Mission Creek and Garnet Hill Subbasins Water Management Plan

Administrative Draft

April 2012

Prepared for:
Coachella Valley Water District
Desert Water Agency
Mission Springs Water District

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Section 1
Introduction

Pumping in the Mission Creek and Garnet Hill subbasins was started in the 1930s. Since then, demands have increased steadily due to increased urban demands, as well as industrial, fish farms, and golf course use. For several decades, demands have annual exceed the limited natural supplies, and the groundwater table in the Mission Creek subbasin has dropped steadily.

The population of Desert Hot Springs and surrounding regions has grown significantly over the past thirty years, and growth is expected to continue. Therefore, water management is required to meet water demands, manage water quality, and manage environmental impacts, at an affordable cost.

1.1 MISSION STATEMENT

To guide the planning and development of the WMP, the following mission statement is developed for the Mission Creek and Garnet Hill WMP:

> ***The purpose of the Mission Creek and Garnet Hill Water Management Plan is to manage the water resources to reliably meet demands and protect water quality in a sustainable and cost-effective manner.***

1.2 BACKGROUND

1.2.1 History

The Mission Creek and Garnet Hill Subbasins of the Coachella Valley Groundwater Basin are an important source of water supply to the City of Desert Hot Springs and surrounding regions. Since the 1940s, the Desert Hot Springs region has been a known for its spas and served as a resort area, supplied by water from the Desert Hot Springs Subbasin. The Mission Creek Subbasin has been the primary water source to the area since that time.

The Coachella Valley Water District (CVWD) was founded in 1918 and has served customers within its service area since that time. The Desert Hot Springs Water District (predecessor to the Mission Springs Water District, MSWD) was formed in 1953 and began serving water from the Mission Creek Subbasin at that time.

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, and became responsible for imported water recharge in their service areas. MSWD was annexed as a sub agency to DWA in 1963 and since that time, land owners within MSWD's boundaries have paid a SWP assessment for the capital costs of the SWP. All land owners within DWA and CVWD's boundaries pay the assessments as well.

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 CVWD and DWA's SWP water. Deliveries of SWP Exchange water to Coachella Valley commenced in 1973, with advanced deliveries commencing in 1983. As early as 1984, MSWD, CVWD and DWA held discussions about recharging the Mission Creek Subbasin and the facilities that would be required. In 2002, DWA completed construction of spreading basins and a turnout from the Metropolitan Colorado River Aqueduct (CRA) and water deliveries began. CVWD and DWA executed the Mission Creek Groundwater Replenishment Agreement in April 2003, which also allowed for storage of advanced deliveries from Metropolitan. In a May 2003 White Paper, MSWD outlined its concerns with the Agreement, underscoring its dependence and interest in the subbasin.

1.2.2 Settlement Agreement

In October 2003, MSWD filed action in the Superior Court of the State of California against DWA seeking a writ of mandate, declaratory relief for prescriptive and appropriative water rights and declaratory and injunctive relief for a physical solution of a groundwater basin. MSWD sought adjudication of the subbasin and questioned the quality of the imported water. Both CVWD and DWA filed answers challenging the complaint. In December 2004, MSWD, DWA and CVWD reached a settlement agreement. The agreement stated the agencies would work jointly to manage the subbasin. The agreement included provisions regarding payment of Replenishment Assessment Charges (RAC), a three-party management committee, shared costs for basin studies and development of a Water Management Plan for the Mission Creek and Garnet Hill Subbasins. In October 2008, final contracts needed for development of the Basin Management Plan were approved by CVWD and MSWD. DWA agreed with development of modeling studies but questioned whether the Basin Management Plan would duplicate efforts expected for the IRWMP. In April 2009, DWA approved a modified proposal to facilitate management plan preparation (CVRWMG RAP, 2009).

1.3 AUTHORIZATION

The development of this Plan is based on a Memorandum of Understanding between CVWD, DWA, and MSWD on July 27, 2009 to prepare this Plan and a groundwater model of the Mission Creek and Garnet Hill subbasins. This Plan is prepared by MWH Americas, Inc. based on an agreement between CVWD and MWH dated July 27, 2009.

1.4 STAKEHOLDER INVOLVEMENT

1.4.1 Management and Technical Committees

As part of the Settlement Agreement, the General Managers from CVWD, DWA, and MSWD meet quarterly to discuss ongoing topics regarding the management of the Mission Creek and Garnet Hill subbasins. A Technical Committee was also formed with primary responsibility for the development of this Plan. The Technical Committee consists of CVWD, DWA, and MSWD each appointed Staff and/or Consultants, as well as the Consultants hired to develop this Plan.

1.4.2 Public Meetings

One public meeting was held on April 21, 2010 during the development of this Plan to obtain input on the development of the plan from water users within the Planning Area.

1.5 RELATIONSHIP TO OTHER PLANNING EFFORTS

Over the past few years, a number of related, compatible planning efforts have been initiated in the Coachella Valley. These are described below.

1.5.1 Integrated Regional Water Management Plan

In 2002, the California legislature enacted the Integrated Regional Water Management (IRWM) Planning Act (Division 6 Part 2.2 of the Water Code §10530 et seq.), amended in 2008. The act encourages local agencies to develop integrated regional strategies for management of water resources and work cooperatively to manage their available local and imported water supplies to improve the quality, quantity and reliability of those supplies. The California Department of Water Resources (DWR) reviews all IRWM plans. DWR provides funding for water management projects through competitive planning and implementation grant programs.

In 2008, Coachella Water Authority (CWA), CVWD, DWA, Indio Water Authority (IWA), and MSWD formed the Coachella Valley Regional Water Management Group (CVRWMG) and signed a Memorandum of Understanding (MOU) for development of an Integrated Regional Water Management Plan (IRWMP). In 2009, the CVRWMG established a planning region boundary and submitted an application for region acceptance to DWR, which was approved.

The CVRWMG completed the Coachella Valley IRWMP in December 2010 (CVRWMG, 2010). The CVIRWMP qualifies the region for DWR grants under proposition 84, Division 43: ***The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006***, and Proposition 1E, ***Article 1.699: Disaster Preparedness and Flood Prevention Bond Act of 2006.*** The Mission Creek/Garnet Hill Water Management Plan is expected to be a significant component of future updates to the CVRWMP.

1.5.2 Urban Water Management Plans

In 1983, the California Legislature enacted the Urban Water Management Planning (UWMP) Act (Division 6 Part 2.6 of the Water Code §§10610 - 10656). This act requires that every urban water supplier providing water to 3,000 or more customers, or more than 3,000 AF of water annually, should ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry years. The act describes the contents of the UWMP as well as how urban water suppliers should adopt and implement the plans. Every five years (in years ending in five and zero), plans are prepared and adopted that define the supplier's current and future water use, sources of supply, source reliability, and existing conservation measures. DWR reviews plans for compliance and provides a report to the California legislature one year after plans are due to DWR.

In compliance with state requirements, CVWD, DWA, and MSWD each prepared a 2010 UWMP for its service area by July 2011. The plans document projected water demands and plans for delivering water supplies to their water service areas. The plan will be updated every 5 years or as required by DWR. The plans also discussed the development and implementation of plans to decrease per capita urban water usage 20 percent by the year 2020. The next deadline for UWMP submission will be December 31, 2015.

1.5.3 Coachella Valley Water Management Plan

CVWD completed a Water Management Plan (WMP) in 2002 (CVWD, 2002) for water supplies throughout the Coachella Valley. The main focus of the 2002 WMP was to develop a plan to combat overdraft in the Whitewater Subbasin. The 2002 WMP was updated in 2010 (CVWD, 2011) in order to respond to changing external and internal conditions.

The purpose of the 2010 WMP was to define projected water demands through 2045, and focused on the five major elements:

- Water conservation (urban, golf course, and agricultural)
- Increasing surface water supplies for the Valley from outsides sources
- Substitution of surface water supplies for groundwater (source substitution)
- Groundwater recharge
- Monitoring and evaluation of subsidence and groundwater levels and quality to provide the information needed to manage the Valley's groundwater resources

A list of projects and implementation plan were developed to guide CVWD to eliminate overdraft in the Coachella Valley.

The development of the Mission Creek/Garnet Hill WMP is being closely coordinated with the 2010 WMP Update to ensure consistent planning assumptions and analyses.

1.6 AB3030 CONTENTS

Sections 10750-10756 of the California Water Code (AB 3030) provide a systematic procedure for an existing local agency to develop a groundwater management plan. While this Mission Creek/Garnet Hill Water Management Plan is not an AB 3030 plan, all the technical components of an AB 3030 plan have been considered in the development of this Plan.

Water Code Section 10753.7 states that a groundwater management plan may include components relating to all of the following:

- The control of saline water intrusion (discussed in **Section 5**)
- Identification and management of wellhead protection areas and recharge areas (discussed in **Section 5**)
- Regulation of the migration of contaminated groundwater (discussed in **Section 5**)

- The administration of a well abandonment and well destruction program (discussed in **Section 7**)
- Mitigation of conditions of overdraft (discussed in **Section 5 and Section 7**)
- Replenishment of groundwater extracted by water producers (discussed in **Section 3**)
- Monitoring of groundwater levels and storage (discussed in **Section 4, Section 5, and Section 7**)
- Facilitating conjunctive use operations (discussed in **Section 7**)
- Identification of well construction policies (discussed in **Section 7**)
- The construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling and extraction projects (discussed in **Section 5**)
- The development of relationships with state and federal regulatory agencies (Discussed in **Section 5 and Section 7**)
- The review of land use plans and coordination with land use planning agencies to assess activities which create a reasonable risk of groundwater contamination (Discussed in **Section 5 and Section 7**)

Section 2
Plan Setting

This section describes the "Planning Area" for the Mission Creek and the Garnet Hill subbasins Water Management Plan (WMP). Population, land use, and socio-economic trends in the Planning Area that may affect water requirements in the Mission Creek and the Garnet Hill subbasins are described. Projections for population and water demands in the Planning Area are presented through year 2045. Historical development and environmental resources in the Planning Area are also presented.

PLANNING 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. The intersection of this trough and the Colorado River 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, San Jacinto, and Santa Rosa Mountains, 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 (MWH, 2002).

The Mission Creek and Garnet Hill subbasins are located in the northern portion of the Coachella Valley, and are part of the larger Coachella Valley Groundwater Basin. The following considerations are used to delineate the Planning Area:

- The Planning Area includes all land that directly overlies the two subbasins so that return flows are adequately accounted.
- The Planning Area includes all land that is currently or expected to be served by groundwater from the two subbasins to account for all groundwater demands.
- Areas that are currently or are projected to be served by the Whitewater subbasin groundwater are excluded.

For the purposes of this WMP, the Planning Area consists of land directly overlying the Mission Creek and Garnet Hill subbasins and those areas that use groundwater from these subbasins as shown on **Figure 2-1**. In addition, to the above mentioned areas, portions of the Mission Springs Water District (MSWD) and the Coachella Valley Water District (CVWD) that are likely to use groundwater from the Mission Creek and Garnet Hill subbasins in the future are included in the Planning Area. A portion of the Planning Area south of the intersection of Interstate 10 and Highway 62 is served by MSWD overlies the Whitewater Basin but receives groundwater supply from the Mission Creek and Garnet Hill subbasins. Also included in the Planning Area south of Interstate 10 and west of the south projection of Little Morongo Road is approximately 460 acres that is not currently served by either CVWD or MSWD.

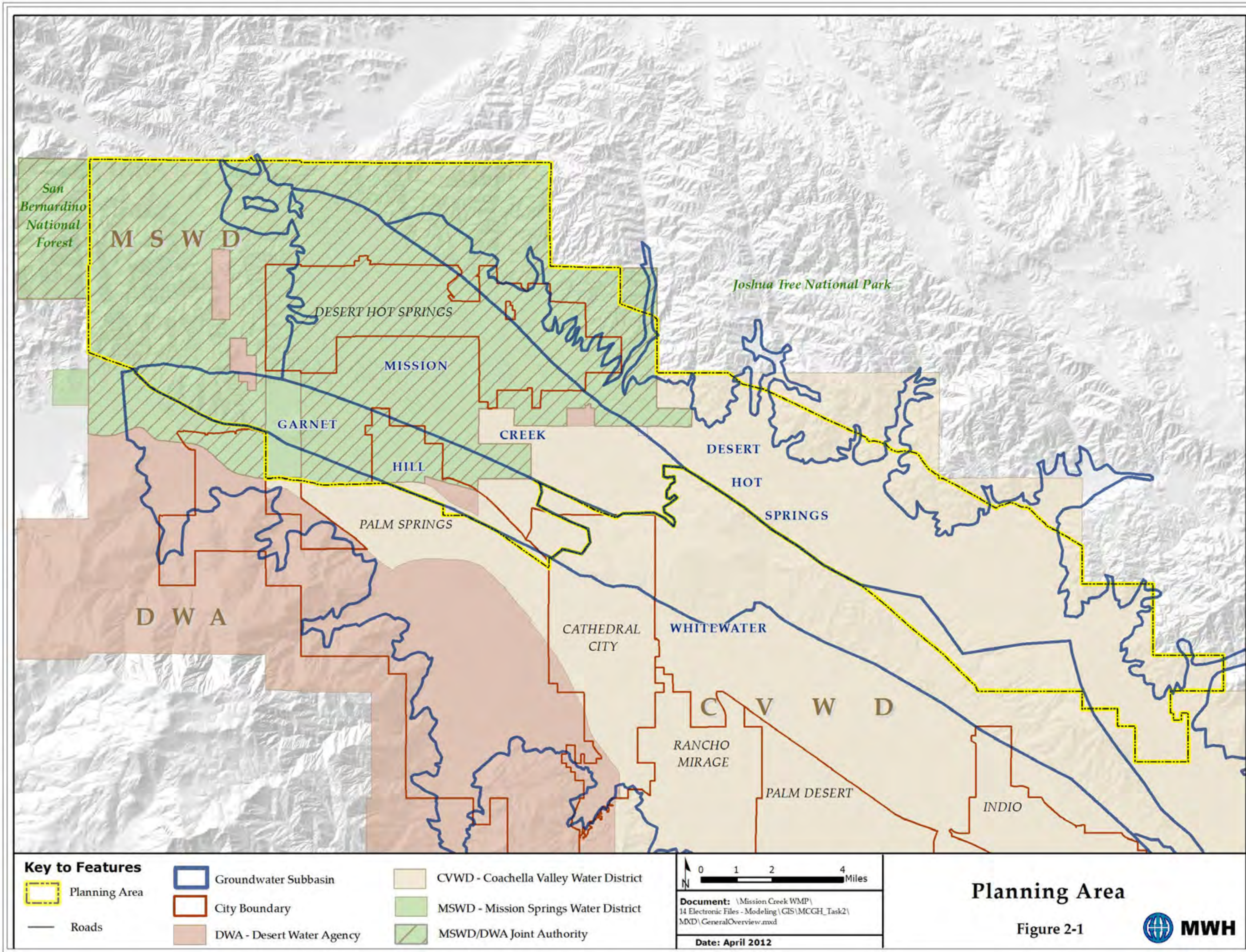
The eastern portion of the Planning Area overlying the Desert Hot Springs subbasin, served by MSWD and CVWD, receives water supply from the Mission Creek subbasin and has been included. Based on land use, the proximity to other sources of supply in the Coachella Valley, and the expected groundwater use from the Mission Creek and Garnet Hill subbasins, the following additional factors are used to define the Planning Area:

- Portions of MSWD, CVWD, and DWA's institutional boundaries that overlie the Mission Creek and Garnet Hill subbasins are included in the Planning Area.
- The Planning Area's southernmost boundary includes the portion of CVWD's service area within the City of Indio's Sphere of Influence where future expansion of infrastructure is expected. This portion south of 32nd Avenue, east of Monroe Street, and north of 36th Avenue encompasses the planned development Inner Beauty/Indio Hills. The service area within the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) is not included in the Planning Area.
- The Joshua Tree National Park and the San Bernardino National Forest are outside the Planning Area since development in these areas is highly unlikely.
- A portion of the Morongo Band of Mission Indians tribal lands overlies the MSWD institutional boundary, but not the Mission Creek or Garnet Hill subbasins. It is unlikely that MSWD will serve this area, and therefore, this area has been excluded from the Planning Area. (**Figure 2-2**).

Jurisdictional Boundaries – Water Districts, Cities, and County

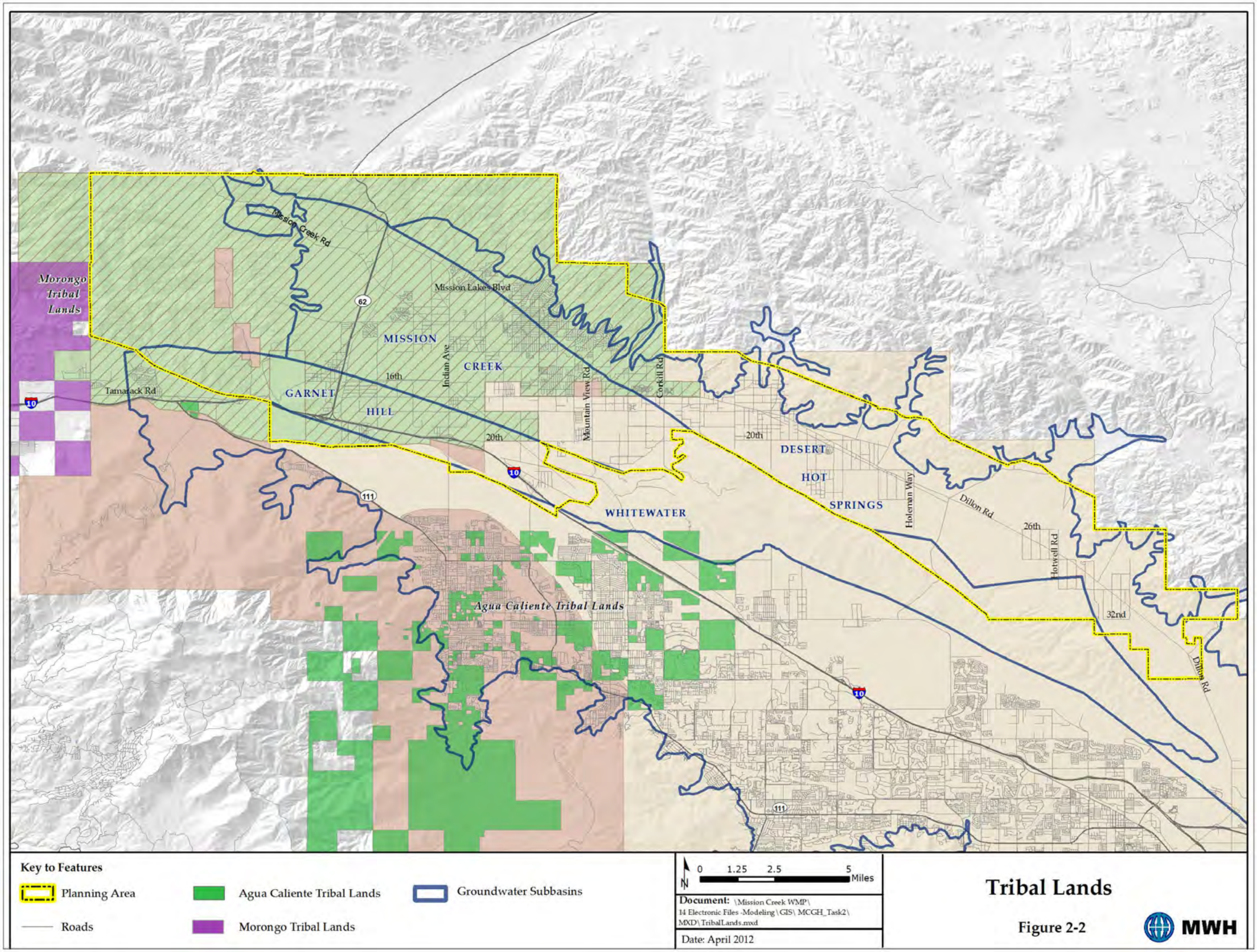
The WMP Planning Area overlies portions of the cities of Palm Springs, Desert Hot Springs, Cathedral City, and unincorporated areas of Riverside County. The County and cities serve as the land use agencies within their jurisdictional boundaries; the county serves are the land use planning agency for unincorporated areas. Riverside County also has responsibility for stormwater over the majority of the Planning Area. The three major water purveyors in the Planning Area are CVWD, DWA, and MSWD and are discussed in greater detail below.

CVWD is a public agency organized under the County Water District Law (Water Code Section 30000 *et seq.*) and was formed in 1918. CVWD's total institutional boundary covers approximately 1,000 square miles. CVWD delivers irrigation water to more than 60,000 acres of agricultural land, potable water to more than 102,000 customers and provides wastewater collection, treatment, recycling and disposal, regional stormwater protection, and water conservation services. Within the Planning Area, CVWD's jurisdiction extends over approximately 73-square miles (MWH and CVWD, 2005). CVWD obtains imported water from the State Water Project (SWP) and the Colorado River. The Planning Area constitutes those portions of CVWD's service area that overlie or receive water from the Mission Creek subbasin. While CVWD is the regional stormwater agency for a large portion of the Coachella Valley, it is not responsible for flood control and stormwater within the Planning Area.



Planning Area

Figure 2-1



Tribal Lands

Figure 2-2

MWH

DWA is an independent special district organized under the Desert Water Agency Law (Water Code Appendix Section 100-1, *et seq.*) and was formed in 1961 to contract for SWP water to replenish the groundwater basin. Since that time, DWA's responsibilities have expanded to include retail water service, water recycling and power generation. DWA's institutional boundary includes the portions of the cities of Desert Hot Springs, Palm Springs and Cathedral City. Within the Planning Area, DWA's jurisdiction extends over approximately 115-square miles (DWA, 2005). Both DWA and CVWD have the authority to import water under contract from the State Water Project, replenish groundwater and levy replenishment assessments to recover a portion of the cost of replenishment.

MSWD is a public water and wastewater agency organized under the County Water District Law. Formed in 1953, MSWD covers 135 square miles and serves approximately more than 12,500 retail water customers and 6,300 wastewater customers. MSWD's institutional boundary encompasses the City of Desert Hot Springs, portions of unincorporated Riverside County, portions of the cities of Palm Springs and Cathedral City, and the communities of West Palm Springs Village and Palm Springs Crest (Psomas and MSWD, 2005). Within the Planning Area, MWSD's jurisdiction extends over approximately 114-square miles.

Figure 2-1 shows each of the three agencies and their jurisdictional areas in relation to each other. DWA's jurisdictional boundary overlies a majority of MSWD's service area with the exception of two areas west of the City of Desert Hot Springs along the terminus of Whitewater Canyon Road. Additionally, DWA has two non-contiguous areas along MSWD's southeastern boundary at the intersections of Interstate 10 and Indian Avenue and at the Sands RV Resort near Dillon Road and Mountain View Road. MSWD's service area does not overlay into DWA service area in two areas: west of Rushmore Ave to the southwest of the Planning Area and a three square mile portion of the windmill farm along Interstate 10. CVWD is adjacent to DWA and does not overlap MSWD's service area.

Groundwater Basins Overview

The groundwater basins in the study are based on designations by the United States Geological Survey (USGS) and the California Department of Water Resources (DWR) and are briefly described below. More detailed descriptions are included in **Section 4**.

Mission Creek Subbasin

The Mission Creek subbasin is located in the northwestern Coachella Valley in the north central portion of Riverside County, California. Groundwater is replenished from the Desert Hot Springs subbasin to the north. The Mission Creek Fault and the Banning Fault form the northern and southern boundaries of the subbasin, respectively. Both act to limit groundwater movement as these faults have folded sedimentary deposits, displaced water-bearing deposits, and caused once permeable sediments to become impermeable (DWR, 1964). The main water bearing units of the Mission Creek subbasin are relatively undisturbed and unconsolidated Holocene and late Pleistocene alluvial deposits. These detritus deposits are formed from the surrounding San Bernardino and Little San Bernardino Mountains, first as filled topographic depressions and then as deposits on the piedmont alluvial fans. The individual beds are lenticular in shape and not extensive, but coalesce with other beds to form larger water bearing areas. Hydrogeologic units included in these water-bearing deposits are: Ocotillo conglomerate, Cabazon fanglomerate and Holocene alluvial and sand dune deposits. DWR has designated this basin as No. 7-21.02 in Bulletin 118 (DWR, 2003).

Garnet Hill Subbasin

The area between the Garnet Hill fault and the Banning fault, named the Garnet Hill subarea by DWR (1964), was considered a distinct subbasin by the USGS because of the effectiveness of the Banning and Garnet Hill faults as barriers to groundwater movement. Bulletin 118 (2003) includes the Garnet Hill Subbasin as a portion of the Indio Subbasin. 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 over the subbasin 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 (DWR, 1964).

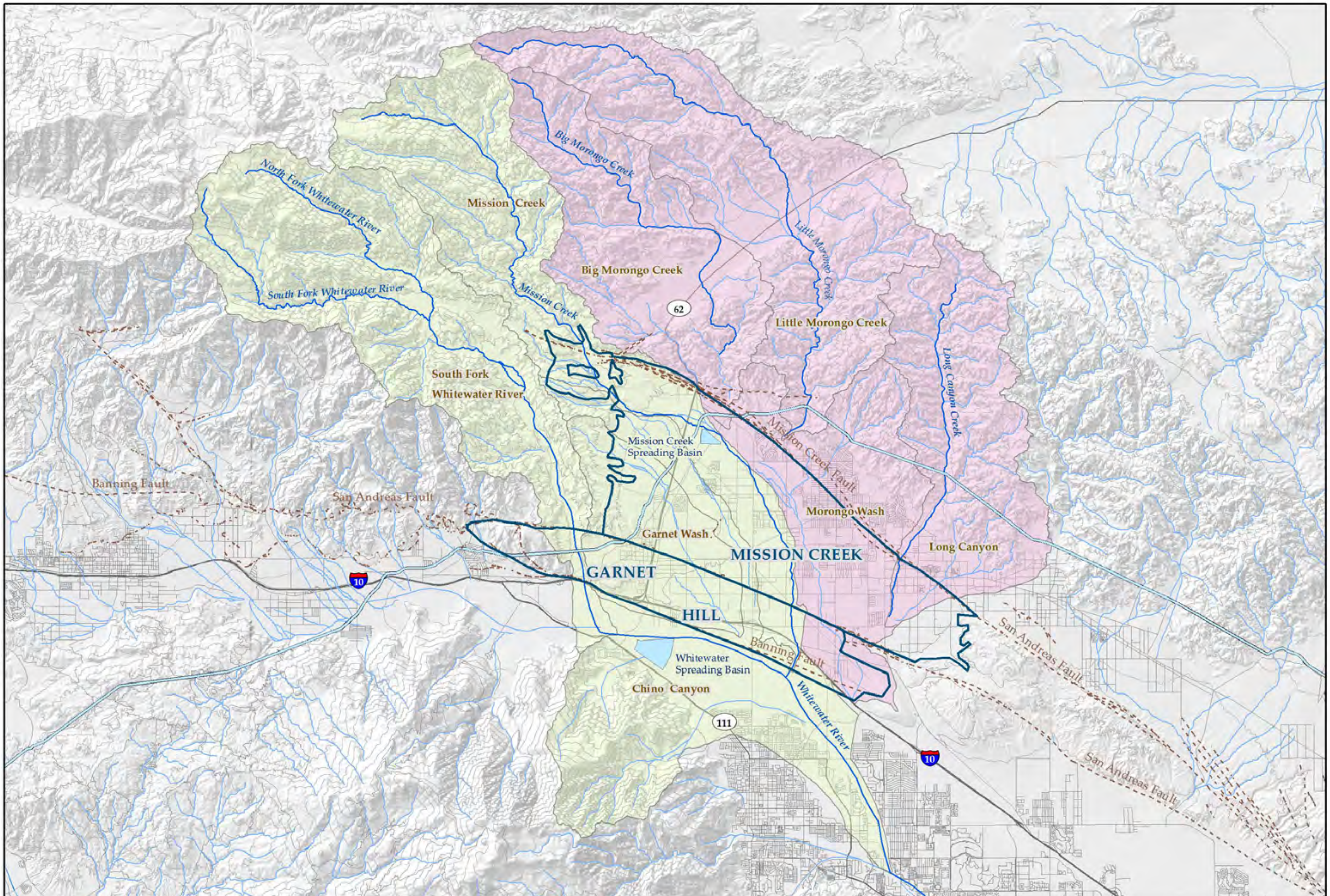
Desert Hot Springs Subbasin

The Desert Hot Springs subbasin is located adjacent to the Mission Creek subbasin and trends northwest-southeast along the foothills of the Joshua Tree National Park. DWR has designated this subbasin as No. 7-21.03 in Bulletin 118 (2003). The subbasin is bounded on the southwest by the Banning and Mission Creek fault and the semipermeable rocks of the Indio Hills. These faults act as groundwater barriers and direct the groundwater in a southeast direction. Hot thermal springs occur on the Mission Creek fault and have been actively pumped for over 50 years. The subbasin is comprised of late Pleistocene and Holocene alluvium, coarse sand and gravel (DWR, 2003). Thermal mineral waters occur near active faults such as the Mission Creek fault in the Miracle Hill subarea where the groundwater is used to supply local resorts. This Water Management Plan does not cover water supplies from the Desert Hot Springs subbasin, however, parts of the Planning Area overlie the Desert Hot Springs subbasin.

SURFACE WATER OVERVIEW

Surface water flow in the Planning Area consists of ephemeral or intermittent streams which originate in the mountains. Two major watersheds replenish the Mission Creek and Garnet Hill subbasins: Little Morongo Creek/Morongo Wash and Whitewater River. Major streams in the area include the Whitewater River, Big and Little Morongo Creeks, Dry Morongo Wash, Long Canyon Creek and Mission Creek. **Figure 2-3** presents the location of the groundwater subbasins, the watersheds that drain into the subbasins, and major streams.

Surface water features that contribute to recharge in the Mission Creek subbasin include Mission Creek, Dry Morongo Wash, and Big Morongo Canyon. Surface water features that contribute to recharge in the Garnet Hill Subbasin includes the Whitewater River. Long Canyon Creek and the Little Morongo Creek provide recharge in the Desert Hot Springs subbasin, and also provide recharge to the Mission Creek subbasin during times of significant flow.



Key to Features

- Topographic Contours (500 feet)
- Major Drainage
- Colorado River Aqueduct
- Groundwater Subbasins
- Spreading Basins

Watersheds
- Little Morongo Creek-Morongo Wash
- Headwaters Whitewater River

- Faults

0 1.25 2.5 5 Miles

Source: USDA, ESRI, USGS, County of Riverside

Document: \Mission Creek WMP\ 14 Electronic Files -Modeling \GIS\ MCGH_Task2\ MXD\Watersheds.mxd

Date: April 2012

Watersheds and Water Bodies

Figure 2-3

MWH

Mission Creek is the only stream feeding the Mission Creek subbasin that flows to the valley floor on a consistent basis, but surface flow usually disappears a short distance from its entrance to the Mission Creek subbasin. Streams flowing through Morongo Valley, Big Morongo, Little Morongo, and Long Canyon periodically reach the valley floor for short periods of time when there are localized, intense storms in the mountains (MTU, 1998).

Psomas (2010) estimates that the total recharge from mountain front precipitation under average conditions would approximately equal 4,900 acre-ft/year. Other previous reports have estimated annual inflows due to natural recharge into the Mission Creek subbasin as 5,360 acre-ft/yr (MTU, 1996), 6,000 acre-ft/yr (DWR, 1964), and a total of 11,800 to 14,300 acre-ft/yr to both the Mission Creek and Desert Hot Springs subbasins (GSI, 2005).

The Whitewater River primarily feeds the Whitewater subbasin, but flows across the Garnet Hill subbasin before reaching the Whitewater subbasin. The Whitewater River flows reach the valley floor on a consistent basis. A portion of the imported water released from the Colorado River Aqueduct into the Whitewater River also percolates into the Garnet Hill subbasin. GSI (2005) estimated that recharge in the Garnet Hill subbasin from the Whitewater River is approximately 7,000 acre-ft/yr. There are no other significant surface water sources that flow into the Garnet Hill subbasin.

PLANNING AREA DEMOGRAPHICS

Population

Based on U.S. Census Bureau decennial population counts, the historical population was estimated based on the percentage land within the Planning Area for each census tract (**Table 2-1**). Between 1960 and 2000, the northern Valley experienced an average annual growth of 5.9 percent. Based on the 2010 census data, the population of the Planning Area is estimated to be 44,571.

Table 2-1
Historical Population within the Planning Area

Year	Population
1960	3,031
1970	4,663
1980	12,168
1990	24,342
2000	30,573
2010	44,571

Source: Minnesota Population Center, *National Historical Geographic Information System* (Historical Census Data Repository)
2010 US Census Data.

During the last decade, the population within the Planning Area has experienced several changes that will affect future water demands. A strong economy and lower than average Southern California housing prices led to rapid housing market growth and precipitated the conversion of open space to residential land uses. Almost as quickly as the housing market boomed, the recession which began in September 2008, has slowed the population growth.

Table 2-2 and **Table 2-3** list the racial and ethnic diversity in the Planning Area based on the 2010 U.S. Census. Estimates are developed for each census tract located within the Planning Area. For census tracts partially located within the Planning Area, the estimated population is adjusted based on the percentage of the census tract area located within the Planning Area. The high percentage of white residents is due to the arrival of Europeans searching for therapeutic mineral springs in the early part of the 20th century. Because the tribal lands are not part of the Planning Area, the percentage of American Indians is approximately one percent despite their earlier arrival in Coachella Valley.

Table 2-2
Race/Ethnicity within the Planning Area in 2010

Race/Ethnicity	Percent
White alone	62.9%
Black or African American alone	5.6%
American Indian and Alaska Native alone	1.3%
Asian alone	2.0%
Native Hawaiian and Other Pacific Islander alone	0.2%
Some other race alone	23.8%
Two or more races	4.2%
Total	**100%**

Source: U.S. Census Bureau, 2010.

Table 2-3
Hispanic Population within the Planning Area in 2010

Category	Percent
Hispanic or Latino	50.9%
Not Hispanic or Latino	49.1%
Total	**100%**

Source: U.S. Census Bureau, 2000.

Employment

The economic climate of the Coachella Valley, the state of California, and the nation as a whole has fluctuated since the turn of the century. Within the last half decade, the Planning Area's economic development has focused primarily on tourism (hot spring/spa industry), retirement services, and seasonal housing. As the population increased, employment expanded to include construction, retail, and service sectors. Between 2000 and 2007, the Coachella Valley economy grew at a faster rate than the state of California (4.1 percent compared to 0.8 percent annually). However, compared with the state of California, the Coachella Valley has fewer manufacturing, wholesale trade, or government jobs. Beginning in 2007, retail, tourism, and construction jobs have sharply declined. As a result of the recession, unemployment rates currently outpace statewide trends and the region may recover more slowly than the state of California (CVRWMG, 2009 and Husing, 2009.)

Income Levels

The US Census Bureau estimates the 2010 State of California's Median Household Income as $60,883. Comparatively, 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 (Census, 2010). (Income levels are reported by city and are not adjusted for those areas within the Planning Area. The median income level for Riverside County is $57,768.) Section 79505.5(a) of the California Water Code defines a Disadvantaged Community as any community with an annual median household income that is less than 80 percent of the statewide annual median household income. (CA Water Code, 2009). Based on this definition, all three cities are classified as Disadvantaged Communities.

Growth Forecasts

In 2005, Riverside County was experiencing rapid growth. Recognizing the need for 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, the Coachella Valley Association of Governments (CVAG), and the University of California, Riverside (UCR) 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, a consistent and standard set of population, housing and employment forecasts for use in their operational and planning activities. The requirements of local and regional planning efforts, including transportation, land use, infrastructure and environmental planning, have all emphasized the importance of and need for accurate projections for use by all jurisdictions, agencies and programs. In addition to the above, 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, that are used for both the Regional Transportation Plan update and the Regional Housing Need Assessment program (RCCDR, 2006). The RCP-06 was approved by the Executive Committee of Western Riverside Council of Governments (WRCOG) on December 4, 2006, the Executive Committee of Coachella Valley Association of Governments on January 29, 2007, and by the Riverside County Board of Supervisors on March 14, 2007. The RCP-06 growth forecasts were updated after the release of the 2010 US Census data resulting in Riverside County Projects 2010 (RCP-10) growth forecasts. The forecasts, prepared by RCP-10 in five-year increments, cover the period of 2010 through 2035 and are presented in the following paragraphs. These growth rates are linearly extrapolated to 2045.

Population Projections

The RCP-10 population forecasts are presented in **Table 2-4** for the period 2010 through 2045. The projections incorporate the 2010 US Census data and are developed by the Riverside County Center for Demographic Research. Population estimates were calculated for each census tract located within the Planning Area. For census tracts partially located within the Planning Area, the estimated population was adjusted based on the percentage of land for each census tract.

Based on these projections, the Planning Area population is estimated to increase to 110,000 people by 2045, an increase of 65,000 between 2010 and 2045.

Table 2-4
RCP-10 Population Projections within the Planning Area

Year	Population
2010	44,571
2015	62,818
2020	70,995
2025	79,890
2030	89,348
2035	96,163
2040	102,978
2045	109,793

Source:
RCCDR, 2012

Employment Projections

The Riverside County Center for Demographic Research (RCCDR) developed and adopted detailed employment projections in late 2006 and early 2007 before the onset of the widespread recession. Slowdown in the housing market, which was one of the primary components of the recession, was not accounted for in the RCP-06 forecasts. These forecasts have been adjusted upon release of the 2010 US Census data and are presented in **Table 2-5**.

Table 2-5
Employment Projections within Planning Area

Year	Employment
2010	10,318
2015	11,632
2020	12,994
2025	15,710
2030	18,425
2035	21,141
2040	23,857
2045	26,573

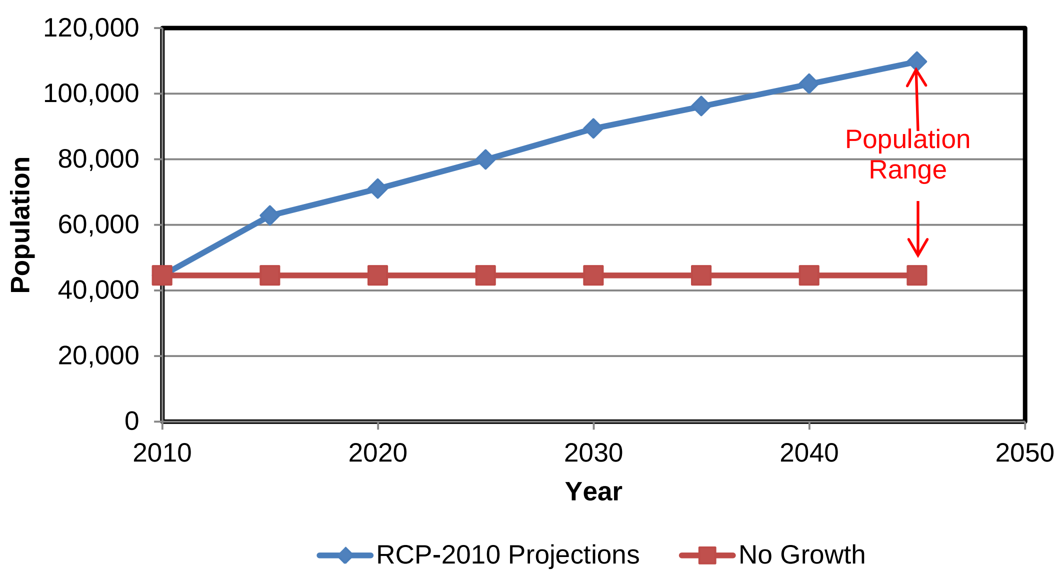
Source:
RCCDR, 2012

Effects of Recession on Growth Forecasts

At the turn of the 21th century, there was a rapid increase in population in the Coachella Valley. The population in the Valley has increased by 35 percent since 2000. In 2006, the RCP-06 estimated that the annual growth rate for Riverside County as a whole will be four percent (4%) between 2005 and 2035. However, since 2008, Riverside County has been particularly hard hit by the recession. It has one of the highest rates of foreclosures and unemployment in the country. Due to this economic downturn, the annual growth rate in the county has significantly moderated over the last two years. According to some expert economists and real estate professionals who have been studying the effects of the recession on the county, it is predicted that economic recovery in the county will be very slow paced (Husing, 2009).

Likewise, it is anticipated that the Planning Area will have a similar slow paced recovery. The exact timing and extent of this reduced growth rate cannot be accurately predicted at this time. Further, since the planning period of this WMP is 35 years (through 2045), it is expected that the effect of the recession on growth in the Planning Area will be attenuated over the long term. Since it is unknown when the current recession will end and the economy will rebound, a scenario considering "No Growth" in the Planning Area is also evaluated and discussed in latter sections of this WMP. The intent of considering a "No Growth" scenario is to assess the effects of uncertainties on the Planning Area water resources. Depending on how, where, and when the actual growth occurs in the Planning Area in the future, the resulting population for 2045 is expected to fall within the band formed by the two population estimates shown on **Figure 2-4**. The population projections developed in the two scenarios are considered to be book-end targets for the Planning Area.

Figure 2-4
Population Projections for the Planning Area



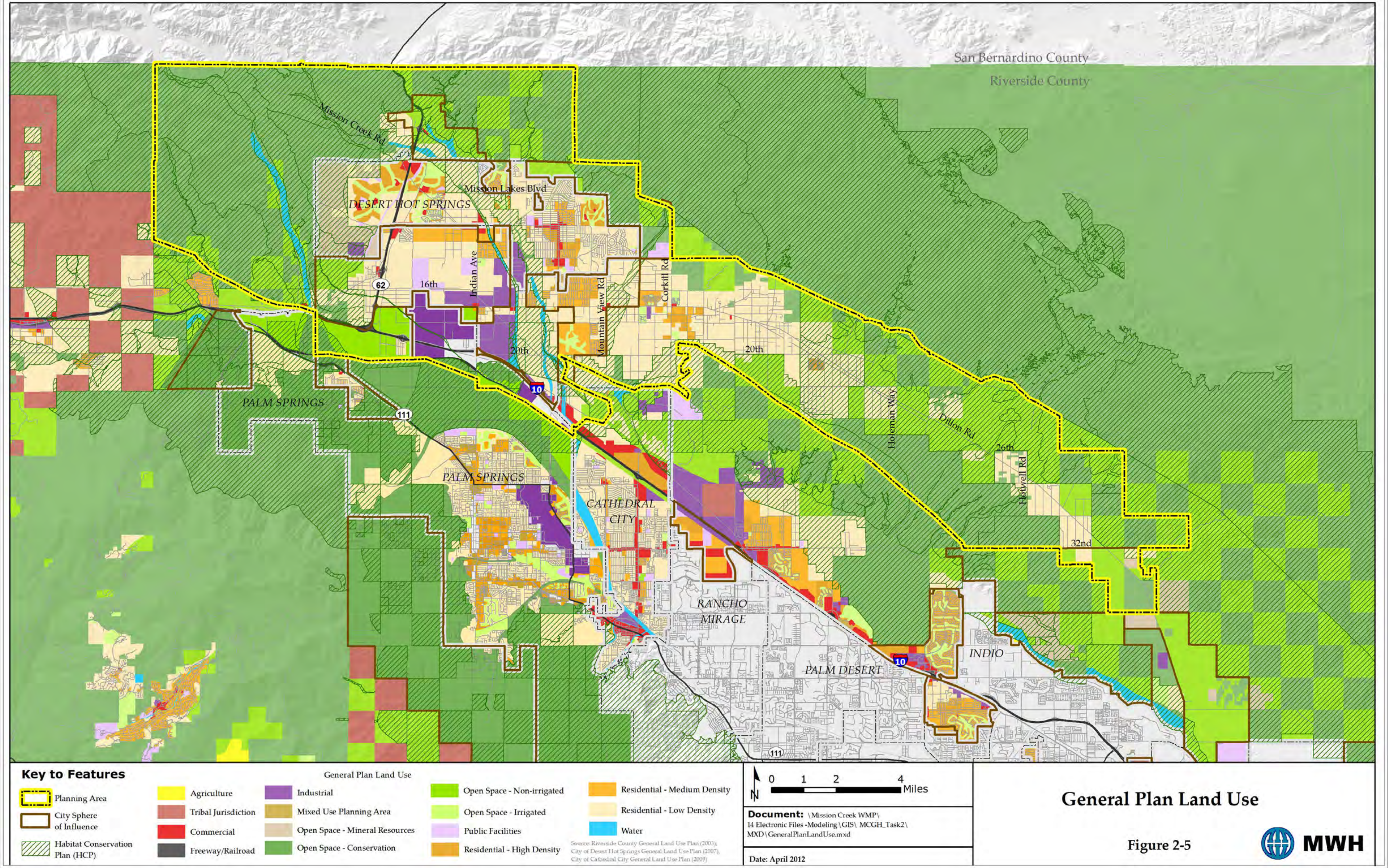
LAND USE

Land use designations used in this section are based on the 2003 Riverside County Integrated Plan (RCIP), Desert Hot Springs's 2007 General Plan, Cathedral City's 2009 General Plan, and Palm Springs' 2007 General Land Use Plan. The land use categories were generalized into the following 15 categories and are presented in **Figure 2-5**.

