| Cost Estimate Basis – Engineering News Record (ENR) 20-City Construction Cost Index (CCI) | 9800.38 |
| Financing Term | 30 years |
| Interest Rate | 3% |
| Buried Pipe Installation (open cut) | $9.00/inch diameter/lineal foot |
| Pipe Installation (Tunneling) | $17.00/in/LF |
| Jacking Pit | $100,000 each (EA) |
| Receiving Pit | $50,000 EA |
| Turnout (flow meter, isolation valve, and vault) | $30,000 EA |
| Pipeline Appurtenances | 10% of total cost |
| Pump Station Capacity (Cost Curve) | 2.3*13,185*HP^(-0.36) |
| Microfiltration | $1.30 per gallon |
| Disinfection | $0.15 per gallon |
| Treatment Electrical Allowance | 5% |
| Treatment Instrumentation and Control System Allowance | 5% |
| Pipeline Annual O&M Costs | 0.50% of installed cost |
| Equipment Annual O&M Costs (not incl. energy) | 2.0% of installed cost |
| Mechanical Annual O&M Costs | 2.0% of installed cost |
| Instrumentation Annual O&M Costs | 2.0% of installed cost |
| Operations and Maintenance Labor Rate (including benefits) | $75 per hour |
| Energy Costs | $0.15/kWh |
| Construction Contingency | 20% of Raw Construction Cost |
| Engineering and Construction Management Costs | 16% of Construction Cost |

Other cost estimate assumptions include the following:

- On-site retrofit costs are not included as that is assumed to be the responsibility of the owner. For large irrigated areas, onsite retrofit cost can range from $50,000 to $100,000 per site.
- No land acquisition costs have been included as pipelines are anticipated to be located in public right of way and treatment is assumed to be located at VSD treatment plant without additional property cost.
- O&M costs for the distribution system do not include customer costs for onsite maintenance, testing, and reporting.

Table 3-2 summarizes the estimated capital, operation and maintenance cost of the Phase 1A project.

**Table 3-2: Phase 1A Cost Estimate**

| Element | Value |
|---|---|
| **Capital** | |
| Distribution Pipelines/System | $3,470,400 |

| | |
|---|---|
| 0.5 MG Partially Buried Distribution Pump Station Clearwell | $1,250,000 |
| 1.5 MG Steel Tank | $2,700,000 |
| Treatment and Pump Stations | $7,225,000 |
| Treatment Electrical Allowance | $361,250 |
| Treatment I&C Allowance | $361,250 |
| **Raw Construction Cost** | **$15,400,000** |
| Construction Contingency (20%) | $3,100,000 |
| **Base Construction Cost** | **$18,500,000** |
| Engineering and Construction Management (16%) | $3,000,000 |
| **Total Capital Cost** | **$21,500,000** |
| | |
| **Annualized Capital Cost (3% interest, 30-year term)** | **$1,100,000** |
| | |
| **Annual Operations and Maintenance** | |
| Annual Cost of Consumables | $167,000 |
| Annual Cost of Power | $93,000 |
| Annual Cost of Chemicals | $100,000 |
| Annual Labor Costs (Two O&M staff) | $312,000 |
| **Total Annual O&M Cost** | **$672,000** |
| | |
| Total Annual Cost | $1,772,000 |
| Annual Yield | 1,926 AFY |
| **Unit Cost** | **$920/AF** |

While the useful life of infrastructure and equipment vary and are also dependent on operations and maintenance practices, the expected useful life based on an approximate average of all the components is 30 years for the project.

# 4 Implementation Plan

Major next steps for Phase 1A implementation include pursuit of grant funding, coordination with proposed customers, development of a financing plan, development of recycled water program tools, design, and construction. The tasks below summarize the upcoming efforts in greater detail. Figure 5-1 shows the implementation schedule for the project.

### Task 1: Project Administration (Funding, Outreach, Program Tools, and Partner Collaboration)

IWA and VSD have formed the East Valley Reclamation Authority, a Joint Powers Authority (JPA), to facilitate the implementation, finance, management, and operation of the recycled water program. IWA and VSD will continue to collaborate on the recycled water program including pursuing funding, defining finance plan, siting of facilities, and identifying the detailed steps needed for program implementation. The agencies plan to procure consultants as needed to assist with implementation activities such as rate studies, design, and construction management.

IWA will coordinate with recycled water customers to confirm recycled water user needs (flow rate, pressure, water quality) and identify connection locations. A recycled water use agreement will be developed with each customer defining the responsibility of the retailer and the end user. IWA will also work with customers to ensure proper onsite retrofit to prevent cross connection between potable and recycled water supplies.

The recycled water project is on the State Water Resources Control Board (SWRCB) State Revolving Fund (SRF) priority list for recycled water funding. IWA will complete and submit the formal application to the SWRCB in the coming months. The SRF application is comprised of five sections including a general information package, technical package, environmental package, financial security package, and final budget approval package.

IWA will develop recycled water program rules and regulations, a recycled water use manual, and miscellaneous recycled water program materials needed to meet Department of Public Health (DPH) requirements (service application, annual reporting template, standard details). The Watereuse Association and other agencies have development guides and standards that can be adopted by IWA to meet DPH requirements.

## Task 2: Permitting

Permits for the project will be obtained for construction of infrastructure and use of recycled water. Many of these permits are typically secured during the design process. Under a design-build approach (see Task 3), the permits are can be secured by the design-build contractor or could be secured ahead of the design-build process if adequate detail is developed in the preliminary design phase. Construction and infrastructure permits include:

- Caltrans Encroachment Permit for Highway 10 crossing
- City Encroachment Permit
- Coachella Valley  Water District (CVWD) Coachella Valley Storm Water Channel Encroachment Permit
- Union Pacific Railroad (UPRR) encroachment permit
- California Department of Fish and Game 1600 Streambed Alteration Agreement (if required)
- US Army Corp of Engineers 404 Permit for River Crossing (if required)
- Regional Water Quality Control Board (RWQCB) Section 401 Water Quality Certification (if required)
- SWRCB Notice of Intent and General Construction Activities Storm Water Permit

Recycled water use and distribution permits

- RWQCB Waste Discharge Requirements for Recycled Water Use
- Division of Water Rights approval for change in discharge location

## Task 3: Design-Build Approach

IWA plans to use a design-build approach for Phase 1A project implementation. To facilitate the design-build approach, a preliminary design will be completed to define the desired scope of work for the design build contractor. The preliminary design will define and identify treatment process, major design criteria, equipment redundancy requirements, materials of construction, available land for treatment facilities, required provisions for future treatment facilities if any, and other pertinent requirements.

The design-build contractor procurement process will include:

1) issue a request for qualification (RFQ)
2) identify top three qualified firms
3) issue request for proposal (RFP) to top three firms
4) interview of top firm(s)
5) selection for design-build contractor
6) contract negotiation
7) council contract award

In a design-build approach, design and construction will overlap. Following council award and notice to proceed, the contractor will initiate required field investigations, design of the facilities, and required permitting steps. Once adequate design details have been set and construction permitting is secured, the construction team will mobilize and site preparation will be initiated. As design is completed for portions of the system, construction will commence on the designed element. Follow construction completion, the contractor will be required to demonstrate performance and proper operation of the treatment facilities and to provide training of operations and maintenance staff. Finally, the recycled water facility will be commissioned and recycled water service will commence.

The construction management team will be responsible for tracking construction activities, managing construction documentation, inspection, ensuring the design-build team meets requirements of the contract, confirming labor compliance, and confirming permit/regulatory compliance. Construction management may be provided by one of the agencies or could be contracted to a consulting firm.

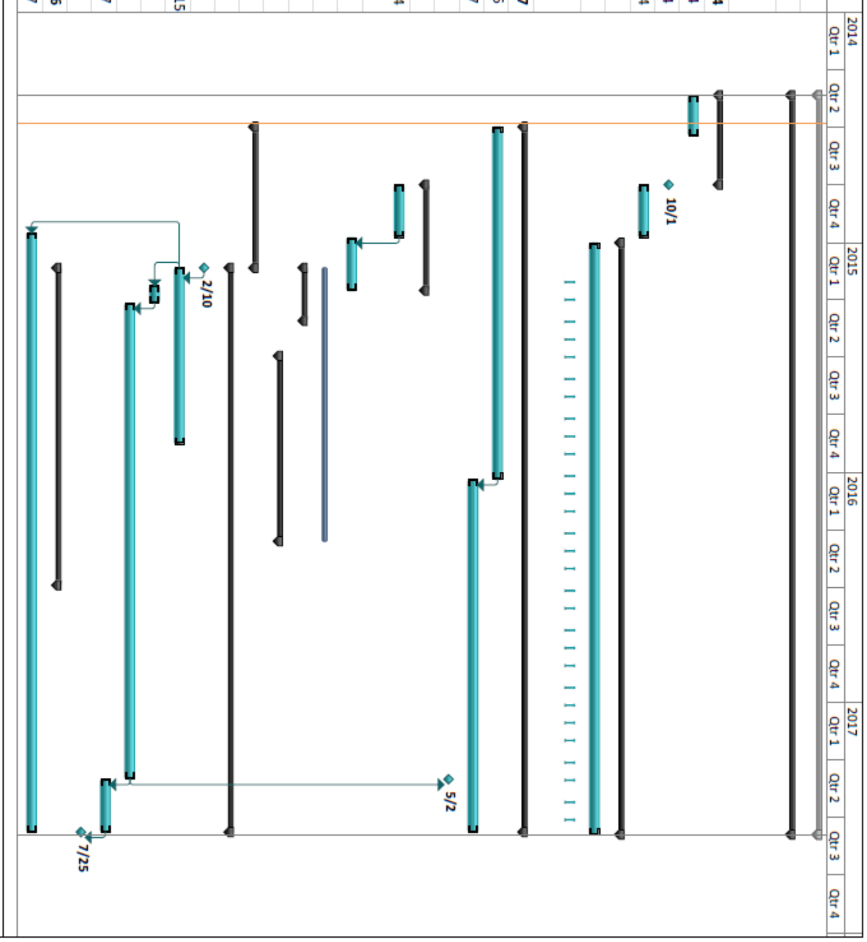
# 5 References

Carollo Engineers, *Indio Water Authority Recycled Water Master Plan*, December 2011.

Tom Dodson and Associates, *Environmental Impact Report for Indio Water Authority Recycled Water Project*, December 2011.

# Figure 5-1: Implementation Schedule

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 0 | **IWA Phase 1A Recycled Water Project** | **840 days?** | **Mon 5/12/14** | **Fri 7/28/17** |
| 1 | **1 Project Adminstration** | **840 days?** | **Mon 5/12/14** | **Fri 7/28/17** |
| 2 | 1.1 Established East Valley Reclamation Authority JPA (Completed) | | | |
| 3 | **1.2 IRWMP Funding** | **102 days** | **Mon 5/12/14** | **Wed 10/1/14** |
| 4 | 1.2.1 IRWMP Funding Pursuit | 2.3 mons | Mon 5/12/14 | Mon 7/14/14 |
| 5 | 1.2.2 IRWMP Award Notification | 0 days | Wed 10/1/14 | Wed 10/1/14 |
| 6 | 1.3 SRF Application | 3 mons | Wed 10/1/14 | Tue 12/23/14 |
| 7 | **1.4 Reporting** | **672 days** | **Thu 1/1/15** | **Fri 7/28/17** |
| 8 | 1.4.1 Quarterly Updates for DWR | 672 days | Thu 1/1/15 | Fri 7/28/17 |
| 9 | **1.4.2 Monthly Progress Report and Reimbursement Request for SRF** | **611 days** | **Wed 3/4/15** | **Wed 7/5/17** |
| 39 | **1.5 Customer and Public Outreach** | **800 days** | **Tue 7/1/14** | **Mon 7/24/17** |
| 40 | 1.5.1 Customer Coordination | 20 mons | Tue 7/1/14 | Mon 1/11/16 |
| 41 | 1.5.2 Customer Agreements | 20 mons | Tue 1/12/16 | Mon 7/24/17 |
| 42 | 1.5.3 Site Supervisor Training | 0 days | Tue 5/2/17 | Tue 5/2/17 |
| 43 | **1.6 Rate Study and Assessment District Evaluation** | **120 days** | **Wed 10/1/14** | **Tue 3/17/15** |
| 44 | 1.6.1 Procure Consultant for Rate Study, Connection Fee Evaluation, and Assessment District | 3 mons | Wed 10/1/14 | Tue 12/23/14 |
| 45 | 1.6.2 Rate Study and Assessment District | 3 mons | Wed 12/24/14 | Tue 3/17/15 |
| 46 | **2 Permitting** | | | |
| 47 | **2.1 Construction Permits** | **60 days** | **Tue 2/10/15** | **Mon 5/4/15** |
| 53 | **2.2 RWQCB WDR for Recycled Water Use** | **210 days** | **Tue 6/30/15** | **Tue 4/19/16** |
| 61 | **3 Design Build Contractor Procurement** | **160 days** | **Tue 7/1/14** | **Tue 2/10/15** |
| 79 | **4 Design Build** | **640 days** | **Tue 2/10/15** | **Tue 7/25/17** |
| 80 | 4.1 NTP | 0 days | Tue 2/10/15 | Tue 2/10/15 |
| 81 | 4.2 Design | 10 mons | Tue 2/10/15 | Mon 11/16/15 |
| 82 | 4.3 Mobilization | 1 mon | Tue 3/10/15 | Mon 4/6/15 |
| 83 | 4.4 Construction | 27 mons | Tue 4/7/15 | Mon 5/1/17 |
| 84 | 4.5 Startup and Training | 3 mons | Tue 5/2/17 | Mon 7/24/17 |
| 85 | 4.6 Facility Commissioned | 0 days | Tue 7/25/17 | Tue 7/25/17 |
| 86 | **5 Environmental Compliance / Mitigation / Enhancement** | **360 days?** | **Tue 2/10/15** | **Mon 6/27/16** |
| 89 | **6 Construction Management** | **34 mons** | **Tue 12/16/14** | **Mon 7/24/17** |




Project: IWA Phase 1A Recycled Water Project
Date: Thu 6/26/14

Task; Split; Milestone; Summary; Project Summary; External Tasks; External Milestone; Inactive Task; Inactive Milestone; Inactive Summary; Manual Task; Duration-only; Manual Summary Rollup; Manual Summary; Start-only; Finish-only; Deadline; Progress

Page 1

# Appendix A – Detailed Cost Estimate

| | | | |
|---|---|---|---|
| **Project:** | **IWA Phase 1A Recycled Water Project** | Date: | June 30, 2014 |
| **Component:** | **1,930 AFY (Terra Lago GC, Posse Park, Rancho Casa Blanca)** | Project Number: | 574-002 |
| | | Prepared by: | MN |
| | | Checked by: | RMB |
| Estimate Type: | Conceptual Design | | |

**Process Cost Summary by Division**

| Spec. Division | | Subtotal | Notes |
|---|---|---|---|
| 2 - Sitework | | $ 3,470,400 | |
| 3 - Concrete | | $ 1,250,000 | |
| 5 - Metals | | $ 2,700,000 | |
| 11 - Equipment | | $ 7,225,000 | |
| 15 - Mechanical | | $ - | |
| 16 - Electrical | | $ 361,250 | |
| 17- I&C | | $ 361,250 | |
| **RAW CONSTRUCTION COST** | | **$ 15,400,000** | |
| **Construction Contingency** | 20% | $ 3,100,000 | |
| **BASE CONSTRUCTION COST** | | **$ 18,500,000** | |
| **Implementation (Design and CM)** | 16% | $ 3,000,000 | |
| **TOTAL PROJECT COST** | | **$ 21,500,000** | |

| Spec. Division | Item | Size | Units | Quantity | Unit | Unit Cost | Total Cost | Notes |
|---|---|---|---|---|---|---|---|---|
| **2 - Sitework** | | | | | | | **$ 3,470,400** | |
| | P-1 Pipe | 30 | in | 400 | LF | $ 270.00 | $ 108,000 | |
| | P-2 Pipe | 24 | in | 1,400 | LF | $ 216.00 | $ 302,400 | |
| | P-3 Pipe | 24 | in | 1,100 | LF | $ 216.00 | $ 237,600 | |
| | P-3 Jack and Boı | 30 | in | 1,100 | LF | $ 510.00 | $ 561,000 | |
| | P-4 Pipe | 20 | in | 3,100 | LF | $ 180.00 | $ 558,000 | |
| | P-7 Pipe | 20 | in | 4,000 | LF | $ 180.00 | $ 720,000 | |
| | P-8 Pipe | 18 | in | 2,700 | LF | $ 162.00 | $ 437,400 | |
| | P-9 Pipe | 20 | in | 1,200 | LF | $ 180.00 | $ 216,000 | |
| | Turnout Connections | | | 3 | EA | $ 10,000.00 | $ 30,000 | |
| | Jacking Pit | | | 2 | LS | $ 100,000.00 | $ 200,000 | |
| | Receiving Pit | | | 2 | LS | $ 50,000.00 | $ 100,000 | |
| | | | | | | | $ - | |
| **3 - Concrete** | | | | | | | **$ 1,250,000** | |
| | Below Grade Storage Tank with Dist. P! | | | 500,000 | Gals | $ 2.5 | $ 1,250,000 | |
| | | | | | | | $ - | |
| **5 - Metals** | | | | | | | **$ 2,700,000** | |
| | Above Grade Steel Storage Tank | | | 1500000 | Gals | $ 1.8 | $ 2,700,000 | |
| | | | | | | | $ - | |
| **11 - Equipment** | | | | | | | **$ 7,225,000** | |
| | Raw Water Pump Station | | | 60 | hp | $ 7,000 | $ 420,000 | |
| | Microfiltration | | | 3.4 | mgd | $ 1,300,000 | $ 4,420,000 | |
| | Disinfection | | | 3.4 | mgd | $ 150,000 | $ 510,000 | |
| | Distribution Pump Station | | | 625 | hp | $ 3,000 | $ 1,875,000 | |
| | | | | | | | $ - | |
| **15 - Mechanical** | | | | | | | **$ -** | |
| | | | | | | | $ - | |
| | | | | | | | $ - | |
| **16 - Electrical** | | | | | | | **$ 361,250** | |
| | | | | | | | $ - | |
| Electrical Allowance | 5% of Division 11 (Equipment) | | | | | 5% | $ 361,250.00 | |
| **17 - I&C** | | | | | | | **$ 361,250** | |
| I&C Allowance | 5% of Division 11 (Equipment) | | | | | 5% | $ 361,250 | |

| **EASEMENT ACQUISITION** | | | | | | | **Total Cost** |
|---|---|---|---|---|---|---|---|
| | **Item** | **Size** | **Units** | **Quantity** | **Unit** | **Unit Cost** | **$ -** |
| | | | | | | | $ - |
| | | | | | | | $ - |
| | | | | | | | $ - |
| | | | | | | | $ - |

| **ANNUAL O&M COSTS** | | **Amount** | **Unit** | **Value** | **Cost** | |
|---|---|---|---|---|---|---|
| **Consumables** | | | | Total Consumables | **$ 167,000** | |
| | Pipeline | $ 3,140,400 | | 0.5% | $ 15,702 | |
| | Equipment Consumables | $ 7,225,000 | | 2% | $ 144,500 | 2% of Equipment |
| | Mechanical Consumables | $ - | | 2% | $ - | 2% of Mechanical |
| | Instrumentation Consumables | $ 361,250 | | 2% | $ 7,225 | 2% of Instrumentation |
| **Power Costs** | | | | Total Power | **$93,000** | |
| | | | kWh | 618,625 | | |
| | | | Annual Cost | | $92,794 | |
| **Chemicals** | | | | Total Chemicals | **$ 100,000** | |
| | Chemicals Allowance | 1 | LS | $ 100,000 | $ 100,000 | |
| | | | | | $ - | |
| **Labor Costs** | | | | Total Labor | $ 312,000 | |
| | Total # Operators | 2 | number | | | |
| | Average Annual Hours per operator | 2080 | hrs/yr | | | |
| | Total Operators per year | 4160 | Total hrs | $ 75 | **$ 312,000** | |
| | **TOTAL ANNUAL O&M COSTS** | | | | **$ 672,000** | |

# Appendix B – Cost Estimates for Alternate Options

**Project:** Indio Water Authority Recycled Water Project Development

**Component:** Option 3 - 1,220 AFY (Eagle Falls GC and Rancho Casa Blanca)

Date: June 2, 2014
Project Number: 574-002
Prepared by:

Estimate Type: Conceptual Design

**Process Cost Summary by Division**

| Spec. Division | | | Subtotal | Notes |
|---|---|---|---|---|
| 2 - Sitework | | | $ 2,734,380 | |
| 3 - Concrete | | | $ 3,250,000 | |
| 5 - Metals | | | $ - | |
| 11 - Equipment | | | $ 5,260,000 | |
| 15 - Mechanical | | | $ - | |
| 16 - Electrical | | | $ 263,000 | |
| 17- I&C | | | $ 263,000 | |
| | | **RAW CONSTRUCTION COST** | **$ 11,770,380** | |
| **Construction Contingency** | | 20% | $ 2,354,076 | |
| | | **BASE CONSTRUCTION COST** | **$ 14,124,456** | |
| **Implementation (Program Management, Design, CEQA, Legal, CM)** | | 16% | $ 2,259,913 | |
| | | **TOTAL PROJECT COST** | $ 16,384,369 | |

| Spec. Division | Item | Size | Units | Quantity | Unit | | Unit Cost | Total Cost | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **2 - Sitework** | | | | | | | | **$ 2,734,380** | |
| | P-1 Pipe | 30 | in | 400 | LF | $ | 270.00 | $ 108,000 | |
| | P-2 Pipe | 24 | in | 1,400 | LF | $ | 216.00 | $ 302,400 | |
| | P-3 Pipe | 24 | in | 1,100 | LF | $ | 216.00 | $ 237,600 | |
| | P-3 Jack and Bor | 30 | in | 1,100 | LF | $ | 510.00 | $ 561,000 | |
| | P-4 Pipe | 20 | in | 3,100 | LF | $ | 180.00 | $ 558,000 | |
| | P-5 Pipe | 18 | in | 2,900 | LF | $ | 162.00 | $ 469,800 | |
| | Turnout Connections | | | 3 | EA | $ | 10,000.00 | $ 30,000 | |
| | Jacking Pit | | | 2 | LS | $ | 100,000.00 | $ 200,000 | |
| | Receiving Pit | | | 2 | LS | $ | 50,000.00 | $ 100,000 | |
| | Pipeline Appurtenances | | | $ 1,675,800 | | | 10% | $ 167,580 | |
| | | | | | | | | $ - | |
| | | | | | | | | $ - | |
| **3 - Concrete** | | | | | | | | **$ 3,250,000** | |
| | Below Grade Storage Tank with Dist. PS | | | 1,300,000 | Gals | $ | 2.5 | $ 3,250,000 | |
| | | | | | | | | $ - | |
| **5 - Metals** | | | | | | | | **$ -** | |
| | | | | | | | | $ - | |
| | | | | | | | | $ - | |
| | | | | | | | | $ - | |
| **11 - Equipment** | | | | | | | | **$ 5,260,000** | |
| | Raw Water Pump Station | | | 60 | hp | $ | 7,000 | $ 420,000 | |
| | Microfiltration | | | 2.2 | mgd | $ | 1,300,000 | $ 2,860,000 | |
| | Disinfection | | | 2.2 | mgd | $ | 150,000 | $ 330,000 | |
| | Distribution Pump Station | | | 500 | hp | $ | 3,300 | $ 1,650,000 | 13,185*HP^(-0.36) |
| | | | | | | | | $ - | |
| | | | | | | | | $ - | |
| | | | | | | | | $ - | |
| **15 - Mechanical** | | | | | | | | **$ -** | |
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| **16 - Electrical** | | | | | | | | **$ 263,000** | |
| | | | | | | | | $ - | |
| Electrical Allowance | 5% of Division 11 (Equipment) | | | | | | 5% | $ 263,000.00 | |
| **17 - I&C** | | | | | | | | **$ 263,000** | |
| I&C Allowance | 5% of Division 11 (Equipment) | | | | | | 5% | $ 263,000 | |

**EASEMENT ACQUISITION**

| | Item | Size | Units | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|---|---|---|
| | | | | | | | **$ -** |
| | | | | | | | $ - |
| | | | | | | | $ - |
| | | | | | | | $ - |
| | | | | | | | $ - |

**ANNUAL O&M COSTS**

| | | Amount | Unit | Value | Cost | |
|---|---|---|---|---|---|---|
| **Consumables** | | | | Total Consumables | **$ 121,644** | |
| | Pipeline | $ 2,236,800 | | 0.5% | $ 11,184 | |
| | Equipment Consumables | $ 5,260,000 | | 2% | $ 105,200 | 2% of Equipment |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Mechanical Consumables | $ - | | | 2% | $ | - | 2% of Mechanical |
| | Instrumentation Consumables | $ 263,000 | | | 2% | $ | 5,260 | 2% of Instrumentation |
| **Power Costs** | | | | | Total Power | | **$92,794** | |
| | | | kWh | | 618,625 | | | |
| | | | Annual Cost | | | | $92,794 | |
| | | | Horsepower | | | | | |
| | | | Hours per year operation | | | | | |
| | | | Annual Cost | | | | $0 | |
| **Chemicals** | | | | | Total Chemicals | **$** | **100,000** | |
| | Chemicals Allowance | 1 | LS | $ | 100,000 | $ | 100,000 | |
| | | | | | | $ | - | |
| | | | | | | $ | - | |
| **Labor Costs** | | | | | Total Labor | $ | 312,000 | |
| | Total # Operators | 2 | number | | | | | |
| | Average Annual Hours per operator | 2080 | hrs/yr | | | | | |
| | Total Operators per year | 4160 | Total hrs | $ | 75 | **$** | **312,000** | |
| | | | **TOTAL ANNUAL O&M COSTS** | | | **$** | **626,438** | |

**Project:** Indio Water Authority Recycled Water Project Development

Date: June 2, 2014
Project Number: 0057-007.02

**Component:** Option 1 - 560 AFY (Indio Municipal GC, Posse Park, Rancho Casa Blanca)

Prepared by:

Estimate Type: Conceptual Design

**Process Cost Summary by Division**

| Spec. Division | | Subtotal | Notes |
|---|---|---|---|
| 2 - Sitework | | $ 3,999,600 | |
| 3 - Concrete | | $ 1,500,000 | |
| 5 - Metals | | $ - | |
| 11 - Equipment | | $ 3,008,000 | |
| 15 - Mechanical | | $ - | |
| 16 - Electrical | | $ 150,400 | |
| 17- I&C | | $ 150,400 | |
| | **RAW CONSTRUCTION COST** | **$ 8,808,400** | |
| **Construction Contingency** | 20% | $ 1,761,680 | |
| | **BASE CONSTRUCTION COST** | **$ 10,570,080** | |
| **Implementation (Program Management, Design, CEQA, Legal, CM)** | 16% | $ 1,691,213 | |
| | **TOTAL PROJECT COST** | $ 12,261,293 | |

| Spec. Division | Item | Size | Units | Quantity | Unit | Unit Cost | Total Cost | Notes |
|---|---|---|---|---|---|---|---|---|
| **2 - Sitework** | | | | | | | **$ 3,999,600** | |
| | P-1 Pipe | 30 | in | 400 | LF | $ 270.00 | $ 108,000 | |
| | P-2 Pipe | 24 | in | 1400 | LF | $ 216.00 | $ 302,400 | |
| | P-3 Pipe | 24 | in | 1100 | LF | $ 216.00 | $ 237,600 | |
| | P-3 Jack and Bor | 30 | in | 1100 | LF | $ 510.00 | $ 561,000 | |
| | P-4 Pipe | 20 | in | 3100 | LF | $ 180.00 | $ 558,000 | |
| | P-7 Pipe | 20 | in | 4000 | LF | $ 180.00 | $ 720,000 | |
| | P-9 Pipe | 20 | in | 1200 | LF | $ 180.00 | $ 216,000 | |
| | P-10 Pipe | 20 | in | 1300 | LF | $ 180.00 | $ 234,000 | |
| | P-11 Pipe | 20 | in | 2500 | LF | $ 180.00 | $ 450,000 | |
| | Turnout Connections | | | 3 | EA | $ 10,000.00 | $ 30,000 | |
| | Jacking Pit | | | 2 | LS | $ 100,000.00 | $ 200,000 | |
| | Receiving Pit | | | 2 | LS | $ 50,000.00 | $ 100,000 | |
| | Pipeline Appurtenances | | | $ 2,826,000 | | 10% | $ 282,600 | |
| | | | | | | | $ - | |
| | | | | | | | $ - | |
| **3 - Concrete** | | | | | | | **$ 1,500,000** | |
| | Storage Tank | | | 600,000 | Gals | $ 3 | $ 1,500,000 | |
| | | | | | | | $ - | |
| | | | | | | | $ - | |
| **5 - Metals** | | | | | | | **$ -** | |
| | | | | | | | $ - | |
| | | | | | | | $ - | |
| | | | | | | | $ - | |
| **11 - Equipment** | | | | | | | **$ 3,008,000** | |
| | Raw Water Pump Station | | | 20 | hp | $ 10,400 | $ 208,000 | |
| | Microfiltration | | | 1 | mgd | $ 1,300,000 | $ 1,300,000 | |
| | Disinfection | | | 1 | mgd | $ 150,000 | $ 150,000 | |
| | Distribution Pump Station | | | 375 | hp | $ 3,600 | $ 1,350,000 | 13,185*HP^(-0.36) |
| | | | | | | | $ - | |
| | | | | | | | $ - | |
| | | | | | | | $ - | |
| **15 - Mechanical** | | | | | | | **$ -** | |
| | | | | | | | $ - | |
| | | | | | | | $ - | |
| | | | | | | | $ - | |
| | | | | | | | $ - | |
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| | | | | | | | $ - | |
| | | | | | | | $ - | |
| | | | | | | | $ - | |
| **16 - Electrical** | | | | | | | **$ 150,400** | |
| | | | | | | | $ - | |
| Electrical Allowance | 5% of Division 11 (Equipment) | | | | | 5% | $ 150,400 | |
| **17 - I&C** | | | | | | | **$ 150,400** | |
| I&C Allowance | 5% of Division 11 (Equipment) | | | | | 5% | $ 150,400 | |

**EASEMENT ACQUISITION**

| Item | Size | Units | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|---|---|
| | | | | | | **$ -** |
| | | | | | | $ - |
| | | | | | | $ - |
| | | | | | | $ - |
| | | | | | | $ - |

| ANNUAL O&M COSTS | | Amount | Unit | Value | Cost | |
|---|---|---|---|---|---|---|
| **Consumables** | | | | Total Consumables | **$ 80,103** | |
| | Pipeline | $ 3,387,000 | | 0.5% | $ 16,935 | |
| | Equipment Consumables | $ 3,008,000 | | 2% | $ 60,160 | 2% of Equipment |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Mechanical Consumables | $ - | | | 2% | $ | - | 2% of Mechanical |
| | Instrumentation Consumables | $ 150,400 | | | 2% | $ | 3,008 | 2% of Instrumentation |
| **Power Costs** | | | | | Total Power | | **$26,225** | |
| | | | kWh | | 174,831 | | | |
| | | | Annual Cost | | | | $26,225 | |
| | | | Horsepower | | | | | |
| | | | Hours per year operation | | | | | |
| | | | Annual Cost | | | | $0 | |
| **Chemicals** | | | | | Total Chemicals | **$** | **50,000** | |
| | Chemicals Allowance | 1 | LS | $ | 50,000 | $ | 50,000 | |
| | | | | | | $ | - | |
| | | | | | | $ | - | |
| **Labor Costs** | | | | | Total Labor | $ | 312,000 | |
| | Total # Operators | 2 | number | | | | | |
| | Average Annual Hours per operator | 2080 | hrs/yr | | | | | |
| | Total Operators per year | 4160 | Total hrs | $ | 75 | **$** | **312,000** | |
| | | | **TOTAL ANNUAL O&M COSTS** | | | **$** | **468,328** | |

# Technical Support Document: -
# Social Cost of Carbon for Regulatory Impact Analysis -
# Under Executive Order 12866 -

**Interagency Working Group on Social Cost of Carbon, United States Government**

**With participation by**

Council of Economic Advisers
Council on Environmental Quality
Department of Agriculture
Department of Commerce
Department of Energy
Department of Transportation
Environmental Protection Agency
National Economic Council
Office of Energy and Climate Change
Office of Management and Budget
Office of Science and Technology Policy
Department of the Treasury

**February 2010**

## Executive Summary

Under Executive Order 12866, agencies are required, to the extent permitted by law, "to assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs." The purpose of the "social cost of carbon" (SCC) estimates presented here is to allow agencies to incorporate the social benefits of reducing carbon dioxide ($CO_2$) emissions into cost-benefit analyses of regulatory actions that have small, or "marginal," impacts on cumulative global emissions. The estimates are presented with an acknowledgement of the many uncertainties involved and with a clear understanding that they should be updated over time to reflect increasing knowledge of the science and economics of climate impacts.

The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change.