- Low Density Residential (< 5 dwelling units/acre)
- Medium Density Residential (5 to 8 dwelling units/acre)
- High Density Residential (> 8 dwelling units/acre)
- Tribal Jurisdiction
- Mixed Use
- Agriculture
- Industrial
- Commercial
- Open Space (Irrigated, Non-irrigated, Mineral Resources, and Conservation)
- Public Facilities
- Transportation
- Water (Water bodies, drainage corridors, and land designated for flood control)

Although the revised growth forecasts discussed in the **Growth Forecast** section indicate significant future growth, it should be noted that these forecasts are based on potential development that has not yet been approved by the cities and the County. The Riverside County Integrated Plan (RCIP) was adopted in 2003. The original intent of the RCIP was to conduct a formal review and update after five years. The Riverside County General Plan was amended in 2008 and 83 amendments have been incorporated through a series of resolutions. The Riverside County Planning Department is currently updating the County General Plan. According to the general land use plans, there are approximately 3,632 acres of non-MSHCP, developable open space within the Planning Area. These areas are subject to significant development pressure as they transition to urban land uses.

It should be noted that neither the Riverside County nor the City of Desert Hot Springs General Plans have been updated in conjunction with the RCCDR growth projections. The County is currently proceeding with a major update to the General Plan, designated General Plan Amendment 960 (GPA 960), which will be completed in the near-term. GPA 960 will review and update a number of the general plan elements, including the Land Use element. Likewise, the City of Desert Hot Springs General Plan is scheduled for completion in the near-term. The city's general plan will include an economic development analysis of the city's annexation south of Interstate 10 and an implementation strategy for the city's incorporation of the Coachella Valley Multi-Species Habitat Conservation Plan (CVMSHCP). Any adjustments related to growth adjustments in light of General Plan updates in the future would be reflected in projected water demands in updates to this WMP.



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Date: April 2012

General Plan Land Use

Figure 2-5

MWH

SOCIAL AND CULTURAL RESOURCES

Since the turn of the last century, the northern Coachella Valley has attracted visitors in search of a warmer climate and hot mineral waters. From these springs, a tourist-based economy began and continues to this day. There are approximately, 23 spas and resorts that provide therapeutic services in the thermal springs located along the foothills of the Joshua Tree National Park. Additionally, there are several resorts and golf courses which have helped to establish the cities of Desert Hot Springs, Cathedral City, and Palm Springs (Visit DHS, 2009).

WATER INFRASTRUCTURE OVERVIEW

Groundwater Production

Among the three major domestic water purveyors, MSWD has the highest groundwater production from the Mission Creek and the Garnet Hill subbasins. MWSD's service area contains a portion of the Upper Coachella Groundwater Basin and includes the Mission Creek and the Garnet Hill subbasins, the Whitewater River subbasin, the San Gorgonio Pass subbasin, and the Desert Hot Springs subbasin. The MSWD service area overlies several sub-basins, with supplies from the Mission Creek and Garnet Hill subbasins, as well as supplies from groundwater basins outside the study area. DWA does not have any groundwater production facilities in the Mission Creek/Garnet Hill subbasins. CVWD has six production wells located in an area overlying the south central portion of the Mission Creek subbasin. Based on available data, it is estimated that are 99 non-municipal wells in the Planning Area of which 86 wells pump water from the Mission Creek subbasin and the remaining 13 wells pump water from the Garnet Hill subbasin. Production data are available for private wells that serve golf courses and fish farms in the Planning Area. Private groundwater wells that do not serve golf courses or fish farms are assumed to serve an individual residence. Since no production information is available for these wells and since it is assumed that these private wells are used for residential purposes, for this WMP, it is assumed that private residential wells produce 1 acre-ft/yr.

Recharge Infrastructure

The DWA owns, operates and maintains a imported water spreading facility in the Mission Creek subbasin. A portion of CVWD's and DWA's SWP water allocation is used for recharge at this facility. A conveyance system to deliver SWP water directly to the Coachella Valley currently does not exist. However, the Metropolitan's Colorado River Aqueduct (CRA) passes through the valley. CVWD and DWA entered into an agreement with MWD to exchange their SWP water allocation for CRA water. In 1997, MWD constructed a turnout from the CRA for DWA and installed a 48-inch turnout just south of Indian Avenue and west of Worsley Road. DWA acquired approximately 190 acres of land in the vicinity of the turnout to construct spreading basins to percolate the Colorado River water into the Mission Creek subbasin. Recharge activities in the Mission Creek subbasin commenced in November 2002 (Psomas, 2006).

Wastewater Collection and Treatment Infrastructure

The study area has two separate wastewater collection systems and treatment plants (WWTP) both of which are operated by the MSWD. The Horton WWTP is located on Verbena Drive about one-half mile south of Two Bunch Palms Trail. The treatment capacity of the Horton WWTP is 2.3 million gallons per day (mgd). The Desert Crest Treatment Plant is located about one-half mile southeast of the intersection of Dillon Road and Long Canyon Road. The treatment capacity of the Desert Crest Treatment Plant is 0.18 mgd. The two WWTPs serve approximately 6,000 parcels of developed land in the MSWD service area. Both WWTPs currently treat wastewater using a secondary treatment process (Psomas, 2007). Treated effluent from both the Horton and Desert Crest plants is disposed by utilizing percolation/evaporation ponds located within the plants. These ponds are located on the southwest side of the Mission Creek Fault. In addition, effluent is used for irrigation and wash-down at the plants (Psomas, 2007).

In addition to the wastewater collection and treatment systems, septic tanks and leach fields/seepage pits are the region used for wastewater treatment and disposal. Approximately half of the customers in MSWD service area are connected to wastewater collection and treatment; the other half use septic tanks. All of the domestic customers in CVWD's service area use septic tanks, as no municipal wastewater collection and treatment systems exist in CVWD's service area.

ENVIRONMENTAL FACTORS

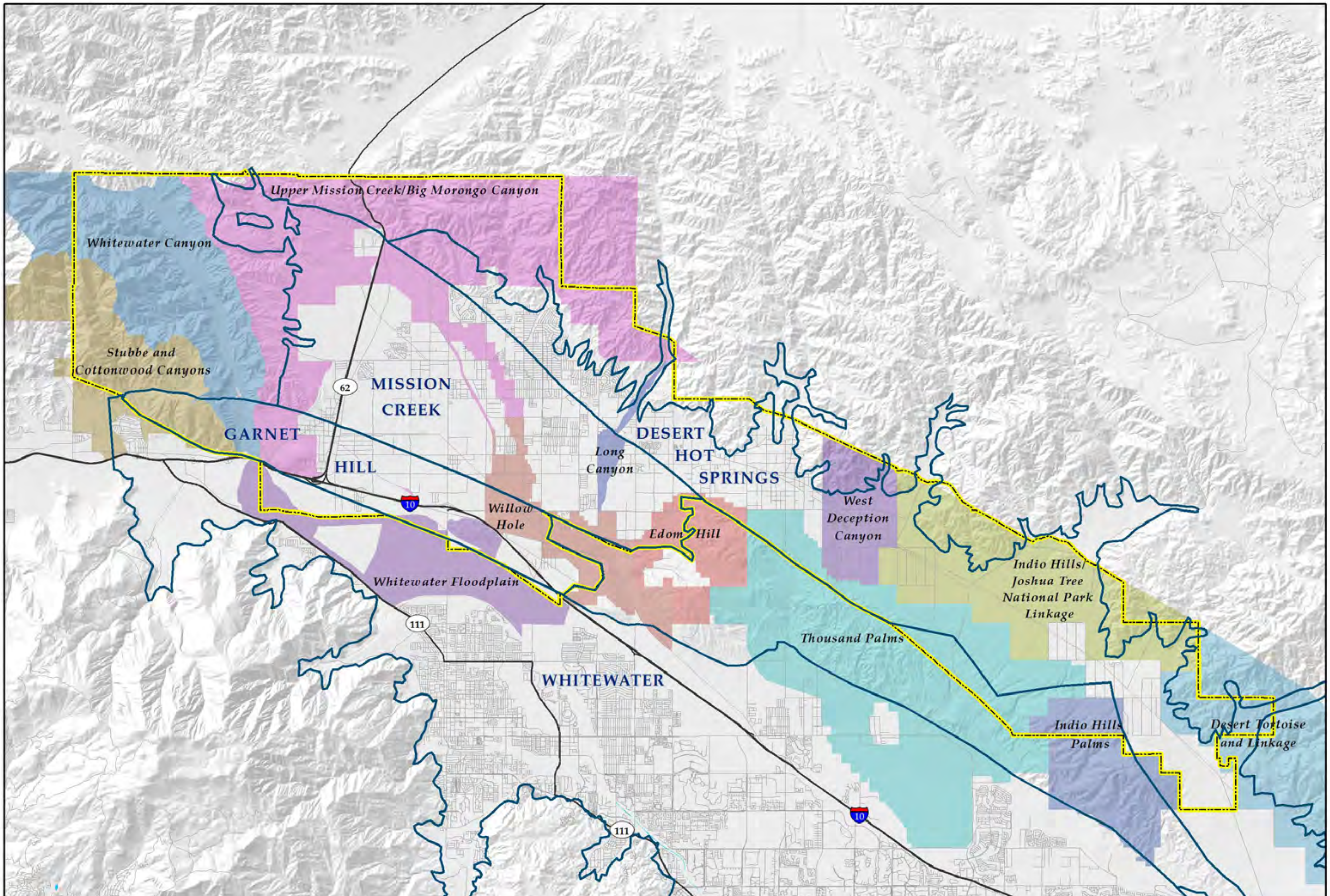
The environmental resources of the Coachella Valley, including ecology and wildlife, the Salton Sea, and groundwater resources, are briefly described in this section.

Coachella Valley Ecology and Wildlife

Biologically, the undeveloped portions of the Coachella Valley are characterized as Colorado Desert scrub, sand dune, desert riparian, fan palm oasis, and marsh vegetation communities. Intact natural desert, dune, riparian and marsh ecosystems support relatively high wildlife species diversity, including species listed, or proposed for listing, as sensitive. The California Natural Diversity Data Base (NDDB, 2009) listings provided 50 sensitive species or habitats within the Planning Area and surrounding vicinity.

Coachella Valley Multi-Species Habitat Conservation Plan

The Coachella Valley Multi-species Habitat Conservation Plan (CVMSHCP) was approved by the United States Fish and Wildlife Service (USFWS) in October 2008. The purpose of the CVMSHCP is to balance the competing goals of maintaining biological diversity and economic growth through the designation of open space. Drawing from state and federal regulatory laws governing the protection of threatened and endangered species, the CVMSHCP is based on the Endangered Species Act (ESA), National Environmental Policy Act (NEPA), the California Fish and Game Code, and the California Environmental Quality Act (CEQA). **Figure 2-6** shows the habitat conservation areas in and around the Planning Area which are based on established ecological systems, biological corridors, and jurisdictional factors (CVMSHCP, 2009).



Key to Features

- Planning Area
- Groundwater Subbasins

0 1 2 4 Miles

N

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Date: April 2012

Multi-Species Habitat Conservation Plan

Figure 2-6

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The CVMSHCP designates about 78,000 acres of land within 13 conservation areas throughout the Planning Area. Of this total, the CVMSHCP allows for low-density residential development (1 du/20 acres) of about 22,400 acres within designated conservation areas. CVWD is currently a signatory to the CVMSHCP, MSWD in the process of becoming a signatory to the CVMSHCP, DWA is not a signatory. **Appendix C** summarizes the conservation areas within the Planning Area.

Hot Springs

Discovered at the turn of the 20th century, naturally-occurring hot mineral water aquifers continue to attract tourists to the foothills of Joshua Tree National Park. Located along the Mission Creek branch of the San Andreas Fault in the Desert Hot Springs subbasin, water travels along fissures deep into the earth's crust where it is heated and returns to the surface as steam where it heats the aquifer. Surface temperatures range from 90 to 180 degrees Fahrenheit and are shown in **Appendix D – Hot Water Maps**. Although water from the Desert Hot Springs subbasin is not used for domestic consumption, approximately 23 resorts rely on these thermal springs (Visit DHS, 2009).

Section 3
Water Requirements

INTRODUCTION

This section discusses the historical water usage and the estimated future water requirements in the Planning Area for the Mission Creek and the Garnet Hill subbasins Water Management Plan (WMP). Using available data and information from published reports, historical and existing water use types in the Planning Area are described. Assumptions are developed to estimate the future water requirements within the Planning Area. Future water requirements are documented in five-year increments from year 2010 through the year 2045. Build-out water requirements for the Planning Area are also presented in this section. The impacts of currently implemented and future water conservation measures on water requirements are presented in this section.

HISTORICAL WATER REQUIREMENTS

Historical water use is documented in a number of data sources including: water agency billing and production data, Engineer's Reports on Water Supply and Replenishment Assessment for the Mission Creek Subbasin Area of Benefit, production reported to the State Water Resources Control Board (SWRCB) for the 1948-1992 period, and data developed by the United States Geological Survey (USGS) (Tyley, 1974) for modeling the Upper Coachella Valley. There are several inconsistencies in the values reported in these sources. Resolving the inconsistencies in these data is essential for understanding the dynamics between the subbasins and to aid in developing and calibrating a groundwater model. As with the Whitewater River subbasin groundwater model, the model calibration period for the Mission Creek/Garnet Hill model will begin in year 1936. In addition, the available data do not fully cover the desired 1936-2008 calibration period. Therefore, estimates of production and return flows are developed for the Planning Area for periods where historical data are not available.

Water use in the Planning Area is predominantly urban in nature and is primarily comprised of domestic and commercial uses. Golf courses and fish farms account for other existing major water use types. There is no agricultural water use within the Planning Area. Major industrial water use (greater than 25 acre-ft/yr) is limited to the water requirements of a peaking power plant within the Garnet Hill subbasin.

Historical water use data for the Planning Area is summarized in **Table 3-1**.

Table 3-1
Summary of Historical Production in the Planning Area

Year	CVWD Area of Benefit (acre-ft/yr)	DWA Area of Benefit (acre-ft/yr)	Total (acre-ft/yr)
1978	854	1,399	2,253
1979	1,001	2,564	3,565
1980	1,107	2,914	4,021
1981	1,421	2,878	4,299
1982	1,302	2,630	3,932
1983	1,442	2,979	4,421
1984	1,915	3,740	5,655
1985	2,148	3,559	5,707
1986	2,159	4,278	6,437
1987	2,234	4,483	6,717
1988	2,302	4,834	7,136
1989	2,606	5,690	8,296
1990	2,512	5,790	8,302
1991	2,292	5,486	7,778
1992	2,188	6,187	8,375
1993	2,528	6,333	8,861
1994	2,863	6,813	9,676
1995	2,865	7,237	10,102
1996	2,838	7,724	10,562
1997	2,104	7,795	9,899
1998	2,757	7,534	10,291
1999	3,004	7,970	10,974
2000	3,433	8,405	11,838
2001	3,929	8,421	12,350
2002	4,371	9,597	13,968
2003	4,425	9,343	13,768
2004	4,628	12,069	16,697
2005	4,247	12,068	16,315
2006	4,757	12,994	17,751
2007	4,547	12,460	17,007
2008	4,543	11,726	16,270
2009	4,813	10,343	15,156
2010	4,484	9,819	14,303

Source: Values in Table 3-1 are obtained from the CVWD's Engineer's Report on Replenishment Assessment for the Mission Creek subbasin

Water requirements for each water use type are briefly discussed in the following paragraphs:

Municipal and Domestic Use

Municipal and domestic water use consists of water used for residential, commercial, institutional and other similar uses. Municipal and domestic water requirements are typically served by local water purveyors (Mission Springs Water District (MSWD) and Coachella Valley District (CVWD)), mutual water companies or private wells.

MSWD Water Use

Historical water consumption and production data for the Mission Springs Water District's (MSWD) water system are presented in **Table 3-2**. The difference between water production and water consumption (water billed to customers) is defined as water loss (or unaccounted-for-water). Water losses may be attributed to leaking pipes, unmetered or unauthorized water use, inaccurate meters, fire flow or other events causing water to be withdrawn from the system and not measured. A review of MSWD's production data for the 1991-2010 period indicates an average annual water loss of nine percent.

A review of the data presented in **Table 3-2** indicates that residential water use (single and multi-family residential) accounts for approximately 70 percent of the total water use. SFR water use increased approximately 70 percent between year 1991 and year 2010 while MFR water use increased approximately 32 percent. The overall residential water use increased by approximately 59 percent for the same period.

Commercial water use increased approximately 3 percent between year 1992 and year 2010. Commercial water use declined approximately 20 percent between year 2007 and year 2009. However, compared to 2007 levels, commercial water use increased in year 2010 by approximately 15 percent. Compared to 2009, commercial water use experienced a significant increase in 2010; increasing by approximately 43 percent.

The most significant increase in water use is for the "Other" category which increased by approximately 186 percent during the 1992-2010 period. In particular, water use for this category increased by over 50 percent between year 2003 and year 2004. This increase is attributed to increased construction activity in the housing industry in the Desert Hot Springs area during this period. The impact of the current slowdown in the housing market and the economy can be observed by comparing year 2007 and year 2009 water consumption data. A reduction of approximately 20 percent in water consumption is observed across the residential, commercial, and "other" water use types. However, with the exception of the single family residential category, water use across all categories has experienced a significant increase in 2010 for MSWD's service area.

Table 3-2
Summary of Historical Consumption and Production Data for MSWD

Year	SFR(1) (acre-ft/yr)	MFR(2) (acre-ft/yr)	Commercial (acre-ft/yr)	Other(3) (acre-ft/yr)	Total Consumption (acre-ft/yr)	Total Production (acre-ft/yr)
1992	3,083	1,294	538	794	5,708	6,187
1993	3,215	1,300	539	779	5,833	6,562
1994	3,753	1,614	640	1,086	7,093	6,784
1995	3,533	1,290	602	742	6,167	6,723
1996	3,736	1,376	693	863	6,668	7,142
1997	3,639	1,279	636	912	6,467	7,146
1998	3,523	1,209	583	870	6,186	7,241
1999	3,787	1,369	671	1,146	6,973	7,627
2000	3,955	1,578	719	1,057	7,309	7,854
2001	3,928	1,457	665	1,083	7,133	7,843
2002	4,108	1,435	669	1,162	7,374	8,102
2003	4,318	1,468	690	1,097	7,572	8,567
2004	4,944	1,548	715	1,647	8,854	10,039
2005	5,348	1,464	674	1,971	9,457	11,721
2006	6,249	1,621	719	1,744	10,332	11,158
2007	6,676	1,651	767	1,382	10,476	10,919
2008	5,741	1,442	660	1,148	8,991	10,130
2009	5,328	1,436	616	1,083	8,463	9,511
2010	5,058	1,553	880	1,427	8,962	10,801

Note: Data provided by MSWD.
(1) SFR = Single Family Residential
(2) MFR = Multi-Family Residential
(3) Other consumption data includes water requirements for schools, irrigation, and tract construction.
Values in Table 3-2 reflect water production from the Mission Creek and Garnet Hill subbasins for MSWD's potable water system.

CVWD Water Use

Historical water consumption data for the Coachella Valley Water District's (CVWD) water system are presented in **Table 3-3**.

Table 3-3
Summary of Historical Consumption Data for CVWD

Year	SFR(1) (acre-ft/yr)	MFR(2) (acre-ft/yr)	MOB(3) (acre-ft/yr)	BUS(4) (acre-ft/yr)	COM(5) (acre-ft/yr)	Public(6) (acre-ft/yr)	IRR(7) (acre-ft/yr)	Total Consumption (acre-ft/yr)	Total Production(8) (acre-ft/yr)
1999	768	2	323	24	8	15	12	1,151	1,946
2000	1,692	3	815	58	18	26	20	2,632	2,375
2001	1,672	3	793	59	16	26	29	2,598	2,871
2002	1,741	4	1,066	59	15	28	40	2,953	3,313
2003	1,671	4	1,124	61	14	20	36	2,929	3,450
2004	1,722	3	1,096	58	17	19	38	2,953	3,528
2005	1,736	3	1,046	61	15	19	31	2,910	2,957
2006	2,114	2	1,155	83	22	18	64	3,458	3,235
2007	2,160	2	1,142	80	55	21	65	3,525	3,119
2008	1,955	2	1,042	65	51	16	65	3,196	3,098
2009(9)	-	-	-	-	-	-	-	2,780	3,580
2010(9)	-	-	-	-	-	-	-	2,647	3,109

Note: Data provided by CVWD.
(1) SFR = Single Family Residential
(2) MFR = Multi Family Residential
(3) MOB = Mobile Homes\Trailer Parks
(4) BUS = Business (includes guardhouses, offices, drinking fountains, ice makers)
(5) COM = Commercial (includes laundries, nurseries, beauty salons, club houses, restaurants)
(6) Public Agencies (includes hospitals, schools, fire stations, churches, and fire protection)
(7) Irrigation (includes landscaping, golf courses, swimming pools, cement/batch plants, rock washing, packing houses, road department, "Resale" Emergency Water)
(8) Total production is estimated as the difference between the total production reported in the Engineer's Report and the production of the large private pumpers. Values in Table 3-3 reflect water consumption and production from the Mission Creek subbasin for CVWD's potable water system
(9) Due to a change in customer billing systems, data for CVWD for 2009 and 2010 are not available for the same customer classes as prior years.

Data presented in **Table 3-3** is summarized in **Table 3-4** as residential (SFR, MFR, and mobile homes), commercial (business and commercial), and "other" (public agencies and irrigation) water use.

Table 3-4
Consolidated Summary of Historical Consumption Data for CVWD

Year	Residential[(1)] (acre-ft/yr)	Commercial[(2)] (acre-ft/yr)	Other[(3)] (acre-ft/yr)	Total (acre-ft/yr)	Total Production[(4)] (acre-ft/yr)
1999	1,093	32	27	1,151	1,946
2000	2,511	76	46	2,632	2,375
2001	2,467	75	55	2,598	2,871
2002	2,811	74	68	2,953	3,313
2003	2,799	75	56	2,929	3,450
2004	2,820	75	57	2,953	3,528
2005	2,785	76	49	2,910	2,957
2006	3,271	105	82	3,458	3,235
2007	3,304	135	86	3,525	3,119
2008	2,999	116	81	3,196	3,098
2009	2,628	86	66	2,780	3,580
2010	2,238	74	56	2,647	3,109

(1) Residential use includes single and multi-family uses and water requirements at trailer parks.
(2) Commercial use includes commercial and business water use requirements.
(3) Other use includes public agencies and irrigation water use requirements.
(4) Total production is estimated as the difference between the total production reported in the Engineer's Report and the production of the large private pumpers
Values in Table 3-4 reflect water consumption and production from the Mission Creek subbasin for CVWD's potable water system.

A review of water consumption data from these subbasins for the Coachella Valley Water District (CVWD) for the period 1999-2010 indicates that residential water use (SFR, MFR, and mobile homes) accounts for approximately 90 percent of CVWD's total water use. Total residential water use has increased approximately 104 percent between year 1999 and year 2010. A decline of approximately 10 percent is observed in the residential water use between year 2007 and year 2008. This can be attributed to the decline in the housing industry in California due to the global economic crisis. Commercial water use exhibits a similar trend, with a decline of approximately 14 percent between year 2007 and year 2008.

Other Domestic Use

There are independent water systems within the Planning Area which produce groundwater from the Mission Creek and Garnet Hill subbasins for domestic use. There is no data available on the existing and the historical water use for these producers. Data obtained from the Riverside County Department of Environmental Health lists the following independent water system within the Planning Area and is summarized in **Table 3-5**.

Table 3-5
Independent Water Systems within MSWD's Service Area

Water System Name[1]	Address
Desert Dunes Golf Club LLC	19300 Palm Drive, Desert Hot Springs
Desert Hot Springs Spa	10805 Palm Drive, Desert Hot Springs
Jack in the Box #5328	22600 Palm Drive, Desert Hot Springs
Mission Creek Preserve	Mission Creek, Desert Hot Springs
Palm Gas Mart/Arco	22755 Palm Drive, Desert Hot Springs

(1) Data obtained via email from the Riverside County Department of Environmental Health on April 14th, 2010.

Water use for the Desert Dunes Golf Course is accounted in historical and future water estimates based on data observed from the CVWD's Engineer's Report on Replenishment Assessment for the Mission Creek subbasin. Based on the physical address provided for the Desert Hot Springs Spa, it can be inferred that its water requirements are met by production from the Desert Hot Springs subbasin. It is believed that the Mission Creek Preserve receives its water from the Mission Creek subbasin and is used as supply for the headquarters and camp groups. Jack in the Box and the Palm Gas Mart/Arco pump groundwater from the Garnet Hill subbasin. It is assumed that water use for the remaining water systems is relatively minimal (approximately 1 acre-ft/yr).

In addition to these independent water systems, some municipal and domestic use may be served by non-municipal production wells. Based on available data, it is estimated that are 99 non-municipal wells in the Planning Area of which 86 wells pump water from the Mission Creek subbasin and the remaining 13 wells pump water from the Garnet Hill subbasin. Since it is assumed that such wells generally serve an individual residence, no information is available regarding how much water each well produces. For this plan, it is assumed that private residential wells produce 1 acre-ft/yr. It is assumed that all private wells use groundwater for residential purposes.

Golf Course Water Use

There are over one hundred golf courses within the Coachella Valley and golf course irrigation represents a significant water use. However, there are only six golf courses located within the Planning Area. These golf courses are listed in **Table 3-6** along with the year the course was established and its number of holes and length.

Table 3-6
Golf Courses in the Planning Area

Name	Address	Year Established	Number of Holes/Length	Source of Supply[1]
Caliente Springs	70-200 Dillon Road, Sky Valley, CA	1998	9 holes 785 yards	CVWD Domestic (overlies Desert Hot Springs Subbasin)
Desert Crest Country Club	16-900 Crest Avenue, Desert Hot Springs, CA	1966	9 holes 1,998 yards	Desert Hot Springs Subbasin
Desert Dunes Golf Course	19-300 Palm Drive, Desert Hot Springs, CA	1989	18 holes 6,876 yards	Mission Creek Subbasin
Hidden Springs Country Club	15-500 Bubbling Wells Road, Desert Hot Springs, CA	1977	9 holes 1,506 yards	Mission Creek Subbasin
Mission Lakes Country Club	8484 Clubhouse Boulevard, Desert Hot Springs, CA	1970	18 holes 6,742 yards	Mission Creek Subbasin
Sands RV Country Club	16-400 Bubbling Wells Road, Desert Hot Springs, CA	1982	9 holes 2,127 yards	Mission Creek Subbasin

Source: www.palmsprings.com/golf/
(1) Indicates the source of groundwater supply for irrigation.

Four of the six golf courses use groundwater from the Mission Creek subbasin. Three of these four golf courses are located within MSWD's service area and one golf course is located within CVWD's service area. The following golf courses use groundwater from the Mission Creek and Garnet Hill subbasins for the purposes of irrigation:

- Desert Dunes Country Club (CVWD's service area)
- Hidden Springs Country Club (MSWD's service area)
- Sands RV and Golf Resort (MSWD's service area)
- Mission Lakes Country Club (MSWD's service area)

The historical water use for these courses is presented in **Table 3-7**. An increase of over 20 percent is observed between year 2003 and year 2004 in golf course water use. Thereafter, an overall increase of five percent in water use is observed between year 2004 and year 2008.

Table 3-7
Summary of Historical Golf Course Water Use

Year	Desert Dunes Country Club (acre-ft/yr)	Hidden Springs Country Club (acre-ft/yr)	Mission Lakes Country Club (acre-ft/yr)	Sands RV and Golf Resort (acre-ft/yr)	Total (acre-ft/yr)
2003	775	196	965	300	**2,236**
2004	917	255	1,171	410	**2,753**
2005	1,164	234	1,045	287	**2,730**
2006	1,214	244	1,186	42	**2,686**
2007	1,140	254	1,190	296	**2,880**
2008	1,137	233	1,186	343	**2,899**
2009	1,042	250	757	253	**2,302**
2010	1,113	258	1,048	280	**2,699**

Note: Data obtained Engineer's Reports on Replenishment Assessment for the Mission Creek and Garnet Hill subbasins.

Fish Farm Water Use

Fish farming is a water-dependent agricultural enterprise. A variety of fish are grown in the Valley for the market, including striped bass, catfish and tilapia. There are three active fish-farms within the Planning Area. The historical water use for these farms is presented in **Table 3-8**. There is no information available on when these fish farms started their operations in the Planning Area.

Table 3-8
Summary of Historical Fish Farm Water Use

Year	Aqua King(1) (acre-ft/yr)	Bluebeyond Fisheries (acre-ft/yr)	Desert Springs Aquaculture (acre-ft/yr)	Too Many Palms (acre-ft/yr)	Total (acre-ft/yr)
2003	100	100	-	-	**200**
2004	76	63	45	-	**184**
2005	-	50	183	76	**309**
2006	-	50	183	76	**309**
2007	-	50	162	75	**288**
2008	-	50	182	75	**308**
2009	-	50	140	75	**265**
2010	-	142	120	0	**262**

Note: Data obtained Engineer's Reports on Replenishment Assessment for the Mission Creek and Garnet Hill subbasins.
(1) Aqua King's operations have been taken over by Desert Springs Aquaculture.

Industrial Water Use

A power generation facility which draws water from the Garnet Hill subbasin constitutes the only industrial water use in the Planning Area. The Wildflower Indigo Facility, owned by the Diamond Generating Corporation, is a 138 megawatt (MW) natural gas fired peaking power plant constructed in year 2001. The 138-megawatt facility is located in North Palm Springs, near the intersection of 19th and Indian Avenue in an area dominated by wind turbines. Using clean-burning natural gas, the plant employs water injection nitrous oxide control technology to reduce emissions. In order to avoid impacting the local infrastructure, the zero-discharge facility draws and purifies any water it requires from its on-site well. Peak water demand at this facility is estimated to be 246 gallons per minute (gpm) or 387 acre-ft/yr (California Energy Commission).

SUMMARY OF RECENT WATER USE FOR THE PLANNING AREA

Historical water use (2003-2010 period) for the Planning Area is summarized in **Table 3-9** using the data presented in **Table 3-2** and **Table 3-3**. The impact of the current housing downturn on water requirements is evident by observing year 2010 water use. Residential and commercial water uses have decreased approximately 13 percent and 15 percent respectively from year 2007 levels. The overall water use in the Planning Area has decreased approximately 10 percent from year 2007.

Table 3-9
Summary of Recent Water Use in the Planning Area

Year	2003 (acre-ft/yr)	2004 (acre-ft/yr)	2005 (acre-ft/yr)	2006 (acre-ft/yr)	2007 (acre-ft/yr)	2008 (acre-ft/yr)	2009 (acre-ft/yr)	2010 (acre-ft/yr)
Residential(1)	8,585	9,312	9,596	11,141	11,631	10,183	9,392	8,346
Commercial(2)	765	790	750	823	902	776	702	1,351
Industrial(3)	387	387	387	387	387	387	387	387
Institutional(4)	1,153	1,704	2,020	1,826	1,467	1,229	1,149	994
Golf Courses(5)	2,236	2,753	2,730	2,686	2,880	2,899	2,303	2,699
Fish Farms(6)	200	184	309.4	309	288	308	266	262
Total	**13,325**	**15,131**	**15,793**	**17,173**	**17,555**	**15,781**	**14,199**	**14,039**

(1) Residential use includes single and multi-family uses and water requirements at trailer parks.
(2) Commercial use includes commercial and business water use requirements.
(3) Industrial use represents estimated water use at the Windflower Indigo Peaker Plant in the Garnet Hill subbasin.
(4) Institutional use includes public agencies and irrigation water use requirements.
(5) Golf course use is obtained from Engineer's Reports on Replenishment Assessment for the Mission Creek and Garnet Hill subbasins.
(6) Fish Farm use is obtained from Engineer's Reports on Replenishment Assessment for the Mission Creek and Garnet Hill subbasins.

FUTURE WATER REQUIREMENTS

A review of the historical water use requirements assists in identifying trends for different water use types. These trends and estimates documented in other published reports are frequently used to estimate future water requirements. Estimates of future water requirements are necessary to identify sources of supply needed to satisfy those requirements. Estimates of future water requirements are developed based on historical and current water use patterns. A discussion of future water use requirements for the Planning Area including the assumptions and the methodology developed is presented in the following paragraphs. These estimates consider the impacts of existing conservation measures as well as future conservation programs in the Planning Area.

Assumptions

The following assumptions are made to estimate water use requirements for the Planning Area for the period year 2010-2045.

Water Use Categories

Based on the consumption data classifications obtained from MSWD and CVWD, the following classifications are proposed for water use projections in the Planning Area:

- Residential (includes water use for SFR, MFR, and mobile homes\trailer parks)
- Commercial (includes water use for businesses and commercial establishments)
- Industrial (includes water use for power plants)
- Institutional (includes water use for public agencies such as schools, fire stations, churches etc.)
- Golf Courses
- Fish Farms

Assumptions for Residential Water Requirements

It is assumed that residential water use requirements will increase in direct proportion to the population projections discussed in **Section 2 Plan Setting**. Per capita residential water use is assumed to remain constant over the planning period. Residential water use factors are computed for year 2000 and year 2005 as the ratio of the residential water use to the population. Residential water use factor (without considering conservation) for the Planning Area is 232 gallon per capita per day (gpcd) which is the average of year 2000 and year 2005 residential water use factors.

Assumptions for Commercial Water Requirements

It is assumed that commercial water use requirements will increase in direct proportion to the residential water use. This assumption implies that commercial water use will largely be a function of residential use. Since projected employment and population are expected to grow at comparable rates, this assumption appears reasonable. Water requirements for hotels and spas in the Planning Area are included in the commercial category.

Assumptions for Golf Course Water Requirements

The number of future golf courses is determined based on available specific plan records for the City of Desert Hot Springs. Two 18-hole golf courses are proposed as part of the Highland Falls development and one 18-hole golf course is proposed as part of the Tuscan Hills development. There is no information available regarding the timing of these developments. It is assumed that these proposed golf courses will become active between year 2020 and year 2040 with one course becoming active each in year 2020, year 2030, and year 2040. The current annual average water use for an 18-hole golf course in the Planning Area is approximately 900 acre-ft/yr based on the consumption of the existing courses. The Coachella Valley Association of Governments (CVAG) Valley-wide model water conservation ordinance (2009) restricts golf course turf areas. New golf courses have a turf limit of 4 acres per hole. For practice areas, the turf limit is 10 acres. The implementation of these restrictions reduces water requirements for future golf courses. The projected water requirement for an 18-hole golf course reduces to 615 acre-ft/yr from the existing 900 acre-ft/yr. Water requirements for proposed golf courses in the Planning Area are estimated based upon the year 2009 water conservation ordinance.

Assumptions for Fish Farm Water Requirements

Fish farm operations in the East Coachella Valley appear to be declining. Owners of several of these fish farms are either shutting down their facilities or replacing their use. One of the largest fish farm owners in the East Coachella Valley is transitioning from their traditional fish farming business and venturing into the business of growing algae in their ponds (used as a biofuel). This shift in operations has significantly reduced their water requirements. For the purposes of growth projections within the Planning Area, it is assumed that there will be no increase in the number of fish farms.

Assumptions for Industrial Water Requirements

It is assumed that there will be no major industrial water use (greater than 25 acre-ft/yr) in the Planning Area until year 2045 other than the water requirements of a proposed peaking power plant in the Mission Creek subbasin. CPV Sentinel is proposing to develop a nominally rated 850 MW power generating facility. The site consists of 37 acres of land situated within the southern portion of the MSWD service area (north of Dillon Road and west of Indian Road), within unincorporated Riverside County, California. The existing Wildflower Indigo Facility is located approximately 1.8 miles southeast. It is estimated that the proposed power plant will require approximately 550 acre-feet of water on an annual basis throughout the life of the facility. Based on information available on the California Energy Commission's website (http://www.energy.ca.gov/sitingcases/sentinel/description.html), it is expected that the proposed peaker plant will become operational in the year 2010.

Assumptions for Institutional Water Requirements

Water use in this category constitutes water requirements for public agencies such as schools, churches, fire stations, etc. It is assumed that water requirements for this category will increase in direct proportion to the residential water requirements based on a historical relationship between the two water use types.

Assumptions for Environmental Enhancements

The Coachella Valley Multi-Species Habitat Conservation Plan (MSHCP) has indicated that management actions include maintaining or increasing groundwater levels so that mesquite hummocks can be maintained and regenerated in the Valley. Groundwater may be used for the environmental restoration of the hummocks and presents a potential water requirement in the Planning Area.

Assumptions for Future Water Requirements in the Garnet Hill Subbasin

Water consumption data by user class is not available for the Garnet Hill subbasin. MSWD currently produces groundwater from Well 33 in the Garnet Hill subbasin. Well 33 has a rated capacity of 800 gpm (1,290 acre-ft/yr). Historical production data indicate a production of 516 acre-ft/yr in year 2007. Thereafter, the production in this well has dropped to approximately 350 acre-ft/yr which could be because of reduced water requirements due to the current economic recession. Year 2007 production is assumed to be representative of future production at this groundwater well. Presently, commercial water requirements constitute approximately 12 percent of the residential water requirements within MSWD's service area. It is assumed that this ratio between commercial and residential water requirements will remain constant in the future.

Conservation

The following assumptions are made to account for the impacts of existing and future conservation practices on water requirements in the Planning Area:

- In order to comply with the requirements of Senate Bill x7-7, it is assumed that per capita urban water use will reduce by 20 percent by year 2020. The residential water use factor adjusted for conservation for the Planning Area is 184 gpcd. Institutional and commercial water use types are assumed to decrease in direct proportion to the residential water use type.
- Water use for golf courses is assumed to decrease by 20 percent by 2020.
- Water use for fish farms is assumed to decrease 20 percent by 2020.

Water Use Projections

Future water requirements for the different water use types are estimated based on the population projections developed in **Section 2 Plan Setting**. Future water requirements are presented for two scenarios:

- No growth occurs in the Planning Area
- Growth occurs in the Planning Area consistent with the Riverside County Center for Demographics Research projections

Water requirements developed in the two scenarios are considered to be book-end targets for the Planning Area. These scenarios are described in the following paragraphs.

No Growth Scenario

This scenario assumes that no growth will occur in the Planning Area through year 2045. This scenario also assumes that water conservation measures will continue to be implemented in the Planning Area. Future water requirements for urban users, golf courses, and fish farms are assumed to decrease to meet the agency targets for year 2020. Thereafter, it is assumed that the water requirements for the Planning Area will remain steady until year 2045. Water use projections developed for the "No Growth" scenario are presented in **Table 3-10** and shown on

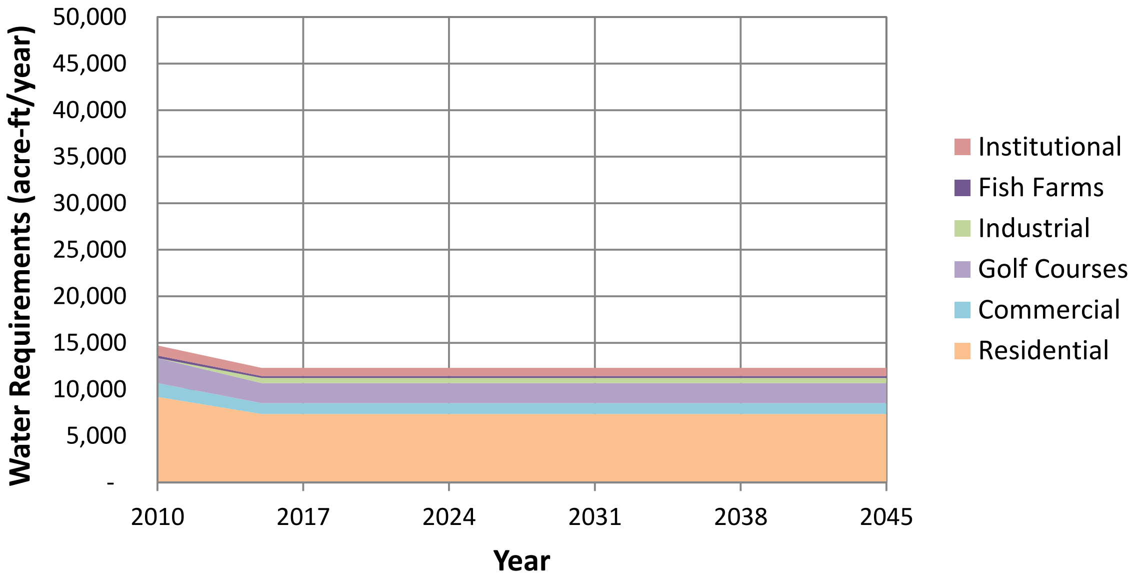


Figure 3-3-1.

Table 3-10
Summary of Water Use Projections (No Growth Scenario)

Category	2010 (acre-ft/yr)	2015 (acre-ft/yr)	2020 (acre-ft/yr)	2025 (acre-ft/yr)	2030 (acre-ft/yr)	2035 (acre-ft/yr)	2040 (acre-ft/yr)	2045 (acre-ft/yr)
Mission Creek Subbasin								
Residential	8,907	7,126	7,126	7,126	7,126	7,126	7,126	7,126
Commercial	1,435	1,148	1,148	1,148	1,148	1,148	1,148	1,148
Industrial	-	550	550	550	550	550	550	550
Institutional	1,083	867	867	867	867	867	867	867
Golf Courses	2,699	2,146	2,146	2,146	2,146	2,146	2,146	2,146
Fish Farms	262	209	209	209	209	209	209	209
Subtotal Mission Creek	**14,386**	**12,046**	**12,046**	**12,046**	**12,046**	**12,046**	**12,046**	**12,046**
Garnet Hill Subbasin								
Residential	289	231	231	231	231	231	231	231
Commercial	38	30	30	30	30	30	30	30
Industrial	387	387	387	387	387	387	387	387
Subtotal Garnet Hill	**714**	**649**	**649**	**649**	**649**	**649**	**649**	**649**
Total Water Requirements	**15,100**	**12,695**	**12,695**	**12,695**	**12,695**	**12,695**	**12,695**	**12,695**

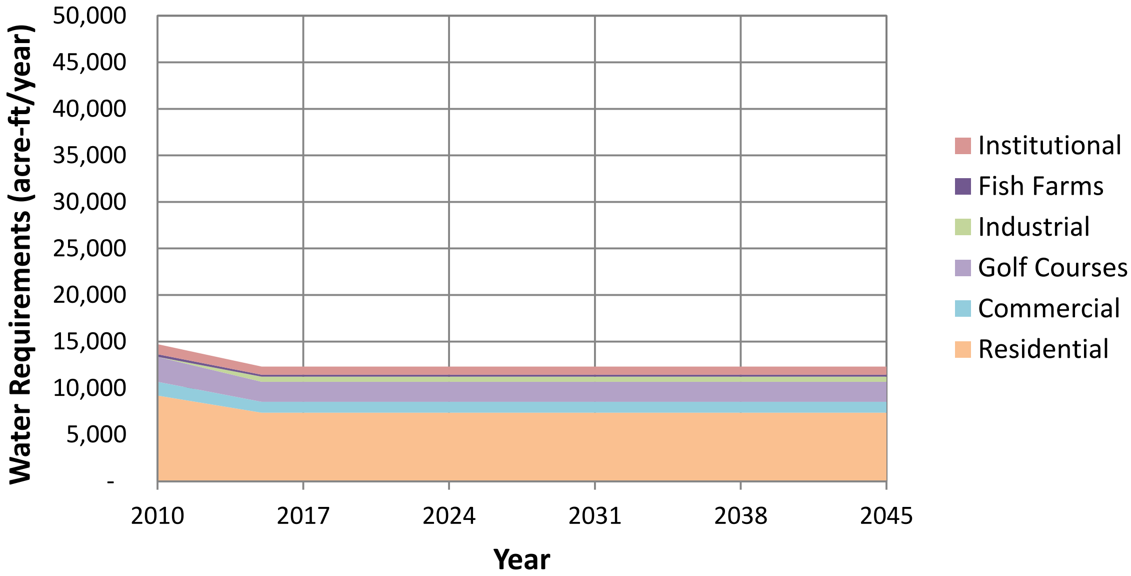


Figure 3-3-1
Water Requirement Projections for the Planning Area – No Growth Scenario

Growth Scenario

Population projections for the Planning Area developed by the Riverside County Center for Demographic Research represents a scenario in which growth occurs in the Planning Area. The product of the residential water use factor and the population projections yields the residential water use projections for the Planning Area. Water requirements for commercial, golf courses, fish farms, and institutional use are projected based on the assumptions described previously. In this scenario, the water requirements for the Planning Area in year 2045 are approximately 150 percent higher than the year 2010 water use. Water use projections developed for the Growth scenario are presented in **Table 3-11** and shown on **Figure 3-2**.