This document presents a summary of the interagency process that developed these SCC estimates. Technical experts from numerous agencies met on a regular basis to consider public comments, explore the technical literature in relevant fields, and discuss key model inputs and assumptions. The main objective of this process was to develop a range of SCC values using a defensible set of input assumptions grounded in the existing scientific and economic literatures. In this way, key uncertainties and model differences transparently and consistently inform the range of SCC estimates used in the rulemaking process.

The interagency group selected four SCC values for use in regulatory analyses. Three values are based on the average SCC from three integrated assessment models, at discount rates of 2.5, 3, and 5 percent. The fourth value, which represents the 95$^{th}$ percentile SCC estimate across all three models at a 3 percent discount rate, is included to represent higher-than-expected impacts from temperature change further out in the tails of the SCC distribution.

**Social Cost of $CO_2$, 2010 – 2050 (in 2007 dollars)**

| Discount Rate<br>Year | 5%<br>Avg | 3%<br>Avg | 2.5%<br>Avg | 3%<br>95th |
|---|---|---|---|---|
| 2010 | 4.7 | 21.4 | 35.1 | 64.9 |
| 2015 | 5.7 | 23.8 | 38.4 | 72.8 |
| 2020 | 6.8 | 26.3 | 41.7 | 80.7 |
| 2025 | 8.2 | 29.6 | 45.9 | 90.4 |
| 2030 | 9.7 | 32.8 | 50.0 | 100.0 |
| 2035 | 11.2 | 36.0 | 54.2 | 109.7 |
| 2040 | 12.7 | 39.2 | 58.4 | 119.3 |
| 2045 | 14.2 | 42.1 | 61.7 | 127.8 |
| 2050 | 15.7 | 44.9 | 65.0 | 136.2 |

## I. Monetizing Carbon Dioxide Emissions

The "social cost of carbon" (SCC) is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services. We report estimates of the social cost of carbon in dollars per metric ton of carbon dioxide throughout this document.[1]

When attempting to assess the incremental economic impacts of carbon dioxide emissions, the analyst faces a number of serious challenges. A recent report from the National Academies of Science (NRC 2009) points out that any assessment will suffer from uncertainty, speculation, and lack of information about (1) future emissions of greenhouse gases, (2) the effects of past and future emissions on the climate system, (3) the impact of changes in climate on the physical and biological environment, and (4) the translation of these environmental impacts into economic damages. As a result, any effort to quantify and monetize the harms associated with climate change will raise serious questions of science, economics, and ethics and should be viewed as provisional.

Despite the serious limits of both quantification and monetization, SCC estimates can be useful in estimating the social benefits of reducing carbon dioxide emissions. Under Executive Order 12866, agencies are required, to the extent permitted by law, "to assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs." The purpose of the SCC estimates presented here is to make it possible for agencies to incorporate the social benefits from reducing carbon dioxide emissions into cost-benefit analyses of regulatory actions that have small, or "marginal," impacts on cumulative global emissions. Most federal regulatory actions can be expected to have marginal impacts on global emissions.

For such policies, the benefits from reduced (or costs from increased) emissions in any future year can be estimated by multiplying the change in emissions in that year by the SCC value appropriate for that year. The net present value of the benefits can then be calculated by multiplying each of these future benefits by an appropriate discount factor and summing across all affected years. This approach assumes that the marginal damages from increased emissions are constant for small departures from the baseline emissions path, an approximation that is reasonable for policies that have effects on emissions that are small relative to cumulative global carbon dioxide emissions. For policies that have a large (non-marginal) impact on global cumulative emissions, there is a separate question of whether the SCC is an appropriate tool for calculating the benefits of reduced emissions; we do not attempt to answer that question here.

An interagency group convened on a regular basis to consider public comments, explore the technical literature in relevant fields, and discuss key inputs and assumptions in order to generate SCC estimates. Agencies that actively participated in the interagency process include the Environmental Protection

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[1] In this document, we present all values of the SCC as the cost per metric ton of $CO_2$ emissions. Alternatively, one could report the SCC as the cost per metric ton of carbon emissions. The multiplier for translating between mass of $CO_2$ and the mass of carbon is 3.67 (the molecular weight of $CO_2$ divided by the molecular weight of carbon = 44/12 = 3.67).

Table 4 shows the four selected SCC values in five year increments from 2010 to 2050. Values for 2010, 2020, 2040, and 2050 are calculated by first combining all outputs (10,000 estimates per model run) from all scenarios and models for a given discount rate. Values for the years in between are calculated using a simple linear interpolation.

**Table 4: Social Cost of $CO_2$, 2010 – 2050 (in 2007 dollars)**

| Discount Rate<br>Year | 5%<br>Avg | 3%<br>Avg | 2.5%<br>Avg | 3%<br>95th |
|---|---|---|---|---|
| 2010 | 4.7 | 21.4 | 35.1 | 64.9 |
| 2015 | 5.7 | 23.8 | 38.4 | 72.8 |
| 2020 | 6.8 | 26.3 | 41.7 | 80.7 |
| 2025 | 8.2 | 29.6 | 45.9 | 90.4 |
| 2030 | 9.7 | 32.8 | 50.0 | 100.0 |
| 2035 | 11.2 | 36.0 | 54.2 | 109.7 |
| 2040 | 12.7 | 39.2 | 58.4 | 119.3 |
| 2045 | 14.2 | 42.1 | 61.7 | 127.8 |
| 2050 | 15.7 | 44.9 | 65.0 | 136.2 |

The SCC increases over time because future emissions are expected to produce larger incremental damages as physical and economic systems become more stressed in response to greater climatic change. Note that this approach allows us to estimate the growth rate of the SCC directly using DICE, PAGE, and FUND rather than assuming a constant annual growth rate as was done for the interim estimates (using 3 percent). This helps to ensure that the estimates are internally consistent with other modeling assumptions. Table 5 illustrates how the growth rate for these four SCC estimates varies over time. The full set of annual SCC estimates between 2010 and 2050 is reported in the Appendix.

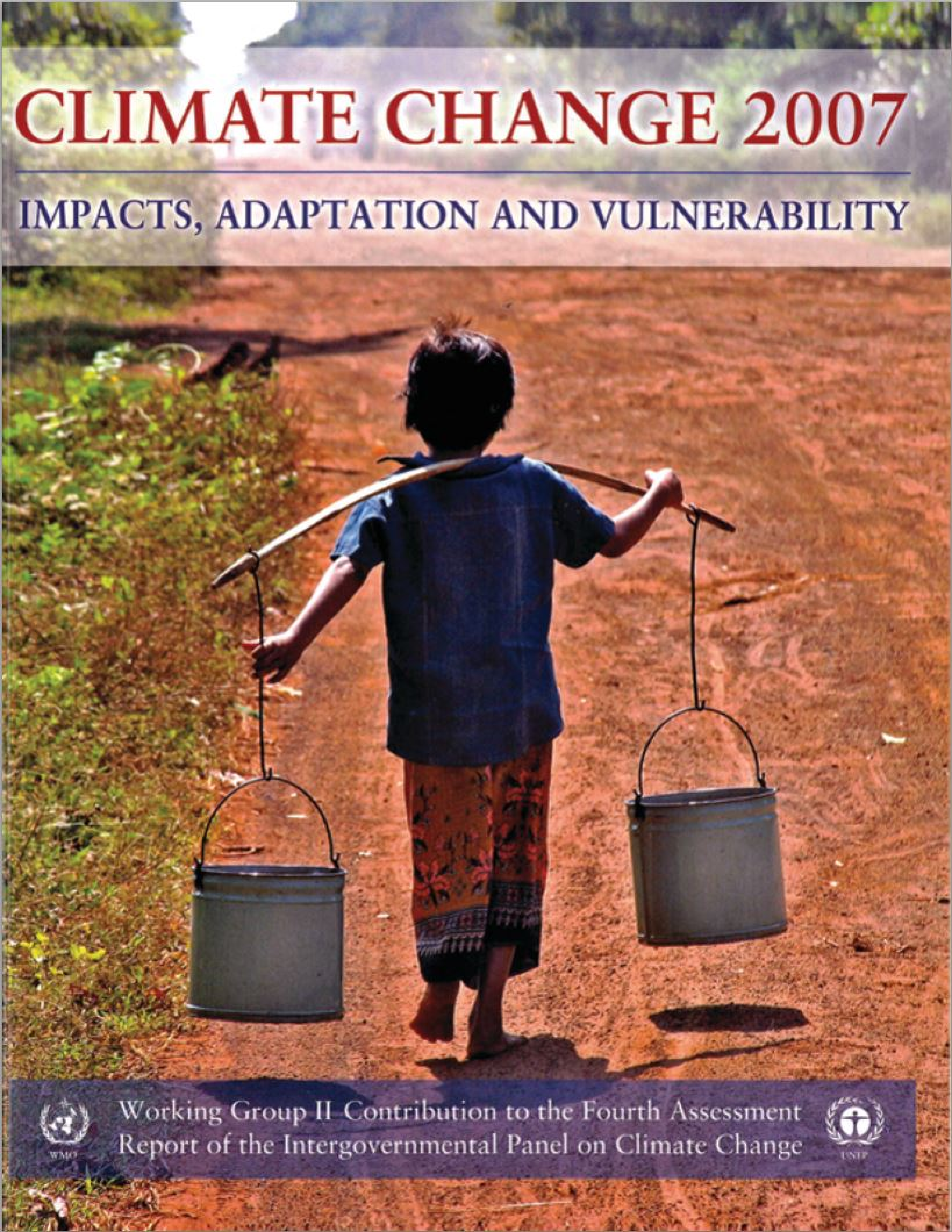
**Table 5: Changes in the Average Annual Growth Rates of SCC Estimates between 2010 and 2050**

| Average Annual Growth Rate (%) | **5%**<br>Avg | **3%**<br>Avg | **2.5%**<br>Avg | **3.0%**<br>95th |
|---|---|---|---|---|
| 2010-2020 | 3.6% | 2.1% | 1.7% | 2.2% |
| 2020-2030 | 3.7% | 2.2% | 1.8% | 2.2% |
| 2030-2040 | 2.7% | 1.8% | 1.6% | 1.8% |
| 2040-2050 | 2.1% | 1.4% | 1.1% | 1.3% |

While the SCC estimate grows over time, the future monetized value of emissions reductions in each year (the SCC in year *t* multiplied by the change in emissions in year *t*) must be discounted to the present to determine its total net present value for use in regulatory analysis. Damages from future emissions should be discounted at the same rate as that used to calculate the SCC estimates themselves to ensure internal consistency—i.e., future damages from climate change, whether they result from emissions today or emissions in a later year, should be discounted using the same rate. For example,

# CLIMATE CHANGE 2007

## IMPACTS, ADAPTATION AND VULNERABILITY



Working Group II Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

WMO

UNEP

**Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change**

# Summary for Policymakers

*This summary, approved in detail at the Eighth Session of IPCC Working Group II (Brussels, Belgium, 2-5 April 2007), represents the formally agreed statement of the IPCC concerning the sensitivity, adaptive capacity and vulnerability of natural and human systems to climate change, and the potential consequences of climate change.*


## Drafting Authors:

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## This Summary for Policymakers should be cited as:

IPCC, 2007: Summary for Policymakers. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 7-22.

**Impacts due to altered frequencies and intensities of extreme weather, climate and sea-level events are very likely to change.**

Since the IPCC Third Assessment, confidence has increased that some weather events and extremes will become more frequent, more widespread and/or more intense during the 21st century; and more is known about the potential effects of such changes. A selection of these is presented in Table SPM.1.

The direction of trend and likelihood of phenomena are for IPCC SRES projections of climate change.

**Some large-scale climate events have the potential to cause very large impacts, especially after the 21st century.**

Very large sea-level rises that would result from widespread deglaciation of Greenland and West Antarctic ice sheets imply major changes in coastlines and ecosystems, and inundation of low-lying areas, with greatest effects in river deltas. Relocating populations, economic activity, and infrastructure would be costly and challenging. There is medium confidence that at least partial deglaciation of the Greenland ice sheet, and possibly the West Antarctic ice sheet, would occur over a period of time ranging from centuries to millennia for a global average temperature increase of 1-4°C (relative to 1990-2000), causing a contribution to sea-level rise of 4-6 m or more. The complete melting of the Greenland ice sheet and the West Antarctic ice sheet would lead to a contribution to sea-level rise of up to 7 m and about 5 m, respectively [Working Group I Fourth Assessment 6.4, 10.7; Working Group II Fourth Assessment 19.3].

Based on climate model results, it is very unlikely that the Meridional Overturning Circulation (MOC) in the North Atlantic will undergo a large abrupt transition during the 21st century. Slowing of the MOC during this century is very likely, but temperatures over the Atlantic and Europe are projected to increase nevertheless, due to global warming. Impacts of large-scale and persistent changes in the MOC are likely to include changes to marine ecosystem productivity, fisheries, ocean carbon dioxide uptake, oceanic oxygen concentrations and terrestrial vegetation [Working Group I Fourth Assessment 10.3, 10.7; Working Group II Fourth Assessment 12.6, 19.3].

**Impacts of climate change will vary regionally but, aggregated and discounted to the present, they are very likely to impose net annual costs which will increase over time as global temperatures increase.**

This Assessment makes it clear that the impacts of future climate change will be mixed across regions. For increases in global mean temperature of less than 1-3°C above 1990 levels, some impacts are projected to produce benefits in some places and some sectors, and produce costs in other places and other sectors. It is, however, projected that some low-latitude and polar regions will experience net costs even for small increases in temperature. It is very likely that all regions will experience either declines in net benefits or increases in net costs for increases in temperature greater than about 2-3°C [9.ES, 9.5, 10.6, T10.9, 15.3, 15.ES]. These observations confirm evidence reported in the Third Assessment that, while developing countries are expected to experience larger percentage losses, global mean losses could be 1-5% GDP for 4°C of warming [F20.3].

Many estimates of aggregate net economic costs of damages from climate change across the globe (i.e., the social cost of carbon (SCC), expressed in terms of future net benefits and costs that are discounted to the present) are now available. Peer-reviewed estimates of the SCC for 2005 have an average value of US$43 per tonne of carbon (i.e., US$12 per tonne of carbon dioxide), but the range around this mean is large. For example, in a survey of 100 estimates, the values ran from US$-10 per tonne of carbon (US$-3 per tonne of carbon dioxide) up to US$350 per tonne of carbon (US$95 per tonne of carbon dioxide) [20.6].

The large ranges of SCC are due in the large part to differences in assumptions regarding climate sensitivity, response lags, the treatment of risk and equity, economic and non-economic impacts, the inclusion of potentially catastrophic losses, and discount rates. It is very likely that globally aggregated figures underestimate the damage costs because they cannot include many non-quantifiable impacts. Taken as a whole, the range of published evidence indicates that the net damage costs of climate change are likely to be significant and to increase over time [T20.3, 20.6, F20.4].

It is virtually certain that aggregate estimates of costs mask significant differences in impacts across sectors, regions, countries and populations. In some locations and among some groups of people with high exposure, high sensitivity and/or low adaptive capacity, net costs will be significantly larger than the global aggregate [20.6, 20.ES, 7.4].

# Why the Grass Isn't Always Greener

In the United States in the eighteenth century, lawns were a novelty, green carpets grown by the wealthy as part of a new European, "naturalistic" fashion in gardening. As farming diminished and cities grew, lawns grew with them, naturalizing into U.S. culture to such a degree that the month of April is known not only for its showers and Earth Day, but also for being National Lawn Care Month.

In the United States, some 46.5 million acres of roadsides, lawns, golf courses, cemeteries, parks, and sports fields are blanketed with turf—more than the total U.S. acreage of cotton, sorghum, barley, and oats, according to the EPA. The green carpet has spread past U.S. borders into Canada and Europe, while booming new turf markets have opened in Southeast Asia and Australia. With the growth of lawns has come a host of concerns about human and environmental health.

Today, some see a velvety lawn as an ideal, others as a plague. Environmentalists and communities accuse the golf and turf industries of misuse or overuse of pesticides and water, destruction of ecosystems, and threats to biodiversity; turf proponents see lawns as a functionally useful and beautiful feature of a developing world. Sorting fact from falsehood involves sifting through a tangle of influencing factors, including the paucity of data on grass and turf, differences in scientific views, and clashes among the cultures of science, business, environmentalism, and recreation.

"This is a very complex field," says James B Beard, a turf grass stress physiologist, professor emeritus at Texas A&M University in College Station, and president of the International Sports Turf Institute. "You can't just focus on a single issue. You need to take a balanced view, and consider the interacting impacts together."

### A History of Grass

The grass family Poaceae is among the most abundant of the vascular and flowering plants. Grasses are quick to colonize barren territory, spreading by means of an extensive fibrous root system. Only about 50 of the estimated 7,500 grass species are cultivated for turf. All 50 of these species are naturalized. Colonists imported them to the United States (along with clover, dandelions, and other "weeds") to feed their livestock—also imported—because the native grasses were so low in nutrition.

Beard says there is an ecological reason why low-growing grasses were superior for this purpose. "Native grasses of North America evolved in concert with bison, antelope, and deer, [whose] mouthparts are adapted to grazing tall grasses. Most of the turf grasses evolved 40 million years ago in Central Europe, along with ungulates like cows and sheep. The basal growth of the European grasses allows them to survive grazing—and mowing. Evolution favors their present function."

The popularization of lawns ran parallel to urbanization, technological advances, and the expansion of national distribution networks. The first U.S. lawn mower patents were filed in 1868, the first sprinkler patents in 1871. By 1987, an agrostologist at the U.S. Department of Agriculture (USDA) publicly advocated single-species lawns for all suburban homes, the grooming of which would "bespeak the character of the owner." And in her book *The Lawn: A History of an American Obsession*, author Virginia Scott Jenkins cites numerous quotes and advertisements implying that well-tended lawns and high moral fiber are inextricably linked. Golf, a game that may have originated in Julius Caesar's day, made its U.S. debut in 1888 in a New York cow pasture; by 1902, there were 1,000 golf courses in the United States. By 1912, the USDA and the U.S. Golf Association (USGA) were collaborating on turf studies.

Today, the lawn and turf industry, including machinery, sod farms, and private and commercial lawn care, generates approximately $25 billion annually and employs over 500,000 people. The U.S. golf industry, with an estimated 16,000 courses covering some 2.4 million acres, 25 million U.S. players, construction, maintenance, club dues, and employment, generates $64 billion each year, and spends $8 billion in chemicals and equipment, according to the Golf Course Superintendants Association of America (GCSAA). Overseas turf sales, though hard to track, are growing; Toro, a Minnesota-based lawn maintenance and irrigation company, earned $152 million in overseas revenues in 1995 alone.

Golf is an international sport. A 1996 survey by the renowned Scottish golf club St. Andrews, though incomplete, tallied over 25 million golfers from respondents at 11,600 golf clubs in Europe, Australia, and parts of South America, Africa, the Middle East, and the Far East.

## The Pros and Cons of Lawns

There's no doubt that a "perfect," weed-free green lawn takes effort to maintain. "I don't think you'd find an ecologist who would say that a treated lawn is not a high-energy, unstable system," says Sam Droege, a wildlife biologist with the U.S. Geological Survey's (USGS) Wildlife Research Center in Patuxent, Maryland.

The roar of lawn machinery contributes to noise pollution, with machines such as leaf blowers reaching 120 decibels, a potentially damaging level. Lawn equipment also contributes to air pollution: according to the EPA, 90 million lawn and garden machines emit 6 million tons of pollutants—5% of total annual emissions—including hydrocarbons, particulates, nitrogen oxides, carbon monoxide, and carbon dioxide. The EPA also reports that lawn clippings constitute almost 21%, or 31 million tons, of material added to municipal dumps annually—an unnecessary use of space, as clippings can benefit lawns if left to decay.

Opponents say that the spread of lawns and golf courses has destroyed native plants and ecosystems in favor of an artificial, "chemically addicted," unsustainable monoculture. In *The Lawn: A History of an American Obsession*, Jenkins describes how forests and marshes have vanished before the "front-lawn aesthetic," creating "a savannah from coast to coast."

## The Chemicals Question

During the post-World War II boom years, a new breed of chemical weapons was trained at the Japanese beetles, crabgrass, grubs, earthworms, and other "pest" organisms that threatened U.S. lawns. Environmental awareness was virtually absent, and DDT (called "the atomic bomb of the insect world") and other pesticides were heavily marketed. Protests against the demands and environmental effects of lawn care surfaced in the mid-1950s and gained momentum with the 1962 publication of *Silent Spring*. In this book, author Rachel Carson pointed out the dangers of lawn care "super poisons" such as arsenic, 2,4-D, chlordane, and DDT. These chemicals, she wrote, "give a giddy sense of power over nature to those who wield them." Arsenic, chlordane, and DDT were eventually banned for most uses, but 2,4-D and other chemicals, some of them highly toxic, are still on the market. Their use and alleged abuse constitute the most complex and controversial issues in the turf wars.

According to the EPA, in 1996 U.S. citizens used an estimated 70 million tons of fertilizer (lawn and garden use combined) and 70–75 million pounds of pesticide active ingredients (12 million pounds of insecticides, 45 million pounds of herbicides, and 5.4 million pounds of fungicides), valued at a total of $1.13 billion. The EPA's 1996 *Fact Sheet on Lawn Care Pesticide Use* reports that approximately 55 pounds of pesticide active ingredients per acre were applied annually to the average golf course. Homeowners rank above lawn care organizations (LCOs) in insecticide and herbicide use, while golf courses lead in fungicide use, employing more than six times more fungicide than homeowners, and nearly 15 times more than LCOs. (Putting greens receive the most intensive doses; roughs may receive little or no pesticides.) This pesticide use has generated outcries among the environmental community against the turf and golf industries, and against lawn cultivation in general.

The EPA is responsible for regulating lawn pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). FIFRA establishes a tolerance, or allowable residue, in raw and processed foods, animal feeds, and food additives, based on the Federal Food, Drug, and Cosmetic Act. All registered chemicals undergo extensive mandatory testing that includes determination of residues in food, environmental fate, degradation rate, accumulation, acute and subchronic hazards from oral and dermal absorption, metabolism if absorbed, teratogenicity and mutagenicity, spray drift, nontarget exposure, and exposure of employees. Registration does not imply that a product is safe, only that it will perform its intended function without "undue adverse effects on the environment." Under the latest modification to FIFRA, the 1996 Food Quality Protection Act, the EPA has also added testing to address risk to vulnerable populations such as children and the elderly, endocrine-disrupting potential, and aggregate risks posed by multiple chemicals with a common mode of action whose synergistic effects must now be examined.

The EPA has been subject to criticism because pesticide reregistration, originally scheduled to be completed in 1976, is still incomplete (with 170 active ingredients reregistered in a 1995 count). Additionally, some groups claim that labeling regulations prevent consumers from assessing potential risks not only from active ingredients, but also from inactive ingredients that are not always listed, though they can also be highly toxic.

One objection to lawn pesticides is their effect on nontarget organisms. In 1986, the EPA banned diazinon for use on golf courses and sod farms because of frequent incidents of bird kills (ranging from 1 to 800 birds at a time) related to its use. However, diazinon is still approved for household use. An insecticide, it is also toxic to beneficial animals such as bees. Chlorpyrifos, used in agriculture and also to control mosquitoes and turf-destroying insects on golf courses, has been shown to cause harm or death to nontarget organisms such as fish, aquatic invertebrates, birds, and humans. In his 1987 book *Pesticide Use and Toxicology in Relation to Wildlife*, Gregory Smith stated that, though there is little evidence that organophosphates and carbamates are causing significant population changes in wildlife species, pesticide users should understand that following label instructions does not ensure wildlife will not be killed—weather conditions, the season, and mating and migratory habits of local fauna should also be considered.

Other concerns center on the level of risk to human health from chemicals that the EPA considers acceptable. In the United States, organochlorines such as DDT, which persist in the environment and in human tissue, have largely been replaced by organophosphates and carbamates. Although these chemicals usually degrade quickly in the environment (though tests of the herbicide glyphosphate showed that the pesticide lingered as long as 140 days in the environment), many can

# MISSION SPRINGS WATER DISTRICT

# 2010 Urban Water Management Plan

June 2011

Prepared By:

PSOMAS

# 2010
# URBAN WATER
# MANAGEMENT PLAN

MSWD
Mission Springs Water District

## Mission Springs Water District

***June 28, 2011***

PSOMAS
3 Hutton Centre Drive, Suite 200
Santa Ana, CA 92707

# 1 INTRODUCTION

## 1.1 PURPOSE AND UWMP SUMMARY

An Urban Water Management Plan (UWMP or Plan) prepared by a water purveyor is intended to demonstrate reliability of water service sufficient to meet the needs of its various categories of customers during normal, single dry or multiple dry years. The California Water Management Planning Act of 1983 (Act), as amended, requires urban water suppliers to develop an UWMP every five years in the years ending in zero and five. Under normal circumstances, all 2010 UWMPs would have been due for submittal to the California Department of Water Resources (DWR) by December 31, 2010; however, Senate Bill (SB) 7-7 (or SBX7-7) provided an additional six months to retail urban water supply agencies to allow them to conduct additional required water conservation analyses. Thus, the District's 2010 UWMP must now be adopted by July 1, 2011 and submitted to DWR within 30 days of adoption.

In addressing urban water management issues, the legislature made a number of significant declarations including:

- The waters of the state are a limited and renewable resource subject to ever increasing demands;
- Conservation and efficient use of urban water supplies are of statewide concern;
- Successful implementation of plans is best accomplished at the local level;
- Conservation and efficient use of water shall be actively pursued to protect both the people of the state and their water resources;
- Conservation and efficient use of urban water supplies shall be a guiding criterion in public decisions; and
- Urban water suppliers shall be required to develop water management plans to achieve conservation and efficient use.

The Mission Springs Water District (MSWD or District) 2010 UWMP has been prepared in compliance with the requirements of the Act, as amended to 2010[1] (Appendix A), and includes the following discussions:

- Water Service Area
- Water Service Facilities
- Water Sources and Supplies
- Water Quality Information

[1]California Water Code, Division 6, Part 2.6; §10610, et. seq. Established by Assembly Bill 797 (1983).

### Palm Springs Crest System

#### *Woodridge 1840 Zone*

The Woodridge 1840 Zone exclusively serves the Woodridge service zone. This system includes two groundwater wells (Well 25 and Well 25A) with production capacity of 575 gpm, and the Woodridge storage tank with a storage capacity of 0.12 mg. The entire Woodridge system is independent of the MSWD system and the Cottonwood system.

### West Palm Springs Village System

#### *Cottonwood 1630 Zone*

The Cottonwood 1630 zone is part of the West Palm Springs Village water system, an independent water system, which is separate from the other systems. This system includes two groundwater wells (Well 26 and Well 26A) with a total capacity of 520 gpm. The Cottonwood 1630 Zone includes one storage facility with a capacity of approximately 0.28 mg. Well 26A is on fulltime Uranium treatment.

### *1.3.3 Demographics*

The MSWD has experienced rapid population growth mirroring the growth pattern across the central and eastern Coachella Valley over the past 20 years. Growth in the more established City of Palm Springs has been slower, as build out in that community is near. Growth was most significant in the cities of Cathedral City, Palm Desert, La Quinta and Indio, while growth was slower in the smaller and more expensive communities of Indian Wells and Rancho Mirage. Growth in the valley was slowest in the furthest east city of Coachella and the furthest west and north city of Desert Hot Springs. Experts and community members expect that as the fast-growing communities approach build out and experience higher land prices, significant growth will spillover into Coachella and Desert Hot Springs over the next 15 years.[6]

The MSWD Comprehensive Water System Master Plan includes two population scenarios to forecast both service connections and water usage: a baseline growth scenario that assumes all single family residential (SFR) developments will occur by 2020, and a second, high growth scenario that assumes the same level of SFR development will occur by 2015. However, uncertainty about SFR growth increases further out in time. The high growth scenario projected 2010 population to equal 35,000. Recent data estimates a 2010 population of 34,800. The high growth scenario is assumed in this study using a population growth rate of 6,500 people every five years, equal to the Master Plan high growth rate for years 2015 through 2035.

[6] MSWD Comprehensive Water System Master Plan., Section 2.2.

Table 1.3-2 presents projected population growth for the high growth scenario in District service area. In order to be conservative, the high growth scenario is used to project water demands for this UWMP.

**Table 1.3-2**
**Mission Springs Water District Population Projections**

| Population Scenario | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|
| **High Growth** | 34,800 | 41,300 | 47,800 | 54,300 | 60,800 | 67,300 |

## Personal Communication

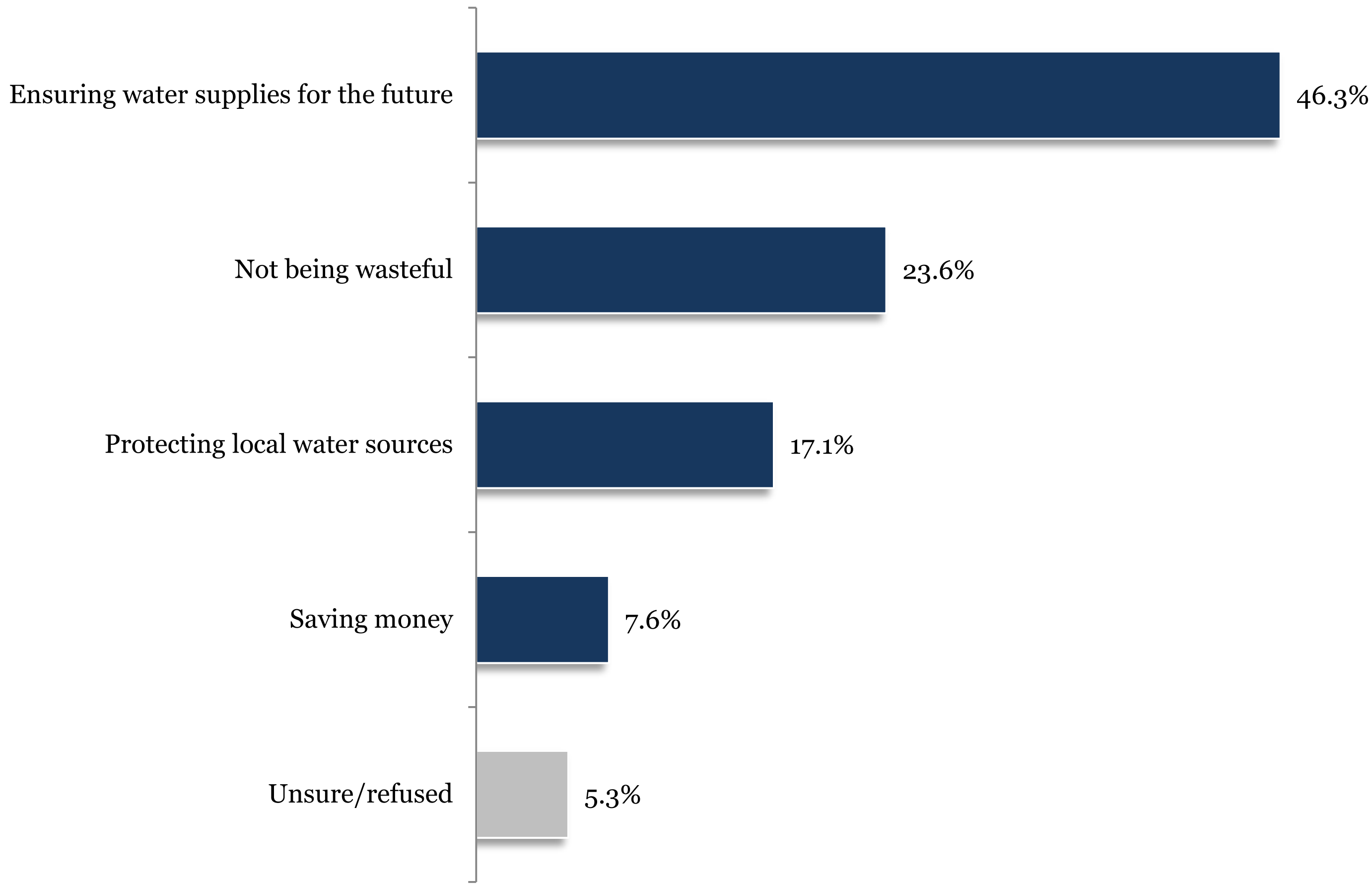
Various local experts were contacted for information to support the technical justification. They were contacted by phone and/or email and shared information from ongoing studies in their organization as well as institutional and community knowledge. The following individuals provided information in this capacity:

- Contact: Sergio Carranza, Executive Director
  - Organization: Pueblo Unido Community Development Corporation
  - Available by telephone at: (760) 777-7550
- Contact: Patti Reyes, Planning and Special Programs Manager
  - Agency: Coachella Valley Water District (CVWD)
  - Available by telephone at: (760) 398-2661, ext. 2270
- Contact: Ryan Sinclair, Assistant Professor
  - Institution: Loma Linda University, Environmental and Global Health
  - Available by telephone at: (909) 558-4000, ext. 47128