Table 3-11
Summary of Water Use Projections (Growth Scenario)

Category	2010 (acre-ft/yr)	2015 (acre-ft/yr)	2020 (acre-ft/yr)	2025 (acre-ft/yr)	2030 (acre-ft/yr)	2035 (acre-ft/yr)	2040 (acre-ft/yr)	2045 (acre-ft/yr)
Mission Creek Subbasin								
Residential	8,907	14,198	16,036	18,034	20,159	21,690	23,221	24,752
Commercial	1,435	2,103	2,374	2,668	2,959	3,182	3,404	3,582
Industrial	-	550	550	550	550	550	550	550
Institutional	1,083	1,588	1,793	2,014	2,234	2,402	2,570	2,704
Golf Courses	2,699	2,683	3,313	3,313	3,943	3,943	4,573	4,573
Fish Farms	262	262	262	262	262	262	262	262

Subtotal Mission Creek	**14,386**	**21,383**	**24,327**	**26,841**	**30,107**	**32,028**	**34,579**	**36,423**
Garnet Hill Subbasin								
Residential	289	455	512	575	642	690	737	785
Commercial	38	55	62	70	78	84	89	94
Industrial	387	387	387	387	387	387	387	387
Subtotal Garnet Hill	714	897	962	1,032	1,106	1,160	1,214	1,267
Total Water Requirements	**15,100**	**22,281**	**25,289**	**27,873**	**31,213**	**33,188**	**35,793**	**37,689**

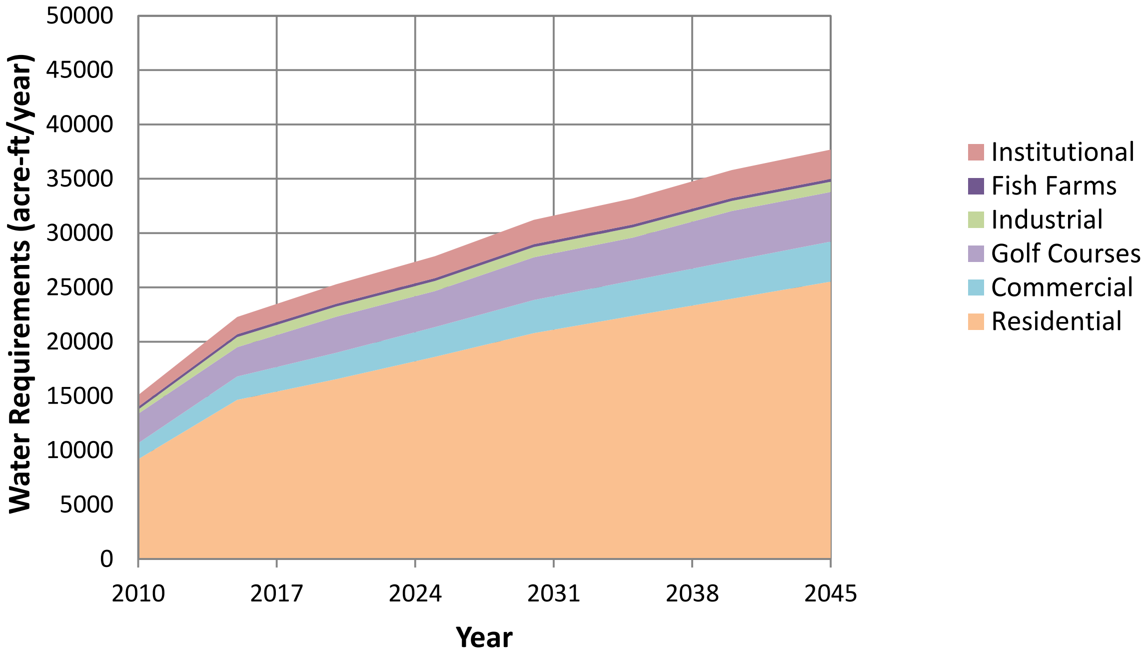


Figure 3-2
Water Requirement Projections for the Planning Area – Growth Scenario

Build Out Water Requirements

Water use requirements under build out conditions are also developed for the Planning Area. These requirements are estimated based on the General Plan land use information for the cities of Desert Hot Springs, Cathedral City, Palm Springs, and unincorporated areas of Riverside County. Assumptions used in the development of water use projections under build out conditions are documented in **Table 3-12**. Additionally, the build out water requirements include the Inner Beauty development, located in the City of Indio's sphere of influence, and is currently undergoing land use modifications for this region. It should be noted that neither the Riverside County nor the City of Desert Hot Springs General Plans have been updated in conjunction with the RCCDR growth projections. Any adjustments related to growth adjustments in light of General Plan updates in the future would be reflected in projected water requirements in updates to this WMP.

There are several land use categories under the residential classification with densities ranging from as low as 1 dwelling unit per 20 acres (du/acre) to as high as 30 du/acre. General Plan Land Use maps for the cities and the county in the Planning Area are included in **Section 2 – Plan Setting**. Dwelling unit densities for the different residential categories are indicated on the maps.

Table 3-12
Assumptions for Estimating Build Out Water Requirements

Category	Quantity	Units
Irrigation (Parks/Recreation)[1]	3,350	gallon/acre-day
Commercial/[2]	2,500	gallon/acre-day
Industrial	500	gallon/acre-day
City, Public, Schools[2]	2,000	gallons/acre-day
Residential[3]	1 to 20	dwelling units/acre
Dwelling Density[4]	2.865	persons/dwelling

(1) Future water requirement for parks is assumed to be 50 percent of the water requirement for golf courses in the Planning Area.
(2) Based on water duty factors computed for the Town of Yucca Valley.
(3) Based on a range of values provided in the general plan land use designations for various classes of residential land use for Cathedral City, Desert Hot Springs, Palm Springs, and Riverside County.
(4) Based on year 2009 California Department of Finance's estimates for the City of Desert Hot Springs.

Build out water requirement for the Planning Area is presented in **Table 3-13**.

Table 3-13
Build Out Water Requirements for the Planning Area

Category	Water Requirements (acre-ft/yr)
Commercial	4,465
Residential	38,451
Industrial	2,316
Public Facilities	3,190
Open Space - Recreation (irrigated)	8,541
Grand Total	**56,963**

Year 2010 water requirement is approximately 27 percent of the build out water requirement for the Planning Area. The projected year 2045 water requirements for the Growth scenario is approximately 66 percent of the build out water requirement for the Planning Area.

Uncertainty In Future Water Projections

The impacts of the on-going recession on future growth cannot be accurately quantified. Although the current slowdown in the economy will impact growth in the Planning Area in the short-term (next five to ten years), it is very likely that growth will resume and steadily continue to occur in the Planning Area during the 35-year planning horizon of the WMP. If the actual growth in the Planning Area is lower than the growth forecasts, then the need for acquiring additional supplies will reduce. It is unlikely that the actual growth in the Planning Area will exceed the projections in the Growth scenario due to the current slowdown in the economy. However, if actual growth exceeds the projected growth, then the increased water requirements will require additional supplies.

For this WMP, it is recommended that the adequacy of existing and the need for water supply sources be evaluated under the Growth scenario. This will provide sufficient contingency if the actual growth in the future falls within the book-end targets established for the Planning Area

Section 4
Water Supplies

INTRODUCTION

This section describes the existing water supply sources in the Planning Area for the Mission Creek and Garnet Hill subbasin Water Management Plan (WMP). The conceptual model for the groundwater basins and results from the groundwater model calibration are discussed. Available data on groundwater quality are summarized with emphasis on total dissolved solids (TDS) and nitrate concentrations in the groundwater basin. A water balance for the groundwater basins is presented in the section which highlights future water needs for the Planning Area. Water management agreements that affect groundwater use in the Mission Creek and the Garnet Hill subbasins are summarized in this section.

WATER RESOURCES OVERVIEW

Water supplies in the Planning Area consist of: groundwater extracted from wells, and imported water allocations from the State Water Project (SWP) which are exchanged for Colorado River water from the Metropolitan Water District of Southern California's (Metropolitan's) Colorado River Aqueduct (CRA). Precipitation in this arid region on average varies from 4 inches in the desert areas to up to 30 inches in the nearby mountain regions annually (DWR, 1964). Most of the precipitation that occurs on the watersheds contributing to the Planning Area either evaporates or is consumed by native vegetation within the watershed. The higher precipitation at the higher elevations in the mountains within the watershed either runs off into the creeks and eventually evaporates or percolates into the basin or flows into the basins as mountain front underflow. However, the groundwater basins in the Planning Area (Mission Creek, Garnet Hill, and Desert Hot Springs) are recharged by precipitation and runoff from the local mountains.

Surface Water

Surface water flow in the Planning Area consists of ephemeral or intermittent streams which originate in the mountains. Mission Creek is the only stream that flows to the valley floor on a consistent basis, but the stream usually disappears a short distance from its entrance to the Planning Area. Streams flowing through Morongo Valley, Big Morongo, Little Morongo, and Long Canyon periodically reach the valley floor for short periods of time when there are localized, intense storms in the mountains (MTU, 1998).

Surface water features that contribute to recharge in the Mission Creek subbasin include Mission Creek, Dry Morongo Wash, and Big Morongo Canyon. The Whitewater River contributes to recharge in the Garnet Hill subbasin through the permeable deposits that underlie the Whitewater Hill. Mission Creek flows across the Garnet Hill subbasin, but is not believed to contribute to recharge since it is mostly dry in the reaches that flow across the subbasin. Long Canyon Creek and the Little Morongo Creek provide recharge in the Desert Hot Springs subbasin.

The Whitewater River primarily feeds the Whitewater River subbasin, but flows across the Garnet Hill subbasin before reaching the Whitewater River subbasin. Non-flood stage flows from the Whitewater River that reach the valley floor are diverted to the Whitewater Spreading Facility.

Natural Recharge

Natural recharge in the Planning Area occurs due to a combination of surface and subsurface flow. Due to the high evapotranspiration rates, recharge from direct precipitation is considered to be insignificant. The main source of natural recharge water to the Planning Area is the subsurface groundwater flow originating from precipitation that falls on the San Bernardino and Little San Bernardino Mountains. Although some precipitation may infiltrate directly into the mountains through fractures, it is believed that the majority of the precipitation runs off to the major canyons in the Little San Bernardino and San Bernardino Mountains. The largest source of subsurface recharge in the Planning Area is Mission Creek in the San Bernardino Mountains. Big Morongo Canyon and Morongo Valley Canyon provide additional subsurface recharge to the Mission Creek subbasin.

There are additional canyons within the Planning Area that provide surface and subsurface flow from the mountains, but the amount of recharge contributed via these canyons is minimal and is assumed to be negligible as compared to the recharge from the major canyons (Tyley, 1974). Psomas (2010) estimates that the total recharge from mountain front precipitation under average conditions would approximately equal 7,600 acre-ft/year. Other previous reports have estimated annual inflows due to natural recharge into the Mission Creek subbasin as 5,360 acre-ft/yr (MTU, 1996), 6,000 acre-ft/yr (DWR, 1964), and a total of 11,800 to 14,300 acre-ft/yr to both the Mission Creek and Desert Hot Springs subbasins (Gsi/water, 2005). Sources also estimate recharge into the Garnet Hill subbasin from the Whitewater River at a range of 7,000 acre-ft/yr (GSI, 2005) to 19,000 acre-ft/yr (Psomas, 2010).

Groundwater

The following paragraphs discuss the groundwater resources in the Planning Area including the physical characteristics of the basins, a conceptual model for the basins, the numerical model for the basin, and groundwater levels and quality. The conceptual model provides a physical description of the Mission Creek and Garnet Hill subbasins and the factors that influence groundwater flow in the subbasins. The physical characteristics of the groundwater basin such as basin geology and structure and a water budget for the basins discussing each inflow and outflow component is presented in the following paragraphs.

Geology and Structure

Groundwater subbasins in the Planning Area include the Mission Creek subbasin (DWR Basin No. 7-21-02), the Garnet Hill subbasin (DWR Basin No. 7-21-02), and the Desert Hot Springs subbasin (DWR Basin No. 7-21-03). Groundwater from the Mission Creek and the Garnet Hill subbasins is the principal source of potable water supply in the Planning Area. The Desert Hot Springs subbasin is a “hot water” basin containing highly mineralized geothermally heated groundwater and is not used for potable water supply. The groundwater basins in the Planning

Area are briefly described below based on designations by the United States Geological Survey (USGS) and the California Department of Water Resources (DWR). **Figure 4-1** shows the groundwater basins within the Planning Area.

Mission Creek Subbasin

Water bearing materials underlying the Mission Creek upland comprise the Mission Creek subbasin. The subbasin is bounded on the south by the Banning Fault and on the north and east by the Mission Creek Fault. It is bordered on the west by non-water bearing rocks of the San Bernardino Mountains. To the southeast of the subbasin are the Indio Hills. The area within this boundary reflects the estimated limit of effective storage within the subbasin. The Mission Creek Fault and the Banning Fault are effective barriers to groundwater movement, as evidenced by offset water levels, fault springs, and changes in vegetation. Water level differences across the Banning Fault, between the Mission Creek and Garnet Hill subbasins, are consistently on the order of 200 to 250 feet (DWR, 1964). Similar water level differences exist across the Mission Creek Fault between the Mission Creek and Desert Hot Springs subbasins. Groundwater elevations in the Desert Hot Springs subbasin are approximately 300 feet to 400 feet higher on the eastern side of the Mission Creek Fault which results in groundwater flow from the Desert Hot Springs subbasin into the Mission Creek subbasin (DWR, 1964).

The pre-Tertiary crystalline rock that underlies and constitutes the northwestern and southeastern borders of the subbasin are a complex assemblage of Pre-cambrian gneisses and schists, that have been intruded by younger granitic rocks associated with the Southern California batholith of Cretaceous age (DWR, 1964). DWR classified these rocks as “non-water bearing”. However, DWR (1964) also acknowledges that in the surrounding mountains, the crystalline rocks may be the only source of water and that groundwater wells extract water from along faults and fractures within the system.

With the amount of faulting in the area due to the San Andreas Fault system, it is possible that this igneous/metamorphic complex is highly fractured and may transmit groundwater more readily than previously assumed (Psomas, 2010). To the southeast of the Mission Creek subbasin are the Indio Hills, which consist of the semi-water bearing Palm Springs formation. The area within this boundary reflects the estimated geographic limit of effective storage within the subbasin. The Indio Hills are not included as part of either the Mission Creek or Garnet Hill subbasins since the potentially water bearing formations are above the water levels of the neighboring groundwater basins (DWR, 1964).

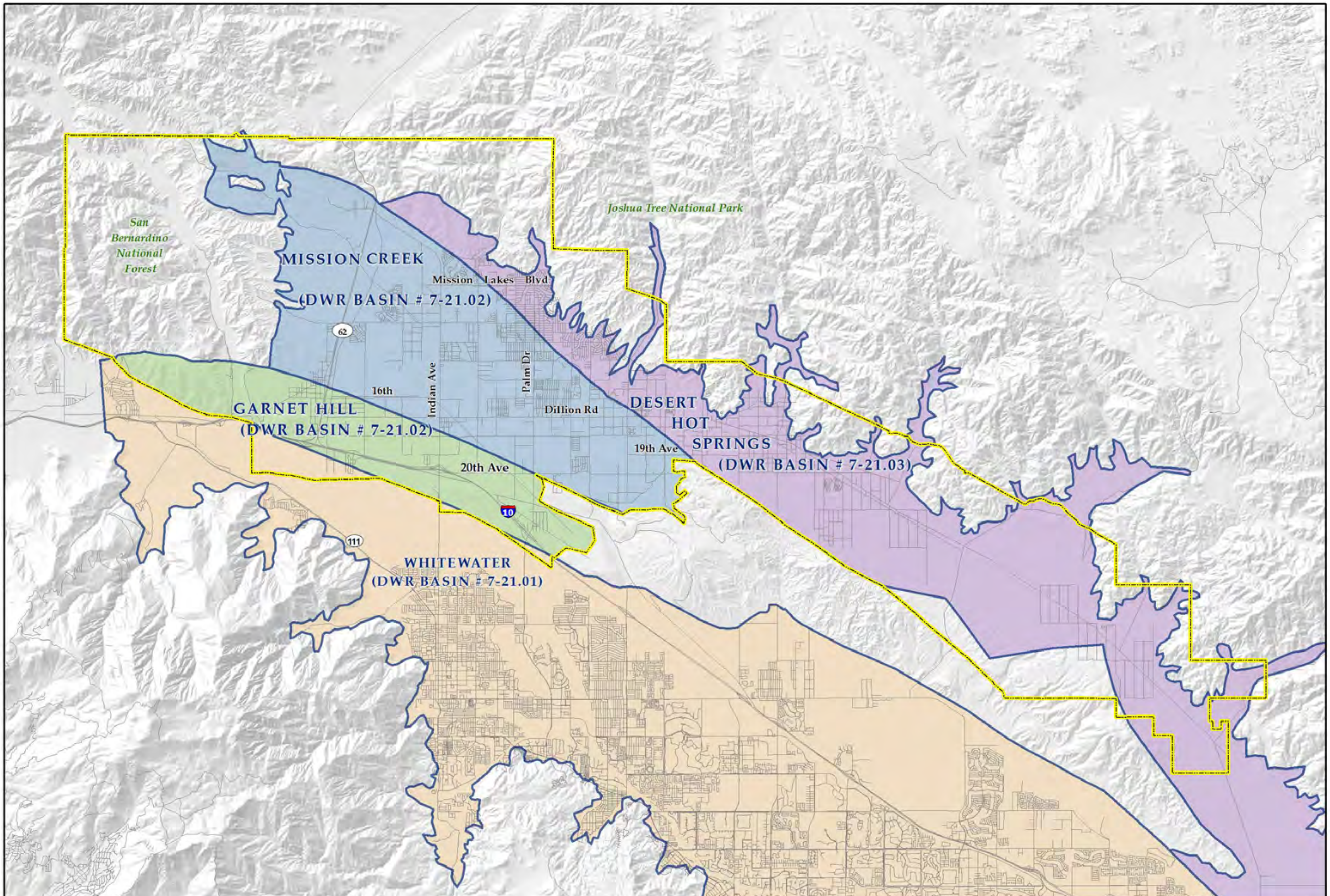
Garnet Hill Subbasin

The area between the Garnet Hill Fault and the Banning Fault, named the Garnet Hill subarea by DWR (1964), was considered a distinct subbasin by the USGS 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 elevation in a horizontal distance of 3,200 feet across the Garnet Hill Fault, as measured in the Spring of 1961 (DWR, 1964). 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 (DWR, 1964).

Although some recharge to this subbasin may come from Mission Creek and other streams that pass through during periods of high flood flows, the main sources of recharge to the subbasin come from the Whitewater River through the permeable deposits which underlie Whitewater Hill and from underflow from the Mission Creek subbasin. In general, there is underflow from the Garnet Hill subbasin to the Whitewater River subbasin. However, it is recognized that artificial recharge in the Whitewater River subbasin may cause underflow to the Garnet Hill subbasin if groundwater levels in the Whitewater River subbasin are high. This is also observed by reviewing groundwater level measurements in the Garnet Hill subbasin upon recharge in the Whitewater River subbasin.

Desert Hot Springs Subbasin

The Desert Hot Springs subbasin is bounded to the north by the Little San Bernardino Mountains and to the southeast by the Mission Creek and San Andreas Faults. The Desert Hot Springs subbasin has limited groundwater use except in the area of Desert Hot Springs. Relatively poor groundwater quality with salinities in the range of 700 mg\L to over 1,000 mg/L (CVWD, 2010) has limited the use of this subbasin for domestic groundwater supply. The Miracle Hill subarea is characterized by hot mineralized groundwater, which supplies a number of spas in the area. Previous studies (Tyley, 1974) and a review of water quality data suggest that underflow occurs across the Mission Creek Fault from the Desert Hot Springs subbasin.



Key to Features

Planning Area

Groundwater Subbasins

- Garnet Hill
- Mission Creek
- Desert Hot Springs
- Whitewater

N

0 0.5 1 2 Miles

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Date: July 8, 2010

Groundwater Basins in the Planning Area

Figure 4-1

MWH

Water Budget

A groundwater budget analysis for the Mission Creek and Garnet Hill subbasins accounts for all inflow and outflow components of the basin. Typical components of groundwater inflows and outflows for a groundwater budget analysis are listed below:

Inflows

- Infiltration from direct precipitation
- Surface water infiltration
- Infiltration from deep percolation of applied water
- Infiltration from septic tanks
- Underflow into basin

Outflows

- Groundwater pumping
- Flow to surface water
- Underflow out of basin

A conceptual water balance equation for the subbasins is provided below. This equation is applied to the groundwater basin to calculate the annual change in groundwater storage and is written as:

$\sum$ Annual Inflows – $\sum$ Annual Outflows = Annual Change in Storage

The water balance components for the Mission Creek subbasin and the Garnet Hill subbasin are described below.

Mission Creek Subbasin

Inflows

Inflows that contribute to groundwater recharge within the Planning Area include natural recharge from streamflow, sub-surface recharge from adjacent groundwater basins, return flows from water use, and artificial recharge. The inflow components are described in detail for the water balance.

Natural Recharge

Due to the low amount of annual rainfall, recharge from direct precipitation is considered negligible. The majority of recharge comes from mountain front runoff from precipitation and snowmelt. DWR (1964) estimated that approximately 6,000 acre-ft/yr was attributed to recharge from precipitation principally from streamflow runoff and mountain front infiltration for the Mission Creek subbasin. Studies published by USGS report approximately 7 to 8 percent of the total precipitation falling on bedrock mountains in other arid basins contributes to mountain front recharge (USGS, 2007). Psomas (2010) developed a conceptual model (described later in the section) that provides the foundation for the development of a numerical model for the Mission Creek and Garnet Hill subbasins. As part of the conceptual model development process, Psomas conducted an evaluation of the Mission Creek subbasin and the sources of natural groundwater recharge associated with mountain front recharge from precipitation. The evaluation concluded that the total recharge from mountain front precipitation under average conditions would approximately equal 7,600 acre-ft/yr.

Return Flows

Return flows are the amount of water applied for irrigation (either agricultural, golf course, or urban) not utilized by plants to satisfy their evapotranspiration (ET) requirement and water returned to the groundwater basin through domestic usage (septic tank flow) or non-consumptive returns.

The following assumptions are used in developing return flows to the groundwater basin:

- Indoor Use – It is assumed that 3 percent of indoor domestic use is consumed; the remainding 97 percent becomes septic or wastewater flows (Templin et. al., 2010, Table 2).
- Wastewater – Based on evapotranspiration data from the California Irrigation Management Information System (CIMIS), it is estimated that 3 percent of the treated wastewater flow evaporates from the percolation ponds, and 97 percent of treated wastewater plants' flows percolate back to the groundwater basin.
- Urban Indoor Use versus Outdoor Use – Based on MSWD billing and wastewater flow data for the 2002-2004 period, MSWD's average demand per connection was 827 gallons per day (gpd) (URS, 2005). The average wastewater flow rate is 319 gpd per connection for the same period (URS & David Miller & Associates, 2007). Therefore, assuming that the average indoor flows are equal to the wastewater flows, indoor use is 40 percent of the total demand for both historical use as well as future projections. All of the indoor flows return to the groundwater basin as either septic flows or wastewater flows. It is assumed that this ratio has remained constant historically and will remain so throughout the planning period. All urban water use that is not an indoor use is assumed to be outdoor use.
- Urban outdoor use and Golf Course Flows - It is assumed that customers reach an average irrigation efficiency of 75 percent (while this is lower than landscape ordinances, this is likely reflective of existing practices), 5 percent is lost to evaporation, and 20 percent of all applied water returns to the groundwater basin.
- Septic Flows for CVWD – For CVWD's billing data for the period 1998 to 2008, customers are identified as either overlying or outside the Mission Creek subbasin (CVWD, 2009a). The septic flows for customers overlying the Mission Creek subbasin are assumed to be equal to their indoor demands. It is assumed that all septic flows for customers overlying the basin returned to the basin. Based on the total septic flows in 1999, percentages are computed for the septic flows overlying and outside the subbasin. These percentages are then used to determine the distribution of septic flows (overlying or outside the subbasin) prior to 1999.
- Septic Flows for MSWD – Septic flows for MSWD are calculated as the difference between the indoor flows and the wastewater flows. Demands overlying and outside the basin cannot be separated due to insufficient data. Based on the total length of water pipeline installed (running average by year), percentages are computed for the length of pipeline overlying and outside the subbasin (MSWD, 2009). These percentages are then

used to determine the distribution of septic flows (overlying or outside the subbasin). Based on discussions with MSWD, at the end of the planning horizon, it is assumed that 500 MSWD customers will remain on a septic system. Production data (prior to 2002) for golf courses with private wells are based on a report published by the Michigan Technical University (MTU, 1998).

- For fish farms, it is assumed that 20 percent of the flows are lost due to evaporative and consumptive uses (Solley, 1995) and 80 percent of the flows return to the groundwater basin.
- It is assumed that the power plants (Indigo Wildwood and CPV Sentinel) operate with zero liquid discharge and no water will be returned to the groundwater basin (CEC, 2010).

An estimate of the infiltration from septic systems along with the irrigation return flow was calculated for the Mission Creek and Garnet Hill subbasins (MWH, 2010) for the period 1978-2008. Total return flows ranged from 983 acre-ft/year in 1978 to over 4,400 acre-ft/year in 2008. **Table 4-1** presents a summary of the estimated return flows for MSWD and CVWD in the Mission Creek subbasin.

Table 4-1
Estimated Return Flows in the Mission Creek Subbasin (1978-2010)

Year	MSWD Supplied Water		Other Return Flows (acre-ft/yr)[(1)]	CVWD Supplied Water		Other Return Flows (acre-ft/yr)[(1)]	Total Return Flows (acre-ft/yr)
	Septic Return Flow (acre-ft/yr)	Outdoor Irrigation Return Flow (Acre-ft/yr)		Septic Return Flow (acre-ft/yr)	Outdoor Irrigation Return Flow (Acre-ft/yr)		
1978	157	303	352	57	89	0	958
1979	208	418	352	67	105	0	1,150
1980	232	473	352	74	116	0	1,247
1981	225	479	352	95	149	0	1,300
1982	205	460	352	87	136	0	1,240
1983	237	576	352	97	151	0	1,413
1984	321	711	352	128	200	0	1,712
1985	333	720	352	144	225	0	1,774
1986	424	844	352	145	226	0	1,991
1987	504	1,046	420	150	233	0	2,353
1988	587	1,227	342	83	130	212	2,581
1989	695	1,456	342	104	162	212	2,971
1990	670	1,537	342	97	152	212	3,010
1991	608	1,469	342	83	129	212	2,843
1992	684	1,589	663	76	118	212	3,342
1993	697	1,707	313	98	154	212	3,181
1994	856	1,952	313	121	189	212	3,643
1995	877	1,937	313	121	189	212	3,649
1996	958	2,068	313	119	186	212	3,856
1997	919	2,042	313	70	109	212	3,665
1998	934	2,123	313	114	178	212	3,874
1999	973	2,230	313	130	203	212	4,061
2000	974	2,309	313	159	248	212	4,215
2001	960	2,306	313	192	300	212	4,283
2002	996	2,393	313	222	346	212	4,482
2003	997	2,529	316	231	361	315	4,749
2004	1,247	2,971	391	236	357	331	5,533
2005	1,549	3,533	337	198	317	480	6,414
2006	1,366	3,364	318	217	383	490	6,138
2007	1,285	3,254	371	209	387	458	5,964
2008	1,192	3,066	376	207	348	474	5,663
2009	1,156	2,975	275	240	402	421	5,469
2010	1,054	2,710	341	208	349	432	5,094

(1) Indicates return flows from private pumpers such as fish farms and golf courses that pump in excess of 25 acre-ft/yr for CVWD's Area of Benefit and 10 acre-ft/yr for DWA's Area of Benefit (includes MSWD's service area).

Artificial Recharge

Since 2002, water from the Colorado River Aqueduct (CVWD and DWA's SWP water, through an exchange agreement with Metropolitan) has been recharged into the groundwater basin through spreading facilities at the upper end of the Mission Creek subbasin. The water is released to the spreading facilities that consist of percolation ponds with a water surface area of 57 acres when the ponds are full (bottom area of the ponds is 47 acres). Since the commencement of recharge activities in 2002, on an average approximately 8,000 acre-ft of water has been recharged annually in the basin. **Table 4-2** summarizes the total volume of water diverted to each of the artificial recharge areas; it is estimated that 2 percent of the water is evaporated from the spreading facilities and 98 percent of the water reaches the groundwater basin.

Inflows from Adjacent Groundwater Basins

As discussed previously, the Mission Creek subbasin receives inflows primarily from the Mission Creek drainage. However, water quality data suggest some underflow is occurring across the Mission Creek Fault from the Desert Hot Springs subbasin. Mayer (1998) and Psomas (2010) used a flow rate of approximately 1,700 acre-feet/year for underflow across the Mission Creek Fault.

According to Gsi/water (2005), a portion of the recharge to the Mission Creek subbasin may come from active stream channels located in the various catchment areas. Upper reaches of the Mission Creek drainages contain extremely coarse alluvial material and that underflow might occur. However, stream underflow is considered part of the mountain front recharge and not included as a separate recharge component.

Outflows

Production from groundwater wells, underflow to the Garnet Hill subbasin, and the loss of water via evapotranspiration are considered to be the only sources of groundwater outflow from the Mission Creek subbasin. Estimated outflows from the Mission Creek subbasin over the Banning Fault to the Garnet Hill subbasin have ranged from as 2,000 acre-ft/year (Tyley, 1974) to 7,400 acre-ft/yr (Psomas, 2010). Psomas (2010) also assumed an outflow also occurs across the semi-waterbearing rocks in the southeastern edge of the subbasin at a rate of approximately 3,500 acre-ft/yr.

Groundwater Production

The main groundwater outflow in the Mission Creek subbasin is due to pumping from production wells. Tyley (1974) estimated that net groundwater production (net groundwater pumping less return flows) for the Mission Creek subbasin for the period between years 1936 and 1967 was 4,370 acre-feet. For the period between years 1947 and 1967, CVWD estimates that net groundwater production for the Mission Creek subbasin was approximately 28,000 acre-feet (SWRCB, 1991). The reason for the discrepancy in the production estimates is unclear.

Table 4-2
Estimated Deliveries to the Groundwater Spreading Facilities in the Upper Whitewater River and Mission Creek Subbasins

Year	Whitewater River Spreading Facility (acre-ft/year)	Mission Creek Spreading Facility (acre-ft/year)
1973	7,475	-
1974	15,396	-
1975	20,126	-
1976	13,206	-
1977	0	-
1978	0	-
1979	25,192	-
1980	26,341	-
1981	32,251	-
1982	27,020	-
1983	53,732	-
1984	83,708	-
1985	251,994	-
1986	298,201	-
1987	104,372	-
1988	1,097	-
1989	12,479	-
1990	31,721	-
1991	12	-
1992	40,870	-
1993	60,183	-
1994	32,325	-
1995	61,318	-
1996	138,266	-
1997	113,677	-
1998	132,455	-
1999	90,601	-
2000	72,450	-
2001	707	-
2002	33,435	4,733
2003	861	100
2004	13,244	5,564
2005	165,554	24,723
2006	98,959	19,901
2007	16,009	1,011
2008	8,008	503
2009	57,024	4,090
2010	**228,330**	**33,210**
Total	**2,140,269**	**93,835**

Source: DWA, 2010 and CVWD, 2009b.

Evapotranspiration

Mayer and May (1998) estimated the total area populated by phreatophytes to be 1,123 acres. Mesquite is the dominant phreatophyte found along the Mission Creek and Banning Faults. The amount of water extracted from the aquifer by the Phreatophytes was estimated using the approach of Lines and Billhorn (1996) who have estimated transpiration losses from phreatophytes in the Mojave desert. They estimated that the annual water consumption by mesquite was 1.3 acre-feet/acre. This method used in the Mojave Desert correlates well to the Mission Creek basin area. Using this methodology, it is estimated that approximately 1,400 acre-feet/year of groundwater is lost from the Mission Creek subbasin due to evapotranspiration (Psomas, 2010).

Garnet Hill Subbasin

Inflows

Inflows that contribute to groundwater recharge within the Garnet Hill subbasin include natural recharge from streamflow and mountain runoff, sub-surface recharge from adjacent groundwater basins, and return flows from water use. The inflow components are described in detail below.

Natural Recharge

As previously mentioned, the potential for recharge from deep percolation of direct precipitation is considered negligible. The principal form of recharge comes from mountain-front runoff derived from precipitation (including snowmelt). The Garnet Hill subbasin lies within two catchment areas: the lower portion of the Mission Creek catchment area and the Whitewater River catchment area. Previous studies have indicated that the majority of runoff generated in the Mission Creek catchment area infiltrates into the Mission Creek subbasin with very little surface runoff making it to surface drainages south of the Banning Fault. Consequently, for estimation purposes, it is assumed that the only mountain-front recharge reaching the Garnet Hill subbasin was associated with the Whitewater River catchment. Psomas (2010) conducted an evaluation of the Garnet Hill subbasin and the sources of natural groundwater recharge associated with mountain-front recharge from precipitation.

Return Flows

An estimate of the infiltration of septic systems along with the irrigation return flow was calculated for the Garnet Hill subbasin for the period 1936-2008. The assumptions for return flow in the Garnet Hill basin are the same as those used in the Mission Creek subbasin. Total return flows ranged from 0 acre-ft/year in 1978 to over 250 acre-ft/year in 2008. **Table 4-3** presents a summary of the estimated return flows for the Garnet Hill subbasin.

Artificial Recharge

No groundwater spreading facilities exist in the Garnet Hill subbasin.

Table 4-3
Estimated Return Flows in the Garnet Hill Subbasin (1978-2010)

	MSWD Supplied Water		Total Return Flows (acre-ft/yr)
Year	Septic Return Flow (acre-ft/yr)	Outdoor Irrigation Return Flow (Acre-ft/yr)	
1978	3	4	7
1979	14	20	34
1980	16	22	38
1981	19	22	41
1982	18	18	36
1983	23	20	43
1984	23	24	47
1985	20	23	43
1986	17	25	42
1987	36	46	82
1988	38	47	85
1989	60	74	134
1990	77	75	152
1991	80	70	150
1992	78	74	152
1993	69	59	128
1994	59	59	118
1995	53	56	109
1996	54	61	115
1997	57	60	117
1998	61	61	122
1999	63	62	125
2000	70	64	134
2001	72	64	136
2002	77	69	146
2003	89	73	162
2004	93	85	178
2005	104	102	206
2006	114	98	212
2007	107	88	195
2008	104	82	186
2009	101	80	181
2010	92	73	165

Inflows from Adjacent Groundwater Basins

The Garnet Hill subbasin receives inflow from both the Mission Creek subbasin (across the Banning Fault) and from underflow from the Whitewater River subbasin. Tyley (1974) suggested that groundwater contours indicate that some groundwater moves across the Banning Fault from the Mission Creek subbasin. This inflow is also shown by heavy phreatophyte growth east of Indian Avenue. Groundwater also moves into this subbasin through the semi-consolidated deposits of Whitewater Hill. Estimated outflows from the Mission Creek subbasin over the Banning Fault to the Garnet Hill subbasin have ranged from as 2,000 acre-ft/year (Tyley, 1974) to 7,400 acre-ft/yr (Psomas, 2010).It is also recognized that artificial recharge in the Whitewater River subbasin may cause underflow to the Garnet Hill subbasin if groundwater levels in the Whitewater River subbasin are high. This is also observed by reviewing groundwater level measurements in the Garnet Hill subbasin upon recharge in the Whitewater River subbasin.

Outflows

Production from groundwater wells and underflow to the Whitewater River Basin are considered to be the only sources of groundwater outflow from the Garnet Hill subbasin.

Groundwater Production

Production in the Garnet Hill subbasin has been extremely limited until recently. The majority of production was associated with wells in the Whitewater River drainage in the upper end of the Garnet Hill subbasin. Records of production data were compiled for various wells from the period between years 1947 and 2009. Production varied from a high of 4,165 acre-ft/year in 1949 to less than 100 acre-ft/year in the 1980s and 1990s.

Evapotranspiration

The depth to groundwater in the Garnet Hill subbasin at the present time is too great to have established any significant phreatophyte population. Consequently, no discharge associated with phreatophytes has been assumed (Psomas, 2010).

Historical change in groundwater storage for the Mission Creek subbasin is presented in Error! Reference source not found. and that for the Garnet Hill subbasin is presented in **Figure 4-3**. These charts show annual change in groundwater storage which is derived by performing an annual water balance of inflows and outflows for the subbasins. Positive values are reflective of increases in total groundwater storage (due to higher recharge than pumping), and negative values are reflective of decreases in total groundwater storage (pumping greater than recharge). The impact of the commencement of imported water recharge is clearly seen for the Mission Creek subbasin for the year 2003.

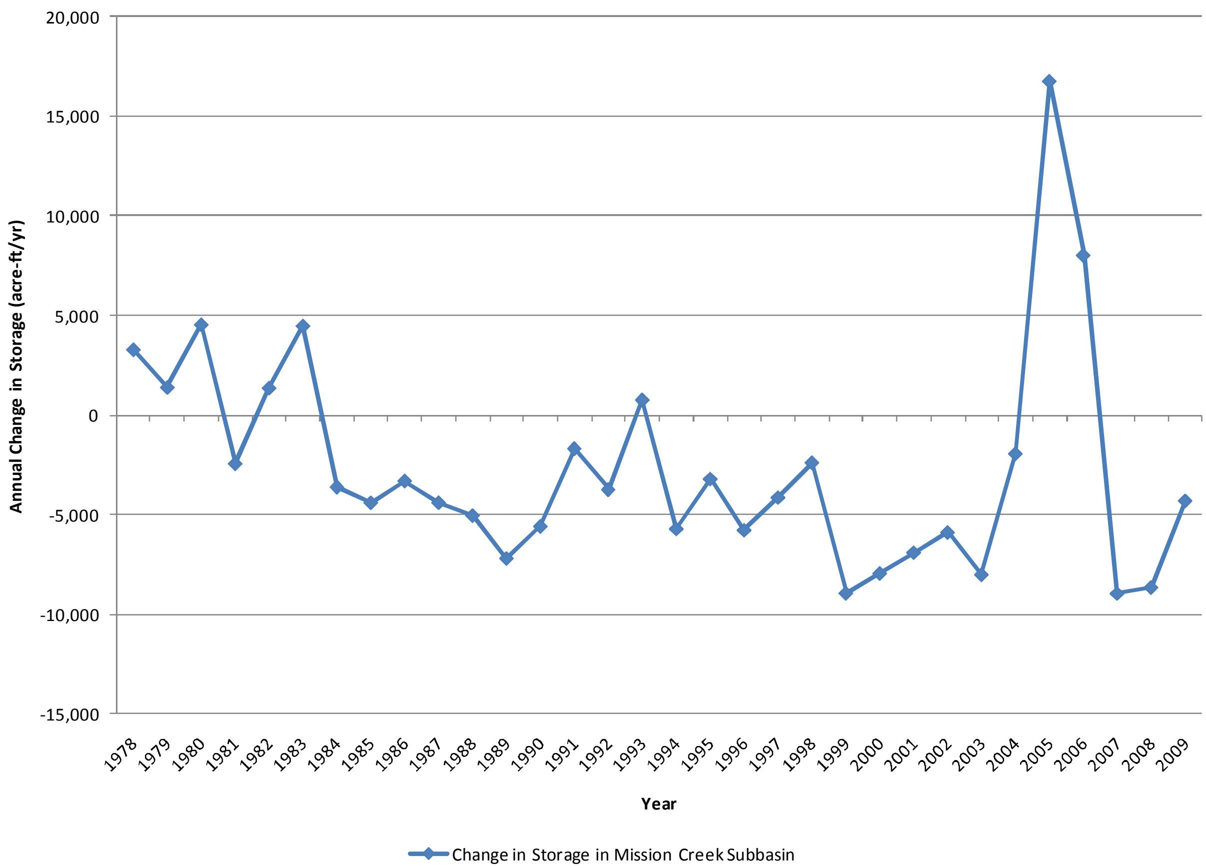


Figure 4-2
Historical Change in Groundwater Storage – Mission Creek Subbasin

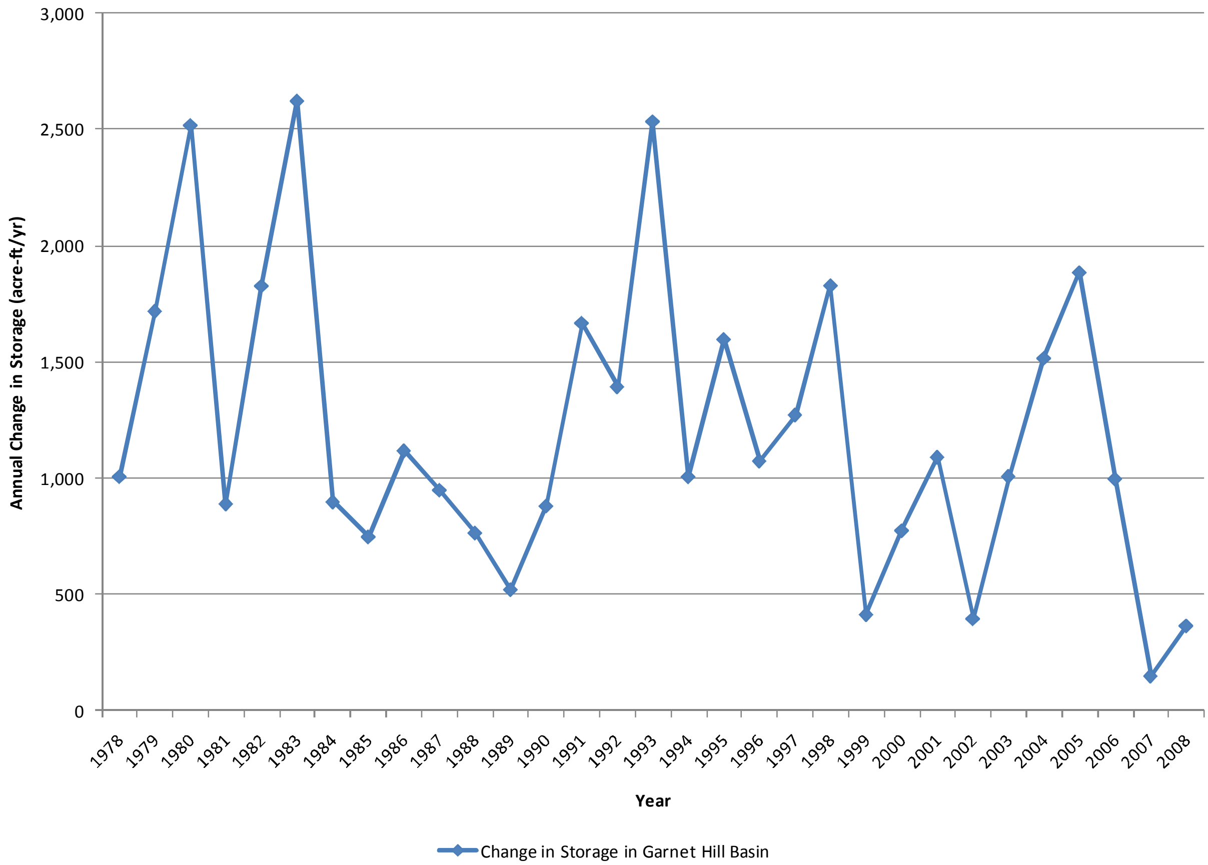


Figure 4-3
Historical Change in Groundwater Storage – Garnet Hill Subbasin

Groundwater Levels

As discussed in Section 3 Water Requirements, the demand for water in the Planning Area has increased dramatically since 1936, resulting in decreased groundwater levels. DWR Bulletin 160-93 describes overdraft as follows:

> "Where the groundwater extraction is in excess of inflow to the groundwater basin over a period of time, the difference provides an estimate of overdraft. Such a period of time must be long enough to produce a record that, when averaged, approximates the long-term average hydrologic conditions for the basin." Bulletin 118-80 defines "overdraft as the condition of a groundwater basin where the amount of water extracted exceeds the amount of groundwater recharging the basin "over a period of time." It also defines "critical condition of overdraft" as water management practices that "would probably result in significant adverse overdraft-related environmental, social or economic effect."

The definition of overdraft incorporates an evaluation of the consequences of extracting more groundwater from a basin than is recharged. Such consequences may include increased pumping costs, water quality degradation, land subsidence, and saltwater intrusion. The existence of overdraft indicates that continuation of current water management practices will result in significant negative impacts on environmental, social or economic conditions (Todd, 1980; ASCE, 1987). The discussion of overdraft in the Coachella Valley focuses on the historical components of the groundwater balance, groundwater levels, water quality, subsidence, and saltwater intrusion. Bulletin 118 of the California DWR identifies the Mission Creek subbasin to be in an overdraft condition. However, since the commencement of groundwater recharge program at the Mission Creek Spreading Facility has increased groundwater levels in the Mission Creek subbasin. The following discussion focuses on historical groundwater levels in the Mission Creek and Garnet Hill subbasins.

Historical Groundwater Levels

The San Andreas Fault system has a dramatic impact on groundwater levels in the Planning Area. Previous studies have shown that the various faults that make up the fault system act as effective barriers to groundwater flowing from north to south through the area. Groundwater levels and at times groundwater temperatures on the north and south sides of each fault are significantly different. Groundwater levels are generally higher on the northeast side of the fault because of its barrier effect, to the extent that springs have been recorded on the north. Thus the groundwater levels within the Mission Creek subbasin are generally higher in the southern portion of the subbasin than the northern portion of the subbasin because of the influence of the Banning Fault. On the other hand, groundwater temperatures in the subbasin are generally higher to the north because of the influence of the Desert Hot Springs subbasin (URS, 2006).

In 1936, groundwater pumping in the valley was significantly lower than current conditions and groundwater flowed under generally natural conditions. **Figure 4-4** shows the 1936 groundwater elevation contour map developed by Tyley (1974). Regional water levels have been declining since the early 1950s due to scarce annual precipitation and groundwater extractions (DWR, 2003). Groundwater level data indicate that since 1952, water levels have declined at a rate of 0.5 to 1.5 feet per year (CVWD, 2000).