# Ensuring water supplies for the future

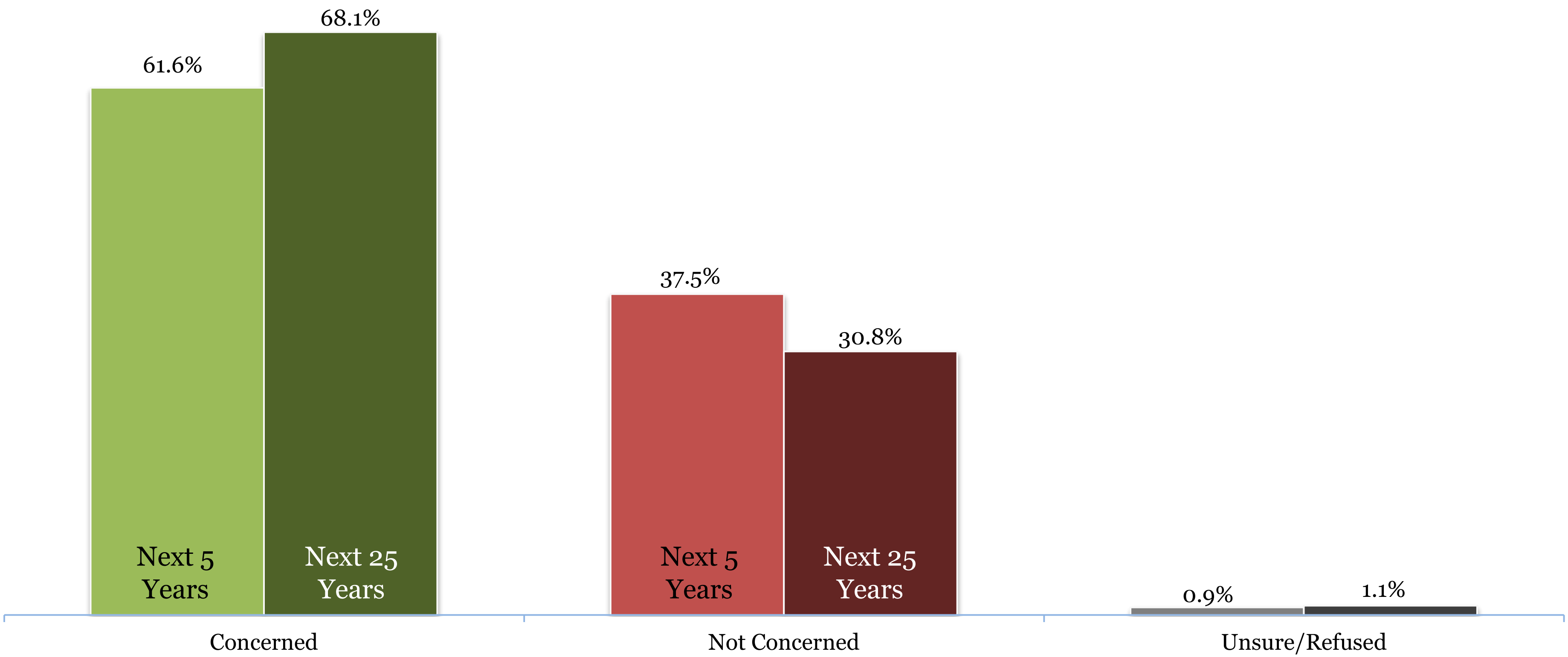
## Is the most compelling reason to conserve water

Question: In your opinion, which of the following is the best reason for conserving water?



# There is greater concern about water

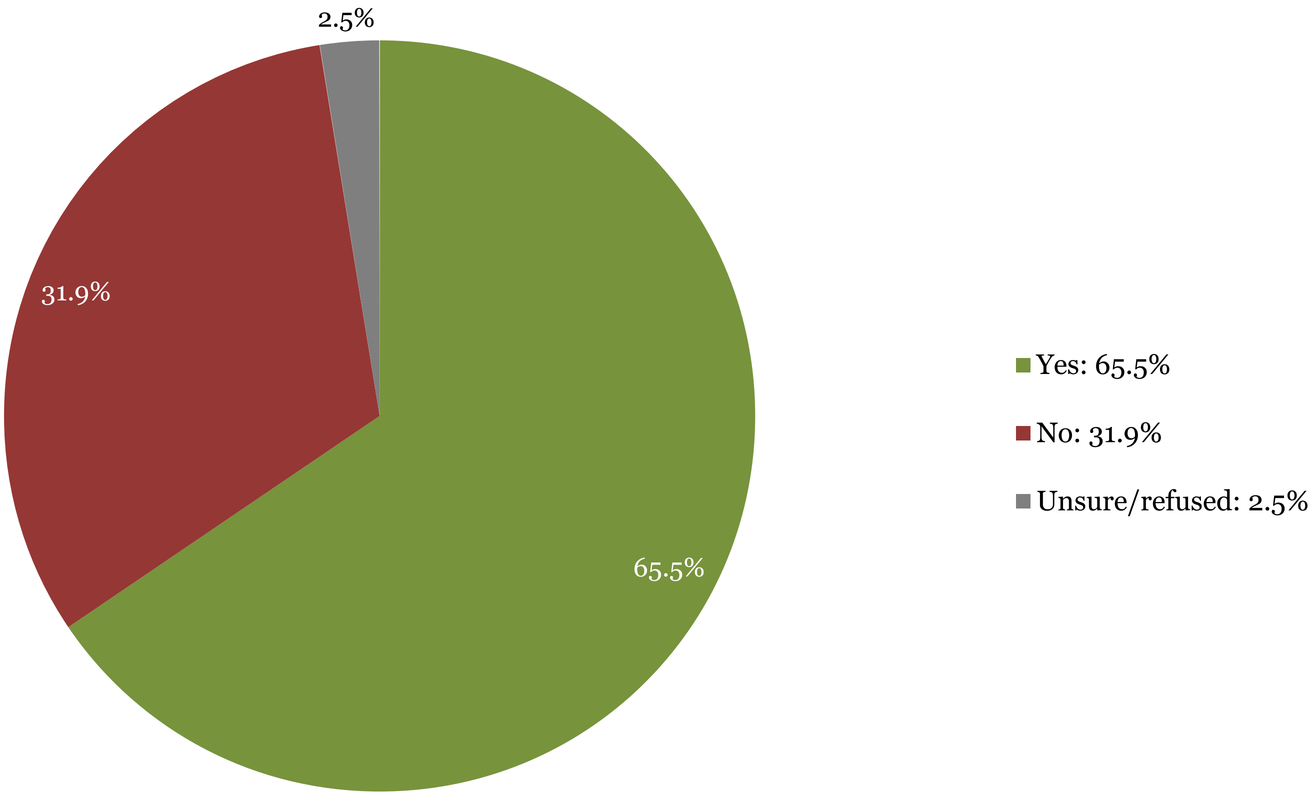
## Over the long-term vs. the short-term



# 65.5% think

## They could do more to conserve water

Question: Do you think that you could do more to conserve water?



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Aug-17-06

# Southern Nevada Water Authority
## *Water Smart Landscapes Rebate Program II*


**Applicant:**
Southern Nevada Water Authority

**Contact for Further Information:**
Kathy Flanagan
1001 South Valley View Blvd., MS 760
Las Vegas, NV 89153

E-mail: kathy.flanagan@snwa.com
Office: (702) 258-3173
Fax: (702) 258-7146

3. **Six month performance period** – After SNWA deems the property eligible for participation, the property owner is given up to six months to complete a landscape conversion. Subject to SNWA approval, participants may be granted up to six additional months.

   **(Step 3 Duration: Customer Dependent up to 6 months)**

4. **Post-conversion site inspection** – Upon notice from the applicant that a conversion is complete, SNWA will inspect the landscape to ensure it meets minimum requirements and to determine the square footage eligible for rebate. If program requirements are not met, the applicant is given an additional 60 days or the remainder of the six-month time period to take corrective action.

5. **Rebate issuance** – Following a successful post-conversion site inspection, the customer is notified of the rebate amount. The customer acknowledges the amount by signing a form and returning it. A rebate check is then processed and mailed.

   **(Step 4-5 Duration: 21 days)**

   On average, this entire process takes approximately three to four months from initial customer request.

**4. Technical Proposal: Evaluation Criteria**

***Criteria A - Water Conservation***

**Subcriteria No. 1(a) — Quantifiable Water Savings:**
The total project cost for this funding request is $3,300,000. Based upon past participation, SNWA estimates that the average rebate during the project period will be $1.26 per square-foot. Based on this cost, the SNWA estimates that 2,619,048 square-feet of turf grass will be removed through this program in the coming fiscal year (during the grant performance period).

$$\textbf{Total Square Feet Converted} \quad \frac{\$3{,}300{,}000}{\$1.26/\text{square-foot}} = 2{,}619{,}048 \text{ square-feet}$$

In 1995, a multi-year Xeriscape Conversion Study was implemented as a result of a cooperative agreement between SNWA and Reclamation. Funded in part by Reclamation, the draft final report finished in 2005. This research involved hundreds of participants that were divided into three treatment groups: Xeric Study, Turf Study, and control groups. Data on both household water consumption and water consumption through irrigation submeters was collected. Submeters were installed to determine per-unit area water application for both xeric- and turf grass-dominated landscapes. The per-unit area savings of xeric- versus turf dominated landscapes as revealed by the submeter data was found to be 55.8 gallons per square-foot per year. This results in a significant savings of 76.4 percent when considered in the context of all available residential water conservation measures.

Based on the data gathered from the Xeriscape Conversion Study, SNWA is able to determine the water savings realized from landscape conversion projects completed through the WSL Program. The number of square feet of lawn converted to Xeriscape under the requirements of the WSL program will determine the number of gallons of water saved.

Based on the results of the joint SNWA and USBR research, this project will result in an 448 AFY savings per year.

$$\textbf{Total AFY Saved} \quad \frac{55.8 \text{ gal} \times 2{,}619{,}048 \text{ square-feet}}{325{,}851 \text{ gal/AF}} = 448 \text{ AFY}$$

The SNWA estimates the expected life of the improvements to be 50 years. Over the life of the improvement, the cumulative recurring impact of this portion of the 2012/2013 WSL Program is estimated to result in the savings of approximately 22,400 AF.

| | | |
|---|---|---|
| **Cumulative Recurring Impact** | 448 AFY x 50 years | = 22,400 AF |

The SNWA and its member agencies depend on the Colorado River for approximately 90 percent of the community's water resource needs. The SNWA's primary resource is its share of Nevada's consumptive-use apportionment of 300,000 AFY of Colorado River water. SNWA's member agencies also have groundwater rights in Las Vegas Valley totaling 46,340 AFY. In addition, the SNWA has a right to purchased/leased rights along the Muddy and Virgin rivers and Coyote Spring Valley groundwater rights, which can be conveyed to the Colorado River for Intentionally Created Surplus (ICS) credit. These resources have a total consumptive use of approximately 44,000 AF expected to be available during 2011. Total water use in 2010 was approximately 484,000 AF, including groundwater, Colorado River water diversions and direct reuse.

In Southern Nevada, the SNWA serves as a regional water wholesaler, which eliminates the need for direct marketing between municipalities. Instead, unused Colorado River resources are stored for future use in water banks located in Southern Nevada, California and Arizona. The Southern Nevada water bank, established in 1987, has approximately 345,000 AF of credits for future use. The SNWA's California bank has 70,000 AF of credits and Arizona's bank guarantees 1.25 million AF of credits. SNWA's water conservation gains have helped further its banking efforts. Since 2004, water efficiency programs have helped allow the SNWA to contribute approximately 131,000 AF of unused Nevada Colorado River water toward interstate banking efforts.

In the event that Colorado River shortages are implemented, the SNWA intends to utilize banked resources to help offset supply availability. Conservation improves the ability to respond to shortages both by directly reducing demand, and be freeing up resources that can be banked for times of emergency. The proposed project will yield a recurring annual water savings of 448 AFY, resulting in a cumulative 22,400 AF available for banking over the life of the project.

**Subcriteria No. 2 — Percentage of Total Supply:**
SNWA member agency customer water use in 2010 was approximately 484,000 AF, including groundwater, Colorado River water diversions (allocation and return-flow credits) and direct reuse. The SNWA meters its Colorado River diversions at individual diversion points in Southern Nevada, including SNWS Intakes 1 and 2. Return-flow credits are based on measured flows at gauges in the Las Vegas Wash. The SNWA reports Colorado River diversions to Reclamation, and the Colorado River Commission of Nevada reports return-flow credits to Reclamation. Nevada Colorado River water diversions, return flow credits, and consumptive use are reported by Reclamation annually in its Colorado River Accounting and Water Use Report.

Water savings resulting from the proposed project represent only a small fraction of the total water supply (0.16 percent). However, the WSL Program is a long-term conservation strategy and cannot be viewed as a single year. Although the incremental gains of each year are small, the cumulative impact of the program has been significant—when considering all projects completed since inception, the WSL Program has achieved an annual recurring savings of more than 27,000 AFY, or 5.34 percent of total annual water supplies. With the WSL Program budget cut by 62 percent since the 2009/2010 fiscal year,

# Xeriscape Conversion Study

SOUTHERN NEVADA
WATER AUTHORITY

## Final Report

SNWA Member Agencies

- *Big Bend Water*
- *City of Boulder City*
- *City of Las Vegas*
- *City of Henderson*
- *City of North Las Vegas*
- *Clark County Water Reclamation District*
- *Las Vegas Valley Water District*

2005


By

Kent A. Sovocool
Senior Conservation Programs Analyst
Southern Nevada Water Authority

With data processing assistance from

Mitchell Morgan
Assistant Management Analyst
Southern Nevada Water Authority



Funded in part by a grant from
Bureau of Reclamation
U.S. Department of Interior

# Executive Summary and Conclusions

The major conclusions of this research are as follows:

1. Xeriscape conversion projects can save vast quantities of water at single-family residences. Homes in this study saved an average of 96,000 gallons annually following completion of an average-size conversion project. This is a savings of 30% in total annual consumption; a finding in line with those yielded by other research studies in this region.

2. Over the long timeframe of this study, total yearly savings have neither eroded nor improved across the years. On average, household consumption drops immediately and quickly stabilizes.

3. There is an enormous difference in application of water to locally used turfgrasses and xeric landscape by residents. On average, each year residents applied 73.0 gallons per square foot (117.2 inches) of water to grow turfgrass in this area and just 17.2 gallons per square foot (27.6 inches) to xeric landscape areas. The difference between these two figures, 55.8 gallons per square foot (89.6 inches) is the theoretical average savings yielded annually by having xeriscape in lieu of turf in this area. This is a *substantial* savings (76.4%) when considered in the context of the available residential water conservation measures. A sub-study of other commercial properties with xeriscape found the average application to xeric areas by these customers to be essentially equivalent to that observed for the residential customers.

4. Over the course of a year, the difference in application between turf and xeric areas varies in a predictable bell-shaped-curve manner, with the greatest difference occurring in summer. This is because turf irrigation peaks to a much greater extent in summer than xeric irrigation. The difference in irrigation between these two types of landscape varies from as little as 1.56 gallons per square foot for the month of December, on up to 9.62 gallons per square foot for the month of July.

5. In comparing irrigation application to the reference evapotranspirational rate ($ET_o$), it was found that on average application to turf exceeded $ET_o$ in every month except March, exceeding it the most May through November. In contrast, xeric application remained well below $ET_o$ year round.

6. The author experimented with using a locally invoked "rule-of-thumb" which holds that xeric plantings require about a third of the evapotranspirational rate as needed for turf. In comparing this developed reference, $0.33(ET_o)$, to application, it was found that these values were, in absolute terms, somewhat close month to month and very close over the entire year. In comparing this developed reference to application, it was found that xeric application was below $0.33(ET_o)$ half the year and above it the other half of the year (September-February).


# State Water Resources Control Board

## Policy for Water Quality Control for Recycled Water (Recycled Water Policy)

Revised January 22, 2013
Effective April 25, 2013

State of California
*Edmund G. Brown Jr., Governor*

California Environmental Protection Agency
*Matthew Rodriquez, Secretary*

State Water Resources Control Board
*P.O. Box100*
*Sacramento, CA  95812-0100*

<u>Recycled Water Policy</u>

1. *Preamble*

California is facing an unprecedented water crisis.

The collapse of the Bay-Delta ecosystem, climate change, and continuing population growth have combined with a severe drought on the Colorado River and failing levees in the Delta to create a new reality that challenges California's ability to provide the clean water needed for a healthy environment, a healthy population and a healthy economy, both now and in the future.