As can be observed from **Figure 4-4**, 1936 groundwater elevations in the Desert Hot Springs subbasin range approximately from 800-1400 feet compared to groundwater levels in the Mission Creek subbasin which range from 750 feet to 1500 feet. Tyley (1974) indicated a south to south-westerly groundwater flow direction. Mission Creek subbasin indicates a southeasterly flow until about mid-basin where the contour lines curve indicating a southerly flow on the eastern side of the subbasin.

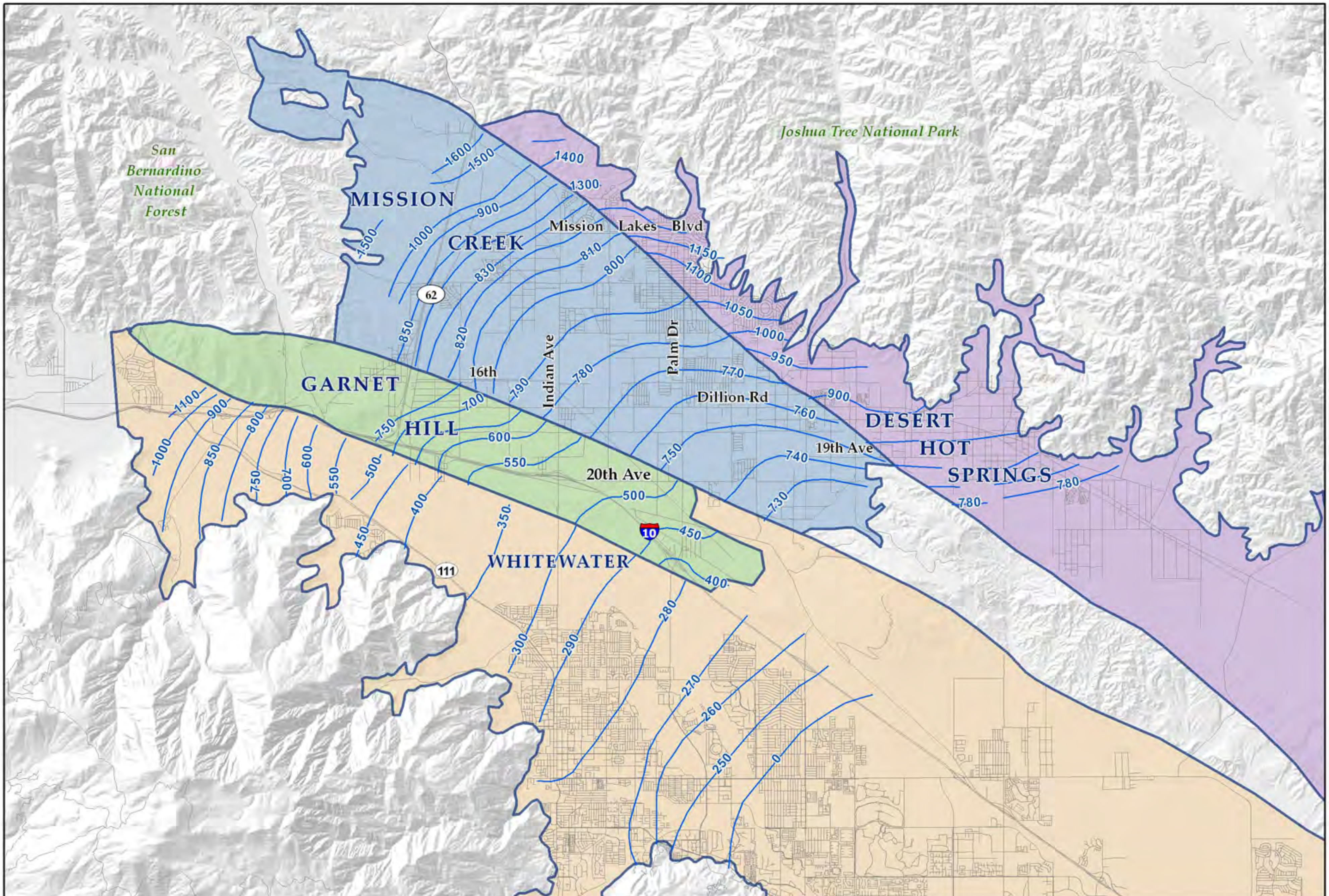
The Garnet Hill subbasin has groundwater elevations approximately 100 to 200 feet lower than the Mission Creek subbasin along the Banning Fault indicating that the groundwater flow is partially restricted by the Banning Fault. Groundwater flow in the Garnet Hill subbasin flows to the east-southeast until the southeastern end of the subbasin where groundwater flow direction turns south and presumably discharges into the Upper portion of the Whitewater subbasin.

The Upper Whitewater subbasin has groundwater elevations approximately 150 feet to 200 feet lower than what is observed in the Garnet Hill subbasin indicating that groundwater flow is partially restricted by the Garnet Hill Fault. Groundwater flow in the Upper Whitewater subbasin area is flowing in an east to southeast direction towards the Salton Sea.

Figure 4-5 presents the groundwater elevation contours for 1951 as interpreted by Tyley (1974). By this time, groundwater development had proceeded with the majority of the extraction occurring in the Whitewater River subbasin. Although one well in the Garnet Hill subbasin was extracting over 2,000 acre-feet per year (acre-ft/year), this well was located in the alluvial gravels of the Whitewater River just north of the Garnet Hill Fault. The contours are similar to what was observed in 1936 (Psomas, 2010).

Figure 4-6 presents the groundwater elevation contours for 2003 as interpreted by Krieger and Stewart (2007). By this time, groundwater development had continued and groundwater depressions were formed in the Mission Creek subbasin around areas with major production wells. The Garnet Hill subbasin has observed a decline in water levels in the upper part of the subbasin and the Upper Whitewater River subbasin has observed an almost 100 feet increase in elevation from the 1951, which is presumably related to the recharge facility located in the same area (Psomas, 2010).

Psomas (2010) presents the groundwater elevation contours based on readings measured in 2009. These are presented in **Figure 4-7**. These contours are similar to the contours developed in 2007 for 2003. Groundwater development has created depressions in the Mission Creek subbasin in the central and the southern portions of the subbasin. The lack of data in the Garnet Hill subbasin did not permit the development of groundwater contours in this subbasin. Data collected between years 2007 and 2009 lacked sufficient coverage to adequately develop groundwater contours for this period.



Key to Features

Groundwater Contours in Feet (1936)

Groundwater Subbasins

- Garnet Hill
- Mission Creek
- Desert Hot Springs
- Whitewater

0 0.5 1 2 Miles

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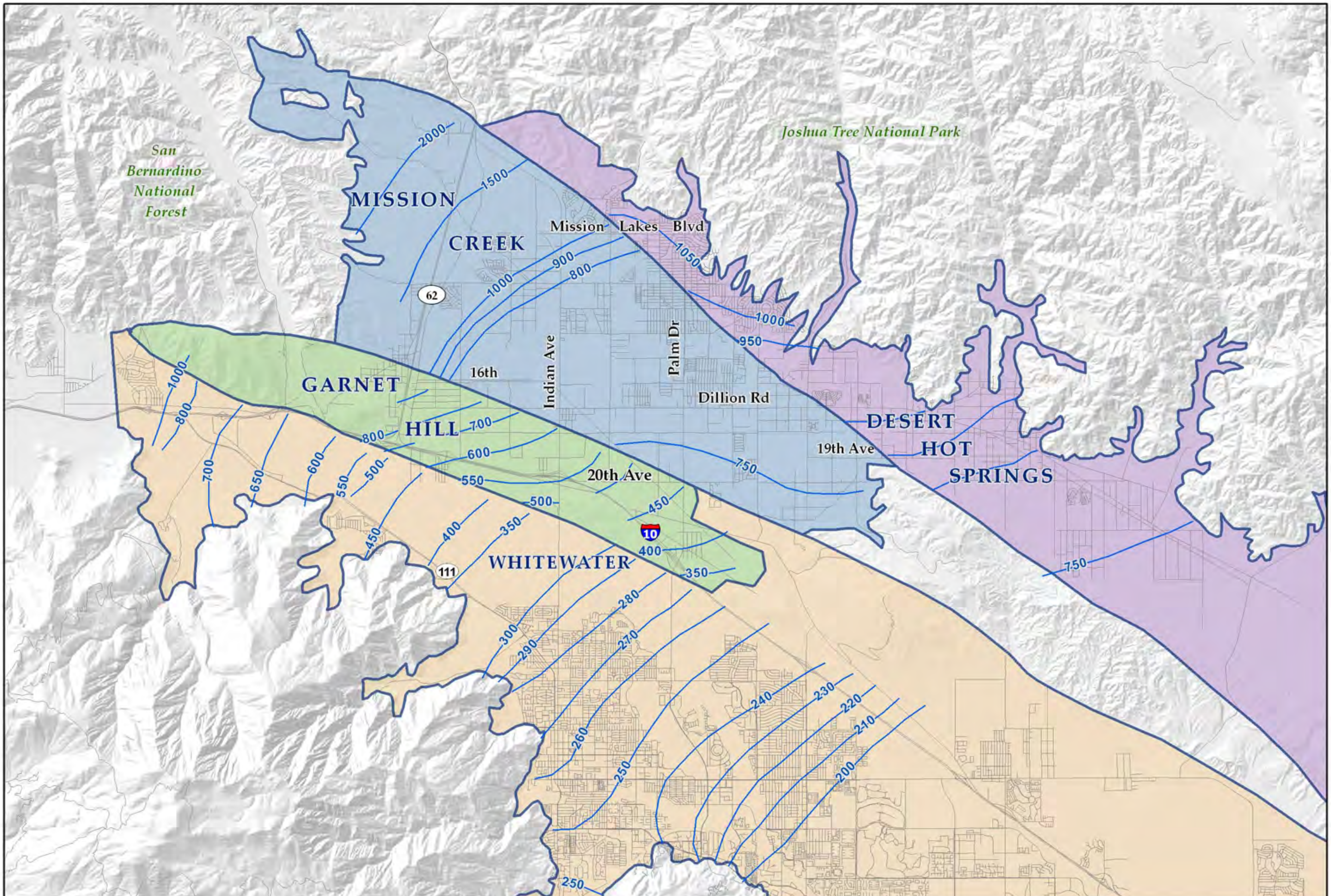
Date: July 8, 2010

Groundwater Contours - 1936

Source:Tyley (1974)

Figure 4 - 4

MWH



Key to Features

Groundwater Contours in Feet (1951)

Groundwater Subbasins

Garnet Hill

Mission Creek

Desert Hot Springs

Whitewater

N

0 0.5 1 2 Miles

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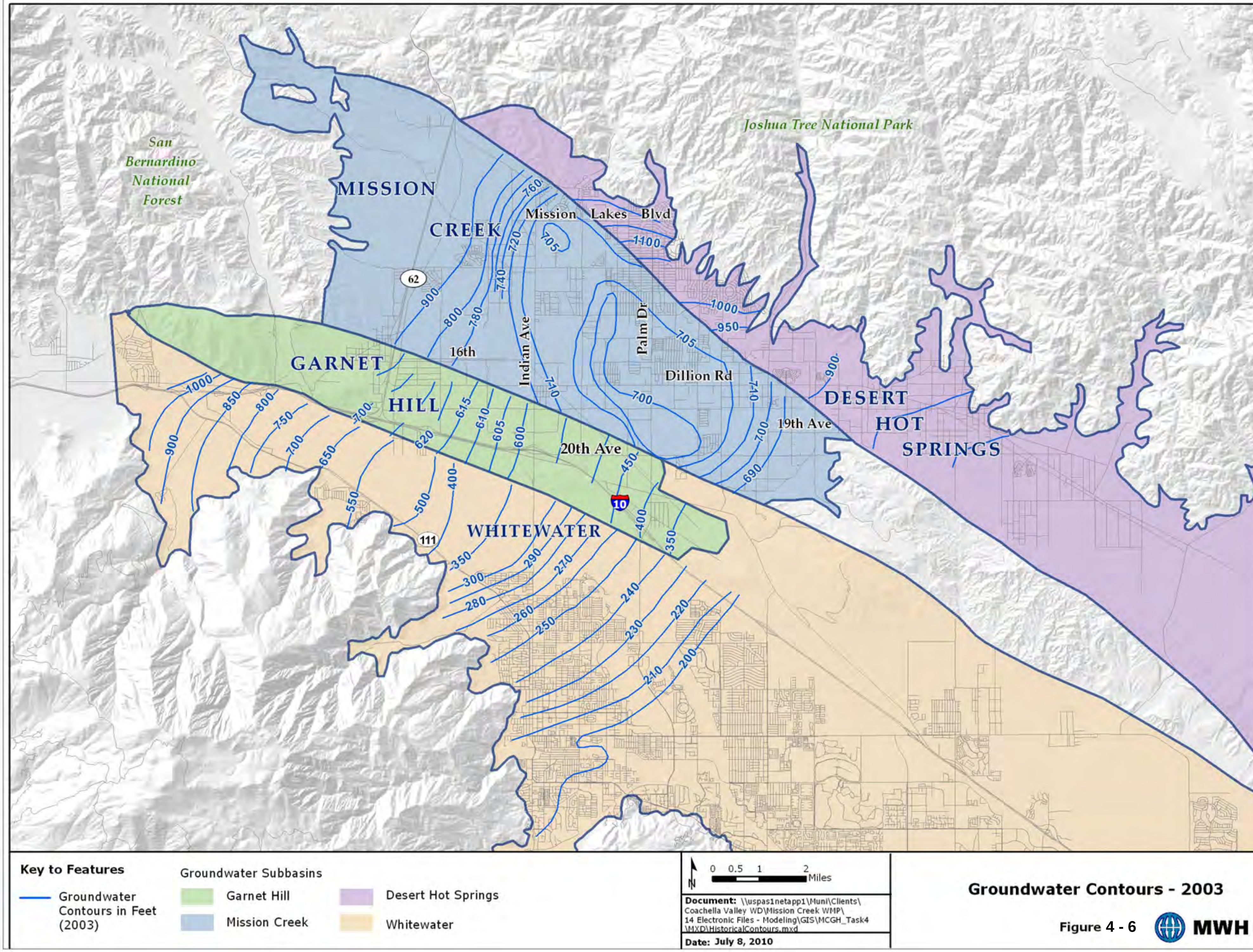
Date: July 8, 2010

Groundwater Contours - 1951

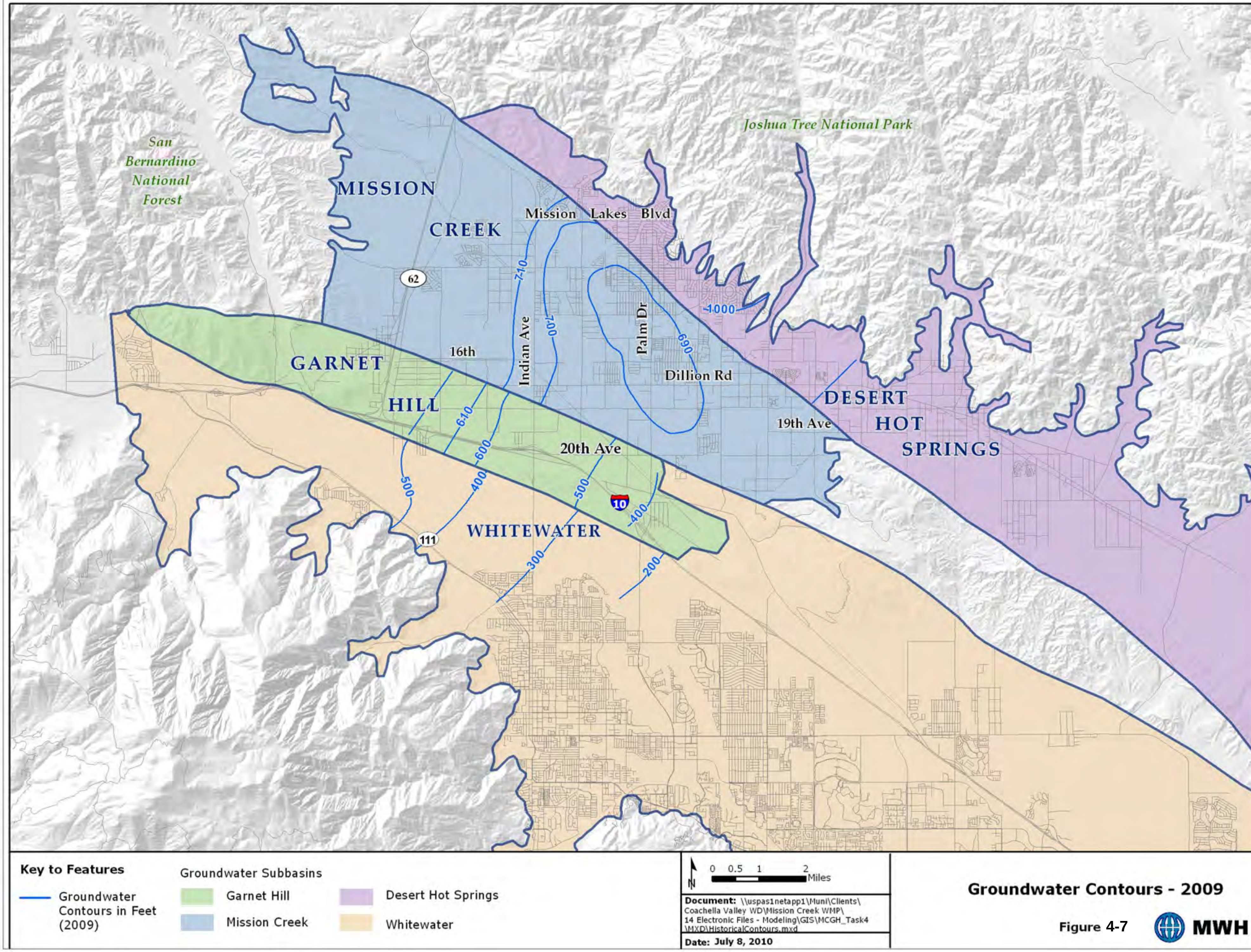
Figure 4 - 5

MWH



Groundwater Contours - 2003

Figure 4 - 6



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Date: July 8, 2010

Groundwater Contours - 2009

Figure 4-7

MWH

Groundwater Quality

The quality of groundwater in the Coachella Valley has been studied by DWR, USGS, other agencies, and local water districts. In general, groundwater quality for the Mission Creek and Garnet Hill subbasins is suitable for domestic water use and meets current drinking water standards. Primary drinking water standards are legally enforceable standards that apply to public water systems. Primary standards protect public health by limiting the levels of contaminants in drinking water. Secondary drinking water standards are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. USEPA recommends secondary standards to water systems but does not require systems to comply.

A review of historical and recent water quality data indicates that the parameters that have exceeded either primary or secondary drinking water standards within the groundwater basins in the Planning Area include total dissolved solids (TDS), nitrate, uranium, and gross alpha. Historical groundwater quality for the Mission Creek and the Garnet Hill subbasins is discussed in detail in the following paragraphs.

Water Quality in the Mission Creek Subbasin

Historical groundwater quality data for the Mission Creek subbasin was evaluated by Slade (2000) from samples taken from MSWD and CVWD wells between 1961 and 1998 and is summarized as follows (MSWD, 2006):

- Groundwater in the subbasin ranges in character from a calcium-magnesium bicarbonate type in the northwest to sodium chloride-sulfate type in the southeast.
- Total dissolved solids (TDS) concentrations in groundwater samples taken from municipal wells ranged from 271 mg/L to 490 mg/L. All samples analyzed were below the State of California recommended Secondary Maximum Contamination Level (MCL) of 1,000 mg/L for TDS.
- Total hardness has historically ranged from 56 mg/L to 252 mg/L as CaCO3 in municipal wells. The pH concentration of groundwater in the Mission Creek subbasin has ranged from 7.2 to 8.3.
- Nitrate as NO3 concentrations have ranged from not detected (ND) to 33.3 mg/L and are below the California Primary MCL of 45 mg/L.
- Iron (Fe) concentrations have ranged from ND to 0.242 mg/L and are below the California Secondary MCL of 0.300 mg/L.
- Manganese (Mn) concentrations have ranged from ND to 0.010 mg/L, below the California Secondary MCL of 0.050 mg/L.
- Well 24 had a violation of the concentration of Lindane (a pesticide) at 0.4 μg/L in 1989 (URS, 2005). The primary MCL for lindane is 0.2 mg/L.

Review of 1980-2009 Water Quality Data

Based on data obtained for the Mission Creek and Garnet Hill WMP, a groundwater quality summary is presented. This summary assumes that water quality data for MSWD's and

CVWD's production wells are representative of the water quality in the Mission Creek and the Garnet Hill subbasins. Water quality is summarized for selected parameters such as TDS nitrates, arsenic, chromium, uranium, and gross alpha.

TDS

TDS concentrations are an indicator of salinity in groundwater. TDS concentrations in the groundwater basin need to be managed properly to prevent long-term degradation of groundwater quality in the basin. The California recommended secondary MCL for TDS is 1,000 mg/L. TDS concentrations range from 240 mg/L to 570 mg/L in the Mission Creek subbasin. In general, groundwater quality improves across the Mission Creek subbasin towards the Garnet Hill Fault. Wells located closer to the Garnet Hill subbasin have TDS concentrations ranging between 300 mg/L and 400 mg/L. Wells located closer to the Desert Hot Springs subbasin have higher TDS concentrations ranging between 400 mg/L and 500 mg/L. In general, based on the field data, no trends are observed with regards to TDS concentrations over time. **Figure 4-9** presents the temporal variations in the TDS concentrations in the Mission Creek subbasin.

Since the TDS concentration of the imported water is higher than the natural TDS concentration of the groundwater, CVWD, DWA, and MSWD recognize that artificial recharge of the Mission Creek subbasin may increase TDS concentrations in the groundwater in the future. Alternatives to manage TDS concentrations while continuing recharge activities include evaluating the feasibility of recharging by importing SWP water to the Coachella Valley and treating Colorado River water prior to recharge. Either alternatives will increase the cost of water to the agencies and ultimately to the customers. In summary, the use of Colorado River water for recharge increases salinity in the Mission Creek and Garnet Hill subbasins. Potential alternatives to mitigate this condition have high costs. A salt balance performed using the Water Evaluation and Planning (WEAP) model shows minor increases in TDS concentrations over time.

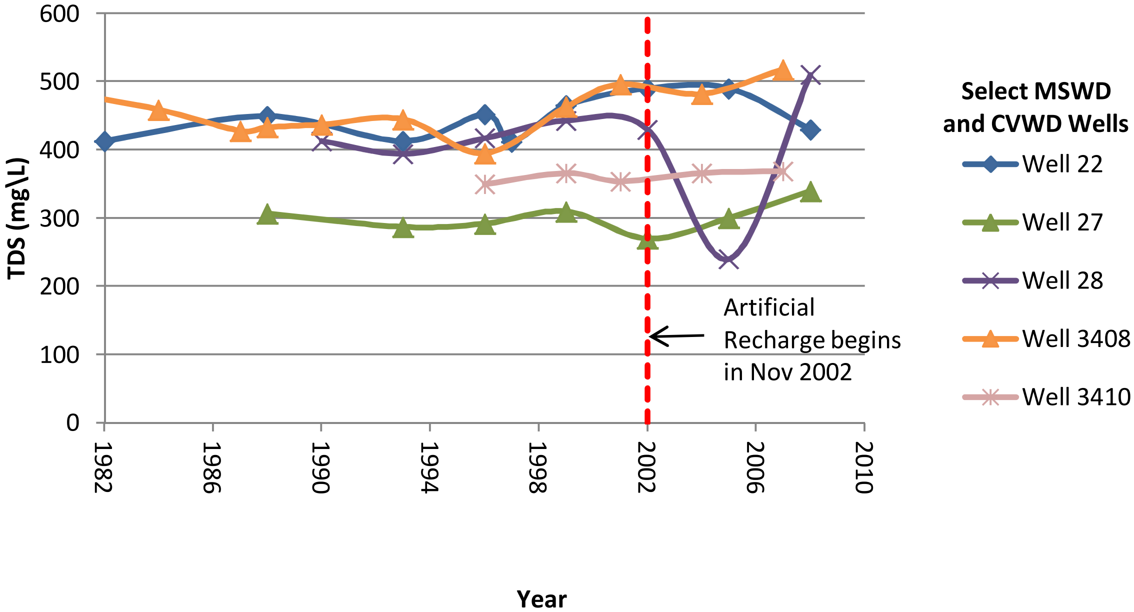


Figure 4-9
Temporal Variations in TDS Concentrations in the Mission Creek Subbasin

Salt (TDS) Balance for the Mission Creek and the Garnet Hill subbasins

Based on the water balance presented earlier and the existing TDS concentrations presented, a salt balance is developed for the Mission Creek subbasin under historical and projected conditions presented here and in Section 5.

The following assumptions apply to the salt balance:

- TDS in natural recharge is 201 mg/L (DWR, 1964).
- TDS from artificial recharge is based on concentrations in the Colorado River Aqueduct as reported by Metropolitan. Future TDS concentrations are as shown in **Table 4-4**, based on the the United States Bureau of Reclamation (USBR)'s projections of their Preferred Alternative for the Colorado River.
- Indoor use increases TDS levels by 250 mg/L.
- All the salts in applied outdoor water use return to the groundwater basin.
- Fertilizer use for outdoor and golf course irrigation is at 0.147 tons/acre/yr (WRE, 1970).
- In the absence of a solute transport model to simulate water quality, it is assumed that the groundwater basins are completely mixed within each subbasin. It should be noted that this assumption significantly simplifies the actual mixing process within a groundwater basin.

Table 4-4
Projected Salinity in Colorado River Water Supplies

Year	Projected TDS Concentrations (mg/L)
2008	657
2016	618
2026	625
2060	650

Source: USBR, 2007. Preferred Alternative Downstream of Parker Dam.

Figure 4-10 summarizes the historical net total change in TDS within the Mission Creek and Garnet Hill subbasins.

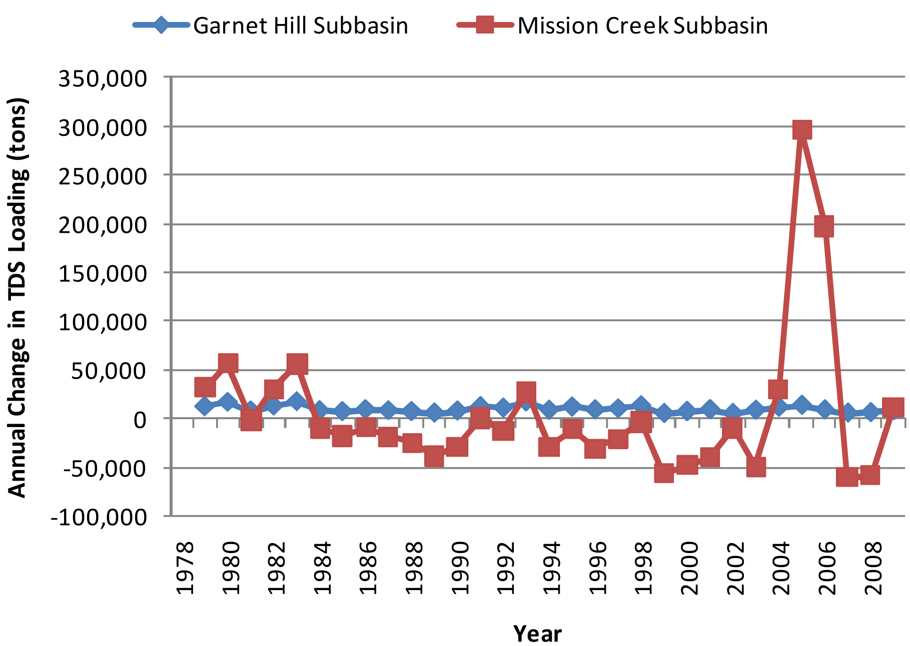


Figure 4-10
Historical Net TDS Change in the Mission Creek and Garnet Hill Subbasins

Nitrates as NO_3

Nitrate is a nitrogen compound that is a nutrient in water and can have public health implications, especially for babies. The California primary MCL for nitrate (as NO_3) is 45 mg/L as nitrate (10 mg/L as nitrogen). Sources of nitrate include nitrogen-based fertilizers used for golf courses and landscaping, septic tank discharges, wastewater disposal through percolation and natural sources like mesquite hummocks, and alluvial fan formations. Generally, nitrates exist 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 concentrations are below the MCL (45 mg/L) for all recorded samples in the Mission Creek subbasin. Nitrate concentrations (as NO_3) range from a low of 1.1 mg/L to a high of 33.3 mg/L. In general, no trends are observed with regards to nitrate concentrations over time. MSWD has an active program to convert existing septic tanks to sewer collection systems for nitrate management in the groundwater basin. **Figure 4-11** presents the temporal variations in the nitrate concentrations in the Mission Creek subbasin.

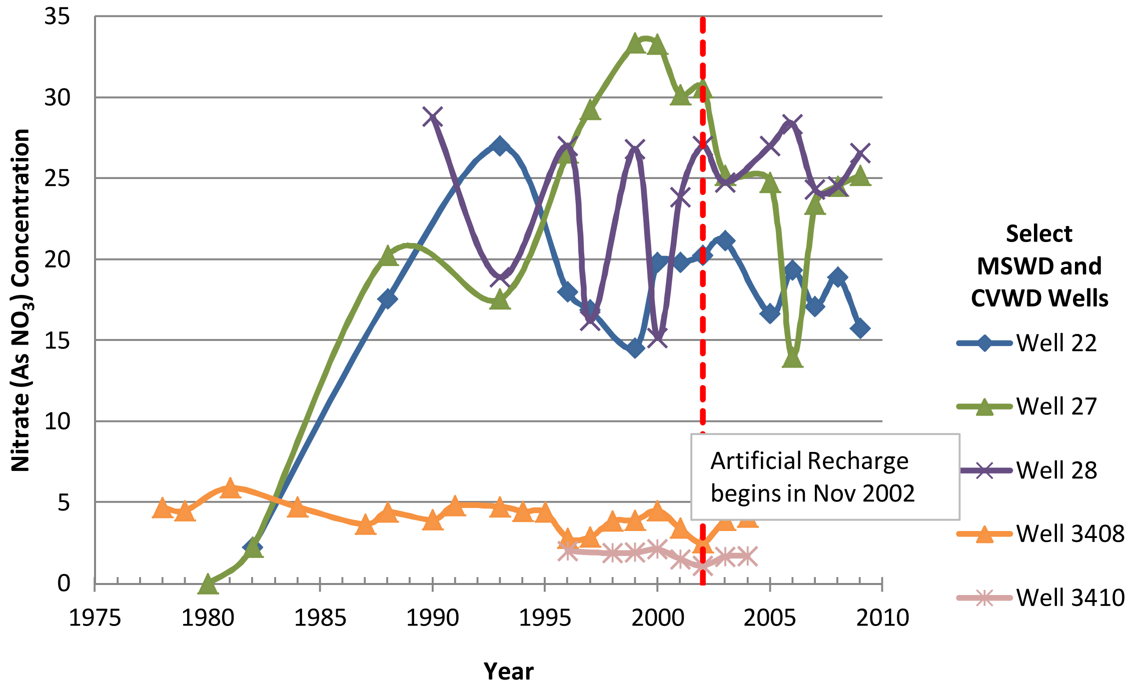


Figure 4-11
Temporal Variations in Nitrate Concentrations in the Mission Creek Subbasin

Chromium

Chromium-6 is currently regulated in California under the 50 µg/L primary MCL for total chromium. The total chromium MCL was established to address exposures to chromium-6, which is considered to be the more toxic form of chromium among the forms found in groundwater. A public health goal (PHG) for chromium-6 has not yet been established, so the California Department of Health (CDPH) cannot proceed with the MCL process (CDPH, 2009). Chromium-6 is toxic and primarily affects the liver and kidneys. Chromium is detected in several groundwater wells in the Mission Creek subbasin. Chromium is detected in MSWD wells 24, 27, 29, and 31, however, the concentrations are lower than the MCL for primary drinking water standards. Chromium is also detected in CVWD wells 3405, 3408, 3409, and 3410 with concentrations ranging from 9 µg/L to 22 µg/L. Currently there are no wells in the Coachella Valley that exceed the 50 µg/L total chromium MCL.

Arsenic

Arsenic is a naturally occurring element found in the earth's crust. It is found to have carcinogenic and non-carcinogenic effects on health if ingested at high levels over a long period of time. The primary MCL for arsenic is 10 µg/L. Arsenic is detected in several groundwater wells in the Mission Creek subbasin. CVWD wells 3405, 3408, 3409, and 3410 indicate the presence of arsenic with concentrations varying from less than 1 µg/L to 28 µg/L. In 1981, only one sample each was collected at Well 3405 and Well 3408 indicating arsenic concentrations greater than the MCL. Arsenic concentrations for samples collected since then have remained below the MCL and do not exceed the four-quarter average MCL of 10 µg/L. Samples collected for MSWD wells in 2008 do not indicate any presence of arsenic.

Uranium

Uranium found in the Mission Creek subbasin is naturally occurring. The primary MCL for uranium is 20 picocuries/liter (pCi/L) based on a four-quarter average. The presence of uranium in drinking water makes the water chemically toxic and detrimental effects on the renal system have been documented for several compounds containing uranium (http://www.ndhealth.gov/wq/gw/pubs/uranium.htm). Uranium is detected in several groundwater wells in the Mission Creek subbasin. For samples collected in 2008, the presence of uranium was detected in MSWD's Wells 22, 24, 28, 29, 30, and 34. The concentrations ranged from 4.4 pCi/L to 23 pCi/L but none of the wells exceed the four-quarter average MCL of 20 pCi/L. Well 30 had uranium concentrations in excess of the primary MCL and has been removed from service. Well 28 has well-head treatment for uranium. Uranium is also detected in CVWD wells 3405, 3408, 3409, and 3410 with concentrations ranging from 2 pCi/L to 17 pCi/L.

Gross Alpha Radiation

Gross alpha occurs naturally in drinking water sources being present in the geologic formations of the groundwater basin. The primary MCL for gross alpha is 15 pCi/L based on a four-quarter average. Regular ingestion of water containing gross alpha in excess of the MCL over several years may increase the risk of cancer (EPA 2010). For groundwater samples obtained in 2008, Well 30 and Well 34 exceed MCL for gross alpha with recorded samples having a concentration of 16 pCi/L, but none of the wells exceeded the four-quarter average MCL of 15 pCi/L.

Water Quality in the Garnet Hill subbasin

There is limited information available on groundwater quality in the Garnet Hill subbasin. In several cases, for a given year data is available at a single well. The available data are not sufficient to make any meaningful conclusions about temporal or spatial distribution of water quality constituents in the subbasin. Historically, recorded TDS concentrations have ranged from a low of 156 mg/L (1999) to a high of 792 mg/L (1969). Samples recorded in 2008 indicate a TDS concentration of 230 mg/L at Well 33 (which came online in 2003). Samples collected in 2008 indicate the presence of uranium, however, the concentrations are below the primary MCL for uranium. Arsenic was detected in 1993 (9.9 µg/L) and 1999 (10.3 µg/L). Arsenic was not detected in Well 33 for samples collected in 2008. Nitrate concentration has varied between 1 mg/L and 7 mg/L in the basin.

Colorado River TDS and NO_3 Data

A review of water quality data at San Jacinto for the January 1999 to July 2009 period indicates an average TDS concentration of 614 mg/L. TDS concentrations ranged from a low of 539 mg/L to a high of 682 mg/L. For the same period, nitrate concentrations ranged from a low of 0.5 mg/L to a high of 2.2 mg/L with an average concentration of 1.2 mg/L. On average TDS concentrations are approximately 200 mg/L higher than the natural groundwater TDS concentrations in the Planning Area.

Groundwater Model

The numerical groundwater model of the Mission Creek and Garnet Hill subbasins was developed by Psomas (2010) is calibrated for steady-state and transient conditions. The steady-state calibration focuses on refining estimates of hydraulic conductivity (or transmissivity) whereas the transient calibration focuses on refining estimates of storativity. The purposes of the model are to evaluate the following:

- Conduct a management level evaluation of selected alternatives for managing groundwater in the Mission Creek and Garnet Hill subbasins;
- Provide information on the sensitivity of the system to variations in various parameters so that, if appropriate, more resources can be allocated to reduce the uncertainty;
- Assist in the design/improvement of the monitoring network so that effective management of the subbasins can be performed.

A detailed description of the groundwater modeling process is presented in **Appendix B – Groundwater Model Development**.

Imported Surface Water

Background

To recharge groundwater supplies, the Coachella Valley Water District (CVWD) and the Desert Water Agency (DWA) obtain imported water supplies by exchanging SWP water allocations for CRA water. SWP is managed by the DWR. CVWD and DWA are two of 29 agencies holding long-term water supply contracts with the State of California for SWP water. SWP water originates from rainfall and snowmelt in Northern California. Runoff is stored in Lake Oroville, the project's largest storage facility, and then released down the Feather River to the Sacramento River and the Sacramento-San Joaquin Delta. Water is diverted from the Delta at the Clifton Court Forebay and then pumped into the 444-mile-long California Aqueduct. SWP water is stored in San Luis Reservoir, which is jointly operated by the DWR and the U.S. Bureau of Reclamation. Six pumping stations lift the water more than 3,000 feet and energy is recovered at power plants along the aqueduct. SWP supplies and delivery costs are allocated among contractors based on their "Table A Amounts" which are defined in each agency's water delivery contract. The combined Table A Amounts of all contractors is 4.173 million acre-ft/yr, of which CVWD and DWA currently have 138,350 acre-ft/yr and 55,750 acre-ft/yr, respectively, as of 2010.

DWA and CVWD contracted for SWP water in 1962 and 1963, respectively. Since there is no conveyance facility to deliver SWP water to the Coachella Valley, CVWD and DWA do not directly receive SWP water. Instead, their SWP water is delivered to Metropolitan at San Bernardino as part of an exchange agreement (Exchange Agreement, 1967). Metropolitan in turn delivers an equal amount of CRA water to CVWD and DWA to be recharged at the Whitewater and Mission Creek subbasins.

In 1973, they jointly commenced a program of artificial recharge of the Whitewater subbasin using imported water. The imported water is infiltrated in the Whitewater River spreading facility near Windy Point, from which it percolates and infiltrates to the ground water basin underlying the spreading area. In 1983, DWA and CVWD extended their water exchange agreements to 2035 and in 1984 they entered advance delivery agreements with Metropolitan to permit Metropolitan to store excess water within the Coachella Valley for later exchange with DWA and CVWD (CVWD, DWA and Metropolitan, 1984). The Water Management Agreement (1976) was amended in 1992 to jointly manage the Whitewater River subbasin, importing sufficient SWP or Colorado River water to meet increasing demands.

Metropolitan Transfer

CVWD's original SWP water allocation (Table A Amount) was 23,100 acre-ft/yr and DWA's original SWP Table A Amount was 38,100 acre-ft/yr -for a combined Table A Amount of 61,200 acre-ft/yr. Metropolitan historically has not made full use of its SWP Table A Amounts in normal and wet years. The Exchange Agreement between DWA, CVWD, and Metropolitan was last amended in 2003, where CVWD and DWA acquired 100,000 acre-ft/yr of Metropolitan's SWP Table A water as a permanent transfer, commencing in 2005. The water is exchanged for Colorado River water and either recharged at the existing Whitewater Spreading Facility or the Mission Creek Spreading Facility. The transferred water may also be subtracted from Metropolitan's Advance Storage account.

The terms of the agreement provide that CVWD receives 88,100 acre-ft/yr and DWA receives 11,900 acre-ft/yr 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 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 acre-feet blocks. To estimate the average supply from this transfer conservatively, it is assumed that Metropolitan would exercise its option to callback the 100,000 acre-ft in four 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, price of the callback water, and the ability of Metropolitan to store the callback water. Since 2005, Metropolitan has exercised its call-back option only once.

Other Permanent Transfers of Table A

In 2004, CVWD purchased 9,900 acre-ft/yr of SWP Table A water allocations from the Tulare Lake Basin Water Storage District in Kings County. In 2007, CVWD and DWA made a second purchase of Table A SWP water allocations from the Tulare Lake Basin Water Storage District totaling 7,000 acre-ft/yr. Also in 2007, CVWD and DWA completed the transfer of 16,000 acre-ft/yr of Table A water allocation Amounts from the Berrenda Mesa Water District in Kern County. These latter two transfers became effective on January 1, 2010. With these additional transfers, the total SWP Table A Amount for CVWD and DWA is 194,100 acre-ft/yr. **Error! Reference source not found.** summarizes CVWD and DWA total allocations of Table A SWP water.

Table 4-5
State Water Project Allocations (acre-ft/year)

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

1. Metropolitan Transfer subject to recall.

Other Transfers

Additionally, CVWD and DWA have acquired non-SWP water supplies using one-time transfers in the past. These transfers have included supplies from Needles (1986, to CVWD), Palo Verde Irrigation District (2006 to 2008, to CVWD), Rosedale-Rio Bravo (2008 to 2009, to CVWD), and for CPV Sentinel (starting from 2009, for DWA).

Mission Creek Subbasin Groundwater Recharge

MSWD was annexed as a sub agency to DWA in 1963 and since that time, land owners within MSWD's boundaries have paid a SWP assessment for the capital costs of the SWP. All land owners within DWA's boundaries pay the assessment as well. As early as 1984, MSWD, CVWD and DWA held discussions about recharging the Mission Creek subbasin and the facilities that would be required. In 2001 construction of a turnout from the Colorado River aqueduct was begun and by 2002, construction of the spreading basins was completed. In 2001, MSWD adopted a resolution declaring its support for DWA's program to replenish the subbasin. Construction of the recharge basins was completed the following year. Water was delivered to the basin in 2002.

In order to arrest declining groundwater levels in the Mission Creek subbasin, DWA completed construction of 57 acres (total surface area with all basins full) of recharge basins as the Mission Creek Recharge Facilities in June 2002. Per an agreement between DWA and CVWD, the two agencies recharge the Mission Creek subbasin with SWP Exchange Water, with the volume calculated based on the available water supply delivered by Metropolitan and the relative percentage of water pumped or diverted from the Mission Creek Management Area and the Whitewater River Management Area subject to operational limitation (CVWD and DWA, 2003). This formula was later adjusted so that the volumes would be balanced 20 years after recharge commenced, and every 20 years thereafter (CVWD, DWA, and MSWD, 2004). On an average, approximately 8,000 acre-ft/yr (shown on **Table 4-7**) of SWP Exchange Water from the CRA has been used to replenish the groundwater basin since recharge commenced in 2002. Since water recharged into the Mission Creek subbasin is also part of the Exchange Agreement (CVWD and DWA, 2003), water recharged into the Mission Creek subbasin became part of the Advanced Delivery Agreement.

SWP Delivery Availability

SWP water contractors submit annual requests to the DWR for water allocations and DWR makes an initial SWP Table A allocation for planning purposes, typically in December of each year. Throughout the year, as additional information regarding water availability becomes available to DWR, its allocation/delivery estimates are updated. **Table 4-6** presents the historic reliability of SWP deliveries, including their initial and final allocations for the past 22 years (1988 through 2009).

Although the SWP has historically provided 77 percent of Table A Amounts, the long-term SWP reliability factor for Table A water, according to the 2009 Draft SWP Reliability Report (DWR, 2009), has been reduced to approximately 60 percent as a result of legal, regulatory and environmental restrictions in the Delta. The factors that could further reduce the SWP reliability considered in this WMP include:

- Uncertainty in modeling restrictions associated with biological opinions
- Risk of levee failure in the Delta
- Additional pumping restrictions resulting from biological opinions on new species or revisions to existing biological opinions
- Impacts associated with litigations such as the California ESA lawsuit
- Climate change impacts

Table 4-6
Historical SWP Table A Allocations (1988-2009)

Year	Water Year Type[1]	Initial Allocation	Final Allocation
1988	Critical	100%	100%
1989	Dry	100%	100%
1990	Critical	100%	100%
1991	Critical	85%	30%
1992	Critical	20%	45%
1993	Above Normal	10%	100%
1994	Critical	50%	50%
1995	Wet	40%	100%
1996	Wet	40%	100%
1997	Wet	70%	100%
1998	Wet	40%	100%
1999	Wet	55%	100%
2000	Above Normal	50%	90%
2001	Dry	40%	39%
2002	Dry	20%	70%
2003	Above Normal	20%	90%
2004	Below Normal	35%	65%
2005	Above Normal	40%	90%
2006	Wet	55%	100%
2007	Dry	60%	60%
2008	Critical	25%	35%
2009	Dry	15%	40%
2010	Below Normal	5%	50%
2011	Wet	25%	80%
Average:		**49%**	**77%**

Source: DWR, Water Contract Branch within the State Water Project Analysis Office, Notices to State Water Contractors, 1988 – 2009.
(1) Water year designation based on Sacramento Valley Water Year Hydrologic Classification which is based on the sum of the unimpaired runoff in the water year as published in the DWR Bulletin 120 for the Sacramento River at Bed Bridge, Feather River inflow to Oroville, Yuba River at Smartville and American River inflow to Folsom reservoir (DWR, 2010).

Increased demand, Delta environmental issues, recent court decisions and other risks including climate change threaten to reduce SWP deliveries in the future. The potential reduction equates to reduced reliability of SWP supplies for all SWP contractors, including CVWD and DWA. These factors are evaluated in subsequent tasks of the WMP to estimate the SWP reliability for the WMP planning horizon.

CVWD's and DWA's SWP Table A Amounts are used to replenish both the Upper Whitewater River and the Mission Creek subbasins. Water for recharge is allocated between the subbasins in proportion to pumping in the two subbasins. The existing availability of SWP Table A Amounts for CVWD and DWA is presented in **Table 4-7.**

Table 4-7
SWP Availability for CVWD and DWA

SWP Components	Existing (acre-ft/yr) (with Metropolitan Call-back)	Existing (acre-ft/yr) (No Call-back)
Table A Amount (Existing)	194,100	194,100
Assumed SWP Reliability[1]	60%	60%
Average SWP Delivery	116,460	116,460
less Metropolitan Call-back[2]	(32,856)	0
Average Net SWP Supply[3]	83,604	116,460
Upper Whitewater Share		
Percent of Total Production[4]	93%	93%
Allocated to Upper Whitewater	77,752	108,308
Mission Creek Share		
Percent of Total Production[4]	7%	7%
Allocated to Mission Creek	5,852	8,153

1 – Based on California DWR's 2009 Draft SWP Reliability Report and adjusted based on the combined CVWD-DWA Table A Amounts and assumed reliability amounts.
2 – Average callback in 4 wet years during a 10 year period.
3 – Net supply is calculated by deducting the Metropolitan callback from the Table A Amount with SWP Reliability
4 - Percent of total production is the percent of production in each subbasin to the combined total production.

SUPPLY DEMAND COMPARISON

A comparison of projected water demands (described in **Section 3 – Water Requirements**) and existing supplies is presented in **Table 4-8**. The table indicates that existing supplies are not sufficient to meet projected water requirements for the Planning Area. It should be noted that factors such growth projections and imported water supply reliabilities significantly impact the water requirements in the Planning Area. The impact of different reliability percentages on available water supply to the Mission Creek subbasin is presented in **Section 5** of this WMP. The uncertainties surrounding imported and local water supplies within the Planning Area make it imperative that this WMP provide a plan to develop new supply sources for the Planning Area including a supply buffer to assure adequate supplies.

Table 4-8
Supply and Demand Comparison under Existing Supply Conditions

Source	Existing (2009)	2045
Average Natural Recharge	7,644	7,644
Average Return Flows	2,882	4,866
SWP Exchange Water[1,2]	5,852	10,868
Total Supplies	**16,378**	**23,378**
Total Demands	**15,414**	**37,618**
Surplus/Deficit	**964**	**-14,240**

1 –Based on average SWP Availability for CVWD and DWA. Assumes that existing production in the Mission Creek subbasin is 7 percent of the total production in the Valley. Future production is assumed to be 13 percent of the total production in the Valley. Assumes 60 percent SWP Reliability.
2 –Assumes an average callback by Metropolitan in 4 wet years during a 10 year period.

DATA GAPS

Several gaps have been observed in the data collected and compiled for this WMP. A number of data sources are used to present facts to draw conclusions regarding water management in the Planning Area including: water agency billing and production data, Engineer's Reports on Water Supply and Replenishment Assessment for the Mission Creek Subbasin Area of Benefit, production reported to the State Water Resources Control Board (SWRCB) for the 1948-1992 period, data developed by the United States Geological Survey (USGS) (Tyley, 1974) for modeling the Upper Coachella Valley, municipal water quality data from CVWD and MSWD, and private well water quality data compiled by CVWD

The items identified as having missing data or incomplete data include:

- Groundwater elevation canvass
- Private well canvass
- Groundwater quality (major ions)
- Garnet Hill subbasin monitoring well
- Mission Creek subbasin water quality data (EC, TDS, general minerals)
- Precipitation monitoring in the Mission Creek watershed
- Percolation rate tests at the Mission Creek spreading facility
- Percolation rate tests at the Horton WWTP percolation ponds
- Subsidence monitoring
- Consistency between CVWD and DWA Engineer's Reports on groundwater recharge
- Methodology for tracking balance in Metropolitan Storage Account
- Discussion of on-going water management activities

Coordination among CVWD, MSWD, and DWA during data collection will enable collaboration and also reduce the costs associated with data collection. Recommendations for monitoring, collect, report, and share data are presented in **Appendix E – Monitoring, Data Management, and Reporting**.

Section 5
Issues, Strategies, and Plan Evaluation

INTRODUCTION

The mission statement for the Mission Creek and Garnet Hill Water Management Plan (WMP) is:

> ***The purpose of the Mission Creek and Garnet Hill Water Management Plan is to manage the water resources to reliably meet demands and protect water quality in a sustainable and cost-effective manner.***

The objectives of the WMP are:

- Meet current and future water demands with a 10 percent supply buffer
- Reduce/eliminate long-term groundwater overdraft
- Manage and protect water quality
- Comply with state and federal laws and regulations
- Manage future costs
- Minimize adverse environmental impacts

This section describes the issues that may affect water management in the Planning Area and identifies strategies to address the issues. Issues are defined as near-term or long-term challenges that need to be addressed to meet the objectives of the WMP. A numbers of strategies are developed and described in this section to address the issues that have been identified. These strategies are used to develop alternative water management plans. Five alternative plans are identified to meet the current and future water needs of the Planning Area. In addition, a No Action Plan is presented to represent current conditions. Each alternative plan has a goal consistent with the objectives of the WMP for the Planning Area. A discussion on the criteria selected for evaluation of the alternative plans and the evaluation process is presented in this section.

ISSUES

Issues identified in this WMP are broadly grouped into the following five categories:

- Water Supply
- Water Quality
- Costs and Economics
- Water Demand
- Environmental

The list of issues presented in **Table 5-1** was identified by CVWD, DWA, and MSWD as areas of concern or interest pertaining to water management in the Planning Area. Each issue is briefly discussed in this section. Relative to one another, each issue has a differing level of importance.

Table 5-1
List of Issues

Category	Issue
Water Supply	Climate Change
	Impact of Whitewater River Subbasin recharge on Garnet Hill basin
	Imported Water Recharge Volumes
	Natural Recharge
	Overdraft
	Recharge Timing and Volume
	Recharge/Percolation pond operations and maintenance
	Recycled Water
	Supply Reliability
	Transfers and Exchanges
	Underflows between the subbasins
Water Quality	Brine Disposal
	Arsenic
	Fluoride
	Gross Alpha
	Uranium
	Hexavalent Chromium
	Nitrate
	Total dissolved solids (TDS)
	Other Water Quality Contaminants
	Hot water entering MC subbasin
	Mission Creek Water Quality
	Salinity Management
	Well abandonment program
Costs and Economics	Cost of water
	Funding
	Pumping Costs
	Replenishment Assessment
Water Demand	Conservation
	Population growth
	Socioeconomic Conditions
Environmental	Greenhouse gas emissions
	Mesquite Hummocks
	Land subsidence
	Coachella Valley Multi-species Habitat Conservation Plan
	Watershed protection
	Stakeholders and regulatory agency coordination
Other	Data Gaps
	Land use protection for basin recharge
	Monitoring and Reporting
	Plan Implementation

WATER SUPPLY ISSUES

Water supply issues generally relate to those impacting the availability or reliability of water supplies serving the Planning Area.

Climate Change

Climate change has the potential to affect the reliability of both local and imported water supplies and climate change could also increase water demand. No formal studies have been conducted to evaluate the impacts of climate change on the Coachella Valley. However, the results of several studies which have been conducted on a larger scale can be used to indicate trends for the Planning Area. For example, studies conducted by the National Center for Atmospheric Research for Inland Empire Utilities Agency suggest a 0.21 to 3.81 degrees F temperature increase and -19 to +8 percent change in winter precipitation in Southern California between 2000 and 2030. Studies conducted by the Southern California Association of Governments (SCAG) suggest that current temperatures will increase by 1 to 2 degrees F by 2050, and by 4 degrees F above current levels by 2100 (SCAG, 2009). Higher temperatures and reduced precipitation are expected to increase evapotranspiration and irrigation water demands; however, higher temperature may also result in increased humidity which could offset a portion of the demand increase. Reliability estimates developed by the California Department of Water Resources (DWR) for the State Water Project (SWP) supplies account for the impacts of climate change.

The consequences of climate change introduce uncertainty in water supply planning for the Planning Area that may require contingency planning. One option to mitigate the impacts of climate change is to plan for a supply buffer. Planning for additional supplies in excess of the amount required to meet projected demands will provide a buffer in the event that planned water supplies do not produce the expected amounts or demands are greater than anticipated.

Impact of Whitewater River Subbasin Recharge on Garnet Hill Subbasin

The Garnet Hill subbasin is upgradient of Whitewater River subbasin; groundwater underflow typically flows from the Garnet Hill subbasin to the Whitewater River subbasin. However, high groundwater levels in the Whitewater River subbasin following large recharge events may limit flow from Garnet Hill subbasin to the Whitewater River subbasin or even cause underflow to the Garnet Hill subbasin. This is observed by reviewing groundwater level measurements in the Garnet Hill and Upper Whitewater River subbasins when recharge occurs in the Whitewater River subbasin. The results of the groundwater modeling also indicate underflows from the Whitewater River subbasin to the Garnet Hill subbasin during periods of high volumes of imported water recharge in the Whitewater River subbasin.

Presently, there is limited groundwater level monitoring data available for the Garnet Hill subbasin. Recommendations for monitoring and reporting for the Garnet Hill subbasin are discussed in **Appendix E – Monitoring, Data Management, and Reporting** of this WMP.

Imported Water Recharge Volumes

Per a 2003 agreement between DWA and CVWD, the two agencies recharge the Mission Creek subbasin with State Water Project (SWP) Exchange Water (exchanged for Colorado River water with Metropolitan) at the Mission Creek Spreading Grounds. The volume recharged into the Mission Creek Spreading Grounds is calculated based on the available water supply delivered by Metropolitan and the relative percentage of water pumped or diverted from the Mission Creek Management Area and the Whitewater River Management Area subject to operational limitation (CVWD and DWA, 2003). This formula was later adjusted so that the volumes would be balanced 20 years after recharge commenced and every 20 years thereafter (CVWD, DWA and MSWD, 2004). However, as a result of advanced deliveries, recent artificial recharge volumes in the Mission Creek subbasin have exceeded the relative percentage of water pumped from the Mission Creek Management Area.

Natural Recharge

The average volume of natural recharge in the Mission Creek and Garnet Hill subbasins has been estimated. The current estimates are significantly higher than estimates of natural recharge from previous studies (Psomas, 2010). Natural recharge can be enhanced by increasing percolation of storm water into the Mission Creek and Garnet Hill subbasins. Riverside County Flood Control District (RCFCD) is developing a Master Drainage Plan for Desert Hot Springs area which presents several flood control alternatives including new recharge basins to capture natural recharge (PACE, 2011).

Currently, all natural recharge generated by storms of low intensities are captured within the Planning Area. Natural recharge is lost only during infrequent storms of high intensity when sufficient runoff is generated to cross the Garnet Hill fault into the Whitewater River subbasin. Capturing the incremental natural recharge during storms of high intensities will require the construction of large storm retention and recharge basins. This may not be economically feasible. There is limited precipitation and streamflow data available for the Planning Area.

Overdraft

Groundwater levels in the Mission Creek subbasin have declined over the past 70 years. Under existing conditions, groundwater pumping is 4,000 acre-feet per year (acre-ft/yr) greater than estimated natural recharge and current artificial recharge activities.

An approach to address overdraft is to set a long-term average groundwater level target as part of the management plan. Potential targets include:

- Raising levels 15 feet above 2009 levels
- Maintaining long term levels at 2009 levels
- Allowing levels to decrease below 2009 Levels

Advantages and disadvantages for these various targets are shown in **Table 5-2.**

Table 5-2
Potential Groundwater Level Targets

Potential Groundwater Level Target	Advantages	Disadvantages
Raise Levels to Historical Levels (15 feet above 2010 Levels)	• Reduces pumping costs • Supports mesquite growth • May reduce land subsidence potential • Increases supply reliability (increases ability to sustain reductions in imported water supplies)	• Requires extra water to fill basin • May entrain nitrate into groundwater currently in the vadose zone • May increase underflow to lower subbasins and decrease underflow from higher subbasins •
Maintain long term Levels at 2009 Levels	• Maintains existing storage space for groundwater banking • Maintains existing pumping costs	• Requires additional water to maintain levels • May impact mesquite growth
Allow Levels to Decrease below 2010 Levels	• Creates storage space for groundwater banking • Reduces need for external supply sources • May increase underflow from higher subbasins and decrease underflow to lower subbasins	• Increases pumping costs • May impact mesquite growth • May increase land subsidence potential • May increase water quality issues • Decreases supply reliability (decreases ability to sustain reductions in imported water supplies)

Recharge Timing and Volume

In conjunction with Metropolitan, CVWD and DWA direct recharge activities in the Mission Creek subbasin. The timing and the amount of water available for recharge is impacted by Metropolitan's water delivery schedule. For example, in order to meet the goals of the WMP, the Mission Creek subbasin will require a certain amount of imported water to be recharged at the Mission Creek Spreading Facility. However, the amount available may be lower than what is required due to several factors such as water supply reliability and the distribution of imported water recharge between the Whitewater and the Mission Creek Subbasins.

Recharge/Percolation Pond Operations and Maintenance

Some water is lost due to evaporation at the artificial recharge site and at the wastewater treatment plant percolation ponds. Conducting regular maintenance of spreading basins and percolation ponds for silt removal will maintain or increase existing infiltration rates and minimize evaporation loss.

Recycled Water

Currently, all treated wastewater in the Planning Area is percolated into the Mission Creek subbasin via percolation ponds. Conversion of customers currently on septic tanks to sewer systems in the Desert Hot Springs subbasin will increase wastewater production at the wastewater treatment plants. If tertiary treatment systems are developed at the wastewater treatment plants, then the wastewater can be treated to Title 22 standards and the effluent recycled water can be used for irrigation and other non-potable uses; treated wastewater is not suitable for direct potable use.

Recycled water has the potential to offset some potable water use in the Planning Area. The principal non-potable uses for recycled water in the Planning Area are:

- Golf course irrigation
- Urban landscape irrigation (Psomas, 2007)

Since irrigation requirements are impacted by seasonal changes, there may also be recycled water supply and demand imbalances. Wastewater that is not recycled will be disposed to percolation-evaporation ponds where most of the percolated water enters the groundwater basin. This typically occurs during the winter months when the irrigation demands are low. The use of recycled water for irrigation may reduce evaporative losses that occur in the percolation ponds. From a water quality point of view, treated wastewater contains nutrients like nitrogen that can adversely affect groundwater quality. When the water is recycled for irrigation uses, much of the nutrients are taken up by the plants and turf reducing the need for fertilizer. Thus, reuse provides a water quality benefit to the Planning Area.

Future recycled water uses could also include indirect potable reuse (IPR), which is the planned use of highly treated wastewater to augment water supplies via groundwater recharge or blending with other potable sources prior to use. IPR is likely to become an important element of water resources development in southern California due to the limitations on imported water supplies. For this plan, IPR is not included as a proposed use for recycled water; however, it could be considered in the future if needed.

Supply Reliability

Groundwater levels and groundwater in storage in the Mission Creek subbasin have declined due to increased groundwater production from the basin. In addition, the reliability of the SWP supply has decreased over the past few years due to drought and strict environmental regulations which led to pumping restrictions in the Bay Delta. In the absence of positive measures to resolve the environmental issues in the Delta, it is unlikely that the SWP supply reliability will increase in the long-term, and the future reliability is uncertain. The SWP supply currently has an estimated reliability of 60 percent of Table A (DWR, 2010); it is projected that the reliability will drop to 50 percent by 2030 (DWR, 2010). If the Bay Delta Conservation Plan is implemented, then SWP supply reliability could potentially be expected increase to 77 percent of Table A (DWR, 2010). To address the uncertainty of water supply reliability (as well as growth, climate change, and economic changes), a supply buffer should be included in the recommended WMP. A supply buffer would result in planning for supplies in excess of the supplies required to meet projected demands. For the purposes of this WMP, it is assumed that planning for a 10 percent supply buffer is appropriate to meet projected demands in the Planning Area. The additional supplies needed to provide the buffer would be implemented when required based on an on-going analysis of projected demands and supplies. The buffer might be provided through option agreements that can be called upon in the future if conditions warrant. Alternatively, a portion of the buffer could be provided through contingency conservation programs that are implemented if future supplies are inadequate.

Transfers and Exchanges

Due to the geographic location of the Mission Creek and Garnet Hill subbasins, groundwater and SWP Exchange Water delivered via the Colorado River Aqueduct are the only current sources of water supply. New water transfer and exchanges could bring additional supplies to the Study Area. Depending on availability, additional imported water could be acquired through transfers from other water in the State. The additional water supplies could be acquired from the following sources:

- Additional SWP water (Turnback Pool, Article 21 (Interruptible), Table A acquisition or other wet water transfers)
- Non-SWP water supplies
- Delta conveyance facilities through the Bay-Delta Conservation Plan (BDCP)
- East Valley drain water desalination and exchange
- Seawater desalination and exchange Additional exchange/transfer opportunities
- Other potential sources such as the Delta Wetlands Project which would store surplus water at two Delta islands for later delivery; Sacramento Valley irrigation water transfers; Cadiz Valley Water Conservation, Recovery and Storage Project and similar projects.

Underflows between the Subbasins

The magnitude of underflows into and out of the Mission Creek and Garnet Hill subbasins has been estimated through groundwater modeling, but these estimates are significantly different compared to previous studies (Psomas, 2010). The impacts of alternative management plans on underflow are evaluated as part of the groundwater modeling for this WMP.

WATER QUALITY ISSUES

Water quality issues generally relate to those impacting the quality of water supplies in the groundwater subbasins or in the water services to customers in the Planning Area. Water quality data is provided by MSWD and CVWD for their municipal wells. Water quality data for private wells in the Planning Area is obtained from CVWD. There is limited water quality data available to assess contaminant concentrations in the Garnet Hill subbasin. As part of this WMP, monitoring wells are recommended for the Garnet Hill subbasin. Such wells would also provide significant information on the geology, water level, and water quality of the Garnet Hill subbasin.

Arsenic

Arsenic occurs naturally in the Planning Area in the Mission Creek subbasin. The maximum contaminant level (MCL) for arsenic is 10 µg/L. Arsenic is detected in several groundwater wells in the Mission Creek subbasin. CVWD wells 3405, 3408, 3409, and 3410 indicate the presence of arsenic at varying concentrations below the MCL. In 1981, one sample was collected at Well 3405 and Well 3408 which had arsenic concentrations greater than the MCL. Arsenic concentrations for samples collected since then have remained below the MCL and do not exceed the four-quarter average MCL of 10 µg/L. Samples collected for MSWD wells in 2008 do not indicate any presence of arsenic. There is limited water quality data available to assess arsenic concentrations in the Garnet Hill subbasin.

Brine Disposal

Any strategy that involves implementing desalination of groundwater or imported water supplies will require a plan for the treatment and disposal of brine. Brine disposal in desert areas may be expensive involving high handling and transportation costs. Evaporation of brine requires significant land areas for ponds. There may also be significant permitting issues with the Regional Water Quality Control Board for the disposal of brine.

Fluoride

The presence of fluoride in drinking water at optimum levels is essential in promoting oral health and preventing tooth decay. The State MCL for fluoride is 2 mg/L. Data collected from 1978 to 2009 indicate that fluoride concentrations in the Mission Creek and Garnet Hill subbasins range from 0.3 mg/L to 1.5 mg/L. Fluoride concentrations are below the MCL for domestic water supply wells owned by MSWD and CVWD.

Fluoride exceeding the MCL has been observed in one private water supply well owned by the Whispering Sands Mobile Home Park with concentrations of 2.2 in 2002 and 2.6 mg/L in 2005 (SWRCB Groundwater Ambient Monitoring and Assessment Program). State law requires water agencies to install fluoride treatment at water supply sources contingent upon the availability of funds. Currently, there is no fluoride treatment at drinking water wells in the Mission Creek or Garnet Hill subbasins.

Gross Alpha

Gross alpha is a measure of one form of radioactivity in water and occurs naturally in the Planning Area in the Mission Creek subbasin. The primary MCL for gross alpha is 15 picocuries/liter (pCi/L) based on a four-quarter average. Some groundwater wells in the Planning Area have had instances of gross alpha concentrations above the MCL. For groundwater samples obtained in 2008, MSWD's Well 30 and Well 34 exceeded the gross alpha MCL with recorded samples having a concentration of 16 pCi/L. None of the sampled wells exceeded the four-quarter average MCL of 15 pCi/L. There is limited water quality data available to assess gross alpha concentrations in the Garnet Hill subbasin.

Hexavalent Chromium

There is no MCL for hexavalent chromium (Chromium VI).. Currently, the MCL for total chromium is 0.05 mg/L, which includes Chromium VI. California DPH is to set a MCL for Chromium VI, however, the Office of Health Hazard Assessment must first establish a public health goal (PHG). A draft PHG of 0.02 microgram per liter (µg/L) was released for public comment in December 2010. Samples collected in 2000 and 2001 from CVWD wells 3405, 3408, 3409, and 3410 showed Chromium VI concentrations that ranged from 9.1 µg/L to 22 µg/L. There is limited water quality data available to assess Chromium VI concentrations in the Garnet Hill subbasin.

Hot Water Entering the Mission Creek Subbasin

The Desert Hot Springs subbasin is a hot-water basin with concentrations of total dissolved solids (TDS) in excess of 750 milligrams per liter (mg/L) (Proctor, 1968). Underflows from the Desert Hot Springs subbasin to the Mission Creek subbasin impact salinity and temperature levels in the eastern portion of the Mission Creek subbasin and affect where potable groundwater can be produced. Estimates of underflows between the basins have been made in previous studies in the Planning Area. The magnitudes of the underflows between the subbasins are also evaluated under different alternative management plans. Currently, no monitoring occurs between the basin boundaries.

Nitrate

The MCL for nitrate is 45 mg/L (as NO_3). Nitrate concentrations (as NO_3) are below the MCL for all recorded samples in the Mission Creek subbasin and range from a low of 1.1 mg/L to a high of 33.3 mg/L. A study conducted by MSWD to assess groundwater quality indicates that the use of septic tanks for waste disposal is a primary contributor of high nitrates to the groundwater (GSi, 2011). Nitrogen concentrations in septage have been observed to range from 20 to 80 mg/L as N (Nishikawa, Densmore, Martin, & Matti, 2003). Migration of water and soluble salts through soil macropores into shallow aquifers has been documented in field studies (Carter & al., 1992). Due to nitrate deposition from septage over time, it is likely that nitrate concentrations are higher in the vadose zone than in the groundwater. Based on observations in other groundwater basins, an increase in groundwater levels in the Mission Creek subbasin due to artificial recharge might intercept nitrate trapped in the vadose zone with groundwater and could increase nitrate concentrations in groundwater.

Total Dissolved Solids (TDS)

The recommended secondary (aesthetic) MCL for TDS is 500 mg/L. Primary contributors of TDS to the groundwater are septage from waste disposal, saline underflows from the Desert Hot Springs subbasin, and percolation of treated wastewater. TDS concentration in the SWP exchange water is higher than naturally occurring TDS in the Mission Creek subbasin. Direct recharge of imported water may also increase TDS concentrations in the basin over time. If salinity concentrations exceed acceptable levels, then it might be necessary to treat for salinity which is expensive and requires brine disposal.

There are three regulations that affect TDS concentrations:

- The California State Water Resources Control Board (Policy No. 68-16) adopted an anti-degradation policy, which requires that existing high quality waters "will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies." Waste discharges are required to "meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that assure that (a) a pollution of or nuisance will not occur and (b) that the highest water quality consistent with maximum benefit will be to the people of the State will be maintained."
- The Regional Water Quality Control Board, in the Colorado Basin Plan (2006) states that studies will be required before specific groundwater quality objectives are set. Before these studies are completed, the Regional Board's goal is minimize the increase in mineral concentrations reaching groundwater basins where feasible.
- The California Department of Public Health has set secondary maximum contaminant levels (MCLs) for TDS delivered to potable water customers. The recommended MCL is 500 mg/L, which is desirable for a higher level of consumer acceptance. The upper MCL is 1,000 mg/L, where is not neither reasonable nor feasible to provide more suitable waters. The short-term MCL is 1,500 mg/L, in which the level is acceptable only on a temporary basis pending construction of treatment facilities or development of new water sources.

Uranium

Uranium occurs naturally in the Planning Area in the Mission Creek subbasin. The MCL for uranium is 20 pCi/L based on a four-quarter average. Uranium has been detected in several groundwater wells in the Mission Creek subbasin. For samples collected in 2008, the presence of uranium was detected in MSWD's Wells 22, 24, 28, 29, 30, and 34. The concentrations ranged from 4.4 pCi/L to 23 pCi/L but none of the wells exceed the four-quarter average MCL of 20 pCi/L. Well 30 had uranium concentrations in excess of the primary MCL and has been removed from service. Well 28 has been equipped with well-head treatment for uranium. Uranium is also detected in CVWD wells 3405, 3408, 3409, and 3410 at levels below the MCL with concentrations ranging from 2 pCi/L to 17 pCi/L. There is limited water quality data available to assess uranium concentrations in the Garnet Hill subbasin.

Other Water Quality Contaminants

Contaminants that are not currently found in the groundwater in the Planning Area; but whose presence in the groundwater may impact water supply reliability are discussed below. Perchlorate is a salt that is used in the manufacture of solid rocket fuel, roadside flares and matches and has also been found in some fertilizers. Perchlorate has not been detected in the groundwater samples within the Planning Area. However, it has been detected in Colorado River water at levels below the State MCL of 6 µg/L. Since the source of perchlorate contamination in Colorado River water has been cleaned up, perchlorate is not expected to be a concern for the Study Area.

Methyl Tertiary Butyl Ether (MTBE), also a contaminant of concern, was used as a gasoline additive until 2004. MTBE has not been detected in the domestic groundwater samples within the Planning Area. However, it has been detected in environmental monitoring wells associated with leaking underground storage tanks.

While MCLs have not been established for several known contaminants, it is likely that as methodologies for testing and detection improve over time, MCLs may be established for such contaminants. The California Department of Public Health identifies pharmaceuticals and personal care products and industrial chemicals present at low concentrations as some examples of emerging contaminants.

Salinity Management Plan

If recycled water is used for irrigation in the Planning Area, then a salinity and nutrient management plan will be required by 2014 for the Mission Creek and Garnet Hill subbasins. The CVRWMG is in the process of preparing a salinity management plan through the IRWMP process. Presently, there is no recycled water use in the Planning Area. There are no established basin plan objectives for TDS and nitrates for these groundwater basins. In addition, as previously discussed in this section, salt load is added to the groundwater basin due to the use of imported water for groundwater recharge and flows from septic tanks overlying the basin. MSWD is currently implementing a program to convert users from septic systems to sewer systems which would reduce the addition of nitrate to the groundwater basin.

Water Quality in the Mission Creek Subbasin

MSWD has won several awards regarding the taste of the water produced from the Mission Creek subbasin. There are concerns that factors such as declining groundwater levels, artificial recharge using SWP Exchange Water, saline underflows from the Desert Hot Springs subbasin, and nitrates from septic tanks might affect the water quality in the basin over time.

Well Abandonment Program

Improperly constructed or abandoned wells may be sources of contamination to the groundwater basin. A well abandonment program for purposes of groundwater protection will be discussed as a potential strategy.

COST AND ECONOMICS ISSUES

Cost issues are generally with respect to those impacting the availability cost of water served in the Planning Area.

Cost of Water

One of the objectives of this WMP is to keep water supply affordable for the customers. However, some of the water supply and water quality issues discussed above have a direct impact on the cost of the produced water. For example, treatment for salinity increases the unit cost of water. Similarly, declining groundwater levels result in increasing energy costs which increases the unit cost of water. Power costs have also been increasing annually over the past decade (White Paper - Understanding California’s Electricity Prices, BloomEnergy, 2011). It is likely that the cost of power will continue to increase in the future due to higher energy costs and increased emphasis on renewable power sources.

Funding

The construction of infrastructure to deliver water and the implementation of water management programs is expensive. The current downturn in the economy further exacerbates the existing funding constraints that exist at the local and state level. It is necessary to explore different sources of funding to secure the finances required for the design, construction, and implementation of the alternatives developed in this WMP. Funding options are presented in **Appendix F** of this WMP.

Pumping Costs

Since water is pumped from the Mission Creek and Garnet Hill subbasins, lower groundwater levels will lead to increased pumping heads, increased energy consumption, and increased operational costs.

Replenishment Assessment

Per a 2003 agreement between DWA and CVWD, the two agencies recharge the Mission Creek subbasin with State Water Project (SWP) Exchange Water (exchanged for Colorado River water with Metropolitan) at the Mission Creek Spreading Grounds. Both CVWD and DWA are permitted by the State Water Code collect water replenishment assessments from any groundwater extractor or surface water diverter (aside from exempt producers) within their jurisdictions who benefits from replenishment of groundwater. The two agencies are not required to implement assessment procedures jointly or identically (CVWD, 2000). The replenishment assessment is charged is to offset certain costs associated with importing State Water Project water to the Coachella Valley. Any producer who produces 25 or fewer acre-feet of groundwater in any year is exempt from the replenishment assessment charge.

DEMAND ISSUES

Demand issues generally relate to those impacting the amount of water needed to serve current and future customers in the Planning Area. Climate change may potentially affect water demands by increasing evapotranspiration.

Conservation

Conservation programs such as water efficient landscape guidelines have been implemented in the Planning Area. Increased conservation may be required to meet the requirements of Senate Bill SB 7X_7 which requires urban water purveyors to reduce water use by 20 percent by the year 2020. CVWD, MSWD, and DWA have developed Urban Water Management Plans that meet the requirements of SB 7x_7 (CVWD, 2011) (MSWD, 2011) (DWA, 2011). The requirements of SB 7x_7 do not apply to private producers. The water agencies can coordinate with top private producers in the Planning Area, assess their water use practices, and develop programs to reduce their water use. Adopting a more stringent landscape ordinance for new developments may help achieve additional conservation. However, considering the existing low outdoor use in the Planning Area, the potential scope for achieving additional conservation may be very limited, but may be extended to water users in the region that are not covered by SB 7x_7.

Population Growth

The Planning Area has significant potential for growth, as the current population is only at 30 percent of build-out. Section 3 discusses the water use requirements for the No Growth and the Growth scenarios for the Planning Area.. Although it is unknown what level of growth will occur in the Planning Area, it is estimated that population in the Planning Area could double between 2010 and 2045.

Population forecasts developed for the Planning Area under the Growth scenario indicate that population will increase from approximately 44,500 in 2010 to approximately 110,000 in 2045 under the high growth scenario.

Socioeconomic Conditions

According to the State of California Water Code, Section 79505.5(a), portions of the cities of Desert Hot Springs, Palm Springs, and Cathedral City are classified as Disadvantaged Communities. Due to the low-income demographics, outdoor water use in the Planning Area is lower than the rest of the Coachella Valley, which may limit the potential for additional conservation due to the existing low outdoor demands.

ENVIRONMENTAL ISSUES

Environmental issues generally relate to environmental conditions that may be affected by the change in water use, water supplies, or groundwater in areas overlying or near the Mission Creek or Garnet Hill subbasins.

Greenhouse Gas Emissions (GHGs)

An accounting of greenhouse gas emissions is required as part of the CEQA process. Water importation, groundwater production, pumped conveyance, and treatment of water and wastewater will result in GHG production. Declining groundwater levels in the Mission Creek subbasin will increase the energy required to pump groundwater and will increase GHGs. The use of locally available water will reduce the dependence on imported water and would assist in the reduction of GHGs.

Mesquite Hummocks

Mesquite hummocks (***Prosopis*** spp**.**) provide important habitat for several special status species in the Study Area. Mesquite is only located in the southeast portion of the Mission Creek subbasin near Willow Hole. Mesquite hummocks require constant groundwater at levels around 100 feet below groundwater surface. The typical root depth for the hummocks is 40 feet while tap roots can reach up to 190 feet below ground surface (http://en.wikipedia.org/wiki/Mesquite). Declining groundwater levels in the Mission Creek subbasin are suspected of having an adverse effect on the growth of mesquite hummocks in designated conservation areas within the Planning Area. However, other environmental factors may also affect mesquite growth.

Land Subsidence

Overdraft conditions in groundwater basins can cause land subsidence in aquifer systems contained significant amounts of fine-grained sediments. Land surface subsidence has occurred in other parts of the Coachella Valley. Due to the absence of a clay layer in the groundwater basin hydrogeology, land subsidence is less likely to occur in regions overlying the Mission Creek or Garnet Hill subbasin.

Coachella Valley Multi-Species Habitat Conservation Plan (CVMSHCP)

Some areas within the Planning Area are designated conservation areas as part of the CVMSHCP. Declining groundwater levels in the groundwater basin may have the potential to impact the growth of mesquite hummocks in conservation areas. CVWD is a signatory to the

CVMSHCP and MSWD is in the process of becoming a signatory. Signatories to the CVMSHCP will have to evaluate the impacts of proposed projects from this WMP on sensitive species identified in the CVMSHCP. DWA is not a signatory to the CVMSHCP and will evaluate the impacts of proposed projects from the WMP in accordance with the requirements of the federal and state endangered species acts and CEQA processes.

Watershed Protection

Watershed protection is necessary to maintain water quality in the Mission Creek and Garnet Hill subbasins. Since most of the existing upstream watershed is mountainous and designated as part of conservation areas, it is unlikely that any development will occur in the near-term that might be detrimental to downstream water quality. Input from the water agencies is sought on proposed developments within the Planning Area to assess the adequacy and reliability of water supplies to meet the demands of the proposed developments. Since watershed protection does not fall under the purview of either CVWD, MSWD, or DWA within the Planning Area, coordination with other stakeholders such as the Regional Water Quality Control Board and the Riverside County Planning Department might be necessary to achieve watershed protection in the Planning Area.

Other Issues

Data Gaps

Several gaps have been observed in the data collected and compiled for this WMP. A number of data sources are used to present facts to draw conclusions regarding water management in the Planning Area including: water agency billing and production data, Engineer's Reports on Water Supply and Replenishment Assessment for the Mission Creek Subbasin Area of Benefit, production reported to the State Water Resources Control Board (SWRCB) for the 1948-1992 period, data developed by the United States Geological Survey (USGS) (Tyley, 1974) for modeling the Upper Coachella Valley, municipal water quality data from CVWD and MSWD, and private well water quality data compiled by CVWD

The items identified as having missing data or incomplete data include:

- Groundwater elevation canvass
- Private well canvass
- Groundwater quality (major ions)
- Garnet Hill subbasin monitoring well
- Mission Creek subbasin water quality data (EC, TDS, general minerals)
- Precipitation monitoring in the Mission Creek watershed
- Percolation rate tests at the Mission Creek spreading facility
- Percolation rate tests at the Horton WWTP percolation ponds
- Subsidence monitoring
- Consistency between CVWD and DWA Engineer's Reports on groundwater recharge
- Methodology for tracking balance in Metropolitan Storage Account
- Discussion of on-going water management activities

Coordination among CVWD, MSWD, and DWA during data collection will enable collaboration and also reduce the costs associated with data collection. Recommendations for monitoring, collect, report, and share data are presented in **Appendix E – Monitoring, Data Management, and Reporting**.

Land Use Protection for Basin Recharge

Land must be identified for developing spreading basins in the future if the amount of water available for artificial recharge exceeds the capacity of the existing recharge facilities. . It is likely that the advance delivery of imported water and factors such as future growth and SWP reliability may drive the need for a new spreading facility. Presently, stormwater is not recharged at the Mission Creek Spreading Facility. It should be noted that land use protection does not fall under the purview of either CVWD, MSWD, or DWA, coordination with other stakeholders might be necessary to achieve land use protection in the Planning Area.

Monitoring and Reporting

Monitoring of groundwater levels and water quality data are necessary for management of the groundwater basin. Under current practices, each agency monitors their own wells. CVWD also has a monitoring program in which they occasionally (every one to three years) measure water levels at a number of private wells throughout the Study Area. There is currently no formal process for sharing of monitoring data in the Mission Creek subbasin.

Plan Implementation

A Recommended Plan is presented in **Section 7** of this WMP and discusses projects that will be implemented as part of the WMP. The implementation plan presented in **Section 7** discusses the proposed plan for water supply development and monitoring and reporting activities.

Stakeholders and Regulatory Agency Coordination

It is necessary to consider regulatory requirements as part of the WMP process. There are several institutions that deal with water, water rights, and water quality from different perspectives such as public health, water management, environmental, and public government. The presence of these institutions aids effective water management. However, often times, there are numerous complex institutional and legal issues that are time consuming and expensive to deal with. Primary regulators include the Regional Water Quality Control Board, the State Water Resources Control Board, the California Department of Public Health, and the Riverside County Flood Control District. Other entities that are interested in management of water in the subbasin include the cities, business groups, community councils, resource agencies, environmental groups, and the Coachella Valley Association of Governments. There are no tribal agencies within the Planning Area.

STRATEGIES

In order to address the issues identified in this section, a number of potential strategies are developed and discussed below. The strategies are potential options that the parties to this WMP could undertake to address one or more of the issues, without regard to the feasibility of the strategy. A strategy may address one or multiple issues falling under the four categories discussed above. This is illustrated in **Table 5-3**.

A wide range of strategies are considered for addressing the issues identified in the Planning Area. These strategies include:

- Maximizing the capture of natural recharge
- Increasing local groundwater production
- Participating in local and statewide desalination projects
- Developing a recycled water system
- Developing sewer systems in unsewered areas
- Exploring availability of additional SWP and non-SWP supplies
- Exploring treatment of imported water used for recharge
- Developing water conservation programs
- Exploring treatment options for water quality contaminants of concern

Most of the strategies result in the development of infrastructure projects. The impact of such strategies on water management in the Planning Area can be quantified in terms of the additional water supply provided. Other strategies improve water quality, or affect general management of the groundwater basin. Assumptions are made to determine the infrastructure requirements and the associated order-of-magnitude costs for the implementation of the projects.

Evaluation Strategies

Some of the strategies identified as part of this WMP are not projects that would be performed by one of the three Agencies developing this Plan. Instead, they are methodologies for developing plan alternatives. The evaluation strategies are listed below:

- Include a supply buffer to deal with the uncertain effects (uncertain growth, climate change, reliability, economic changes)
- Plan for different growth scenarios
- Select plans with greater supply reliability (dry years and emergencies)
- Consider effects of water management on the hummocks
- Develop a methodology for data sharing and to address data gaps
- Consider other environmental impacts of various water management activities
- Limit pumping to estimated natural recharge
- Limit pumping to artificial recharge
- Establish basin operating parameters (establish operating levels, timing/volume of recharge and the basin to be recharged)
- Maintain groundwater level to current groundwater levels
- Restore groundwater levels to historical levels
- Allow groundwater levels in the basins to decline further

Funding Strategies

Other strategies have been developed which address funding mechanisms for projects. These potential funding strategies include:

- Establishing replenishment assessment for Garnet Hill subbasin
- Identifying grants
- Identifying zero/low interest loans
- Exploring public-private partnerships
- Identifying bonds/COPs/other borrowing
- Exploring funding from rate base
- Exploring funding from connection fees
- Implementing conservation strategies that include incentives
- Requiring developers to bring, or pay for, water supplies in order to connect to the water system
- Identify limits of the RAC process for developing additional supply projects

A financial plan may also be required to allocate project costs to those who benefit from the programs. The cost allocation is beyond the scope of this WMP and will require discussion between CVWD, DWA, MSWD, and other stakeholders. A combination of funding sources will likely be used to best meet the needs of the individual projects and the users who benefit from the implementation of the projects. A discussion on funding options is presented in **Appendix F – Funding Options**.

Strategies Evaluated

The strategies considered and evaluated in this WMP are discussed in the following paragraphs.

Divert Little Morongo Creek/Long Canyon Creek to Recharge the Mission Creek Subbasin

The intent of this strategy is to increase natural recharge in the Mission Creek Subbasin by diverting Little Morongo Creek recharge to a spreading basin overlying the Mission Creek subbasin. This strategy will increase the use of local supply sources and reduce the amount of imported water supplies required for the Planning Area. The drawback of this strategy is that it reduces natural recharge in the Desert Hot Springs subbasin.

Line Little Morongo Creek Channel/Long Canyon Creek Channel Flowing over the Desert Hot Springs Subbasin

Lining Little Morongo Creek along segments where it flows through the Desert Hot Springs subbasin will result in additional recharge into the Mission Creek subbasin. This strategy will increase the use of local supply sources and reduce the amount of imported water supplies required for the Planning Area. The drawback of this strategy is that it reduces natural recharge in the Desert Hot Springs subbasin. Another drawback of this strategy is that it reduces flood control capacity of the Little Morongo Creek Channel.

Increase Capture of Local Stormwater into the Mission Creek Subbasin

This strategy aims at constructing a large spreading basin to capture stormwater flows into Mission Creek and recharge the water into the Mission Creek subbasin. This project could involve the construction of large spreading basins which would only be used during storms of very high intensities when runoff leaves the groundwater basin by crossing over the Banning fault. Runoff from storms of low intensities is already captured in the groundwater basin.

Obtain Additional SWP Supplies (Table A/Wet Water)

Additional SWP supplies could be obtained for the Planning Area by purchasing additional SWP Table A from a willing SWP contractor and conveying it through the existing exchange agreement with the Metropolitan Water District of Southern California (Metropolitan); delivery amounts will vary based on percentages of Table A available through SWP on a year-to-year basis. While this strategy reduces groundwater pumping, it increases reliance on imported water supplies. Purchased SWP water is more expensive than locally available groundwater. In addition, TDS concentrations in the Exchange Water delivered via the Colorado River Aqueduct (CRA) are higher than the concentrations in the groundwater basin

Obtain non-SWP Supplies

Water would be obtained on a contractual (lease) basis from other (non-SWP) entities with committed deliveries for the contracted period and transferred through the SWP and Metropolitan exchange agreement. While this strategy reduces groundwater pumping, it increases reliance on imported water supplies. Purchased SWP water is more expensive than locally available groundwater. In addition, water obtained on a contractual basis available only for a fixed period of time.

Participate in the Construction of Delta Conveyance Facilities (Existing Table A)

CVWD, DWA, and MSWD can participate and encourage the construction of a cross-Delta canal as part of Bay Delta Conservation Plan. The canal would increase reliability of the Table A supplies and amount of water available for the Planning Area. However, it is cost prohibitive and also requires the participation of all of the SWP Contractors.

Pump Groundwater from the Desert Hot Springs Subbasin for Potable Use/Irrigation Use

This strategy would involve constructing new groundwater wells constructed in the Desert Hot Springs subbasin. It is a local supply source and would reduce dependence on imported water supplies. The Desert Hot Springs subbasin contains approximately 2.5 million acre-feet of water in storage (DWR, 2004). However, the groundwater is of poor quality characterized by the presence of high levels of chlorides, fluorides, sulfates, and total dissolved solids (TDS). TDS values range from 800 to 1,000 milligram per liter (mg/L) and the extracted groundwater may require microfiltration/ultrafiltration membrane treatment systems for salt removal if used for potable purposes. In addition, the groundwater is hot (>100 deg F) in this subbasin. Groundwater extraction will require both, treatment and cooling, making groundwater utilization an expensive option.

Pump Groundwater from the Garnet Hill Subbasin

This strategy would involve constructing new groundwater wells constructed in the Garnet Hill subbasin. It is a local supply source and would reduce dependence on imported water supplies. The Garnet Hill subbasin contains approximately 1.0 million acre-feet of water in storage (DWR, 2004). In addition, relative to the Mission Creek subbasin, this subbasin has good quality groundwater. However, yields from wells in this basin have historically been low.

Pump Additional Groundwater from the Mission Creek Subbasin

This strategy would involve constructing new groundwater wells constructed in the Mission Creek subbasin. It is a local supply source and would reduce dependence on imported water supplies. The Mission Creek subbasin contains approximately 2.5 million acre-feet of water in storage (DWR, 2004). Adopting this strategy would exacerbate existing overdraft conditions without additional recharge, increase energy costs associated with pumping, and lower yields at groundwater wells due to lowered water levels.

Participate in Drain Water Desalination in the East Coachella Valley

Participation in local desalination projects such as the proposed East Valley Drain Water Desalination can offset some of the water supply needs for the Planning Area. The produced water could be wheeled through the Colorado River and CRA and delivered to the Mission Creek subbasin. This project would generate additional local water supply in Coachella Valley. However, desalination will involve significant capital and operational investment.

Participate in Sea Water Desalination in California

Participation in desalination projects within the State of California can offset some of the water supply needs for the Planning Area. The produced water could be exchanged for either Colorado River water or SWP water. Desalination offers a drought-proof supply for the Planning Area. However, desalination will involve significant capital and operational investment. While a unit volume of desalinated seawater is currently more expensive than treated imported water, in the future it is projected that this cost differential will narrow considerably due to increasing costs for imported water. Desalination plants in Southern California have been proposed at Los Angeles, Long Beach, San Onofre, Dana Point, Huntington Beach, Carlsbad, and El Segundo (http://www.desalresponsegroup.org/socal.html). However, information on the timing of these proposed plants is unknown.