These challenges also present an unparalleled opportunity for California to move aggressively towards a sustainable water future. The State Water Resources Control Board (State Water Board) declares that we will achieve our mission to "preserve, enhance and restore the quality of California's water resources to the benefit of present and future generations." To achieve that mission, we support and encourage every region in California to develop a salt/nutrient management plan by 2014 that is sustainable on a long-term basis and that provides California with clean, abundant water. These plans shall be consistent with the Department of Water Resources' Bulletin 160, as appropriate, and shall be locally developed, locally controlled and recognize the variability of California's water supplies and the diversity of its waterways. We strongly encourage local and regional water agencies to move toward clean, abundant, local water for California by emphasizing appropriate water recycling, water conservation, and maintenance of supply infrastructure and the use of stormwater (including dry-weather urban runoff) in these plans; these sources of supply are drought-proof, reliable, and minimize our carbon footprint and can be sustained over the long-term.

We declare our independence from relying on the vagaries of annual precipitation and move towards sustainable management of surface waters and groundwater, together with enhanced water conservation, water reuse and the use of stormwater. To this end, we adopt the following goals for California:

- Increase the use of recycled water over 2002 levels by at least one million acre-feet per year (afy) by 2020 and by at least two million afy by 2030.
- Increase the use of stormwater over use in 2007 by at least 500,000 afy by 2020 and by at least one million afy by 2030.
- Increase the amount of water conserved in urban and industrial uses by comparison to 2007 by at least 20 percent by 2020.
- Included in these goals is the substitution of as much recycled water for potable water as possible by 2030.

with the process for such modification as established by existing law.

7. *Landscape Irrigation Projects*[1]

a. *Control of incidental runoff.* Incidental runoff is defined as unintended small amounts (volume) of runoff from recycled water use areas, such as unintended, minimal over-spray from sprinklers that escapes the recycled water use area. Water leaving a recycled water use area is not considered incidental if it is part of the facility design, if it is due to excessive application, if it is due to intentional overflow or application, or if it is due to negligence. Incidental runoff may be regulated by waste discharge requirements or, where necessary, waste discharge requirements that serve as a National Pollutant Discharge Elimination System (NPDES) permit, including municipal separate storm water system permits, but regardless of the regulatory instrument, the project shall include, but is not limited to, the following practices:

(1) Implementation of an operations and management plan that may apply to multiple sites and provides for detection of leaks, (for example, from broken sprinkler heads), and correction either within 72 hours of learning of the runoff, or prior to the release of 1,000 gallons, whichever occurs first,

(2) Proper design and aim of sprinkler heads,

(3) Refraining from application during precipitation events, and

(4) Management of any ponds containing recycled water such that no discharge occurs unless the discharge is a result of a 25-year, 24-hour storm event or greater, and there is notification of the appropriate Regional Water Board Executive Officer of the discharge.

[1] Specified uses of recycled water considered "landscape irrigation" projects include any of the following:
i. Parks, greenbelts, and playgrounds;
ii. School yards;
iii. Athletic fields;
iv. Golf courses;
v. Cemeteries;
vi. Residential landscaping, common areas;
vii. Commercial landscaping, except eating areas;
viii. Industrial landscaping, except eating areas; and
ix. Freeway, highway, and street landscaping.

b. *Streamlined Permitting.*

(1) The Regional Water Boards shall, absent unusual circumstances (i.e., unique, site-specific conditions such as where recycled water is proposed to be used for irrigation over high transmissivity soils over a shallow (5' or less) high quality groundwater aquifer), permit recycled water projects that meet the criteria set forth in this Policy, consistent with the provisions of this paragraph.

(2) If the Regional Water Board determines that unusual circumstances apply, the Regional Water Board shall make a finding of unusual circumstances based on substantial evidence in the record, after public notice and hearing.

(3) Projects meeting the criteria set forth below and eligible for enrollment under requirements established in a general order shall be enrolled by the State or Regional Water Board within 60 days from the date on which an application is deemed complete by the State or Regional Water Board. For projects that are not enrolled in a general order, the Regional Water Board shall consider permit adoption within 120 days from the date on which the application is deemed complete by the Regional Water Board.

(4) Landscape irrigation projects that qualify for streamlined permitting shall not be required to include a project specific receiving water and groundwater monitoring component unless such project specific monitoring is required under the adopted salt/nutrient management plan. During the interim while the salt management plan is under development, a landscape irrigation project proponent can either perform project specific monitoring, or actively participate in the development and implementation of a salt/nutrient management plan, including basin/sub-basin monitoring. Permits or requirements for landscape irrigation projects shall include, in addition to any other appropriate recycled water monitoring requirements, monitoring for priority pollutants in the recycled water at the recycled water production facility once per year, except when the recycled water production facility has a design production flow for the entire water reuse system of one million gallons per day or less. For these smaller facilities, the recycled water shall be monitored for priority pollutants once every five years.

(5) It is the intent of the State Water Board that the general permit for landscape irrigation projects be consistent with the terms of this Policy.

c. *Criteria for streamlined permitting*. Irrigation projects using recycled water that meet the following criteria are eligible for streamlined permitting, and, if otherwise in compliance with applicable laws, shall be approved absent unusual circumstances:

(1) Compliance with the requirements for recycled water established in Title 22 of the California Code of Regulations, including the requirements for treatment and use area restrictions, together with any other recommendations by CDPH pursuant to Water Code section 13523.

(2) Application in amounts and at rates as needed for the landscape (i.e., at agronomic rates and not when the soil is saturated). Each irrigation project shall be subject to an operations and management plan, that may apply to multiple sites, provided to the Regional Water Board that specifies the agronomic rate(s) and describes a set of reasonably practicable measures to ensure compliance with this requirement, which may include the development of water budgets for use areas, site supervisor training, periodic inspections, tiered rate structures, the use of smart controllers, or other appropriate measures.

(3) Compliance with any applicable salt and nutrient management plan.

(4) Appropriate use of fertilizers that takes into account the nutrient levels in the recycled water. Recycled water producers shall monitor and communicate to the users the nutrient levels in their recycled water.

8. *Recycled Water Groundwater Recharge Projects*

a. The State Water Board acknowledges that all recycled water groundwater recharge projects must be reviewed and permitted on a site-specific basis, and so such projects will require project-by-project review.

b. Approved groundwater recharge projects will meet the following criteria:

(1) Compliance with regulations adopted by CDPH for groundwater recharge projects or, in the interim until such regulations are approved, CDPH's recommendations pursuant to Water Code section 13523 for the project (e.g., level of treatment, retention time, setback distance, source control, monitoring program, etc.).

(2) Implementation of a monitoring program for CECs that is consistent with Attachment A and any recommendations from CDPH.

# THE SUSTAINABLE SITES INITIATIVE™



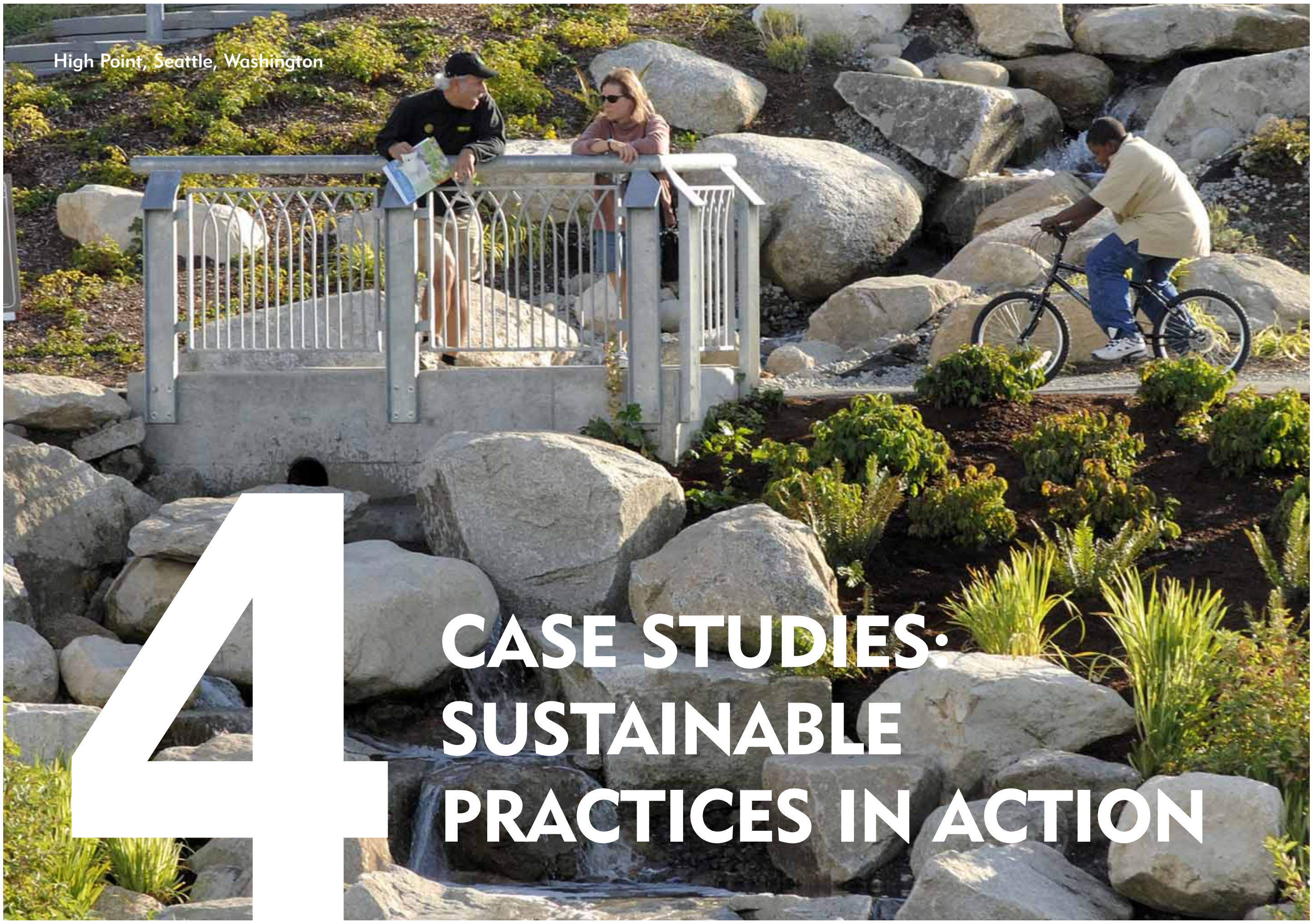
# THE CASE FOR SUSTAINABLE LANDSCAPES


American Society of Landscape Architects

Lady Bird Johnson Wildflower Center
at The University of Texas at Austin

United States Botanic Garden

*The Sustainable Sites Initiative is a partnership of the American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center, and the United States Botanic Garden in conjunction with a diverse group of stakeholder organizations to establish and encourage sustainable practices in landscape design, construction, operations, and maintenance.*






# 4 CASE STUDIES: SUSTAINABLE PRACTICES IN ACTION

Often the best way to communicate an idea is to see it in practice. With this in mind, the Sustainable Sites Initiative has created a library of case studies that illustrate sustainable landscape practices at various stages of development. The projects were selected during the spring of 2008 when the Initiative announced its Call for Case Studies. The purpose was to document instances of sustainable land development and management practices to inspire and educate the public.

More than 130 projects submitted applications that monitored and documented the success or failure of sustainable land practices. A project was not required to be a sustainable site in all respects but rather to illustrate individual sustainable practices such as stormwater management, integrative design teams, habitat restoration, education, design for user health and well-being, and materials selection and management.

By showcasing projects representing different geographic regions, sizes, types, and stages of development, the Initiative hopes to demonstrate the feasibility of creating sustainable sites virtually anywhere. Whether on many acres of a former brownfield or in one family's front yard, a sustainable site has the capacity to regenerate many of the natural benefits and services provided by ecosystems in their undeveloped state and to conserve energy and resources for the larger community.

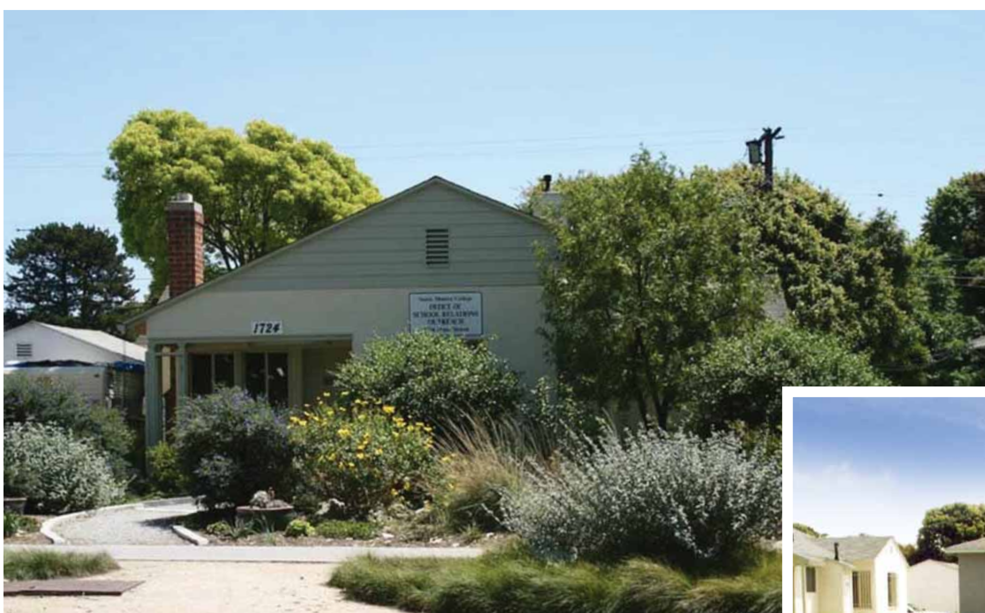
The projects on the following pages are a small sample. More can be found on the Initiative's website *(http://www.sustainablesites.org/cases/)*.

# GARDEN\GARDEN

## A Comparison in Santa Monica

In 2003, the City of Santa Monica, CA, initiated a project called garden\garden, designed to encourage city residents and the local landscaping community to adopt sustainable garden practices. The city wished to promote practices that would, among other things, conserve water and energy, reduce waste and also decrease urban runoff, the single largest source of pollution in Santa Monica Bay. Although the city had been providing seminars and tours of local sustainable landscapes, as well as a large demonstration garden at City Hall, most residents were not moved to alter their gardening practices. Similarly, members of the landscaping community were still inclined to continue recommending and installing the traditional kinds of non-native plants with which they were most familiar.

The City of Santa Monica's challenge was to persuade both homeowners and landscape professionals that sustainable gardening was not only better for the environment than traditional gardening, but also was attractive and made good economic sense. To prove their case, the city created garden\garden—two gardens in adjacent residential front yards, one landscaped in the traditional manner and the other with a climate-appropriate, sustainable design, allowing residents to make a direct comparison. Using garden\garden as a model, the city has since awarded 51 Sustainable Landscape Grants for properties including single-family homes, multi-family buildings, and two schools. Sustainable landscape principles have been taught to more than a hundred residents and more than 120 landscape professionals since 2004. Garden\garden has served as a learning laboratory and working example for all of the workshop attendees, garden tour visitors, and for the general public who walk past the garden daily.




In the native garden (above), California native cultivars replicate the drought-tolerant chapparal of the Santa Monica Mountains and use 77 percent less water than required by conventional turf and exotic plants from the Eastern United States and Europe in the traditional garden (right).

**SIZE/TYPE OF PROJECT**
Approximately 1,900 square feet in each garden

**SITE CONTEXT**
Southern California's climate is coastal Mediterranean and is dominated by the Pacific Ocean. Average daily temperatures are mild and morning fog is common, with daily afternoon winds. The air tends to be salt laden and the average annual rainfall ranges from 11 to 20 inches. The soils are commonly alkaline and sandy in texture. The side-by-side bungalows are in an urban residential neighborhood. Each garden is approximately 1,900 square feet in area.

**ISSUES/CONSTRAINTS OF THE SITE**
In both gardens the soil type was sandy loam (moderate permeability), poor in organic matter, and highly compacted from decades of turf. Tests also indicated high alkalinity and high levels of heavy metals, including zinc and copper. The existing landscape on both sites was completely removed to create an identical environmental base condition for study, with all waste exported for recycling. Soil amendments were applied as appropriate for the respective plant material. The intent was to bring the soil to a basic level of balance, facilitate a long-term development of healthy soil life, and to increase plant health. Both gardens also are exposed to unusually high vehicular traffic and resulting air pollution.

**SUSTAINABLE PRACTICES IN THE NATIVE GARDEN**
- No chemical herbicides or insecticides (per Santa Monica City policy)
- Climate-appropriate California native cultivars, designed to replicate the chaparral of the Santa Monica Mountains
- Low-volume drip irrigation with a weather-sensitive controller
- System for capturing stormwater runoff for groundwater recharge
- Wildlife habitat for local and migratory fauna

**PRACTICES IN THE TRADITIONAL GARDEN**
- No chemical herbicides or insecticides; occasional use of blood meal
- Exotic plants from northern Europe and the eastern United States
- Standard, user-controlled sprinkler irrigation system
- No provision for runoff mitigation

**CONSTRUCTION COSTS**

| | |
|---|---|
| Traditional garden | $12,400 |
| Native garden | $16,700 |

The higher cost of the native garden included demolition and replacement of an existing access ramp, installation of permeable paving, and installation of a rainwater recovery system—rain gutters that tie into an underground infiltration pit. These figures do not take into account the costs and benefits to the larger community. Benefits may include, for example, water conservation, waste reduction, and improvements in human and environmental health.

**MONITORING**
Construction was completed in March 2004. From 2004 to 2008, the city tracked costs, labor hours, plant growth, water consumption, green waste production, and other environmental factors for both gardens. The ever increasing costs of water, maintenance man hours, and the transporting costs of green waste disposal required to support a traditional landscape will determine the long-term dollar amount offset of costs for installation.

- **Water Use (gallons):** Each garden is separately metered. Water consumption was recorded at two-month intervals until November 2004, after which it was recorded monthly.
  - TG = 283,981 gallons/year
  - NG = 64,396 gallons/year
  - Difference = 219,585 gallons/year or 77% less water use for NG
- **Green Waste (pounds):**
  - TG =647.5 pounds/year
  - NG = 219.0 pounds/year
  - Difference = 428.5 pounds/year or 66% less waste produced from NG
- **Maintenance Labor (U.S. dollars):**
  - TG = $223.22/year
  - NG = $ 70.44/year
  - Difference = $152.78/yr or 68% fewer dollars spent on maintenance labor for NG

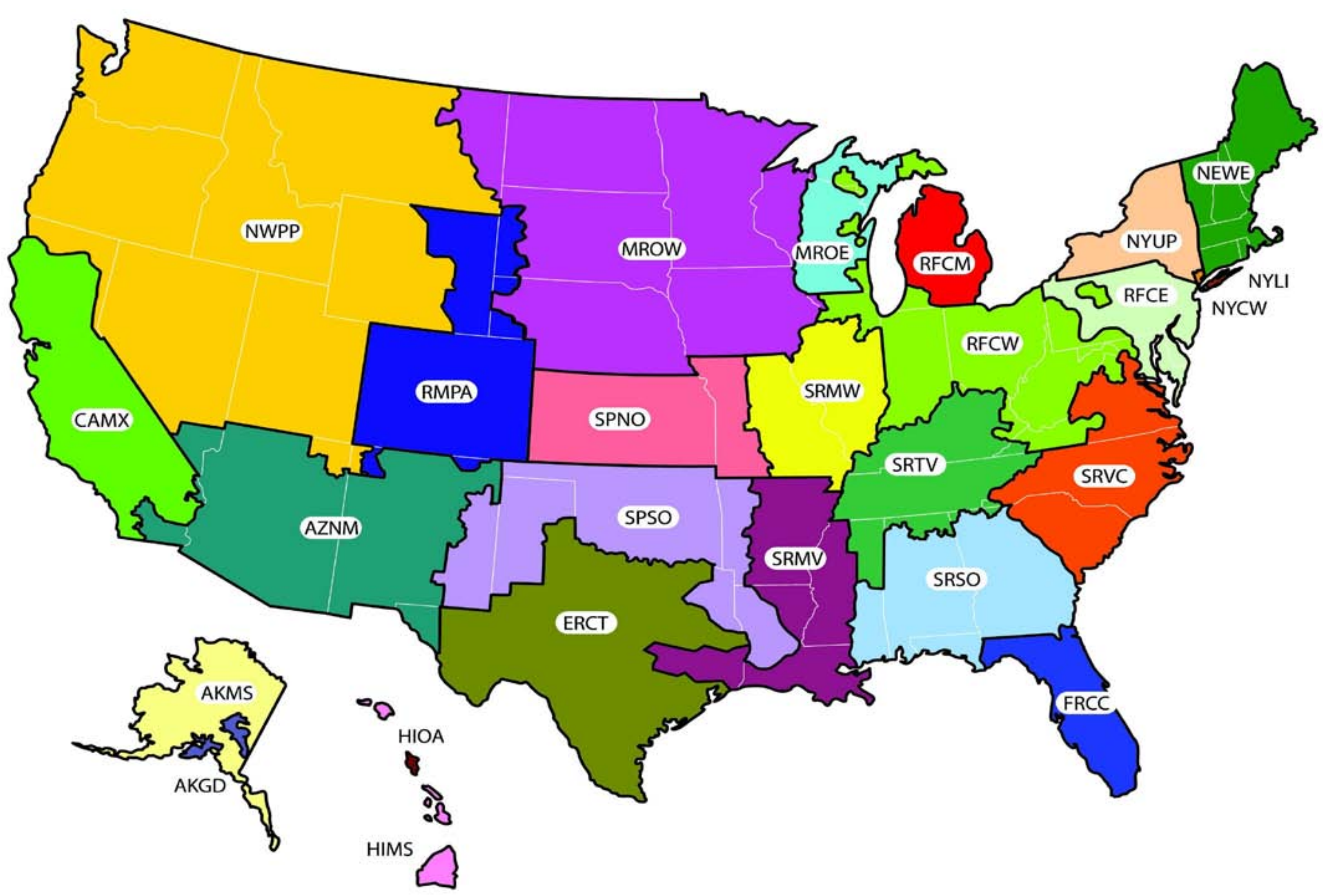
**LESSONS LEARNED**
Collected site data have validated theories that a south California native landscape would yield significant reductions in resource consumption and waste production as compared to a traditional south California–style landscape.

# eGRID 9th edition Version 1.0
# Year 2010 Summary Tables

(created February 2014)

## Year 2010 eGRID Subregion Emissions - Greenhouse Gases

| eGRID subregion acronym | eGRID subregion name | Carbon dioxide ($CO_2$) Emissions (tons) | Carbon dioxide ($CO_2$) Total output emission rate (lb/MWh) | Methane ($CH_4$) Emissions (lbs) | Methane ($CH_4$) Total output emission rate (lb/GWh) | Nitrous oxide ($N_2O$) Emissions (lbs) | Nitrous oxide ($N_2O$) Total output emission rate (lb/GWh) | Carbon dioxide equivalent ($CO_2e$) Emissions (tons) | Carbon dioxide equivalent ($CO_2e$) Total output emission rate (lb/MWh) |
|---|---|---|---|---|---|---|---|---|---|
| AKGD | ASCC Alaska Grid | 3,350,817.0 | 1,256.87 | 139,035.5 | 26.08 | 38,279.9 | 7.18 | 3,358,210.3 | 1,259.64 |
| AKMS | ASCC Miscellaneous | 317,398.6 | 448.57 | 26,527.0 | 18.74 | 5,208.6 | 3.68 | 318,484.5 | 450.10 |
| AZNM | WECC Southwest | 104,967,483.8 | 1,177.61 | 3,424,005.1 | 19.21 | 2,802,975.8 | 15.72 | 105,437,897.1 | 1,182.89 |
| CAMX | WECC California | 64,799,260.4 | 610.82 | 6,044,809.1 | 28.49 | 1,278,773.3 | 6.03 | 65,060,940.8 | 613.28 |
| ERCT | ERCOT All | 210,366,837.2 | 1,218.17 | 5,820,108.3 | 16.85 | 4,859,884.0 | 14.07 | 211,181,230.4 | 1,222.88 |
| FRCC | FRCC All | 130,376,587.7 | 1,196.71 | 8,478,102.7 | 38.91 | 2,995,217.6 | 13.75 | 130,929,866.5 | 1,201.79 |
| HIMS | HICC Miscellaneous | 1,963,642.7 | 1,330.16 | 218,438.7 | 73.98 | 40,985.9 | 13.88 | 1,972,289.1 | 1,336.02 |
| HIOA | HICC Oahu | 6,393,027.4 | 1,621.86 | 782,825.4 | 99.30 | 176,679.8 | 22.41 | 6,428,632.4 | 1,630.90 |
| MROE | MRO East | 26,009,237.7 | 1,610.80 | 784,331.9 | 24.29 | 888,770.5 | 27.52 | 26,155,232.6 | 1,619.84 |
| MROW | MRO West | 156,444,752.4 | 1,536.36 | 5,809,874.5 | 28.53 | 5,354,351.3 | 26.29 | 157,335,680.5 | 1,545.11 |
| NEWE | NPCC New England | 46,905,984.7 | 722.07 | 9,322,707.0 | 71.76 | 1,685,853.4 | 12.98 | 47,265,180.4 | 727.60 |
| NWPP | WECC Northwest | 112,891,853.5 | 842.58 | 4,300,901.6 | 16.05 | 3,502,980.9 | 13.07 | 113,479,975.1 | 846.97 |
| NYCW | NPCC NYC/Westchester | 12,733,660.7 | 622.42 | 974,161.1 | 23.81 | 114,582.6 | 2.80 | 12,761,649.6 | 623.78 |
| NYLI | NPCC Long Island | 8,115,858.7 | 1,336.11 | 989,929.6 | 81.49 | 124,943.6 | 10.28 | 8,145,619.2 | 1,341.01 |
| NYUP | NPCC Upstate NY | 24,165,154.6 | 545.79 | 1,443,157.6 | 16.30 | 641,283.5 | 7.24 | 24,279,706.7 | 548.37 |
| RFCE | RFC East | 137,558,868.7 | 1,001.72 | 7,434,984.1 | 27.07 | 4,210,267.5 | 15.33 | 138,289,527.5 | 1,007.04 |
| RFCM | RFC Michigan | 74,602,328.8 | 1,629.38 | 2,789,651.5 | 30.46 | 2,457,844.2 | 26.84 | 75,012,586.0 | 1,638.34 |
| RFCW | RFC West | 449,994,271.4 | 1,503.47 | 10,897,168.6 | 18.20 | 14,813,680.5 | 24.75 | 452,404,812.2 | 1,511.52 |
| RMPA | WECC Rockies | 61,839,528.9 | 1,896.74 | 1,477,560.7 | 22.66 | 1,904,448.4 | 29.21 | 62,150,232.8 | 1,906.27 |
| SPNO | SPP North | 62,457,258.2 | 1,799.45 | 1,444,401.4 | 20.81 | 1,986,994.1 | 28.62 | 62,780,408.5 | 1,808.76 |
| SPSO | SPP South | 117,325,297.0 | 1,580.60 | 3,444,187.9 | 23.20 | 3,095,469.5 | 20.85 | 117,841,258.7 | 1,587.55 |
| SRMV | SERC Mississippi Valley | 90,967,299.2 | 1,029.82 | 3,650,522.7 | 20.66 | 1,900,187.0 | 10.76 | 91,300,158.7 | 1,033.58 |
| SRMW | SERC Midwest | 123,042,911.4 | 1,810.83 | 2,783,643.6 | 20.48 | 4,019,051.2 | 29.57 | 123,695,092.6 | 1,820.43 |
| SRSO | SERC South | 183,236,856.9 | 1,354.09 | 6,176,437.4 | 22.82 | 5,653,138.2 | 20.89 | 184,177,945.9 | 1,361.05 |
| SRTV | SERC Tennessee Valley | 163,960,526.8 | 1,389.20 | 4,177,202.5 | 17.70 | 5,290,412.2 | 22.41 | 164,824,401.3 | 1,396.52 |
| SRVC | SERC Virginia/Carolina | 167,452,188.6 | 1,073.65 | 6,766,296.6 | 21.69 | 5,502,582.8 | 17.64 | 168,376,135.0 | 1,079.57 |
| **U.S.** | | **2,542,238,893.0** | **1,232.35** | **99,600,972.2** | **24.14** | **75,344,845.9** | **18.26** | **2,554,963,154.4** | **1,238.52** |




This is a representational map; many of the boundaries shown on this map are approximate because they are based on companies, not on strictly geographical boundaries.

United States Environmental Protection Agency

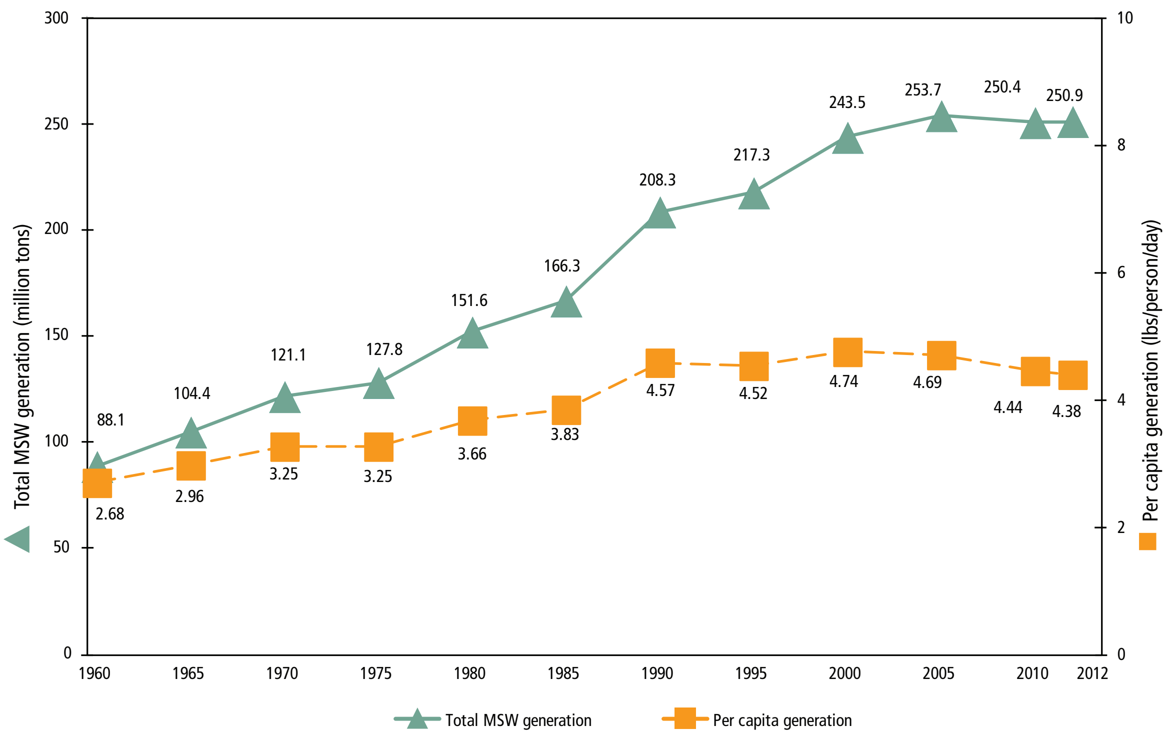
# Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012

The U.S. Environmental Protection Agency (EPA) has collected and reported data on the generation and disposal of waste in the United States for more than 30 years. We use this information to measure the success of waste reduction and recycling programs across the country. These facts and figures are current through calendar year 2012.

In 2012, Americans generated about 251 million tons[1] of trash and recycled and composted almost 87 million tons of this material, equivalent to a 34.5 percent recycling rate (See Figure 1 and Figure 2). On average, Americans recycled and composted 1.51 pounds out of our individual waste generation rate of 4.38 pounds per person per day.

EPA is thinking beyond waste and seeking a systematic approach that provides a transition from waste management to sustainable materials management (SMM). In this year's report, EPA explores the connection between personal consumer expenditures and the generation of wastes. The transition is well under way, with the U.S. economy continuing to provide goods and services for household consumption more efficiently when looking at the MSW generated from consuming those goods and services.

**Figure 1. MSW Generation Rates, 1960 to 2012**




[1] U.S. short tons unless specified.