Expand the Horton WWTP from 2.3 mgd to 3.0 mgd and Add Nitrogen Removal

MSWD could expand the Horton WWTP to treat additional wastewater flows (0.7 mgd expansion), including nitrogen removal. This would reduce nitrate contamination of the groundwater basin due to the presence of septic tanks. This also allows utilization of an existing facility to its planned capacity and also defers capital investment in the proposed Regional Wastewater Treatment Plant (WWTP).

Construct Wastewater Collection Systems in Unsewered MSWD Areas and a New Wastewater Treatment Plant (4.5 mgd) in the Mission Creek Subbasin or the Garnet Hill Subbasin

MSWD could capture and treat indoor flows via a new sewer system and construct a new Regional WWTP (4.5 mgd) which includes nitrogen removal. This would reduce nitrate contamination of the groundwater basin due to the presence of septic tanks and also return a portion of the water pumped from the Mission Creek subbasin back to the basin. This WWTP could also serve a portion of CVWD's service area. If the Regional WWTP is constructed overlying the Mission Creek subbasin, then this strategy will reduce existing inflows to the Desert Hot Springs subbasin. If the Regional WWTP is constructed overlying the Garnet Hill subbasin, then this strategy will reduce existing inflows to both, the Mission Creek subbasin and the Desert Hot Springs subbasin.

Construct Collection Systems in Unsewered CVWD Areas in Planning Area

CVWD could capture and treat indoor flows via a new sewer system and new wastewater treatment plant (3.5 mgd) including nitrogen removal, with percolation to Mission Creek subbasin. This would reduce nitrate contamination of the groundwater basin due to the presence of septic tanks and also return a portion of the water pumped from the Mission Creek subbasin back to the basin.

Develop Conservation Programs to Meet 20 Percent by 2020 Requirement

This strategy aims at reducing existing demands by 20 percent by implementing conservation strategies to meet the requirements of SB 7x_7. CVWD, MSWD, and DWA have developed Urban Water Management Plans that meet the requirements of SB 7x_7 (CVWD, 2011) (MSWD, 2011) (DWA, 2011). Adopting a more stringent landscape ordinance for new developments may help achieve additional conservation. However, considering the existing low outdoor use in the Planning Area, there is very limited scope for additional conservation.

Develop Conservation Programs for Private Producers

While the potential scope for achieving additional conservation may be very limited in the Planning Area, the conservation programs could be extended to water users in the region that are not covered by SB 7x_7. Although the requirements of SB 7x_7 do not apply to private producers, the water agencies will coordinate with the top private producers in the Planning Area, assess their water use practices, and encourage and assist them to develop programs targeted at reducing their water use.

Construct SWP Extension to the Coachella Valley

CVWD, DWA, and MSWD could collaborate to construct a pipeline to convey SWP Water directly to the Coachella Valley with turnouts for Whitewater and Mission Creek recharge facilities. Such a project would improve groundwater quality in the Planning Area if the water is used for recharge. It also provides CVWD, DWA, and MSWD with greater flexibility to control the timing and the volume of amount recharged. In addition, it offers an increased ability to access surplus water when available.

In 2006, CVWD and DWA in association with Metropolitan, San Gorgonio Pass Water Agency and Mojave Water Agency commenced an investigation of four alternative routes for a Coachella Valley extension of the California Aqueduct. Following completion of an initial evaluation, two routes – one through the Lucerne Valley and one through San Gorgonio Pass – were evaluated in detail. A final draft report was presented to the participating agencies in 2011 with no recommendation for a preferred route. The SWP Extension Project is currently on hold pending resolution of various feasibility constraints, resolution of the BDCP and the potentially participating agencies ability to finance the project. However, the project is cost prohibitive with capital costs expected to be in excess of $1 billion.

Install Tertiary Treatment at Wastewater Treatment Plant(s) and Develop a Recycled Water System

Currently, all treated wastewater in the Planning Area is percolated into the Mission Creek subbasin via percolation ponds. Conversion of customers currently on septic tanks to sewer systems in the Desert Hot Springs subbasin will increase wastewater production at the wastewater treatment plants. If tertiary treatment systems are developed at the wastewater treatment plants, then the wastewater can be treated to Title 22 standards and the effluent recycled water can be used for irrigation and other non-potable uses; treated wastewater is not suitable for direct potable use.

Recycled water has the potential to offset some potable water use in the Planning Area. The principal non-potable uses for recycled water in the Planning Area are:

- Golf course irrigation
- Urban landscape irrigation

Since irrigation requirements are impacted by seasonal changes, there may also be recycled water supply and demand imbalances. Wastewater that is not recycled will be disposed to percolation-evaporation ponds where most of the percolated water enters the groundwater basin. This typically occurs during the winter months when the irrigation demands are low. The use of recycled water for irrigation may reduce evaporative losses that occur in the percolation ponds. From a water quality point of view, treated wastewater contains nutrients like nitrogen that can adversely affect groundwater quality. When the water is recycled for irrigation uses, much of the nutrients are taken up by the plants and turf reducing the need for fertilizer. Thus, reuse provides a water quality benefit.

Treat Extracted Groundwater for TDS/Nitrates/Contaminants of Concern

If groundwater wells have high nitrate concentrations, then install ion exchange treatment plant to treat for nitrates. This strategy would reduce nitrate concentrations in groundwater to levels where the water would be suitable for potable use. Likewise, if groundwater wells have high TDS concentrations, then using microfiltration and reverse osmosis treatment processes, the TDS concentrations can be significantly reduced. Treatment for TDS requires significant capital investment. In addition, this option also has associated high costs for brine management and disposal.

Avoid Drilling Wells in Areas with Water Quality Contaminants

Construction of groundwater wells in contaminated areas of the groundwater basin would be avoided. This would minimize or eliminate treatment costs associated with groundwater production reducing the unit cost of water and also reduce the risk of human health hazard due to contaminated water. However, such a strategy could also lead to the potential spread of water quality contaminants to other areas in the groundwater basin.

Implement Direct Delivery of Imported Water for Potable Use

Treatment of SWP Exchange Water delivered via the CRA through the construction of a new surface water treatment plant can make the water suitable for direct potable use. In this case, since the water is not used for groundwater recharge, TDS concentrations in groundwater are not adversely impacted. It also opens the door to explore potential groundwater injection options. In addition, it also allows for basin recovery in other areas without groundwater recharge. Significant capital investments required for this alternative might make it cost prohibitive.

Treat Imported Water Prior to Groundwater Recharge for TDS

Treatment of SWP Exchange Water delivered via the CRA through the construction of a new surface water treatment plant using microfiltration and reverse osmosis can reduce TDS concentrations in the Exchange water. If the treated water is used for groundwater recharge, then salt loading into the Mission Creek subbasin is reduced. This option requires significant capital investment. In addition, this option also has associated high costs for brine management and disposal.

Pump and Treat Poor Quality Groundwater from Eastern Mission Creek Subbasin

By constructing a line of extraction wells east of Palm Drive a hydraulic trough to intercept poor quality groundwater can be created. This water can then be used either for non-potable purposes or treated for potable use. This project may prevent water quality degradation of wells near Palm Drive and Dillon Road. It will also reduce TDS concentrations in groundwater for potable use. Treatment for TDS requires significant capital investment. In addition, this option also has associated high costs for brine management and disposal.

Treat Extracted Groundwater for Contaminants of Concern

If wells have high arsenic, uranium, gross alpha, or other water quality contaminants at high concentrations, then install an ion exchange treatment plant to address these contaminants of concern.

Construct New Recharge Basins for Additional Imported Water

CVWD and DWA can construct additional spreading basins if existing capacity is not sufficient to recharge additional imported water. The benefits of such a strategy are that it increases the amount of water that can be recharged and provides flexibility in recharge operations if spreading operations are temporarily suspended in any basin for maintenance. In addition, the new recharge basins could be located closer to areas of pumping.

Enhance Regular Maintenance of Spreading Basins

DWA could conduct periodic maintenance at the recharge basins to remove silting and reduce clogging. Regular maintenance would increase existing percolation volumes by 1 percent and also reduce the volume of water lost due to evaporation.

Enhance Regular Maintenance of the Percolation Ponds

MSWD could conduct periodic maintenance at the wastewater percolation ponds to remove silting and reduce clogging. Regular maintenance would increase existing percolation volumes by 2 percent and also reduce the volume of water lost due to evaporation.

Install Monitoring Wells and Monitor Water Quality and Levels

Installation of monitoring wells to monitor water quality and water levels at key locations in the Planning Area will gather additional data and help better understand the dynamics between the different subbasins. Some of the benefits include:

- Will help monitor water levels and quality in areas for which no data is previously available
- Will help understand the underflows between the subbasins
- Will assist in understanding the movement of contaminants in the different subbasins within the Planning Area

These are discussed in further detail in Appendix E.

Require New Developments to have Storm Capture and Recharge Infrastructure (Low Impact Development)

CVWD, DWA, and MSWD could require developers to build new developments with local storm capture and recharge infrastructure. While stormwater management for the Planning Area does not fall under the purview of the participating agencies, there are benefits to the Mission Creek subbasin as low impact developments would increase natural recharge in to the Mission Creek subbasin. It is recommended that the agencies coordinate with the Riverside County Flood Control and Water Conservation District to develop ordinances related to low impact development for the Planning Area.

Monitor and Encourage Remediation Activities Required by the RWQCB

Monitoring and encouraging remediation activities required by RWQCB will help reduce point source contamination in the Mission Creek and Garnet Hill subbasins. It will also reduce point source contamination in the Planning Area such as point source contamination due to MTBE plumes around gas stations.

Develop a Well Abandonment and Construction Policy

Developing a well abandonment and construction policy will reduce the risk of groundwater contamination caused due to poorly sealed wells after abandonment. It also eliminates the risk of groundwater contamination due to abandoned wells that are improperly sealed. Riverside County Department of Environmental Health is the primary agency with responsibility for enforcement of this policy.

Work with Riverside County to Designate Land Appropriately in the General Plan for Basin Recharge

Land use protection for basin recharge is necessary if additional recharge is recommended as part of the WMP. This is outside the purview of CVWD, DWA, and MSWD and will require coordination with the Riverside County.

Encourage Land Use Policies that Minimize Development in Watersheds

Although outside their purview, CVWD, DWA, and MSWD should encourage land use policies that minimize development in the upper watersheds contributing to the Planning Area to avoid contamination of natural water supply sources. This would reduce the risk of contamination of natural recharge contributing to the Mission Creek subbasin.

Implement Drinking Water Source Protection Program

Implementing a drinking water source protection program will identify the area around supply sources through which contaminants move and reach drinking water supply sources.

Table 5-3

Strategies Excluded from Further Consideration

CVWD, DWA, and MSWD reviewed the issues and strategies presented in this section for various criteria such as the supplies provided during normal and dry year hydrology, costs, technical feasibility, environmental impacts, and public acceptance. Based upon this review, some of the projects were excluded from further consideration in the WMP.

Projects that involve capturing and diverting natural recharge from the Desert Hot Springs subbasin to the Mission Creek subbasin are excluded from further consideration in the WMP due to potentially sensitive environmental and community concerns accompanying those projects. One of the projects presented in the preceding pages involved capturing additional local stormwater in the Mission Creek subbasin. This project could involve the construction of large spreading basins which would only be used during storms of very high intensities when runoff leaves the groundwater basin by crossing over the Banning fault. Runoff from storms of low intensities is already captured in the groundwater basin. Due to the substantial cost (over $200 million) and the minimal potential benefit (low recharge) offered by this project, this project is excluded from further consideration.

Projects that involve the use of groundwater from the Desert Hot Springs subbasin are also excluded based on concerns about depleting the hot water resources, which provides a significant economic component for the community. In addition, previous studies suggest that groundwater extraction for potable use from the Desert Hot Springs subbasin is not feasible high levels of salinity and high temperature of the groundwater (Harding Lawson and Associates, 1985).

PLAN EVALUATION

The alternative management plans are based on the potential strategies discussed earlier and the overall management plan objectives. These projects are then grouped together in portfolios such that each portfolio represents an alternative management plan with the goal of either stabilizing long-term average groundwater levels to year 2009 levels or increasing groundwater levels in the basin. Each alternative plan also has a sub-objective; for example, one plan may focus on improving the water quality in the basin while another plan may focus on minimizing imported water supplies by implementing conservation programs for private producers. The intention of this exercise is to stress different management objectives such as increasing groundwater levels, maximizing use of local supplies, improving water quality, or minimizing dependence on imported water. A No Action Plan is also developed to serve as a baseline for comparing the impacts of implementing alternative management plans in the Planning Area.

Some of the strategies presented earlier serve as common elements for all alternative plans. Moreover, some of these common elements can be varied slightly to meet specific needs. For example, while each alternative plan has an imported water supply component, the amount of imported water required in each alternative plan is different. Similarly, while water conservation projects are a part of each alternative plan, the extent of targeted conservation is different. The following paragraphs discuss such projects used in the development of the alternative plans.

Common Projects

A number of projects are identified that are included in all of the alternative plans, as discussed below:

- Continue using the Mission Creek recharge facility for imported water recharge
- Continue production from existing groundwater wells and drill new wells in the Mission Creek and Garnet Hill subbasins to meet future growth
- Continue using the Horton Waste Water Treatment Plant for collecting and treating indoor return flows in MSWD's service area
- 20 percent conservation by 2020 (20 by 2020) – This is a state requirement for municipal water retailers as required by Senate Bill x7-7
- Monitor and encourage remediation activities required by the RWQCB
- Work with Riverside County Department of Environmental Health (DEH) to follow state well abandonment policies for groundwater protection
- Implement drinking water source protection program
- Stormwater capture in new developments to meet low-impact development (LID) requirements
- Installation of monitoring wells to monitor groundwater quality and levels
- Regular maintenance of percolation basins for maintaining recharge rates

Projects that Vary Between Alternative Plans

There are categories of projects which are included in each of the alternative plans, but the specific strategies included in each of the alternative plans vary between plans. These variable projects fall in the following categories, and are discussed further:

- Water conservation measures
- Imported water supplies
- Collection, treatment, and disposal and reuse of wastewater
- Water quality protection measures

Water Conservation

While conservation programs such as water efficient landscape guidelines have been implemented in the Planning Area, increased conservation may be required to meet the requirements of Senate Bill SB 7X_7 which requires urban water purveyors to reduce water use by 20 percent by the year 2020. However, considering the existing low outdoor use in the Planning Area, the potential scope for achieving additional conservation may be very limited, but may be extended to water users in the region that are not covered by SB 7x_7.

Although the requirements of SB 7x_7 do not apply to private producers, the water agencies can coordinate with top private producers in the Planning Area, assess their water use practices, and develop programs to reduce their water use. Adopting a more stringent landscape ordinance for new developments may help achieve additional conservation. Some of the alternative plans require additional conservation as presented below:

- Additional conservation beyond 20 by 2020 – Water conservation could be encouraged beyond the 20 by 2020 requirements by encouraging conservation at private users that pump directly from the groundwater basin.

Imported Water Supplies

Due to the geographic location of the Mission Creek and Garnet Hill subbasins, local runoff from the surrounding watersheds and State Water Project (SWP) Exchange Water delivered via the Colorado River Aqueduct are the only current sources of water replenishing the basins. The amount of imported water supplies available for recharge is impacted by the reliability of the State Water Project (SWP) and the advanced deliveries by the Metropolitan Water District (Metropolitan).

The reliability of the SWP supply has decreased over the past few years due to drought and strict environmental regulations which led to pumping restrictions in the Bay Delta. In the absence of positive measures to resolve the environmental issues in the Bay Delta, it is unlikely that the SWP supply reliability will increase in the long-term, and the future reliability is uncertain. The SWP supply currently has an estimated reliability of 60 percent of Table A Amounts (DWR, 2010); it is assumed that the reliability will decrease to 50 percent of Table A Amounts by 2030 and remain at that level for the rest of the planning period. If they Bay Delta Conservation Plan (BDCP) is implemented, then SWP supply reliability could potentially increase to 77 percent of Table A (BDCP Steering Committee, 2010). Taking these factors discussed above into consideration, each alternative plan assumes different future Table A reliability and different volumes of Metropolitan callback. The impacts of varying reliability on imported water requirements for the Planning Area are presented in **Table 5-4**. The amount of imported water supply required for the Planning Area varies from a low of 8,800 acre-feet per year (acre-ft/yr) to a high of 25,000 acre-ft/yr. This wide range highlights the governing influence of growth rate projections and SWP reliability on the imported water supply needs for the Planning Area. For the No Growth scenario, total imported water needs in 2045 are lower than in 2010 due to conservation assumptions for the Planning Area

Table 5-4
Imported Water Needs for the Planning Area in 2045

Reliability	Metropolitan Callback	No Growth Scenario			Growth Scenario		
		Available Imported Water Supply (acre-ft/yr)	Additional Supply Required (acre-ft/yr)	Total Imported Water Needs (acre-ft/yr)	Available Imported Water Supply (acre-ft/yr)	Additional Supply Required (acre-ft/yr)	Total Imported Water Needs (acre-ft/yr)
50%	Yes	5,200	3,600	8,800	10,300	14,700	25,000
50%	No	7,100	1,700	8,800	13,900	11,200	25,000
60%	Yes	6,300	2,500	8,800	12,400	12,600	25,000
60%	No	8,500	300	8,800	16,700	8,400	25,000
77%	Yes	8,100	700	8,800	15,900	9,100	25,000
77%	No	10,900	0	8,800	21,400	3,700	25,000

1. RCCDR: Riverside County Center for Demographics Research 2010 Projections
2. Imported water needs are estimated on for the No Growth Scenario and RCCDR projections while maintaining 2009 groundwater levels.

Additional imported water supplies may be necessary beyond the existing imported water supplies in order for the Mission Creek subbasin to reach desired groundwater levels. The additional water supplies could be acquired from the following sources, however, this Plan does not define where the additional imported water would be acquired from:

- Additional SWP (Table A acquisition or wet water transfers)
- Non-SWP water supplies
- Delta conveyance facilities
- East Valley drain water desalination
- Seawater desalination
- Additional exchange/transfer opportunities such as the Delta Wetlands Project which would store surplus water at two Delta islands for later delivery; Sacramento Valley irrigation water transfers; Cadiz Valley Water Conservation, Recovery and Storage Project and similar projects.

Additional imported water recharge may require an additional recharge basin to be constructed if the amount of recharge exceeds the current basin capacity.

Collection, Treatment, Disposal, and Reuse of Wastewater

Currently, approximately 1.3 million gallons per day (mgd) of indoor return flows are collected and treated at MSWD's two wastewater treatment plants, Horton and Desert Crest, while the remainder of customers in the service area (including all of CVWD's customers) are on septic tanks. The following strategies have been developed for wastewater collection:

MSWD plans to expand the Horton WWTP from 2.3 mgd to a capacity of 3 mgd or 3,400 AFY. MSWD wastewater flows are projected to be approximately 7.5 mgd (8,400 AFY) by 2045. MSWD is planning a Regional WWTP is also proposed to treat wastewater flows associated with future growth. The proposed Regional WWTP will be located along the southernmost boundary of the District, just northeast of the intersection of Interstate 10 and Indian Avenue. CVWD wastewater is currently treated and disposed via on-site systems. CVWD wastewater flows could be treated at MSWD's Regional WWTP, a new CVWD WWTP, or at CVWD's existing WRP-7. The current MSWD WWTPs do not treat for nitrates, but it is expected that any new WWTP or any WWTP expansion will include nitrate treatment to reduce the amount of nitrogen returning to the groundwater basin.

Currently, wastewater treated at the Horton and Desert Crest WWTPs is percolated into the Mission Creek subbasin. Flow from the proposed Regional WWTP could be percolated either into the Garnet Hill subbasin, or additional property could be purchased (also requiring pumping) and percolated into the Mission Creek subbasin. A recycled water system is another option for wastewater disposal.

Water Quality Protection Measures

Several strategies to address water quality issues in the Planning Area are discussed previously. The five alternative plans consider some or a combination of the following water quality protection measures listed below.

Projects to address the presence of total dissolved solids (TDS) could include:

- Direct importation of SWP water to the Coachella Valley which offers the potential for improved water quality compared to the current SWP Exchange Water delivered via the Colorado River Aqueduct.
- Treatment of the SWP Exchange Water prior to recharge which would reduce the concentration of total dissolved solids (TDS) in the recharge water.

Projects to address the presence of nitrates include:

- The development of a sewer system which would reduce the contamination of groundwater due to ammonia and nitrate in septic tank effluent.
- The treatment of wastewater for recycled water use which would reduce nutrients such as nitrogen that affect groundwater quality.
- Treatment of extracted groundwater for nitrate which would remove existing sources of nitrate contamination.

Projects to address other contaminants of concern include:

- Avoid drilling wells in areas with other contaminants of concern such as uranium, gross alpha, and arsenic.
- Treatment of extracted groundwater for other contaminants of concern such as uranium, gross alpha, and arsenic.
- Extraction and treatment of poor quality groundwater from the eastern portions of the Mission Creek subbasin.

Growth

Additionally, growth is an important planning consideration. While it is not a strategy itself, variable growth factors must be considered as part of these alternative plans. The Planning Area has significant potential for growth, as the current population is only at 30 percent of the projected build-out population. While it is estimated that population in the Planning Area could double between 2010 and 2045, it is unknown what level of growth will occur in the Planning Area. **Section 3 – Water Requirements** considers two growth scenarios. These scenarios are listed below:

- No growth
- Growth (based on projections developed by the Riverside County Center for Demographics Research)

Considering different growth scenarios helps gauge the effects of different levels of growth on the water resources in the Planning Area. Currently, all five alternative management plans consider the Growth scenario as a conservative planning assumption.

MANAGEMENT PLAN ALTERNATIVES

Five management plan alternatives are developed to meet the objectives of the WMP. These alternative plans are not comparable plans, as they do not provide for the same water supply volumes or qualities at the end of the planning period. Instead, the alternative plans each have different goals or objectives.. The goals of the five alternative plans are presented below:

- Alternative Plan # 0: No Management Action
- Alternative Plan # 1: Maintain Water Levels at 2009 Levels
- Alternative Plan # 2: Increase Water Levels to 15 Feet Above 2009 Levels
- Alternative Plan # 3: Maintain Water Levels at 2009 Levels and Minimize Imported Water
- Alternative Plan # 4: Maintain Water Levels at 2009 Levels and Maximize Water Quality
- Alternative Plan # 5: Maintain Water Levels at 2009 Levels, Minimize Imported Water, and Maximize Water Quality

While each management plan attempts to meet the objectives listed above; each plan is tailored to achieve a specific goal. **Table 5-5** presents the management elements within each alternative plan. Alternative Plans # 1 and 2 have been evaluated using the groundwater model.

Alternative Plan # 0 – Maintain Status Quo in the Groundwater Basin

This plan is developed to gauge the impacts of not implementing any additional water management strategies in the Planning Area. The intent of this alternative is to serve as a baseline for comparing the impacts of implementing alternative management plans. This plan assumes that the Growth scenario will occur in the Planning Area. This alternative assumes that a 20 percent reduction in urban demand will be achieved by 2020 per SB 7x_7. Imported water supplies are available to the Planning Area under existing Table A conditions at 60 percent reliability, declining to 50 percent reliability by 2030, and allocated based on the formula specified in the 2004 Settlement Agreement. Recycled water is not a component of this alternative plan. Wastewater treated at the Regional Plant is percolated in the Garnet Hill subbasin. No treatment measures are implemented to reduce TDS concentrations in imported water or reduce nitrate concentrations in the groundwater.

Alternative Plan # 1 – Maintain Water Levels at 2009 Levels

The goal of this plan is to maintain water levels in the Mission Creek and Garnet Hill subbasin at 2009 levels. This alternative assumes the Growth scenario and assumes that a 20 percent reduction in urban demand will be achieved by 2020. Imported water supplies are available to the Planning Area under existing Table A conditions at 50 percent reliability. This plan requires additional imported water to maintain groundwater levels at 2009 levels while meeting future growth. Recycled water is not a component of this alternative plan. Wastewater treated at the Regional Plant is percolated in the Mission Creek subbasin. No treatment measures are implemented to reduce TDS concentrations in imported water or reduce nitrate concentrations in the groundwater.

Alternative Plan # 2 – Increase Water Levels 15 feet above 2009 Levels

The goal of this plan is to increase water levels in the Mission Creek and Garnet Hill subbasin to 15 feet above year 2009 levels. Review of historical water levels indicates this criterion generally corresponds to year 2000 water levels. This alternative assumes that the Growth scenario will occur and assumes that a 20 percent reduction in urban demand will be achieved by 2020. Imported water supplies are available to the Planning Area under existing Table A Amounts at 77 percent reliability. This plan requires additional imported water recharge to maintain groundwater levels at 2000 levels while meeting future growth. Since the goal of this plan is to increase water levels in the basin beyond the levels required for a balanced basin, the amount of imported water required in this alternative plan is higher than the amount of imported water required in Alternative Plan # 1. A new spreading facility at another location within the Mission Creek subbasin may be included in this plan if the existing recharge basin capacity is not sufficient to meet the recharge needs. Recycled water is not a component of this alternative plan. Wastewater treated at the Regional Plant is percolated in the Mission Creek subbasin. No treatment measures are implemented to reduce TDS concentrations in imported water or reduce nitrate concentrations in the groundwater.

Alternative Plan # 3 – Maximize Local Water Supplies

The goal of this plan is maximize local water supplies. This alternative assumes that the Growth scenario will occur in the Planning Area. Reduction in the groundwater use is achieved by implementing additional conservation for private producers. In addition, this alternative plan captures wastewater generated from CVWD’s service area and areas overlying the Desert Hot Springs subbasin and percolates the wastewater in the Mission Creek subbasin, offsetting a portion of pumping. Wastewater treated at the Regional Plant is percolated in the Mission Creek subbasin. No treatment measures are implemented to reduce TDS concentrations in imported water or reduce nitrate concentrations in the groundwater.

Alternative Plan # 4 – Improve Water Quality in the Mission Creek Subbasin

The goal of this plan is to stabilize groundwater levels and improve water quality in the Mission Creek subbasin. This alternative assumes that the Growth scenario will occur and assumes that a 20 percent reduction in urban demand will be achieved by 2020. Imported water supplies are available to the Planning Area under existing Table A conditions at 77 percent reliability. This plan requires additional imported water to meet future growth. Since the focus of this alternative is to stabilize groundwater levels in the Mission Creek subbasin, the amount of imported water required for this alternative is equal to the amount of imported water required in Alternative Plan # 1.

This plan assumes that imported water will be delivered to the Planning Area by the construction of the SWP extension. The use of SWP water for groundwater recharge improves groundwater quality due to its reduced salinity. Recycled water use is a component of this alternative plan which further enhances groundwater quality in the Planning Area by reducing nitrogen loading to the basin through plant uptake. Use of recycled water in this alternative also offsets an equal volume of potable water extracted from the Mission Creek subbasin. This plan also assumes that CVWD customers on septic tanks will be connected to a sewer system and that the wastewater generated by the CVWD system will be treated at CVWD's WRP-7 plant thereby reducing nitrate loading to the groundwater basin. Wastewater treated at the Horton and the Regional WWTPs will be percolated in the Mission Creek subbasin. If required, production from groundwater wells contaminated by nitrate will be treated for nitrate removal. This alternative also involves extraction and treatment of poor quality groundwater from the eastern portions of the Mission Creek subbasin.

Alternative Plan # 5 – Improve Water Quality and Maximize Local Water Supplies

The goal of this plan is to stabilize water levels, improve water quality while maximizing local water supplies in the Mission Creek subbasin. This alternative assumes that the Growth scenario will occur and assumes that a 20 percent reduction in urban demand will be achieved by 2020. Imported water supplies are available to the Planning Area under existing Table A conditions at 50 percent reliability. This plan requires additional imported water to meet future growth.

This plan assumes that the imported water delivered to the Planning Area via the CRA will be treated prior to recharge. The use of treated CRA water for groundwater recharge improves groundwater quality. Recycled water is not a component of this alternative plan. This plan also assumes that CVWD customers on septic tanks will be connected to a sewer system and that the wastewater generated by the CVWD system will be treated at a new WWTP located within the Mission Creek subbasin thereby reducing nitrate contamination in the groundwater basin. Wastewater treated at the Horton and the Regional WWTPs will be percolated in the Mission Creek subbasin. Production from groundwater wells contaminated by nitrate will be treated for nitrate removal.

Table 5-5
Assumptions for Alternative Management Plans

Alternative Plan	0	1	2	3	4	5
Goal	Status Quo – Continued operation under existing supply limitations	Maintain Water Levels	Increase Water Levels to 15 Feet Above 2009 Levels	Maintain Water Levels and Maximize Local Water Supplies	Maintain Water Levels and Maximize Water Quality	Maintain Water Levels, Maximize Local Water Supplies and Maximize Water Quality
Growth	Growth	Growth	Growth	Growth	Growth	Growth
Supply	Imported Water (Existing Table A at 50% Reliability with Metropolitan Callback)	Imported Water (Existing Table A + Additional Water as Needed; 50% Reliability with Metropolitan Callback)	Imported Water (Existing Table A + Additional Water as Needed; 77% Reliability with No Metropolitan Callback)	Imported Water (Existing Table A + Additional Water as Needed; 50% Reliability with Metropolitan Callback)	Imported Water (Existing Table A + Additional Water as Needed; 77% Reliability with No Metropolitan Callback)	Imported Water (Existing Table A + Additional Water as Needed; 50% Reliability with Metropolitan Callback)
Additional Imported Water Needed	No	Yes	Yes	Yes	Yes	Yes
Urban Conservation	20 percent by 2020	20 percent by 2020	20 percent by 2020	20 percent by 2020	20 percent by 2020	20 percent by 2020
Additional Conservation by Urban and Private Producers	No	No	No	Additional Conservation	No	Additional Conservation
Recycled Water (Irrigation System)	No	No	No	No	Yes	No
Return Flows from Wastewater Treatment Plants	3 mgd at Horton WWTP, Rest at Regional Plant	3 mgd at Horton WWTP, Rest at Regional Plant	3 mgd at Horton WWTP, Rest at Regional Plant	3 mgd at Horton WWTP, Rest at Regional Plant	3 mgd at Horton WWTP, Rest at Regional Plant	3 mgd at Horton WWTP, Rest at Regional Plant
Percolation from Regional Wastewater Treatment Plant	Garnet Hill	Mission Creek	Mission Creek	Mission Creek	Mission Creek	Mission Creek

Alternative Plan	0	1	2	3	4	5
Goal	Status Quo – Continued operation under existing supply limitations	Maintain Water Levels	Increase Water Levels to 15 Feet Above 2009 Levels	Maintain Water Levels and Maximize Local Water Supplies	Maintain Water Levels and Maximize Water Quality	Maintain Water Levels, Maximize Local Water Supplies and Maximize Water Quality
CVWD Wastewater	All septic	All septic	All septic	Regional Plant with Recharge to Mission Creek	Treatment at WRP-7	Regional Plant with Recharge to Mission Creek
Nitrate/Other Water Quality Strategy	Avoid	Avoid	Avoid	Avoid	Treat	Treat
TDS Strategy	Do nothing	Do nothing	Do nothing	Do nothing	Build SWP Extension	Treat CRA Recharge Water
Recharge Location	Mission Creek Spreading Facility	Mission Creek Spreading Facility	Mission Creek Spreading Facility and a New Spreading Basin	Mission Creek Spreading Facility	Mission Creek Spreading Facility	Mission Creek Spreading Facility
Pumping from the Eastern Portion of the Mission Creek Subbasin	No	No	No	No	Yes	No

EVALUATION OF ALTERNATIVE PLANS

The following paragraphs discuss the evaluation of the alternative plans discussed previously against a set of evaluation criteria. The evaluation criteria and the results from the Water Evaluation and Planning (WEAP)[1] model for the Planning Area are discussed. Results from the groundwater modeling are also discussed. A detailed report prepared by Psomas discussing results from the groundwater modeling is presented in **Appendix B – Groundwater Model Development**.

The evaluation of the alternative plans considers the objectives of the WMP and criteria needed to measure the effectiveness of each alternative plan. A discussion on each criterion selected for evaluation and the evaluation process is described in the following paragraphs.

Evaluation Criteria

Each management alternative is evaluated using the following set of criteria:

- Total Capital Cost
- Water Quality (as represented by concentrations of total dissolved solids (TDS))
- Groundwater Levels
- Amount of Imported Water Supplies

Total Capital Cost

A major consideration in this WMP is to minimize the future cost of water to customers in the Planning Area to the extent practicable while ensuring a sustainable water supply. Costs are expressed in year 2012 dollars. Alternatives are compared based on the total capital investment required over the planning period.

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 TDS expressed in milligrams per liter (mg/L). Annual average TDS concentrations are estimated using the Water Evaluation and Planning (WEAP) model by performing a TDS mass balance for the groundwater basin

Groundwater Levels

The ability to maintain a sustainable water balance over long-term hydrologic conditions is one of the primary goals of the WMP. This can be quantified by groundwater levels in the basin. Groundwater modeling is performed for Alternative Plan 0 and Alternative Plan 1. Results from these groundwater model runs are used to estimate the groundwater levels in the basin for the six alternative plans.

[1] WEAP is an integrated water management planning tool developed by Stockholm Environment Institute.

Amount of Imported Water Supplies

Presently, imported water is the principal source of supplemental water supply for the Planning Area. As indicated by the growth projections presented in **Section 3 – Water Requirements**, the need for additional imported water is expected to increase in the future. The amount of imported water supplies required can be used as an indicator of the efficiency of conservation measures and the development of other local supplies.

WEAP Modeling Results

Each management plan alternative is modeled using Water Evaluation and Planning, (WEAP) developed by Stockholm Environmental, to simulate the groundwater balance and long term trends in TDS concentrations and groundwater storage. WEAP estimates are consistent with the groundwater modeling results for the basin conditions simulated. . Alternative Plans 3 and 5 have include additional conservation for both, urban users and private producers. Water consumption for private producers such as fish farms and golf courses is reduced by 20 percent. For all urban users, implementation of additional conservation measures related to outdoor water use and assuming an indoor residential water use of 55 gallons per capita per day (gpcd) (per Water Code Section 10608.20 (b)(2)(A)) reduces per capita demand to 138 gpcd from a baseline per capita demand (no conservation) of 232 gpcd. . Results from the WEAP modeling are summarized in **Table 5-7**.

Table 5-6
WEAP Modeling Results

Alternative	Goal	Projected 2045 TDS in Mission Creek Subbasin (mg/L)	Projected Net Change in Groundwater Levels 2010 to 2045 (AF)
Plan 0	No Management Action	575	Decline
Plan 1	Maintain Water Levels at 2010 Levels	699	Stabilized
Plan 2	Increase Water Levels to 15 Feet Above 2009 Levels	732	Increase
Plan 3	Maintain Water Levels at 2010 Levels and Minimize Imported Water	673	Stabilized
Plan 4	Maintain Water Levels at 2010 Levels and Maximize Water Quality	528	Stabilized
Plan 5	Maintain Water Levels at 2010 Levels, Minimize Imported Water Use, and Maximize Water Quality	626	Stabilized

Results from the WEAP model indicate that TDS levels increase in all alternative plans with the exception of Alternative Plan 4 where Exchange Water delivered via the Colorado River Aqueduct is treated for TDS removal. Trends in average basin TDS for the Mission Creek and Garnet Hill subbasins are depicted in **Figure 5-1** and **Figure 5-2** respectively. It is believed that along with the imported water used for recharge, return flows from indoor and outdoor use result in an increase in the TDS concentrations over time caused by the addition of salt through use and evapotranspiration from landscaping. Percolation of the Regional Plant effluent in the Mission Creek subbasin provides the basin approximately 5,000 to 7,000 acre-ft/year annually. However, it also increases the salinity in the basin. Treatment of imported water or obtaining better quality SWP water will dampen the increase of TDS concentrations in the basin. However, TDS concentrations in the basin will increase with future growth.

As expected, without any management action, net groundwater storage declines for Alternative Plan 0. For the other alternative plans, there is an increase in the net amount of water in storage. For Alternative Plans 1, 3, 4, and 5, the results indicate that the groundwater levels in the Mission Creek subbasin stabilize over the planning period. For Alternative Plan 2, groundwater levels increase by 15 feet over 2009 levels.

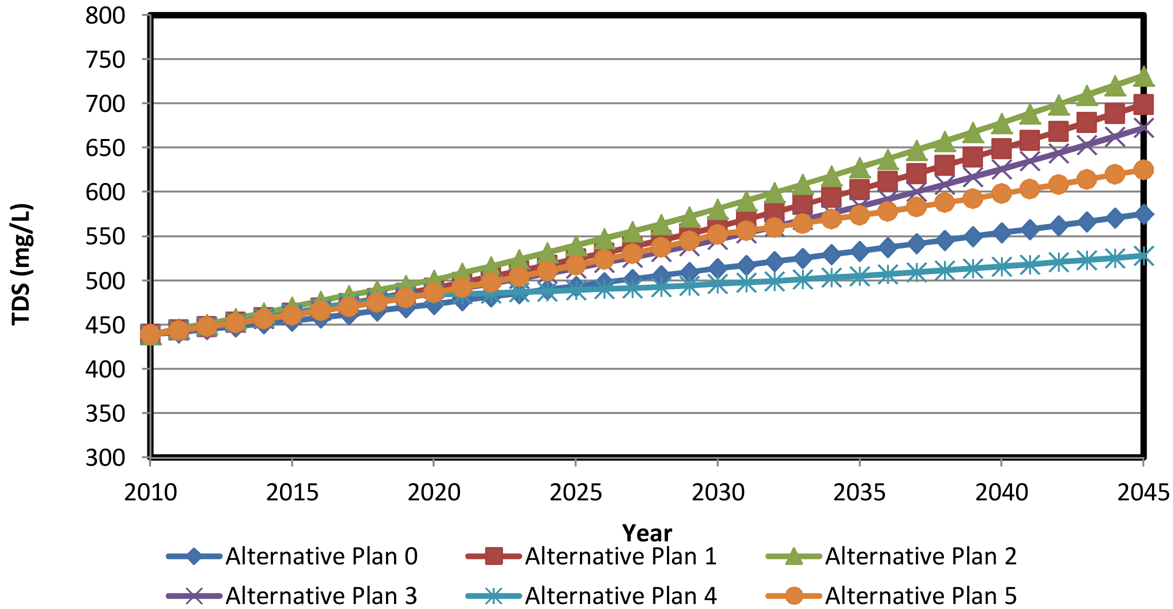


Figure 5-1
Average TDS Concentrations in the Mission Creek Subbasin

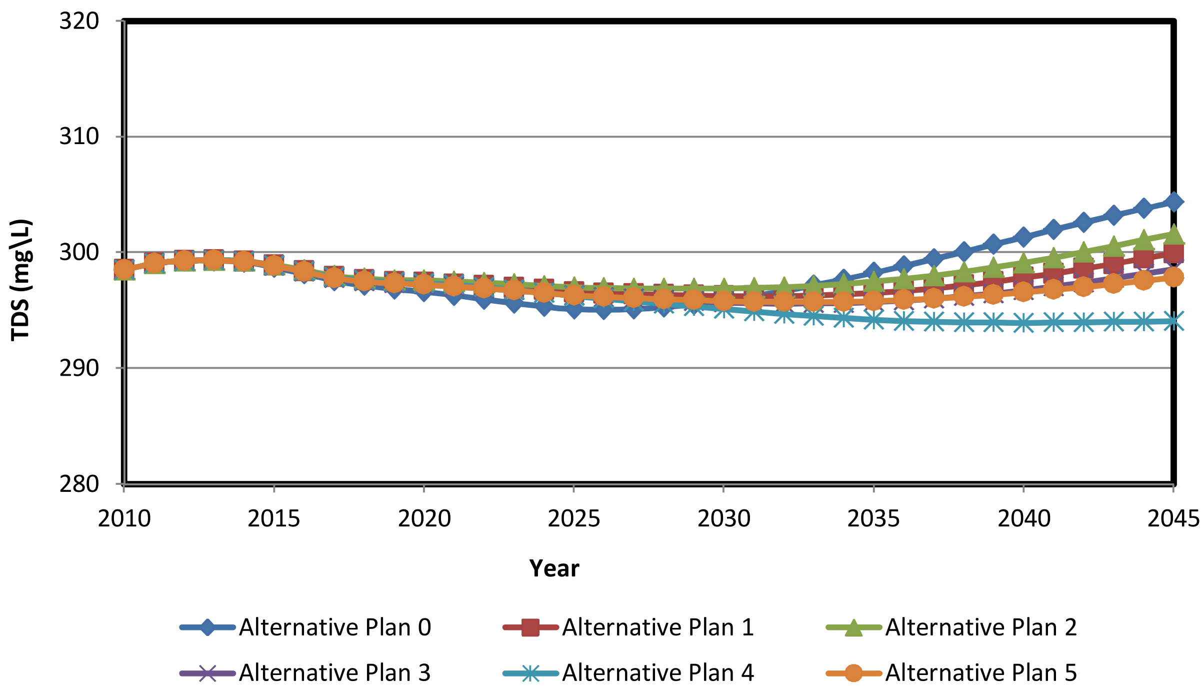


Figure 5-2
Average TDS Concentrations in the Garnet Hill Subbasin

Groundwater Modeling

A groundwater model has been developed for the Mission Creek and Garnet Hill subbasins to assess the impact of various management alternatives on groundwater levels, groundwater storage, localized impacts such as pumping holes or groundwater mounding, and flow of groundwater across faults in the groundwater basin. The purpose of each of the five scoped groundwater model runs and the assumptions involved are presented in **Table 5-6.**

Table 5-7
Groundwater Model Runs

Model Run	Purpose of Model Run	Corresponding Alternative Management Plan	Growth Assumptions	Recharge Assumptions	Hydrology Assumptions
1	Establish Baseline	Plan 0	Growth with Conservation	Existing Table A	Average Hydrology
2	Long-Term Trends	Plan 1	Growth with Conservation	Additional Recharge	Average Hydrology
3	Outflow Variation; Evaluate Level and Mounding Variation	-	Growth with Conservation	Additional Recharge	Wet/Dry Recharge Cycle
4	Outflow Variation; Evaluate Level and Mounding Variation	-	No Growth with Conservation	Additional Recharge	Wet/Dry Recharge Cycle

Groundwater Modeling Results

While the WEAP modeling provides useful information such as water budgets, trends for TDS concentrations, and trends for groundwater storage, the WEAP model cannot predict groundwater levels in the basin. Groundwater modeling is performed to test the response of the Mission Creek and Garnet Hill subbasins to various supply stresses. Groundwater modeling is performed for the following scenarios:

- Groundwater Model Run 1: Baseline Run
- Groundwater Model Run 2: Stabilize Water Levels
- Groundwater Model Run 3: Test Basin Response to Variable Hydrology
- Groundwater Model Run 4: Test Basin Response to Variable Hydrology under No Growth Conditions

The results of the groundwater model are briefly described below:

Assumptions for Groundwater Model Runs

The following assumptions are included for groundwater model runs 1, 2 and 3:

- High growth scenario will occur in the Planning Area

- 20 percent reduction in urban demand will be achieved by 2020 per SB 7x_7
- New wells are included in the model to meet future demand requirements
- In MSWD's service area, all customers currently connected to the septic system will be connected to a sewer system. All future customers will be connected to the sewer system.

Groundwater Model Run 4 assumes a No Growth scenario. This run also assumes a 20 percent reduction in urban demand by 2020.

Groundwater Run 1

This model run simulates the impacts of not implementing any additional water management activities in the Planning Area on the groundwater basins. This model run corresponds to Alternative Plan 0. Imported water supplies are available to the Planning Area under existing Table A conditions at 50 percent reliability and allocated based on the formula specified in the 2004 Settlement Agreement. Imported water recharge is approximately 10,330 acre-feet per year (acre-ft/yr) in 2045. Wastewater treated at the MSWD's proposed Regional Plant is percolated in the Garnet Hill subbasin.

The results from this model run indicate that groundwater levels in the Mission Creek subbasin decline by approximately 70 feet in 2045 compared to 2010 levels. This corresponds to a reduction of approximately 162,000 acre-feet in cumulative groundwater storage in 2045. Cumulative groundwater storage in the Garnet Hill subbasin increases by approximately 50,000 acre-feet in 2045. Outflows across the Banning Fault reduce from approximately 4,000 acre-ft/yr in 2010 to 500 acre-ft/yr in 2045. The reduction in the outflows across the Banning Fault can be attributed to lowered groundwater levels in the Mission Creek subbasin relative to those in the Garnet Hill subbasin. Outflows across the Garnet Hill Fault to the Whitewater River subbasin are approximately 20,000 acre-ft/yr in 2045 and are largely a pass-through of natural and imported water flowing in the Whitewater River.

Groundwater Run 2

The objective of this model run is to stabilize groundwater levels in the Mission Creek subbasin. This model run corresponds to Alternative Plan 1. This model run assumes that sufficient imported water is available or can be acquired to stabilize groundwater levels in the Mission Creek subbasin. Imported water recharge is approximately 25,000 acre-ft/yr in 2045. Wastewater treated at MSWD's proposed Regional Plant is percolated in the Mission Creek subbasin. New wells are included in the model to meet future demand requirements.

The results from this model run indicate that groundwater levels in the Mission Creek subbasin increase by approximately 10 feet in 2045 compared to 2010 levels. This corresponds to an increase of approximately 100,000 acre-feet in cumulative groundwater storage in 2045. Cumulative groundwater storage in the Garnet Hill subbasin increases by approximately 45,000 acre-feet between 2010 and 2045. Outflows across the Banning Fault reduce from approximately 4,000 acre-ft/yr in 2010 to 3,000 acre-ft/yr in 2045. Outflows across the Garnet Hill Fault are approximately 20,000 acre-ft/yr in 2045.