**Figure 5. Total MSW Generation (by material), 2012**
**251 Million Tons (before recycling)**

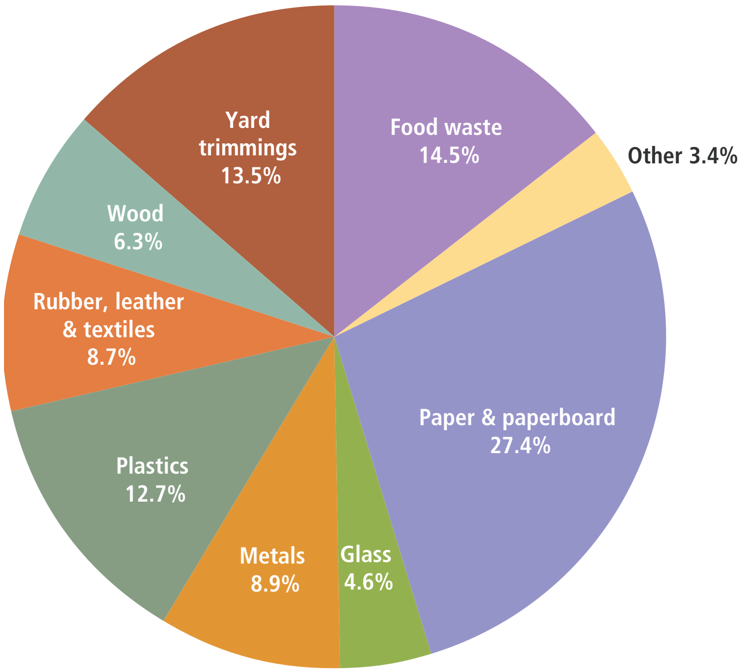



**Figure 6. Total MSW Recovery (by material), 2012**
**87 Million Tons**

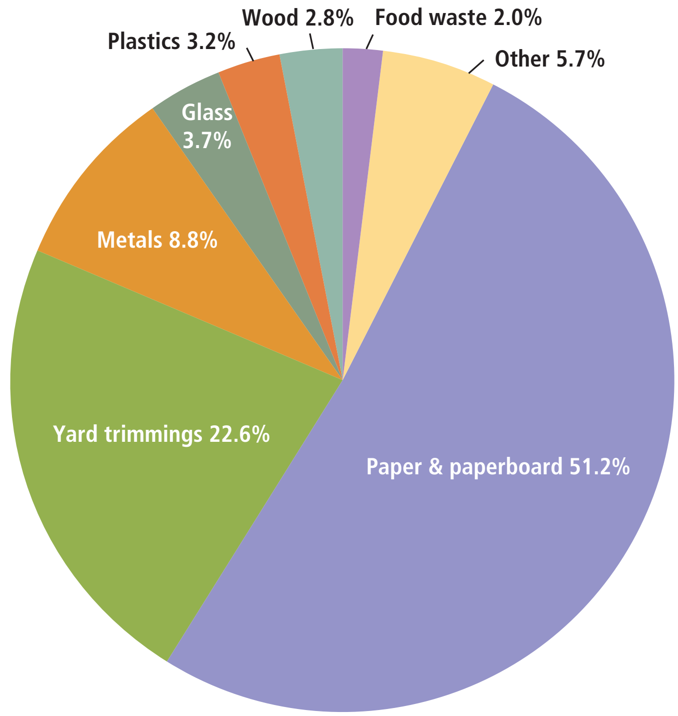



**Figure 7. Total MSW Discards (by material), 2012**
**164 Million Tons (after recycling and composting)**

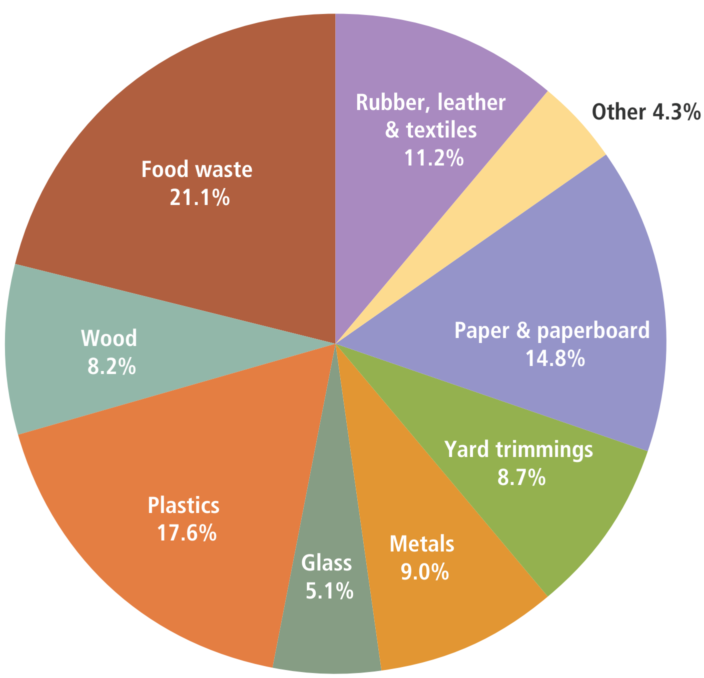



**Figure 8. Total MSW Generation (by product category), 2012**
**251 Million Tons (before recycling)**

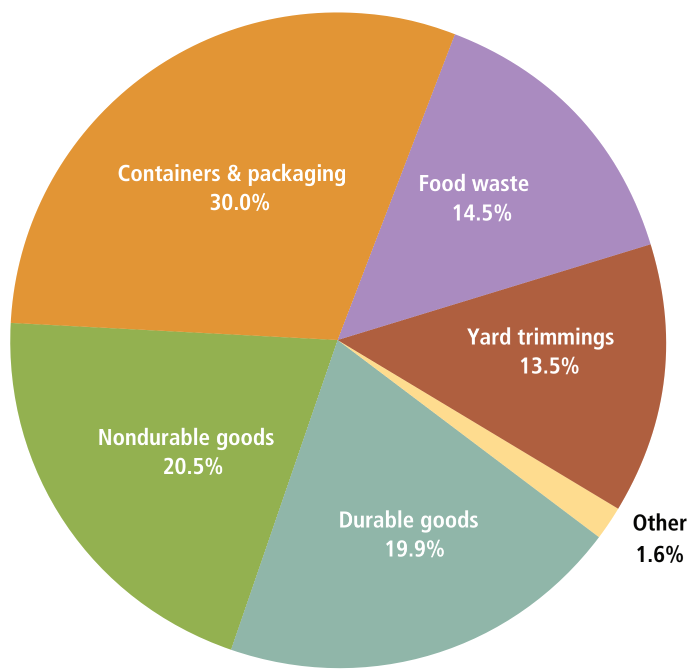


**Table 1. Generation, Recovery, and Discards of Materials in MSW, 2012***
**(in millions of tons and percent of generation of each material)**

| Material | Weight Generated | Weight Recovered | Recovery as Percent of Generation | Weight Discarded |
|---|---|---|---|---|
| Paper and paperboard | 68.62 | 44.36 | 64.6% | 24.26 |
| Glass | 11.57 | 3.20 | 27.7% | 8.37 |
| Metals | | | | |
| Steel | 16.80 | 5.55 | 33.0% | 11.25 |
| Aluminum | 3.58 | 0.71 | 19.8% | 2.87 |
| Other nonferrous metals† | 2.00 | 1.36 | 68.0% | 0.64 |
| **Total metals** | **22.38** | **7.62** | **34.0%** | **14.76** |
| Plastics | 31.75 | 2.80 | 8.8% | 28.95 |
| Rubber and leather | 7.53 | 1.35 | 17.9% | 6.18 |
| Textiles | 14.33 | 2.25 | 15.7% | 12.08 |
| Wood | 15.82 | 2.41 | 15.2% | 13.41 |
| Other materials | 4.60 | 1.30 | 28.3% | 3.30 |
| **Total materials in products** | **176.60** | **65.29** | **37.0%** | **111.31** |
| Other wastes | | | | |
| Food, other‡ | 36.43 | 1.74 | 4.8% | 34.69 |
| Yard trimmings | 33.96 | 19.59 | 57.7% | 14.37 |
| Miscellaneous inorganic wastes | 3.90 | Negligible | Negligible | 3.90 |
| **Total other wastes** | **74.29** | **21.33** | **28.7%** | **52.96** |
| **Total municipal solid waste** | **250.89** | **86.62** | **34.5%** | **164.27** |

* Includes waste from residential, commercial, and institutional sources.
† Includes lead from lead-acid batteries.
‡ Includes recovery of other MSW organics for composting.
Details might not add to totals due to rounding.
Negligible = Less than 5,000 tons or 0.05 percent.

## Materials and Products

We track both materials and products. Materials are what products are made of and will ultimately be what is recovered and be reprocessed in the recycling process. Examples are metals and plastic. Products are what people buy and handle. Products are manufactured out of materials. Examples include packaging and newspapers. We track products to learn how people are consuming, using, and discarding materials. This information allows us to target activities that will ultimately maximize the recovery of materials.

USGS
science for a changing world

Prepared in cooperation with the Coachella Valley Water District

# Detection and Measurement of Land Subsidence Using Global Positioning System Surveying and Interferometric Synthetic Aperture Radar, Coachella Valley, California, 1996–2005

Scientific Investigations Report 2007–5251

Version 2.0, June 2013

U.S. Department of the Interior
U.S. Geological Survey

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**U.S. Geological Survey**
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# Detection and Measurement of Land Subsidence Using Global Positioning System Surveying and Interferometric Synthetic Aperture Radar, Coachella Valley, California, 1996–2005

By Michelle Sneed and Justin T. Brandt


## Abstract

Land subsidence associated with ground-water-level declines has been investigated by the U.S. Geological Survey in the Coachella Valley, California, since 1996. Ground water has been a major source of agricultural, municipal, and domestic supply in the valley since the early 1920s. Pumping of ground water resulted in water-level declines as large as 15 meters (50 feet) through the late 1940s. In 1949, the importation of Colorado River water to the southern Coachella Valley began, resulting in a reduction in ground-water pumping and a recovery of water levels during the 1950s through the 1970s. Since the late 1970s, demand for water in the valley has exceeded deliveries of imported surface water, resulting in increased pumping and associated ground-water-level declines and, consequently, an increase in the potential for land subsidence caused by aquifer-system compaction.

Global Positioning System (GPS) surveying and interferometric synthetic aperture radar (InSAR) methods were used to determine the location, extent, and magnitude of the vertical land-surface changes in the southern Coachella Valley. GPS measurements made at 13 geodetic monuments in 1996 and in 2005 in the southern Coachella Valley indicate that the elevation of the land surface had a net decline of 124 to 9 mm ±54 mm (0.41 to 0.03 ft ±0.18 ft) during the 9-year period. Changes at 9 of the 13 monuments exceeded the maximum expected uncertainty of ±54 mm (±0.18 ft) at the 95-percent confidence level, indicating that subsidence occurred at these monuments between June 1996 and August 2005. GPS measurements made at 20 geodetic monuments in 2000 and in 2005 indicate that the elevation of the land surface changed –192 to +51 mm ±36 mm (–0.63 to +0.17 ft ±0.12 ft) during the 5-year period. Changes at 6 of the 20 monuments exceeded the maximum expected uncertainty of ±36 mm (±0.12 ft) at the 95-percent confidence level—subsidence occurred at five monuments and uplift occurred at one monument between August 2000 and August 2005. GPS measurements at two of the five subsiding monuments for which subsidence rates could be compared indicate that subsidence rates decreased during this period compared with subsidence rates before 2000.

InSAR measurements made between May 7, 2003, and September 25, 2005, indicate that land subsidence, ranging from about 75 to 180 millimeters (0.25 to 0.59 foot), occurred in three areas of the Coachella Valley: near Palm Desert, Indian Wells, and La Quinta; the equivalent subsidence rates range from about 3 to more than 6 mm/month (0.01 to 0.02 ft/month). The subsiding areas near Palm Desert, Indian Wells, and La Quinta were previously identified using InSAR measurements for 1996–2000, which indicated that about 35 to 150 mm (0.11 to 0.49 ft) of subsidence occurred during the four-year period; the equivalent subsidence rates range from about 1 to 3 mm/month (0.003 to 0.01 ft/month). Comparison of the InSAR results indicates that subsidence rates have increased 2 to 4 times since 2000 in these three areas.

Water-level measurements made at wells near the subsiding monuments and in the three subsiding areas generally indicated that the water levels fluctuated seasonally and declined annually between 1996 and 2005; some water levels in 2005 were at the lowest levels in their recorded histories. The coincident areas of subsidence and declining water levels suggest that aquifer-system compaction may be causing subsidence. If the stresses imposed by the historically lowest water levels exceeded the preconsolidation stress, the aquifer-system compaction and associated land subsidence may be permanent. Although the localized character of the subsidence signals is typical of the type of subsidence characteristically caused by localized ground-water pumping, the subsidence may also be related to tectonic activity in the valley.

University of California
Division of Agriculture and Natural Resources

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http://anrcatalog.ucanr.edu
UC PEER REVIEWED

# Sustainable Landscaping in California

## How to Conserve Resources and Beautify Your Home Landscape

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While being a good steward of our environment has been a goal of home landscapers for many years, there is increasing emphasis on adopting sustainable landscaping practices and principles. What exactly is sustainable landscaping? In a nutshell, it involves selecting plants that are adapted to your climate and microclimate and implementing maintenance practices that reduce water waste, protect water quality, nurture soil, recycle organic matter, incorporate integrated pest management (IPM), protect and encourage desirable wildlife, and conserve energy.

Benefits of sustainable landscaping include

- healthy, low-maintenance landscapes
- lower water bills (for those on metered water)
- less water quality degradation
- increased energy conservation due to less pumping and water treatment
- extended life of water resources infrastructure (pumping, water treatment facilities, etc.)
- enhanced wildlife habitat and wildlife corridors
- reduced air pollution
- reduced home cooling and heating costs through strategic plant placement

Following the specific recommendations discussed in this publication will help guide you through the process of developing your own beautiful, low-maintenance sustainable landscape.


This drip-irrigated home landscape on a slope demonstrates both water-efficient and wildlife-friendly best management practices. *Photo:* J. Hartin.

2. Provide snags and brush piles. As trees become diseased, insect infested, or die, consider leaving them either standing or lying. (Note that this practice should be avoided in situations where disease or insect spread can occur.)
3. Plant native vegetation whenever possible. Natives provide optimum food and cover and often require less maintenance.
4. Remove invasive exotic plants. Invasive plants aggressively take over natural habitats and can outcompete native vegetation.
5. Plant a wide variety of flowering plants with varying bloom periods to ensure pollination. Make sure to include species that produce berries or seeds that provide food for wildlife.
6. Provide bird and bat houses and bird feeders. Adding different types of feeders and houses helps increase wildlife diversity.
7. Manage pets. Cats and dogs can drastically impact wildlife. Cats are excellent hunters and kill millions of birds and mammals in the United States each year.
8. Reduce pesticide use. Implement integrated pest management strategies discussed in this publication and found at the UC IPM website, http://www.ipm.ucdavis.edu/.
9. Expand the size of your habitat. The required habitat for many wildlife species is much larger than what you could provide within your yard. Consider partnering with your neighbors to create larger wildlife habitats.

## Conserve Energy

Energy-efficient landscape practices include choosing plants wisely to reduce inside energy consumption while maintaining the functionality of the outdoor landscape. Incorporating recommended sustainable landscaping principles and practices that modify your outdoor environment also positively impacts your indoor environment, reducing energy and utility costs. Properly placed vegetation, use of energy-conserving landscape maintenance measures, and use of energy-efficient lighting can significantly reduce energy use while keeping your home warm in the winter and cool in the summer. Increasing the energy efficiency of your home and landscape can increase its real estate value as well as its aesthetic value.

An obvious starting point is in the area of tool selection. Consider dusting off your hand tools and retiring power tools. As mentioned earlier in this publication, using a rake or broom instead of a hose to sweep up yard waste conserves energy, keeps fertilizers and pesticides out of the waterways—and provides exercise!

What about lawn mowers? Electric mowers are more energy efficient and quieter than their gas-powered counterparts. Push mowers are another green option. If you are currently using an older-model gas mower, consider replacing it with a more efficient model or an electric or push-type mower. Newer gas mowers with small engines run much cleaner than older models.

You can significantly reduce indoor energy use by strategic placement of trees. In hot inland regions of California, well-placed trees can provide shade that cools roofs, walls, and windows. Trees can reduce surrounding air temperatures by 9° to 12°F. Since about 40 percent of the unwanted heat that builds up in your house enters through windows, it is important to prevent sunlight from entering. Because the summer sun is so high, almost twice as much solar energy enters through the east and west windows as the south windows. This is especially true if there is a roof overhang on the south side of your house.

Deciduous trees (trees that lose their leaves each winter) offer one of the best opportunities to reduce home cooling costs and energy use. Planting them on the northeast-to-southeast and northwest-to-southwest sides of your house provides excellent protection from the summer sun by shading the roof, walls, and windows. Deciduous trees permit winter sunlight to warm the house. This is why it is best to avoid planting deciduous trees on the south side of your house if you live in a cool climate. In the winter, even bare branches of mature deciduous trees can reduce the amount of sun reaching your home.

When choosing a shade tree to plant, consider its ultimate height, spread, growth rate, and shape. These factors influence the cooling benefits of the tree. For western exposures, wide-spreading trees are best. Tree species that never grow tall will not provide much shade. In general, select trees that shade as much of the roof