Groundwater Run 3

The objective of this model run is to evaluate the response of the Mission Creek and Garnet Hill subbasins under extreme hydrologies, i.e., prolonged wet and dry cycles. This run is intended to indicate a possible maximum range in groundwater levels under such conditions. An alternative plan corresponding to this model run is not modeled in WEAP. The overall volume of imported water recharge for this model run is equal to the overall volume of imported water recharge for Groundwater Run 2. This model run assumes annual recharge of 35,000 acre-ft/yr for the periods 2011-2017 and 2038-2045. There is no recharge for the period 2018-2028. Low or dry year recharge is assumed for the period 2029-2037. Wastewater treated at the Regional Plant is percolated in the Mission Creek subbasin. New wells are included in the model to meet future demand requirements.

Cumulative groundwater storage increases up to 200,000 acre-feet between 2010 and 2018 and decreases to approximately 40,000 acre-feet between 2018 and 2038. The fluctuation in groundwater levels between 2018 and 2038 in the Mission Creek subbasin is approximately 70 feet. Cumulative groundwater storage in the Garnet Hill subbasin increases by approximately 45,000 acre-feet between 2010 and 2045. Outflows across the Banning Fault reduce from approximately 4,000 acre-ft/yr in 2010 to 3,000 acre-ft/yr in 2045. Outflows across the Garnet Hill Fault are approximately 15,000 acre-ft/yr in 2045. An increase in groundwater levels in the Whitewater River subbasin reduces outflows from the Garnet Hill subbasin in this model run.

Groundwater Run 4

The objective of this model run is to evaluate the response of the Mission Creek and Garnet Hill subbasins under a “No growth” scenario and a variable hydrology similar to Groundwater Run 3. This run is intended to indicate a maximum possible increase in groundwater levels under No Growth conditions. An alternative plan corresponding to this model run is not modeled in WEAP. .This model run assumes high recharge during the initial years followed by little to no recharge for the remainder of the planning period.

Due to the increased recharge during the initial years of the planning period, cumulative storage increases to 154,268 acre-feet in the Mission Creek subbasin. However, since there is little to no recharge in the remaining years, cumulative groundwater storage decreases by 26,685 acre-feet between 2010 and 2045. Between 2015 and 2045, groundwater levels decline throughout the basin. Cumulative groundwater storage in the Garnet Hill subbasin increases by approximately 27,288 acre-feet between 2010 and 2035. Outflows across the Banning Fault remain fairly constant between 4,500 acre-ft/yr to 5,000 acre-ft/yr.

Outflows across the Garnet Hill Fault vary from a low of approximately 11,500 acre-ft/yr to a high of approximately 28,000 acre-ft/yr. A decrease in groundwater levels in the Whitewater River subbasin during periods of no recharge increases outflows from the Garnet Hill subbasin in this model run.

Observations and Conclusions

The following observations and conclusions can be drawn based on the results of the groundwater modeling:

- It is observed that recharge water accumulates near the recharge facility causing mounding in that area. The cause of this accumulation could be a change in the geologic structure of the basin causing by faulting or changes in bedrock depth, or simply by hydrogeologic constraints such as insufficient transmissivity to convey the water away from the recharge site. Additional monitoring near the Mission Creek recharge facility is required to validate this observation.
- As levels in the groundwater basin increase due to increased storage, outflows to downstream basins will also increase. The relationship between basin storage and outflow is not linear due to the accumulation of water near the recharge area.
- Due to the high variability in imported water deliveries from one year to the next, it is important to allow for sufficient groundwater storage and water level fluctuation to accommodate this supply variability.
- Percolation of wastewater from the Regional Plant in the Garnet Hill subbasin does not have a significant impact on groundwater levels in that basin.

A comparison of hydrographs for groundwater model runs 1, 2, 3, and 4 is presented in **Figure 5-3.** Change in groundwater storage for the Mission Creek and Garnet Hill subbasin for all groundwater model runs are presented in **Figure 5-4** and **Figure 5-5** respectively. A detailed report describing the groundwater modeling process and its results is presented in **Appendix B**.

Figure 5-3
(placeholder for hydrographs)

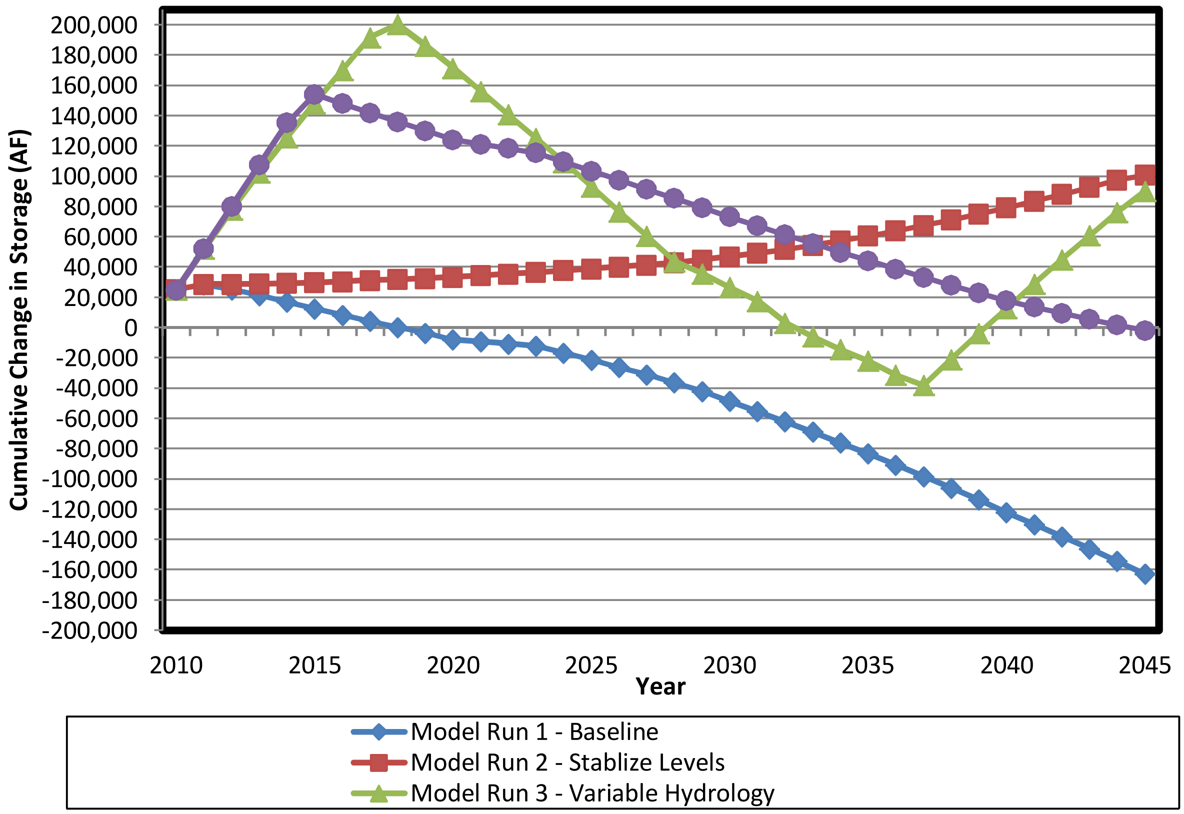


Figure 5-4
Cumulative Change in Storage – Mission Creek Subbasin

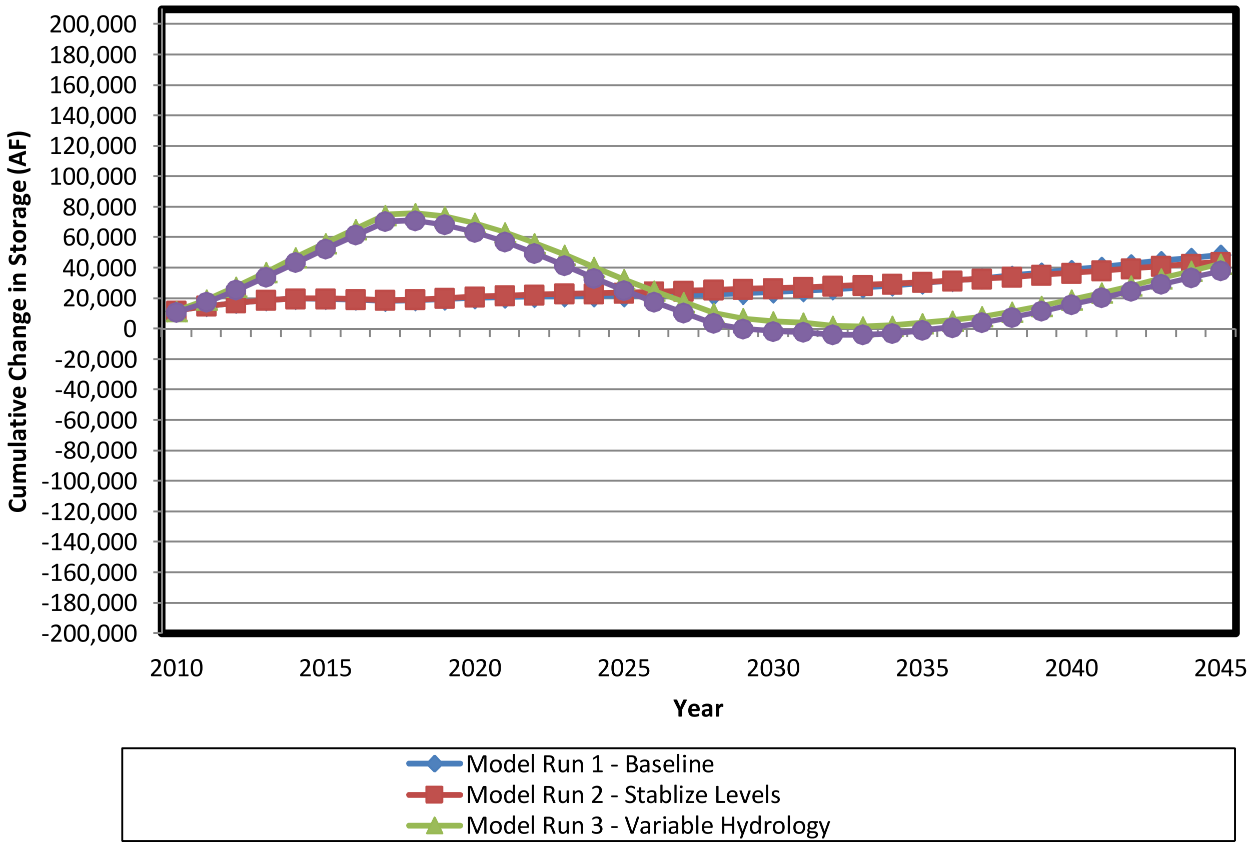


Figure 5-5
Cumulative Change in Storage – Garnet Hill Subbasin

Plan Evaluation

The alternative plans are evaluated against the criteria discussed previously in this section. A comparison of the performance of each alternative plan relative to one another is summarized in **Table 5-8**. Each alternative plan achieves its objective. However, since the composition of each alternative plan, governed mainly by its objective, is different, the consequences of each alternative plan are different.

Table 5-8
Comparison of Alternative Plans

Alternative	Alt 0	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Total Capital Costs (in millions of dollars)	$287	$287	$288	$392	$702	$440
Projected TDS in 2045 (mg/L)	575	699	732	673	528	626
Change in Groundwater Levels from 2010- to 2045 (AF)	-	0	1	0	0	0
Volume of Imported Water (AF) - Annual Average 2010-2045	9,748	18,212	21,560	15,528	18,310	15,528

Notes:
- indicates a decline in groundwater levels
+ indicates an increase in groundwater levels
0 indicates stabilized groundwater levels

Alternative Plan 4 includes additional imported water recharge to offset brine losses associated with the East Mission Creek Pumping Project. Therefore, the amount of imported water required for this plan is slightly higher than Alternative Plan 1.

From a TDS perspective, Alternative Plan 0 ranks second only relative to Alternative Plan 4 with a TDS of approximately 575 mg/L in 2045, due to its low use of imported water. However, the consequences of implementing this alternative are not sustainable. This alternative will lead to declining groundwater levels in the basin over the planning period and may cause land subsidence which can damage structures such as utilities, roads, and bridges. To prevent the consequences of declining groundwater levels, water levels in the Mission Creek subbasin either need to be raised or stabilized.

Alternative Plan 1 achieves the objective of stabilizing groundwater levels by increasing the amount of imported water recharge in the Mission Creek subbasin. Alternative Plan 1 does not require any additional capital investment compared to Alternative Plan 0. The increased recharge also increases the amount of salt imported to the basin and TDS concentrations increase to approximately 700 mg/L by 2045. The amount of imported water recharge required and the percolation of wastewater effluent from the proposed Regional Plant in the Mission Creek subbasin increase the TDS concentrations in the plan relative to Alternative Plan 0.

Salinity in the basin can be reduced by reducing the salt concentrations in the imported water supply. Alternative Plan 4 achieves this objective by directly utilizing SWP water for recharge through the SWP Extension. Compared to the TDS concentration (650 mg/L) in the Exchange Water delivered via the CRA, the SWP water has a lower average TDS concentration (245 mg/L). Alternative 4 requires the most capital investment among all alternatives. In addition, in comparison to Alternative Plan 1, Alternative Plan 4 requires an additional $420 million in capital investment for projects such as a recycled water system, desalination of groundwater in the East Mission Creek subbasin, and the implementation of the SWP extension to the Coachella Valley. Because the investment in delivery of SWP water to the Coachella Valley is so significant, it will require widespread support and participation by all water users in the Valley. The feasibility of this alternative may be affected by actions outside the control of water agencies in the Valley.

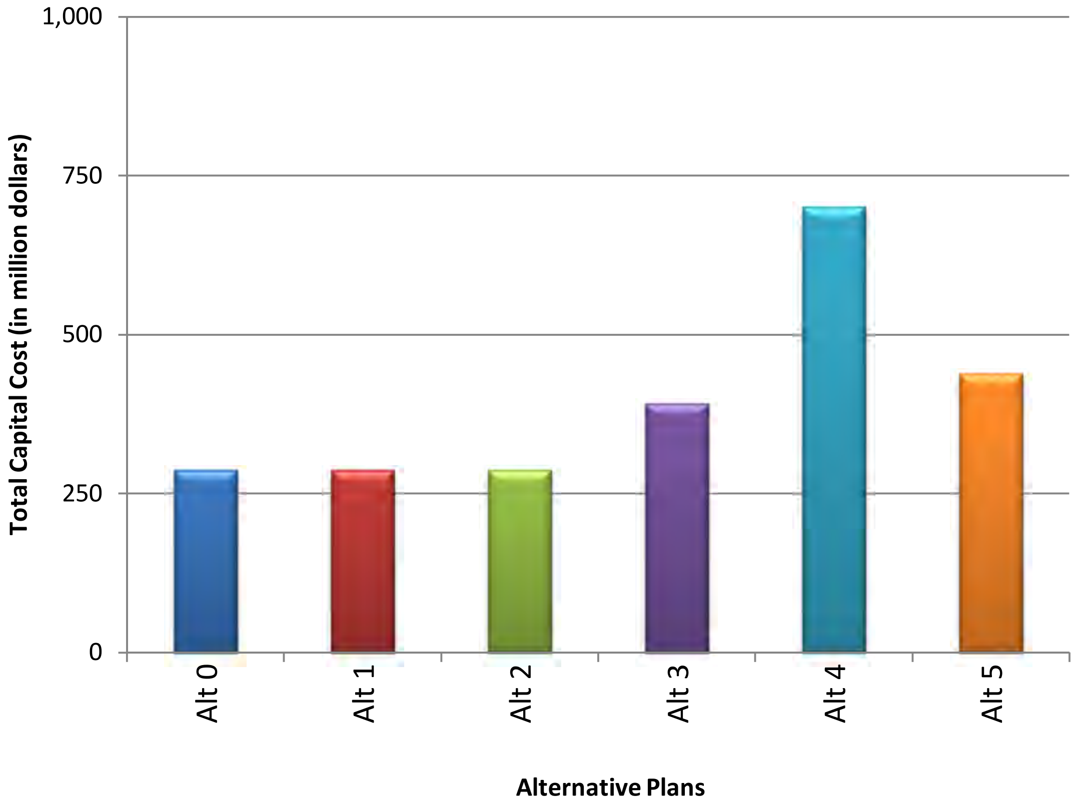
Alternative Plans 3 and 5 are variations of Alternative Plans 1 and 4. Both plans have extreme conservation measures in addition to achieving their objective of stabilizing groundwater levels. Alternative Plan 3 achieves its objective of stabilizing groundwater levels in the Mission Creek subbasin by minimizing imported water use. TDS concentrations are slightly lower than the concentrations observed for Alternative Plan 1. This reduction is attributed to lower amounts of imported water recharge and wastewater return flows relative to Alternative Plan 1.

Alternative Plan 5 also achieves its objective of improving water quality in the Mission Creek subbasin. This is achieved by treating SWP Exchange Water delivered via the CRA to remove TDS prior to recharge. The increased cost of Alternative Plan 5 is attributed to the costs associated with the implementation of additional conservation measures and the desalinization of the Exchange Water delivered via the CRA. However, the capital investment required for Alternative Plan 5 is approximately $260 million lower than Alternative Plan 4.

Alternative Plan 2 has an objective of increasing groundwater levels in the basin by 15 feet. This objective is achieved by increasing the amount of imported water recharge in the Mission Creek subbasin. Compared to Alternative Plan 1, this alternative requires an additional capital investment of approximately $1 million for the construction of a new recharge facility. However, the addition of salts from the imported water increases TDS concentrations in the basin to approximately 730 mg/L by 2045. From a salt balance perspective, this alternative plan is the least efficient.

Total capital funding required for each alternative plan is presented on **Figure 5-6**. It is noticed that Alternative Plans 1 and 2 have the same capital costs. Alternative Plan 3 is only slightly more expensive than Alternative Plans 1 and 2. Alternative Plan 4 is the most expensive as it requires a significant investments in capital infrastructure to improve water quality such as building the SWP extension, implementing a recycled water system, and implementing a wastewater collection system. Alternative Plans 3 and 5 are fairly comparable in terms of initial capital required with the exception that Alternative Plan 5 includes additional capital investment to treat the Exchange Water delivered via the CRA.

Figure 5-6
Capital Cost of Alternative Plans



Note:
SWP costs presented above in Alt 4 only include Mission Creek's share of the total costs. The total cost of the SWP project is expected to approximately range from $878 M - $1180 M for the depending on the route selected and capacity of the project.

Wastewater costs presented above in Alt 4 also include costs for developing a collection system in MSWD's and CVWD's service areas.

CONCLUSIONS

Based on the evaluation of the Alternative Plans against the criteria discussed above, it is recommended that Alternative Plan 1 be selected for further evaluation. Not only is Alternative Plan 1 least costly among the management plans, it also meets the objective of maintaining long term average water levels in the basin. While there are other management plans that result in lower TDS concentrations compared to Alternative Plan 1, they require costly treatment and conveyance infrastructure. Options such treating SWP Exchange Water delivered via the CRA for TDS, building an extension of the SWP aqueduct to the Coachella Valley, and treating and using saline inflows from the Desert Hot Springs subbasin are considered economically infeasible due to the high costs associated with their implementation.

The Recommended Plan discussed in Section 7 of this WMP is a variation of Alternative Plan 1. The components of the Recommended Plan will be governed by cost, TDS, and the groundwater level objectives for the Planning Area. The Recommended Plan will be flexible to respond to uncertainty in growth as well as water supply conditions. Details of the Recommended Plan will be discussed in **Section 7** of this WMP.

Section 6
Water Management Objectives

This section presents the Mission Statement and Water Management Objectives developed by CVWD, DWA and MSWD for the Mission Creek and Garnet Hill subbasins.

MISSION STATEMENT

To guide the planning and development of the WMP, the following mission statement is developed for the Mission Creek and Garnet Hill WMP:

> ***The purpose of the Mission Creek and Garnet Hill Water Management Plan is to manage the water resources to reliably meet demands and protect water quality in a sustainable and cost-effective manner.***

WATER MANAGEMENT OBJECTIVES

In order to meet the goals of the WMP, described in the Mission Statement for this WMP, the participating agencies (CVWD, MSWD, and DWA) developed objectives for the management of the Mission Creek and Garnet Hill subbasins. These objectives are listed below:

- Meet current and future water demands with a 10 percent supply buffer
- Reduce/eliminate long-term groundwater overdraft
- Manage and protect water quality
- Minimize adverse environmental impacts
- Comply with state and federal laws and regulations
- Manage future costs

These objectives are developed based on quarterly discussions between the General Managers of CVWD, DWA, and MSWD on issues that directly affect water management in the Planning Area. In addition, a Technical Committee was formed with the primary responsibility of developing the WMP. The Technical Committee comprises of one staff member each from CVWD, DWA, and MSWD. The Technical Committee is supported by a team of consultants.

A discussion on the Basin Management Objectives (BMO) is presented below.

Meet Current and Future Water Demands with a 10 Percent Supply Buffer

The intent of this BMO is to meet current and projected demands for the Planning Area reliably and to provide a 10 percent buffer on an average basis to meet unanticipated reductions in existing supplies or difficulties in developing new supplies. In its simplest form, supply reliability is ability to meet demands without interruption. Meeting demands reliably requires sufficient supplies through the full range of hydrologic conditions. Because the imported water supplies available to the Coachella Valley are not fully reliable, it is important that sufficient imported water capacity be available to deliver and capture wet period flows to provide sufficient water during dry or shortage periods. The storage capacity of the groundwater basin is a critical element to balancing the variable imported water supplies and demands.

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. The additional supplies needed to provide the buffer would be implemented when required based on on-going analysis of projected demands and supplies. The buffer might be provided through purchase option agreements that can be called upon in the future if conditions warrant. Alternatively, a portion of the buffer could be provided through contingency conservation programs that are implemented if future supplies are inadequate.

Reduce/Eliminate Long-Term Groundwater Overdraft

Since the commencement of the imported water recharge program in 2003 at the Mission Creek Spreading Facility, groundwater levels in the Mission Creek and Garnet Hill subbasins have increased in comparison to prior years. CVWD, DWA, and MSWD understand that lowering of the groundwater aquifer can have adverse impacts ranging from increased energy costs to the need to deepen existing private and public wells. While groundwater level declines cannot be avoided during very dry years when groundwater production is required to meet the needs of the Planning Area, the intent of this BMO is to manage the basin such that long-term average groundwater levels do not significantly decline from their present condition (year 2009).

It is recognized that groundwater levels will vary based on year-to-year changes in imported water deliveries. Therefore, overdraft and groundwater levels should be evaluated over a long-term period of at least twenty years.

Although groundwater overdraft has historically occurred in the basin, geologic conditions do not appear to be suitable for the occurrence of inelastic land subsidence. Inelastic subsidence has not been observed in the Mission Creek subbasin and it does not appear that subsidence will become a major problem in the future, especially if long-term overdraft is eliminated. Therefore, specific objectives relative to land subsidence are not established at this time.

Manage and Protect Water Quality

Groundwater is principal water source for meeting water demands in the Planning Area. Groundwater quality degradation can have a significant adverse effect on CVWD, DWA, and MSWD recognize that the principal water quality parameters of concern for the Planning Area are nitrate, total dissolved solids (TDS) and uranium in groundwater. Emerging contaminants will also be tracked to evaluate whether there is any impact on the groundwater supply. Since municipal wastewater generated by septic systems is a major source of nitrate in the basin, wastewater management will be a critical component of water quality protection. CVWD, DWA, and MSWD will consider all actions to address elevated concentrations of the other contaminants mentioned above in groundwater in a sustainable manner such that water quality in the basin is not degraded. Since water quality requirements are changing almost continually, it will be important that CVWD, DWA and MSWD track regulations related to emerging contaminants and develop proactive programs to address these contaminants as needed.

Minimize Adverse Environmental Impacts

The California Environmental Quality Act (CEQA) requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. The intent of this BMO is to ensure that change in water use, water supplies, or groundwater in areas overlying or near the Mission Creek or Garnet Hill subbasins do not adversely impact the environment in the Planning Area. Some areas within the Planning Area are designated conservation areas as part of the Coachella Valley Multi-Species Habitat Conservation Plan (CVMSHCP). Declining groundwater levels in the groundwater basin may have the potential to impact the growth of mesquite hummocks in conservation areas. CVWD is a signatory to the CVMSHCP and MSWD is in the process of becoming a signatory. The CVMSHCP provides its signatories mitigation for their covered actions; groundwater pumping is not included in the CVMSHCP. As DWA is not a signatory to the CVMSHCP, DWA will evaluate the impacts of proposed projects from the WMP in accordance with the requirements of the federal and state endangered species acts and CEQA processes.

Comply with State and Federal Laws and Regulations

A variety of local, state and federal laws, agreements, and regulations affect water management. Some of these agreements and regulations that affect water management are listed below.

- Drinking water regulations
- Waste discharge requirements
- Water conservation (20x2020)
- Well construction standards and permits
- CalGreen Building Code
- State and federal water supply contracts

The Agencies agree to make their best efforts to comply with applicable laws and regulations and to plan for future changes to those regulations.

Manage Future Costs

While managing long-term groundwater levels and water quality are essential basin management objectives, achieving an appropriate balance between the benefits associated with those objectives and associated costs is likely to remain a challenge. For example, treatment for salinity increases the cost of water. Similarly, declining groundwater levels result in increasing energy costs which increases the cost of water. Acquiring additional water supplies to manage groundwater levels in the basin also increases the cost of water. Therefore, implementation of actions to meet the BMOs should be performed in a practical manner such that water supply remains affordable for the customers in the Planning Area.

MANAGEMENT OBJECTIVES CONTRIBUTION TO SUPPLY RELIABILITY

The management objectives described above work together to provide improved supply reliability for the Planning Area. Examples to highlight the above statement are provided below:

- The implementation of conservation programs contribute will lead to greater efficiencies in water use thereby extending the available supplies for the Planning Area.
- Continued importation of water to replenish the groundwater basins and reduce/eliminate overdraft will ensure that adequate water supplies are available in storage to meet current and future water demands.
- Development of additional conservation measures and water supplies that can be held in reserve for implementation, if needed, contribute to supply reliability by providing contingencies in the event of unanticipated demand increases or supply decreases in the future.
- The implementation of a wastewater collection and treatment systems will reduce nitrogen loading in the groundwater basin and will improve groundwater quality. Improved groundwater quality in the basin reduces the future need for treatment and reduces the cost of water supply.
- Improvement in groundwater contamination tracking and treatment will decrease water quality-related disruptions in groundwater production operations increasing groundwater supply reliability.

Accomplishing the management objectives will increase supply reliability for the Planning Area in the long-term.

Section 7
Water Management Plan

The purpose of the Mission Creek and Garnet Hill Water Management Plan (WMP) is to manage the water resources in the Planning Area (as defined in TM 2: Planning Area and Resources, (MWH 2010) to meet demands reliably and protect water quality in a sustainable and cost-effective manner. This will be accomplished by achieving the following basin management objectives:

- Meet current and future water demands with a 10 percent supply buffer
- Reduce/eliminate long-term groundwater overdraft
- Manage and protect water quality
- Comply with state and federal laws and regulations
- Manage future costs
- Minimize adverse environmental impacts

The Recommended Plan, presented in this section, meets the objectives set forth by the Coachella Valley Water District (CVWD), Desert Water Agency (DWA) and Mission Springs Water District (MSWD). Key components of the Recommended Plan include measures for reducing demand, managing water supply sources, managing overdraft by maintaining groundwater levels on a long-term basis, protecting water quality, managing wastewater through septic conversions, and developing a recycled water system for the Planning Area. In addition, the Recommended Plan includes recommendations for monitoring and reporting to facilitate data sharing and coordination between CVWD, DWA and MSWD, stakeholder involvement through an advisory committee comprised of staff from CVWD, DWA and MSWD, and financial and implementation guidelines needed to actualize the proposed projects for the Planning Area.

PLAN ELEMENTS

The components of the Recommended Plan are listed below. Each of these components is discussed in detail in this section.

- Demand Management
- Water Supply Development
- Imported Water Recharge
- Water Quality Protection
- Monitoring and Data Management
- Adaptive Management
- Planning Integration
- Stakeholder Involvement

Demand Management

Population growth, environmental concerns, periodic droughts and the economics of new water supply development demonstrate the need to make efficient use of the available water supplies through the implementation of conservation programs. Since the groundwater pumping exceeds natural recharge, lower water demands result in less groundwater pumping making replenishment more effective. CVWD, DWA and MSWD have already implemented significant water conservation programs in the Planning Area. Existing per capita water demand within the Planning Area is already below the urban water target required by Senate Bill SB X7-7. Consequently, there is limited potential for additional conservation within the Planning Area. However, CVWD, DWA and MSWD should continue to implement the programs to ensure that per capita use does not increase in the future.

Considering the existing low outdoor use in the Planning Area, CVWD, DWA and MSWD will explore the potential scope for achieving additional conservation among water users in the region that are not covered by SB X7-7. Although the requirements of SB X7-7do not apply to private producers, CVWD, DWA and MSWD will coordinate with the top private producers in the Planning Area, and offer assistance for making efficient use of the water they extract.

The Coachella Valley Regional Water Management Group has developed the Regional Water Conservation Program that is designed to bring water conservation activities to a wide range of constituents throughout the region through outreach, water audits and various mechanisms to assist in implementation of water conservation methods. New programs will be developed and existing conservations plans will be expanded. The program will stretch supplies and provide a shield against drought, which addresses critical water supply issues in the Coachella Valley.

The Regional Water Conservation Program seeks to accomplish the following objectives:

- Continue to conduct outreach activities to encourage regional water use efficiency;
- Perform a concentrated outreach effort to extend to local schools through the Water Wise outreach program;
- Continue to conduct water audits and corresponding workshops to communicate recommendations regarding ways to increase water use efficiency to local constituents; and
- Assist in the ability of local constituents to act upon recommendations from water audits by subsidizing the costs of these audits both indoor and outdoor.

The CVRWMG agencies have created an umbrella conservation program that allows the region to address conservation needs through a collaborative and united process, but still allows each agency the flexibility to address the specific needs of the communities they serve (CVRWMG, 2011).

CVWD, DWA and MSWD will track the effectiveness of their urban water conservation programs and the progress towards achieving their water conservation goals in Urban Water Management Plans (UWMP) prepared at five-year intervals.

Water Supply Development

To meet projected demands while managing groundwater overdraft, the coordinated use of local groundwater supplies with other water supplies is a critical element of this WMP. Supply development consists of groundwater pumping, imported water supplies and use of local supplies such as recycled water.

Groundwater Pumping

Unlike other areas of the Coachella Valley, options for source substitution (replacement of pumping) with imported water are limited due to the extreme variability in imported water exchange delivery from the Colorado River Aqueduct. Consequently, groundwater pumping is expected to remaining the primary source of water delivered to meet the current and future water needs of the Planning Area. As growth occurs consistent with the 2010 RCCDR estimates, additional groundwater production wells may be required to meet the water demands of the Planning Area. New wells will be located to minimize their impact on existing adjacent wells in the Mission Creek and Garnet Hill subbasins while meeting the needs of the water agency. Locations of new wells are not identified in this WMP but are left to the discretion of the water agency. Hydrogeologic investigations and well siting studies should be conducted to identify locations that are most conducive for groundwater production.

Imported Water Supply Needs

During the development of this WMP, CVWD, DWA and MSWD agreed that overdraft in the Mission Creek subbasin should be managed with the goal of maintaining long-term average water levels at year 2009 levels to the extent practicable. Groundwater modeling indicated the amount of recharge needed to maintain groundwater levels assuming average hydrologic periods and imported water deliveries during the planning period. In order to manage overdraft in the groundwater basin and to meet future water demands, additional water supplies may be required for the Planning Area. The amount of imported water supplies required is governed by factors such as future growth, reliability of State Water Project (SWP) deliveries, implementation of the Bay-Delta Conservation Plan (BDCP), the frequency of Metropolitan callback of the 100,000 acre-ft/yr of SWP Table A transfer and the efficacy of implemented conservation practices. Average future imported water needs could range from essentially zero for no growth conditions with completion of the BDCP to as much as 14,700 acre-ft/yr if SWP reliability declines to 50 percent and Metropolitan makes relatively frequent callbacks[1].

Due to the uncertainties associated with growth and SWP reliability, imported water supply availability will be reviewed periodically to determine the amounts and timing for future supply acquisition.

Potential Imported Water Supply Acquisitions

Additional imported water supplies for the Planning Area could be acquired from the following sources:

- Modification to the allocation of existing SWP Table A between the Mission Creek and Whitewater areas of benefit;
- Short-term SWP water (Turnback Pool, Article 21 (Interruptible), or other wet water transfers);
- Additional long-term SWP water (Table A acquisitions);

[1] Since the transfer became effective in 2004, Metropolitan has made one call-back in 2005.

- Non-SWP water supply acquisitions;
- Delta conveyance facilities through the Bay-Delta Conservation Plan (BDCP);
- East Valley drain water desalination and exchange;
- Additional exchange/transfer opportunities;
- Other potential sources such as the Delta Wetlands Project that would store surplus water at two Delta islands for later delivery; Sacramento Valley irrigation water transfers; Cadiz Valley Water Conservation, Recovery and Storage Project and similar projects; and
- Seawater desalination and exchange

Decisions regarding the amounts and timing of new supply acquisition will be made by CVWD and DWA in their roles as regional imported water suppliers on the basis of need, availability and cost. As opportunities arise, CVWD and DWA will continue to make water purchases from programs such as State's Drought Water Bank and the Yuba River Accord. Additional water purchases from the SWP and from others with water rights, mainly in the Central Valley of California, will be evaluated as they become available to determine whether they meet the needs of CVWD, DWA and MSWD in the Planning Area.

Due to the lead time required to acquire or develop additional water supplies, it is incumbent on CVWD, DWA and MSWD to closely coordinate their current and projected water demands. Approval of water supply assessments/written supply verifications and issuance of will-serve letters should be tracked and communicated between the water purveyors and the water importers so that appropriate action can be taken if demands could exceed available supplies.

Recycled Water

While imported water is the principal source of supplemental water for the Planning Area, recycled water offers the potential to offset a portion of groundwater pumping. Currently, all treated municipal wastewater in the Planning Area is disposed via percolation/evaporation ponds. Conversion of septic tanks to sewer systems in the Planning Area will increase wastewater production at the wastewater treatment plants. If tertiary treatment systems are developed at the wastewater treatment plants, then the wastewater can be treated to Title 22 standards and the recycled water can be used for irrigation and other non-potable uses; treated wastewater is not suitable for direct potable use.

Recycled water has the potential to offset a portion of the groundwater use in the Planning Area. The principal non-potable uses for recycled water in the Planning Area are:

- Golf course irrigation
- Urban landscape irrigation

Future recycled water uses could also include indirect potable reuse (IPR), which is the planned use of highly treated wastewater to augment water supplies via groundwater recharge or blending with other potable sources prior to use. IPR is likely to become an important element of water resources development in southern California due to the limitations on imported water supplies.

For this plan, IPR is not included as a proposed use for recycled water; however, it could be considered in the future if needed.

MSWD prepared a recycled water feasibility that identified several potential recycled water users, principally golf courses and landscape irrigation (Psomas, 2007). The feasibility of a recycled water system is driven by the proximity of suitable users to the recycled water supply source. MSWD plans to develop a recycled water system in phases if construction and operational costs are economically feasible.

Planning for Uncertainty – Supply Buffer

Water supply acquisition 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 supply buffer serves as a contingency in the event that demands are higher than expected or supplies cannot be implemented at the levels expected. The additional supplies needed to provide the buffer would be implemented when required based on on-going analysis of projected demands and supplies. The buffer might be provided through purchase option agreements that can be called upon in the future if conditions warrant. Alternatively, a portion of the buffer could be provided through contingency conservation programs that are implemented if future supplies are inadequate.

Stormwater Management

While stormwater management for the Planning Area does not fall under the direct purview of CVWD, DWA and MSWD, there are benefits to the Mission Creek subbasin of implementing low impact development practices would increase natural recharge into the Mission Creek subbasin. Currently, larger developments and other projects (designated Priority Development Projects) are required to prepare and implement site-specific water quality management plans and implement appropriate best management practices (RCFCWCD, et al., 2009). CVWD, DWA and MSWD will work with the planning departments of the City of Desert Hot Springs and the Riverside County and the Riverside County Flood Control and Water Conservation District to implement low impact development for the Planning Area including local storm capture and recharge infrastructure to maximize runoff capture and minimize water quality impacts.

SWP Extension

In 2006, CVWD and DWA in association with Metropolitan, San Gorgonio Pass Water Agency and Mojave Water Agency commenced an investigation of four alternative routes for a Coachella Valley extension of the California Aqueduct. Following completion of an initial evaluation, two routes – one through the Lucerne Valley and one through San Gorgonio Pass – were evaluated in detail. A final draft report was presented to the participating agencies in 2011 with no recommendation for a preferred route. The SWP Extension Project is currently on hold pending resolution of various feasibility constraints, resolution of the BDCP and the potentially participating agencies ability to finance the project. The project is identified as an element for possible inclusion in future updates to this WMP.

Imported Water Replenishment

The principal source of water delivered to water users in the Planning Area is pumped groundwater as noted above. Because the natural inflows to the basin are not sufficient to sustain the current and future pumping amounts, groundwater replenishment with imported water is required to manage overdraft. Nearly 120,000 acre-ft of imported water has been recharged into the basin since 2002. Since water demand and pumping are expected to increase in the future, the current groundwater replenishment program will need to be continued and increased in the future to manage overdraft. As discussed under **Imported Water Supply Needs** above and in **Section 5**, additional replenishment is needed to achieve the goal of stabilizing average groundwater levels based in 2009 conditions. Under existing conditions, at least 9,100 acre-ft/yr of imported water should be recharged on average. As growth occurs, the amount of imported water recharge may increase to about 25,000 acre-ft/yr by 2045.

The ability to increase the replenishment program in the future may be limited by the existing recharge capacity. The existing Mission Creek Recharge Facility has a long-term recharge capacity of 35,000 acre-ft/yr. For example, if average SWP reliability drops to 50 percent, the Mission Creek Recharge Facility may have to accommodate approximately 50,000 acre-ft/yr of imported water by 2045 to make up for reduced water deliveries in other years. In such a scenario, a new recharge basin may be required to absorb the additional imported water volume in wet years. Because increased recharge capacity may not be required for almost 20 years, CVWD, DWA and MSWD have decided to defer consideration of additional recharge capacity.

Water Quality Protection

In this WMP, the principal water quality parameters of concern for the Planning Area are nitrate, total dissolved solids (TDS) and uranium in groundwater. Since municipal wastewater generated by septic systems is a major source of nitrate in the basin, wastewater management is a critical component of water quality protection. Actions to address elevated concentrations of the other contaminants mentioned above in groundwater are also discussed. Other constituents including arsenic and chromium 6 have been identified as potential constituents of concern depending on future regulatory actions. Additional water quality protection measures relative to stormwater management are incorporated in the Whitewater River Region Stormwater Management Plan (RCFCWCD, et al., 2009).

Wastewater Management

Currently, approximately 1.3 million gallons per day (mgd) of municipal wastewater is collected and treated at MSWD's two wastewater treatment plants (WWTP), Horton and Desert Crest. The remainder of wastewater flows generated in the Planning Area, including wastewater flows from all of CVWD's customers, are treated and disposed through on-site septic tanks and leach field/seepage pit systems.

MSWD wastewater flows are projected to be approximately 7.5 mgd (8,400 acre-ft/yr) by 2045. MSWD is currently working to expand its Horton WWTP from 2.3 mgd to a capacity of 3 mgd or 3,400 acre-ft/yr. As part of this plant expansion, MSWD plans to add nitrogen removal treatment via nitrification-denitrification to reduce the amount of nitrogen returning to the groundwater basin. Wastewater treated at the Horton and Desert Crest WWTPs will continue to be percolated into the Mission Creek subbasin unless a recycled water system is constructed.

MSWD also plans to construct a Regional WWTP to meet all future wastewater needs for its service area. The proposed Regional WWTP will be located along the southernmost boundary of the District, just northeast of the intersection of Interstate 10 and Indiana Avenue. Initially, this plant will have a 1 mgd average capacity with future expansions based on growth in the service area. Flow to the proposed Regional WWTP will be treated using secondary treatment and nitrogen removal followed by tertiary treatment to Title 22 requirements for reuse or percolated into the Mission Creek subbasin. The Desert Crest plant will be removed from service in the future after the Regional WWTP is constructed.

Wastewater generated by CVWD water users is currently treated and disposed via on-site septic tanks and leach field/seepage pit systems. In the future, CVWD wastewater flows could be collected and treated at MSWD's Regional WWTP, at a new CVWD-constructed WWTP, or at CVWD's existing WRP-7 in north Indio.

The following actions will be taken regarding wastewater management in the Planning Area.

- Continue septic to sewer conversions within MSWD's service area based on available funding;
- Continue with plans for expansion of the Horton Wastewater Treatment Plant (WWTP) including nitrogen removal;
- Support MSWD's existing plans to construct the Regional WWTP;
- Consider percolating treated Regional WWTP effluent in the Mission Creek subbasin at a location that does not adversely impact existing and future production wells; and
- Consider septic to sewer conversions within CVWD's service area subject to development and availability of funding.

Nitrate Management

Elevated nitrate concentrations but below the MCL exist in portions of the Mission Creek groundwater basin. Generally, nitrate is believed to be present in the unsaturated zone and shallow aquifers primarily because of septic tank effluent disposal (GSi, 2011). Concentrations exceeding the MCL (45 mg/L as nitrate) have not been observed in the deeper aquifers. Imported water recharge activities provide low nitrate water that may help dilute nitrate concentrations. Increased groundwater levels because of recharge activities have been observed to mobilize the nitrate in the unsaturated and shallow aquifers in the Warren groundwater basin, increasing nitrate concentrations in pumped groundwater (Nishikawa, Densmore, Martin, & Matti, 2003).

The following actions will be taken for nitrate management in the groundwater basins:

- Continue with plans to implement nitrogen removal at the Horton WWTP and any proposed WWTP that may serve the Mission Creek subbasin;
- Encourage septic to sewer conversions within MSWD's and CVWD's service areas;

- Monitor nitrate levels in groundwater wells; and
- Perform additional investigations of nitrate fate and transport as required

Salt Management

Salinity in the Mission Creek subbasin is expected to increase over time due to mineralized inflows from the Desert Hot Springs subbasin, imported water used for recharge and addition of salt from return flows through use and evapotranspiration from landscaping. Options such as treating SWP Exchange Water delivered via the CRA for TDS, building an extension of the SWP aqueduct to the Coachella Valley and treating and using brackish water inflows from the Desert Hot Springs subbasin could be implemented to reduce salinity in the Mission Creek subbasin. However, these options are considered economically infeasible due to the high costs associated with their implementation. Managing groundwater levels in the Mission Creek subbasin will also help contain brackish water inflows from the Desert Hot Springs subbasin and allow outflows to Garnet Hill subbasin for salt export.

The State Water Resources Control Board (SWRCB) Recycled Water Policy (adopted February 11, 2009) encourages every region in the state to develop a salt/nutrient management plan by 2014. The salt/nutrient management plans are intended for management of all sources contributing salt/nutrients on a basin-wide basis to ensure that water quality objectives are achieved. The CVRWMG plans to undertake a valley-wide salt-nutrient management plan to meet the SWRCB requirements. The CVRWMG has obtained grant funding to commence development of a strategy to develop this plan. As members of the CVRWMG, CVWD, DWA and MSWD will participate in the valley-wide salt-nutrient management plan development, which will include the Mission Creek and Garnet Hill subbasins.

Uranium Management

Uranium is naturally occurring in the Mission Creek subbasin and is believed to originate from the granitic rocks of surrounding mountains (GSi, 2011). Currently, MSWD stops pumping from wells when uranium above the MCL is detected in the groundwater and drills wells in areas known to have no or low uranium concentrations. In some cases, MSWD has installed treatment facilities to remove uranium. MSWD conducted an initial investigation of uranium in Mission Creek subbasin groundwater (GSi, 2011). MSWD plans to conduct a follow-up groundwater quality study to determine the extent of uranium occurrence in the basin and the risk of uranium migration due to the drilling of new wells. While CVWD wells have not been impacted by uranium, CVWD will continue to monitor for uranium and other radiological constituents as required by state and federal drinking water regulations.

Other Water Quality Protection Activities

The Agencies will take the following additional actions to protect water quality in the groundwater basins.

- Continue to monitor basin water quality (See Monitoring and Data Management);
- Continue to track potential regulatory actions of CDPH and USEPA that could affect CVWD, DWA and MSWD ability to comply with drinking water regulations;

- Coordinate with the appropriate local, state and federal regulatory agencies that are responsible for monitoring and regulating potentially contaminating activities within well capture zones and principal recharge zones including underground storage tank locations and other sources of contamination such as landfills;
- Work cooperatively with Riverside County Department of Environmental Health (DEH) to ensure that existing well construction, destruction and abandonment policies are followed;
- Develop a cooperative program with Riverside County DEH to identify and cap or destroy wells that are no longer being used for groundwater production or monitoring to prevent potential groundwater contamination;
- Review and comment on proposed land developments, environmental documents and land use plans developed by the cities of Desert Hot Springs, Cathedral City and Palm Springs and Riverside County to ensure that groundwater quality is protected; and
- Continue to support the Groundwater Guardian program, a community educational program developed by the non-profit Groundwater Foundation.

Monitoring and Data Management

The need for monitoring and data management is described in **Appendix D**. The following programs/projects should be implemented to improve monitoring and data management in the Planning Area:

- Evaluate precipitation data from gauges in the surrounding watershed to determine the amount of natural inflow and report in the Engineer's Reports prepared by CVWD and DWA;
- Install CIMIS station in Desert Hot Springs area to provide data for irrigation scheduling;
- Update the existing canvasses of private wells in the Mission Creek and Garnet Hill subbasins to determine their location, operational status (active, inactive, abandoned, destroyed), whether a meter is installed, and whether production is being reported;
- Continue to monitor public and private wells for water levels and quality;
- Install data loggers on selected wells to provide more continuous water level data;
- Report pertinent water level data to the State's CASGEM program and in the Engineer's Reports prepared by CVWD and DWA;
- Identify additional existing private wells that could be monitored routinely for water level and quality;
- Evaluate potential locations to construct monitoring wells near the basin boundaries to document natural inflow to and outflow from the basin and near the recharge basin to better track recharge effects;
- Develop a water resources database to facilitate data sharing between participating agencies;
- Develop and calibrate a water quality model capable of simulating the changes in salinity and possibly other conservative water quality parameters in conjunction with the salt/nutrient management plan; and
- Assess the need for periodic ground elevation surveys to determine whether land subsidence is occurring.

Stakeholder Involvement

Stakeholder input and concurrence is vital to the implementation of water management programs in the Planning Area. DWR's guidelines for groundwater management planning recommends establishing an advisory committee of stakeholders (interested parties) within the plan area that will help guide the development and implementation of the plan and provide a forum for resolution of controversial issues. CVWD, DWA and MSWD have significantly increased their public outreach through water conservation programs, implementation of water management projects, development of the 2010 Urban Water Management Plans, and the development of the Coachella Valley Integrated Regional Water Management Plan.

For the purposes of plan implementation, the Mission Creek and Garnet Hill Management Committee formed by the 2004 Settlement Agreement provides this function. This committee consists of the General Managers of CVWD, DWA and MSWD or their designated representatives. As stated in Settlement Agreement, "the purpose of the Management Committee is to exchange information, express ideas and otherwise discuss in a free, comprehensive, and frank manner any and all aspects regarding the management of water resources within the Mission Creek Subbasin, the Whitewater River Subbasin, and the Garnet Hill Subbasin of the Upper Coachella Valley Groundwater Basin (collectively "Subbasins")." Discussions shall include "costs proposed to be included within replenishment assessments, quantities and timing of water to be recharged into the Subbasins, water quality and other water resource issues within the Subbasins, including conservation activities and recycled water issues."

The Management Committee will continue to meet at least quarterly and, in addition to those topics specified in the Settlement Agreement, would be involved with the following programs and activities:

- Implementation of projects identified in the WMP;
- Implementation of the monitoring and reporting program; and
- Other activities as determined necessary by the Committee.

The Management Committee will seek input from affected private pumpers as appropriate. The Management Committee will also coordinate stakeholder outreach with CVRWMG, which has implemented an extensive regional stakeholder outreach program consisting of:

- Stakeholder coordination and public involvement;
- Disadvantaged communities outreach; and
- Tribal outreach and coordination.

Adaptive Management

Adaptive management is the process whereby basin management decisions are made on an incremental basis in response to actual data. In essence, it is learning through implementation. Use of this process avoids the dangers of over-investment in water supplies and infrastructure and unanticipated shortages due to inadequate action. The adaptive management process consists of the following steps:

- Planning
- Implementation
- Monitoring
- Analysis
- Modification

The key to the adaptive management process is one of continual evaluation and program adjustment to meet the overall basin management objectives. For example, water supply availability is compared to current and projected water demand to determine the amount and timing for new supply development. As changes occur to either water supplies or demands, the water managers can implement a series of actions in response to those changes. Ideally, these actions would be taken in relatively small steps to avoid excessive investment while minimizing the potential for supply shortages. The effectiveness of the changes is then monitored to verify whether additional actions are needed.

Effective implementation of water resources programs in relatively small increments requires almost continual evaluation and adjustment. For the Mission Creek-Garnet Hill Management Area, the groundwater basin storage serves as a significant buffer that provides protection from hydrologic variations in supplies and changes in economic or demand patterns. However, excessive reliance on this storage buffer must be avoided to prevent continued overdraft.

The following steps will be performed to implement adaptive management in the Planning Area:

1. Implement the management plan outlined in this document.
2. Maintain a basin monitoring program to track the status of basin demands, supplies and storage (via water levels).
3. Evaluate the monitoring results annually relative to management objectives.
4. Document changes in water supply conditions and water demands including proposed developments.
5. Assess the potential effects of supply and demand changes on groundwater conditions.
6. Implement modified management programs to achieve objectives in light of changed conditions.

An important component of adaptive management is periodic review and update of this WMP. CVWD, DWA and MSWD agree that the plan should be reviewed on five-year intervals to determine if the planning assumptions have changed sufficiently to warrant preparation of an update.

PLANNING INTEGRATION

A number of related, compatible water management planning efforts have been initiated in the Coachella Valley. These are described below.

Integrated Regional Water Management Plan

In 2002, the California legislature enacted the Integrated Regional Water Management (IRWM) Planning Act (Division 6 Part 2.2 of the Water Code §10530 et seq.), amended in 2008. The act encourages local agencies to develop integrated regional strategies for management of water resources and work cooperatively to manage their available local and imported water supplies to improve the quality, quantity and reliability of those supplies. The California Department of Water Resources (DWR) reviews all IRWM plans and provides funding for water management projects through competitive planning and implementation grant programs.

In 2008, CWA, CVWD, DWA, IWA, and MSWD formed the Coachella Valley Regional Water Management Group (CVRWMG) and signed a Memorandum of Understanding (MOU) for development of an Integrated Regional Water Management Plan (IRWMP). In 2009, the CVRWMG established a planning region boundary and submitted an application for region acceptance to DWR, which was approved.

The CVRWMG completed the Coachella Valley IRWMP in December 2010 (CVRWMG, 2010). The CVIRWMP qualifies the region for DWR grants under proposition 84, Division 43: *The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006*, Proposition 1E, *Article 1.699: Disaster Preparedness and Flood Prevention Bond Act of 2006* and other future funding programs.

Following completion of the IRWMP, the CVRWMG successfully obtained a $1 million planning grant to update the IRWMP with respect to on-going outreach activities, water quality evaluation for disadvantaged communities, development of a salt-nutrient management planning strategy, development of integrated flood management strategies, establishment of a groundwater elevation monitoring framework and development of climate change adaptation and mitigation strategies. The CVRWMP also obtained a $4 million IRWM implementation grant to fund regional water conservation, short-term arsenic removal treatment and two groundwater quality protection projects involving septic to sewer conversions in the Cathedral City and Desert Hot Springs areas.

Urban Water Management Plans

In 1983, the California Legislature enacted the Urban Water Management Planning (UWMP) Act (Division 6 Part 2.6 of the Water Code §§10610 - 10656). This act requires that every urban water supplier providing water to 3,000 or more customers, or more than 3,000 AF of water annually, should ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry years. The act describes the contents of the UWMP as well as how urban water suppliers should adopt and implement the plans. Every five years (in years ending in five and zero), plans are prepared and adopted that define the supplier's current and future water use, sources of supply, source reliability, and existing conservation measures. DWR reviews plans for compliance and provides a report to the California legislature one year after plans are due to DWR.

SB X7-7 (2009), which mandated the development and implementation of plans to decrease per capita urban water usage 20 percent by the year 2020, also extended the deadline to submit the

2010 UWMPs until July 1, 2011. In compliance with state law, CVWD, DWA and MSWD each prepared 2010 UWMPs for their respective service areas and adopted those plans in 2011.

Coachella Valley Water Management Plan Update

The Coachella Valley Water Management Plan was adopted by the CVWD Board of Directors in September 2002. The goal of the Water Management Plan is to meet current and future water demands reliably in a cost effective and sustainable manner. The planning area of the 2002 WMP encompassed the Whitewater and Garnet Hill subbasins and those areas that depend on groundwater from these two subbasins. The 2002 WMP served as a guide for CVWD and DWA in efforts to eliminate overdraft and prevent groundwater level decline, protect water quality, and prevent subsidence within the Whitewater River subbasin and its related planning area. The 2002 Water Management Plan identified the significant groundwater overdraft that had occurred over decades and, equally important, the threat of continued overdraft to the Valley's economy and quality of life. It was based on then current projections of growth and corresponding water demand. The Plan identified the actions needed to eliminate overdraft while maintaining the quality of life and avoiding adverse impacts to the environment including water conservation, water supply acquisition, groundwater source substitution and groundwater recharge.

CVWD recently completed an update of the 2002 WMP. The 2010 WMP Update reaffirmed the objectives of the 2002 WMP. However, the 2010 WMP Update focused on the significant changes in the planning environment since 2002 including 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 because 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. The 2010 WMP Update and its Supplemental Program Environmental Impact Report were adopted by the CVWD Board of Directors in January 2012.

Coachella Valley Multiple Species Habitat Conservation Plan

The purpose of the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) is to provide a regional approach to balanced growth that will help conserve the Coachella Valley's natural heritage and allow for economic development by providing comprehensive compliance with federal and state laws to protect endangered species. The CVMSHCP permanently conserves 240,000 acres of open space and 27 threatened plant and animal species across the Coachella Valley. It allows for more timely construction of infrastructure essential to improving the Coachella Valley. The CVMSHCP was prepared by the Coachella Valley Association of Governments (CVAG) and the Coachella Valley Mountains Conservancy. Current signatories to the CVMSHCP include Riverside County, the cities of Cathedral City, Coachella, Indian Wells, Indio, La Quinta, Palm Desert, Palm Springs, Rancho Mirage, CVWD and Imperial Irrigation District (IID). The Coachella Valley Conservation Commission (CVCC), a joint powers authority of elected representatives, oversees and manages the CVMSHCP. The CVCC has no regulatory powers and no land use authority. Its primary purpose is to buy land from willing sellers in the conservation areas and to manage that land. The Plan provides 75 years of habitat and species mitigation coverage for the water management and development activities of the signatories.

MSWD is working with the City of Desert Hot Springs to become permittees to the CVMSHCP through a Major Plan Amendment, which is on-going. The Amendment process will include public review, as well as coordination with federal and State wildlife agencies.

Linkage Between Water Management and Land Use Planning

The local land use planning agencies in the Coachella Valley Region consist of nine cities and the County of Riverside. These agencies are responsible for managing growth and development in the Coachella Valley to ensure a healthy and sustainable economy long into the future. They make decisions and seek stakeholder input utilizing the land use planning tools discussed in this section. Public involvement in local land use planning helps define the community's vision of future growth and development. Water agency involvement ensures that the water planning goals of the region are supported by local communities and are harmonious with the future growth plans (CVRWMG, 2010).

CVWD, DWA and MSWD, while not associated with city or county governments, work closely with the municipalities in their service areas to ensure quality coordination in land use planning. Within the Planning Area, CVWD provides water service to the unincorporated Riverside County communities of Indio Hills and Sky Valley. DWA provides imported water supply and operates the Mission Creek recharge facility. MSWD provides water and wastewater service to the City of Desert Hot Springs and nearby unincorporated areas.

The following sections describe how local land use planning decisions relate to water management. As applicable, CVWD, DWA and MSWD will use the information shared and collaborated with regional land use planning agencies to help adapt water management systems to meet future needs.

General Plans

General Plans are prepared by the Valley cities and the County, as required by state law. General Plans represent each community's comprehensive and long-term view of its future and provide a blueprint for growth and development. The General Plans must address each city's physical development, such as general locations, appropriate land use mixtures, timing and extent of land uses, and supporting infrastructure including water, sewer and stormwater infrastructure.

General Plans are periodically updated and General Plan Advisory Committees are appointed to serve as the primary means of citizen involvement in the formulation of the draft General Plans. General Plan Advisory Committees provide a means for local water planners to have input on General Plan development.

City Councils and Planning Commissions use the goals and policies of General Plans as a basis from which to make land use decisions. General Plans in this region include goals for water and sewer service such as the following:

- Provision of water, sewer and utility facilities which safely and adequately meet the needs of the city at build out;
- Conservation of the quality and quantity of the groundwater basin; and
- Establishment of a city-wide sewer system.

The three water agencies participate in General Plan development to ensure that water management goals are accurately represented, and to ensure that the water-related needs of future development have been considered in the land use planning process. Water-related needs include supporting long-term programs that ensure adequate quantities of safe drinking water and water for outdoor irrigation; making sure that developed areas are safe from flood hazards; and that water, sewer and flood control infrastructure are incorporated into future development.

Specific Plans

Specific Plans establish a link between General Plan policies and individual development proposals in a defined area. They are important in water planning because they specify allowable land uses, describe existing infrastructure and identify future infrastructure needs. They can result in policies specific to infrastructure master planning and financing to ensure that facilities are not undersized or otherwise insufficient. The Coachella Valley cities follow specific plan processes that provide opportunities for water agencies, the general public, as well as residents located within planning areas, to assist in the planning of their particular communities. Local water agencies provide input and enforce development policies to ensure that the water-related needs of specific plan areas are addressed. By being included in the Specific Plan review process, water agencies are able to help developers quantify their water infrastructure needs and costs, plan their land uses to address flood hazard mitigation requirements, and provide assessments of water supply adequacy.

Water Supply Assessments

Water Supply Assessments (WSAs) are evaluated by the water purveyors in the region to determine if sufficient water supplies exist long-term to sustain proposed development when the proposed development is 500 residential units or more or a large commercial project as defined in California Water Code §10912(a). Generally, before a city or county determines what level of CEQA analysis is required for a proposed project, it requests that a WSA either be prepared by water purveyor or be prepared by the project proponent and subsequently approved by the water purveyor. The WSA includes a determination by the water service provider whether its total projected supplies will enable it to meet the projected water demands of the proposed project in normal, single-dry and multiple-dry years during a 20-year projection, in addition to all other existing and planned future uses.

In the Planning Area, the three Agencies prepare and/or evaluate WSAs for approval within their own service areas based on data presented in their UWMPs. Regional coordination on the current and future water planning effort will ensure that WSAs are consistent and that long-term water supply programs are carried out to ensure that projected water demands are met.

Other Development Approval Processes

Additional land use planning tools such as Subdivision maps (dividing land into smaller lots), and Conditional Use Permits, Variances, Building and other Permits for individual development provide water planners with opportunities to work with planning agencies to approve water smart developments. In addition, coordination related to land use planning is equally important and will be addressed in the following ways:

- CVWD, DWA and MSWD are committed to purposeful, collaborative, and informed coordination with the land use planning agencies within the Valley;
- As General Plans for local cities and the County are updated in the future, it is important that water planners are involved to ensure that the water planning goals of the Region are represented in and supported by land use and development plans;
- In Specific Plans, it is also important that water planners are involved early in the process to ensure that developers have a thorough understanding of available water supplies, flood hazards, and the infrastructure costs and needs of their developments;
- As development approvals are processed, coordination with water planners through development of WSAs are essential for ensuring adequate water supplies to meet future demand;

This review and approval process by local utilities (water supply, wastewater, storm drainage and flood control) should also occur during development of project-level CEQA documentation.

As above, the ongoing IRWM program will provide the Region's water and land use planners with an established forum to engage in discussions about water management topics. The quarterly Planning Partners meetings, which include both water managers and land use planners, are designed to discuss regional water issues and concerns. This improved interaction between water managers and land use planners will advance implementation of the IRWM Plan and this WMP by keeping the group informed about critical issues and needs (CVRWMG, 2010).

IMPLEMENTATION OF WMP

The three Agencies prioritized the water management programs and projects presented in this section on the basis of:

1. Continuation of existing programs
2. New programs to be implemented
3. New programs requiring further investigation
4. Potential future programs

This section lists the programs within each category. **Table 8-1** presents the list of management programs, their relationship to the basin management objectives and their potential implementation timing. From a timing perspective, near-term means within the next five years, mid-term means five to 15 years and long-term is greater than 15 years.

Table 7-1
Water Management Plan Projects and Programs

List	Project/Program	Category	Applicable Goal						Additional Benefits	Provides Multiple Benefits	Readiness to Implement	Recom-mended Action
			Meet current and future demands with 10% buffer	Reduce/ eliminate long-term GW Overdraft	Manage & Protect Water Quality	Comply with State and Federal Laws and Regs	Manage Future Costs	Minimize Adverse Environ. Impacts				
A-1	Continue to implement urban water conservation programs	Conservation	x	x		x			Meet 20x2020	Yes	On-going	Continue
A-2	Private pumper conservation program	Conservation	x	x						Yes	Near-term	Pursue
A-3	Track water conservation effectiveness through UWMPs	Conservation	x	x		x	x			Yes	On-going	Continue
B-1	Construct additional wells as needed to meet future demands	Water Supply	x							No	Mid-term	Agency Decision
B-2	Locate new wells to minimize interference with adjacent wells	Water Supply	x	x				x		Yes	Mid-term	Agency Decision
B-3	Periodically review imported water supply availability and needs	Water Supply	x				x			Yes	Mid-term	Continue
B-4	Acquire additional imported water supplies as needed	Water Supply	x				x			Yes	Mid-term	Defer
B-5	Develop recycled water system(s) if feasible	Water Supply	x	x	x		x	x		Yes	Mid-term	Phase or Defer
B-6	Develop water supply and conservation contingency programs to provide supply buffer	Water Supply										
B-7	Construct SWP Extension	Water Supply			X					No	Long-term	Defer
C-1	Continue existing imported water replenishment program	Imported Water Replenishment	x	x	x			x		Yes	On-going	Continue
C-2	Increase imported water replenishment to stabilize groundwater levels	Imported Water Replenishment	x	x						Yes	Near-term	Pursue
C-3	Expand recharge basin capacity (if needed)	Imported Water Replenishment		x				x	Improved recharge distribution; more rapid basin level response	Yes	Long-term	Defer
C-4	Work with planning entities and RCFCWD on local stormwater capture and low impact development	Imported Water Replenishment	x	x	x	x				Yes	Near-term	Pursue
D-1	Convert from septic to sewer in MSWD area	Water Quality Protection	x	x	x	x				Yes	On-going	Continue
D-2	Expand Horton WWTP and install nitrogen removal	Water Quality Protection			x	x		x		Yes	Near-term	Continue
D-3	Construct Regional WWTP with nitrogen removal	Water Quality Protection	x	x	x					Yes	Near-term	Phase
D-4	Recharge Regional WWTP Effluent in MCSB	Water Quality Protection	x	x						Yes	Mid-term	Pursue

D-5	Evaluate conversion of septic to sewer in CVWD area	Water Quality Protection	x	x	x	x		x		Yes	Long-term	Pursue
D-6	Evaluate occurrence and risk of nitrate migration	Water Quality Protection			x	x				Yes	Mid-term	Agency Decision
D-7	Participate in valley-wide salt/nutrient management plan (SNMP)	Water Quality Protection	x		x	x		x		Yes	Near-term	Pursue
D-8	Develop and calibrate water quality model in conjunction with SNMP	Water Quality Protection			x	x			Need for salt/nutrient management plan	Yes	Near-term	Discuss w/ GMs
D-9	Manage groundwater levels in MCSB to minimize migration of warm brackish water from DHSSB	Water Quality Protection			x					No	Mid-term	Linked to C-2
D-10	Evaluate occurrence and risk of uranium migration	Water Quality Protection	x		x					Yes	Near-term	Agency Decision
D-11	Track potential regulatory actions of CDPH and USEPA that could affect drinking water regulation compliance	Water Quality Protection			x					No	Near-term	Pursue
D-12	Coordinate with appropriate regulatory agencies responsible for preventing contaminating activities in well capture and recharge zones	Water Quality Protection			x					No	Near-term	Pursue
D-13	Work cooperatively with Riverside County DEH to ensure well construction, abandonment, destruction policies are followed	Water Quality Protection			x	x	x			Yes	Near-term	Work with Riverside Co.
D-14	Develop a cooperative program with Riverside County DEH to identify and cap/destroy unused wells	Water Quality Protection			x	x				Yes	Near-term	Pursue
D-15	Review and comment on development proposals, environmental documents and land use plans to protect water quality	Water Quality Protection										Continue
D-16	Support Groundwater Guardian Program to educate public on water quality	Water Quality Protection										Continue
D-17	Desalination of Colorado River recharge water	Water Quality Protection			x			x		Yes	Long-term	Defer
D-18	Desalination of East MC groundwater	Water Quality Protection			x					Yes	Long-term	Defer
E-1	Evaluate precipitation data annually to estimate natural inflows to basins	Monitoring	x	x					Improved data on basin supply	Yes	Near-term	Pursue
E-2	Install a CIMIS station in DHS area	Monitoring	x	x			x		Improved irrigation scheduling	Yes	Near-term	Pursue
E-3	Update well canvass and determine well operational status	Monitoring		x	x				Improved monitoring	Yes	Near-term	Update Existing
E-4	Continue to monitor public and private wells for water level and quality	Monitoring		x	x				Improved monitoring	Yes	On-going	Continue
E-5	Incorporate additional private wells in routine water level and quality monitoring	Monitoring		x	x				Improved monitoring and reporting	Yes	Near-term	Pursue
E-6	Install production meters on private wells no having meters	Monitoring					x		Improved monitoring and reporting; cost recovery	Yes	Near-term	Pursue
E-7	Install water level dataloggers in 5-10 monitoring wells	Monitoring		x					Improved monitoring and reporting	Yes	Near-term	Pursue

E-8	Monitor local surface runoff quality	Monitoring			x				Improved monitoring and reporting	Yes	Near-term	Defer
E-9	Investigate viability of conducting geophysical survey near recharge basin	Monitoring		x			x		Improved basin understanding and groundwater modeling	Yes	Near-term	Investigate
E-10	Construct 1-2 new monitoring wells to document recharge activities	Monitoring		x					Improved monitoring and reporting	Yes	Near-term	Investigate
E-11	Construct 1-3 new monitoring wells to document water levels near mesquite hummocks	Monitoring		x				x	Improved monitoring and reporting	Yes	Near-term	By Others
E-12	Conduct flow loss study on Whitewater River	Monitoring	x						Document recharge to GHSB	Yes	Near-term	Defer
E-13	Periodic groundwater model update and recalibration; combine with Whitewater model	Monitoring						x	Improved monitoring and operational planning	Yes	Near-term	Pursue
E-14	Conduct ground surface elevation surveys	Monitoring		x			x	x	Early subsidence documentation	Yes	Near-term	Defer
E-15	Construct 1-3 new monitoring wells to document basin inflows	Monitoring	x	x					Improved monitoring and reporting	Yes	Mid-term	Defer
E-16	Investigate additional stream gauging in MCSB	Monitoring	x	x					Document recharge to MCSB	Yes	Mid-term	Defer
F-1	Improved reporting of water resources data in Engineers' reports	Data Management and Reporting							Improved reporting and data sharing	No	On-going	Pursue
F-2	Develop valley-wide water resources database	Data Management and Reporting	x	x					Improved reporting and data sharing	Yes	Near-term	
G-1	Continue existing basin management committee structure	Other							Promote improved communications	No	Near-term	Continue
G-2	Develop adaptive management procedures to monitor management progress and adjust as needed	Other	x	x	x	x	x	x	Allows progressive implementation	Yes	Mid-term	Pursue

Continuation of Existing Programs

The following on-going programs and projects will continue to be implemented:

- Municipal water conservation
- Track effectiveness of conservation measures
- Imported water replenishment program
- Conversion of septic systems to sewers in MSWD service area
- Nitrogen removal at Horton WWTP
- Monitoring of existing public and private wells
- Existing three-agency basin management structure
- Construction of new wells – individual agency decision based on need
- Evaluate uranium occurrence – individual agency decision based on need
- Investigate nitrate occurrence – individual agency decision based on need

New Programs

The following new programs will be implemented over the next five years:

- Offer water conservation services to private pumpers
- Increase imported water recharge to stabilize groundwater levels
- Coordinate with planning and flood control agencies to improve stormwater capture opportunities
- Develop recycled water for non-potable use to offset pumping where feasible – implement in phases
- Monitor actions of other responsible agencies to prevent contaminating activities in recharge areas and well capture zones
- Implement cooperative program with Riverside County Environmental Health to locate and cap or destroy unused wells
- Develop valley-wide salt/nutrient management plan with CVRWMG
- Construct Regional WWTP and percolate effluent in Mission Creek subbasin at a suitable location that does not adversely affect existing production wells
- Incorporate additional wells in water level and quality monitoring program
- Install production meters on any existing unmetered private wells
- Install data loggers on 5-10 existing wells to improve water level monitoring
- Evaluate watershed precipitation annually and report in Engineers' reports
- Periodically review and update the groundwater model and combine with Whitewater model
- Improve reporting in existing Engineers' reports to include precipitation, stream flow and additional hydrographs.
- Develop adaptive management procedures to monitor basin management progress and adjust as needed.

Potential Programs Requiring Further Investigation

The following programs and projects may be implemented in the future but require further investigation into their feasibility or need:

- Acquire additional imported water supplies – amount depends on growth, BDCP and other actions
- Construction of additional recharge basins – depends on growth, future imported water availability and siting
- Convert septic tanks to sewers in CVWD service area – depends on development and funding
- Monitor local surface water runoff quality – depends on frequency and magnitude of runoff from adjacent watersheds
- Conduct geophysical survey near existing recharge basins – depends on results of on-going water level monitoring of recharge activities
- Construct monitoring wells near the existing recharge basins – depends on results of on-going water level monitoring of recharge activities
- Construct monitoring wells in the basin uplands to document inflows – depends on whether suitable existing wells can be monitored
- Construct shallow monitoring wells near mesquite hummocks – to be performed by others (CVCC, DFG, USFWS, etc.) based on need
- Conduct flow loss study of Whitewater River to estimate channel infiltration to groundwater basins – to be performed in conjunction with a future groundwater model update/recalibration
- Conduct ground surface elevation monitoring – depends on observations regarding land subsidence.

Some of the investigations could be performed within the next five years with full implementation (if approved) over the next ten or more years.

Potential Future Programs

The following programs are sufficiently long-term or require significant additional investigation or funding that they are not currently included in this water management plan. However, they could be included in future updates to this plan if feasibility is demonstrated or sufficient need exists:

- Construction of the SWP Extension to the Coachella Valley – depends on outcome of BDCP and funding
- Treatment of SWP Exchange water (Colorado River water) for salinity removal – depends on need and costs
- Desalination of brackish groundwater from the east Mission Creek subbasin – depends on future impact on existing production wells

Due to the long-term and uncertain nature of these programs, no implementation activities are expected within the next 15 years.

IMPLEMENTATION COSTS

The costs to implement the Mission Creek-Garnet Hill Water Management Plan need to be resolved with the Technical and Management Committees prior to inclusion in this report. For the 2010 Coachella Valley WMP Update, a table was presented the listed the total capital and O&M costs along with the average annual cost by major program element as shown below:

Component	Total Capital Cost $millions	Total O&M Cost $millions	Total Cost $millions	Average Annual Cost $millions
Water Conservation	$ 1	$ 230	$ 231	$ 6.6
Recycled Water	161	153	314	9.0
Colorado River Water		409	409	11.7
SWP Water		1,907	1,907	54.5
Delta Conveyance		472	472	13.5
Desalinated Drain Water	462	277	739	21.1
Groundwater Pumping and Treatment	135	1,950	2,085	59.6
Water Transfers	0	282	282	8.1
Other New Water		262	262	7.5
Source Substitution	1,142	782,	1,924	55.0
Recharge	48	181	229	6.5
Total	**$1,949**	**$6,907**	**$8,856**	**$253.0**
Annual Average	$56	$197	$253	

These costs reflect on-going as well as future activities.

Another option would be to show no costs in the plan. A third option would be to show detailed costs by project/program.

FINANCING

Successful financing of large capital programs consistently depends on optimizing three financing objectives:

- Produce capital in sufficient amounts when needed;
- Produce capital at lowest cost; and
- Produce capital with greatest equity among customers, including the principle that growth-pays-for-growth.

Because the implementation of the Water Management Plan will involve program refinement over the years, financial planning should also have flexibility to accommodate changes in law, system requirements, capital requirements, constituency requirements, and the methodologies available to the water management group to generate funds.

A variety of financing options have been considered as presented in Appendix E and summarized below:

- Water rates – water purveyor charges to water customers for the purchase of water for urban or agricultural use
- Replenishment assessments – charges for replenishment water to groundwater pumpers based on their annual production
- Developer fees – charges applied to new development on a per-connection basis to cover the capital cost of supply acquisition and water/wastewater system construction
- Assessment districts – charges applied to property tax bills to recover the capital cost of utility construction for new development
- Property taxes – charges applies to property tax bills of land owners to recover bonded indebtedness such as the SWP capital costs and other authorized bonds
- Grants – state or federal money provided for specific water management programs, usually awarded on a competitive basis
- Bonds – voter- authorized (general obligation) or water agency-authorized (revenue) funding for capital facilities

The specific financing mechanisms that will be applied to each WMP element will be determined by the governing bodies of participating agencies. A combination of funding sources will likely be used to meet the needs of the Valley water users.

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Appendix C
Conservation Areas

The following discusses the sensitive species and habitats potentially affected in each conservation area within the Planning Area.

Whitewater Canyon Conservation Area

The Whitewater Canyon Conservation Area includes the Whitewater River and its watershed north of Interstate 10. Of the total 14,170 acres, approximately 11,707 acres are within the Planning Area. Portions of the San Bernardino Mountains are a sand source for the Whitewater River fluvial sand transport system. This system is an essential ecological process for several species. The core habitat for this Conservation Area contains riparian birds, desert tortoise, and the triple-ribbed milkvetch. A complete list of species can be found in Section 4.3.4 of the CVMSHCP. Historically, this Conservation Area contains the only confirmed habitat for the arroyo toad. The natural communities include: Sonoran creosote bush scrub, Sonoran mixed woody and succulent scrub, Sonoran cottonwood-willow riparian forest, desert fan palm oasis woodland, semi-desert chaparral, chamise chaparral, and interior live oak chaparral. The Conservation Area also provides a biological corridor under Interstate 10 along the Whitewater River and serves as a linkage between the San Bernardino Mountains and Snow Creek/Windy Point Conservation Areas (CVMSHCP, 2009).

The major water related objectives for this conservation area are:

- Triple-ribbed milkvetch, arroyo toad, and desert tortoise habitat preservation
- Sand source conservation in the San Bernardino Mountains for the maintenance of the blowsand ecosystem
- Maintain Whitewater River's current capacity for fluvial sand transport

Upper Mission Creek/Big Morongo Canyon Conservation Area

Due west of the Whitewater Canyon Conservation Area is the Upper Mission Creek/Big Morongo Canyon Conservation Area. This Conservation Area encompasses the Mission Creek watershed, Big Morongo Canyon watershed, portions of the Mission Creek flood control channel and the Morongo Wash within the City of Desert Hot Springs. Of the total 29,440 acres, approximately 25,941 acres are within the Planning Area. With the exception of the flood control areas and associated habitat conservation along the Morongo Wash, private land within the City of Desert Hot Springs is not included in this Conservation Area based on the decision of the Desert Hot Springs City Council.

The core habitat for this Conservation Area includes the largest habitat area for the Little San Bernardino Mountains linanthus, as well as habitat for the triple-ribbed milkvetch, Palm Spring pocket mouse, desert tortoise, and burrowing owl. A complete list of species can be found in Section 4.3.7 of the CVMSHCP. Historically, this Conservation Area contains the only confirmed habitat for the arroyo toad. The natural communities include: Sonoran creosote bush scrub, Sonoran mixed woody and succulent scrub, Sonoran cottonwood-willow riparian forest, desert fan palm oasis woodland, semi-desert chaparral, chamise chaparral, and interior live oak chaparral. The Conservation Area also provides a biological corridor under Interstate 10 along the Whitewater River and serves as a linkage between the San Bernardino Mountains and Snow Creek/Windy Point Conservation Areas (CVMSHCP, 2009).

The major water-related objectives for this conservation area are:

- Preserve the Little San Bernardino Mountains linanthus, triple-ribbed milkvetch, desert tortoise, Palm Springs pocket mouse and the associated ecological processes
- Preserve fluvial sand transport areas in the Desert Hot Springs, Palm Springs, and Riverside County areas
- Conserve Le Conte's thrasher, Coachella Valley Jerusalem cricket, and burrowing owl habitats
- Maintain existing fluvial sand transport along Mission Creek Channel

Long Canyon Conservation Area

The Long Canyon Conservation Area includes the 100-year floodplain and extends southwest from the Long Canyon flood control channel to the northern boundary of the Willow Hole Preserve at 20th Avenue. Mountain View Road is the conservation area's westernmost boundary. The entire conservation area is located within the Planning Area and contains approximately 810 acres. As described in Section 4.3.9 of the CVMSHCP, this conservation area does not provide core habitat for any species, however other conserved habitat has been noted for the Coachella Valley milkvetch, Coachella Valley Jerusalem cricket, desert tortoise, burrowing owl, Le Conte's thrasher, Coachella Valley round-tailed ground squirrel, Palm Springs pocket mouse and potentially the flat-tailed horned lizard. Natural communities include the Sonoran creosote bush scrub and the Sonoran mixed woody and succulent scrub. The major objective for this conservation area is to provide fluvial sand transport in flood conditions to the Willow Hole Preserve (CVMSHCP, 2009).

West Deception Canyon Conservation Area

Located north of the Indio Hills, the West Deception Canyon Conservation Area is a significant sediment transportation area between the Little San Bernardino Mountains and the Thousand Palms Canyon and the Coachella Valley Fringe-toed Lizard Preserve (CVFTL). The entire conservation area is located within the Planning Area and contains approximately 4,150 acres. While this conservation area does not provide core habitat for any covered species, it does contain conserved habitat for the Coachella Valley milkvetch, desert tortoise, Le Conte's thrasher, Coachella Valley round-tailed ground squirrel, and the Palm Springs pocket mouse. Natural communities listed in Section 4.3.12 of the CVMSHCP include the Sonoran creosote bush scrub and the Mojave mixed woody scrub (CVMSHCP, 2009).

The major water related objectives for this conservation area are:

- Maintain the natural erosion processes that provide sediment for the blowsand ecosystem
- Maintain existing fluvial sand transport in the West Deception Canyon

Indio Hills/Joshua Tree National Park Linkage Conservation Area

The Indio Hills/Joshua Tree National Park Linkage Conservation Area is bounded to the north by the Joshua Tree National Park, to the south by the Thousand Palms Conservation Area, to the east by includes the West Deception Canyon and to the east by the Desert Tortoise and Linkage Conservation Area. Of the total 13,410 acres, approximately 12,642 acres are within the Planning Area. Core habitat for the desert tortoise is included in this Conservation Area as described in Section 4.3.13 of the CVMSHCP. Other conserved habitat occurs here however the area is not large enough to maintain viable populations of species. Natural communities include Sonoran creosote bush scrub and Mojave mixed woody scrub. The Conservation Area provides a biological corridor between the Indio Hills and Joshua Tree National Park. This area is also classified as a contact zone between the Palm Spring pocket mouse and the little pock mouse. A separate biological corridor is located within the Pushawalla Canyon. The topographic Biological linkage between the National Park (5000') and the Indio Hills (near sea level) contributes to the climate-induced habitat and resulting biodiversity (CVMSHCP, 2009).

The major water related objectives for this conservation area are:

- Desert tortoise and Le Conte's thrasher habitat preservation
- Maintain the Little San Bernardino Mountain wash current capacity for fluvial sand transport

Desert Tortoise and Linkage Conservation Area

The Desert Tortoise Linkage Conservation Area is located between the Mecca Hills to the west and the Orocopia Mountains Wilderness/Joshua Tree National Park to the east. Interstate 10 divides this conservation area. Of the total 89,900 acres, approximately 2,308 acres are within the Planning Area. In addition to providing core habitat for its namesake, this area contains other conserved habitat for the Le Conte's thrasher, Coachella Valley round-tailed ground squirrel, the Palm Springs pocket mouse and certain migratory riparian birds. A detailed list of species can be found in Section 4.3.17 of the CVMSHCP. Natural communities include the Sonoran creosote bush scrub, Sonoran mixed woody and succulent scrub, and desert dry wash woodland.

The Conservation Area also provides a biological corridor under Interstate 10 and serves as a linkage between the Mecca Hills and Orocopia Mountain Wilderness with Joshua Tree Nation Park (CVMSHCP, 2009).

The major water related objectives for this conservation area are:

- Desert tortoise, Mecca aster, Orocopia sage, Le Conte's thrasher habitat preservation
- Maintain current capacity for fluvial sand transport in the dry desert wash woodland for riparian birds

Indio Hills Palms Conservation Area

The Indio Hills Palms Conservation Area includes the Whitewater River and its watershed north of Interstate 10. Of the total 14,170 acres, approximately 1,446 acres are within the Planning Area. Portions of the San Bernardino Mountains are a sand source for the Whitewater River fluvial sand transport system. This system is an essential ecological process for several species. The core habitat for this Conservation Area contains riparian birds, desert tortoise, and the triple-ribbed milkvetch. A complete list of species can be found in Section 4.3.14 of the CVMSHCP. Historically, this Conservation Area contains the only confirmed habitat for the arroyo toad. The natural communities include: Sonoran creosote bush scrub, Sonoran mixed woody and succulent scrub, Sonoran cottonwood-willow riparian forest, desert fan palm oasis woodland, semi-desert chaparral, chamise chaparral, and interior live oak chaparral. The Conservation Area also provides a biological corridor under Interstate 10 along the Whitewater River and serves as a linkage between the San Bernardino Mountains and Snow Creek/Windy Point Conservation Areas (CVMSHCP, 2009).

The major water related objectives for this conservation area are:

- Mecca aster and Le Conte's thrasher habitat preservation
- Conservation of natural communities: desert dry wash woodland (riparian birds), mesquite hummocks (riparian birds), and desert fan palm oasis woodland (southern yellow bat)
- Maintain current capacity for fluvial sand transport in the dry desert wash woodland for riparian birds

Thousand Palms Conservation Area

The Thousand Palms Conservation Area includes the CVFTL Preserve and the Indio Hills sand source/transport. This area includes the proposed Whitewater River Flood Control Project and is the hottest and driest area of the Coachella Valley floor. Of the total 25,900 acres, approximately 7,379 acres are within the Planning Area. The core habitat for this Conservation Area contains the Coachella Valley milkvetch, Coachella Valley giant sand-treader cricket, Coachella Valley fringe-toed lizard, flat-tailed lizard, Coachella Valley round-tailed ground squirrel and the Palm Springs pocket mouse and Mecca aster habitat. A complete list of species can be found in Section 4.3.11 of the CVMSHCP. Additionally, the Le Conte thrasher and burrowing owl conserved habitat occurs in this area. The natural communities include active desert dunes, active desert sand fields, mesquite hummocks, Sonoran creosote bush scrub, Sonoran mixed woody and succulent scrub, Sonoran cottonwood-willow riparian forest, desert dry wash woodland, and desert fan palm oasis woodland. The Conservation Area also provides biological corridors and linkages to the Willow Hole Conservation Area, Edom Hill Conservation Area, East Indio Hills Conservation Area, Indio Hills Palms Conservation and the Indio Hills/Joshua Tree National park Linkage Conservation Area. Desert bighorn sheep, bobcats, kit foxes searching for water, depend on the linkage from the National Park to the Indio Hills (CVMSHCP, 2009).

The major water related objectives for this conservation area are:

- Habitat preservation for the species listed above
- Sand source conservation for the maintenance of the blowsand ecosystem
- Maintain current capacity for fluvial sand transport for washes in the Indio Hills for the Thousand Palms Conservation Area.
- Conserve groundwater levels necessary to maintain refugia locations for desert pupfish and natural communities listed above

Edom Hill Conservation Area

Located between the Willow Hole Preserve and the Thousand Palms Conservation Area, the Willow Hole Conservation Area is includes portions of the Indio Hills. Of the total 9,090 acres, approximately 1,119 acres are within the Planning Area. This area does not encompass core habitat for any covered species, however several conserved habitat area located here including: Coachella Valley milkvetch, Mecca aster, Coachella Valley giant sand-treader cricket, Coachella Valley Jerusalem cricket, Coachella Valley fringe-toed lizard, flat-tailed horned lizard, Coachella Valley round-tailed ground squirrel and the Palm Springs pocket mouse. A complete list of species can be found in Section 4.3.10 of the CVMSHCP. The natural communities include desert sand fields, Sonoran creosote bush scrub, and Sonoran mixed woody and succulent scrub.

The Conservation Area provides linkages between Willow Hole and Thousand Palms Conservation areas for the above listed species as well as their predators (CVMSHCP, 2009).

The major water related objectives for this conservation area are:

- Habitat preservation for the species listed above
- Maintain current capacity for fluvial sand transport from Indio Hills
- Conserve sand source adjacent to the Thousand Palms Conservation Area

Willow Hole Conservation Area

The Willow Hole Conservation Area is bounded by the Upper Mission Creek/Big Morongo Canyon Conservation Area and the Long Canyon Conservation Area to the north, Edom Hill Conservation Area to the east. The southern edge is bounded by a connection of culverts under Interstate 10 to the Whitewater Floodplain Conservation Area. Of the total 5,600 acres, approximately 3,206 acres are within the Planning Area. The core habitat for this Conservation Area contains the Coachella Valley milkvetch, Coachella Valley fringe-toed lizard, Coachella Valley round-tailed ground squirrel and the Palm Springs pocket mouse. Long-term viability of the fringe-toed lizard requires movement between the wetter, cooler western portion of the conservation area with the hotter drier central and eastern portions. A complete list of species can be found in Section 4.3.8 of the CVMSHCP. Additionally, the Le Conte thrasher and burrowing owl conserved habitat occurs in this area. The natural communities include desert dunes, desert sand fields, mesquite hummocks, Sonoran creosote bush scrub, Sonoran mixed woody and succulent scrub, desert salt bush scrub, and desert fan palm oasis woodland. This area contains two of the largest natural communities in the entire MSHCP: mesquite hummocks and desert dunes. Groundwater levels, north of the fault dunes, is critical for the preservation of the mesquite hummocks here. In addition, the desert dunes natural communities are necessary for the fringe-toed lizard habitat and represents nearly 93% of desert dunes in the entire MSHCP.

The Conservation Area also provides biological corridors and linkages to the Willow Hole Conservation Area, Edom Hill Conservation Area, East Indio Hills Conservation Area, Indio Hills Palms Conservation and the Indio Hills/Joshua Tree National park Linkage Conservation Area. Desert bighorn sheep, bobcats, kit foxes searching for water, depend on the linkage from the National Park to the Indio Hills (CVMSHCP, 2009).

The major water related objectives for this conservation area are:

- Habitat preservation for the species listed above
- Conserve fluvial and Aeolian sand transport areas in Cathedral City and Riverside County.
- Maintain current capacity for fluvial sand transport in Mission Creek and Morongo Wash to Willow Hole/Edom Hill Reserve. Also maintain fluvial transport in Mission Creek Channel.
- Conserve mesquite hummocks and desert dunes

Whitewater Floodplain Conservation Area

The Whitewater Floodplain Conservation Area includes portions of the Whitewater River floodplain south of Interstate 10. This area contains habitat east and southeast of the CVFTL Preserve, west and east sides of the Gene Autry Trail, and south and east areas of CVWD’s spreading basins. Of the total 7,400 acres, approximately 1,241 acres are within the Planning Area.

The core habitat for this Conservation Area contains the Coachella Valley milkvetch, Coachella Valley giant sand-treader cricket, Coachella Valley fringe-toed lizard, Coachella Valley round-tailed ground squirrel and Palm Springs pocket mouse. A complete list of species can be found in Section 4.3.6 of the CVMSHCP. Historically, this Conservation Area contains the only confirmed habitat for the arroyo toad. The natural communities include various desert sand fields, Sonoran creosote bush scrub and Sonoran mixed woody and succulent scrub. After connecting with the San Gorgonio River, the Whitewater River provides fluvial sand transport to the Whitewater Floodplain Preserve.

The Whitewater River provides a natural biological corridor and linkage to the Snow Creek/Windy Point Conservation Area. As of the printing of the CVMSHCP, CVWD is designing a channel on the south side of Interstate 10 for Edom Wash and Willow Wash flows for sand transport and wildlife movement between Willow Hole and Whitewater Floodplain Conservation Areas (CVMSHCP, 2009).

The major water related objectives for this conservation area are:

- Habitat preservation for the species listed above

- Conserve desert sand fields in the City of Palm Springs and unincorporated sections of Riverside County
- Maintain Whitewater River floodplain's current capacity for fluvial sand transport

Stubbe and Cottonwood Canyons Conservation Area

The Stubbe and Cottonwood Canyons Conservation Area includes the northwest portion of Garnet Hill subbasin, north of Interstate 10 and west of Whitewater Canyon. This area also includes alluvial fans from Stubbe Canyon and Cottonwood Canyons. Of the total 9,840 acres, approximately 6,173 acres are within the Planning Area.

This conservation area contains the most dense population of desert tortoise in the entire MSHCP. Other species include the Coachella Valley milkvetch, Coachella Valley giant sand-treader cricket, Coachella Valley fringe-toed lizard, Coachella Valley round-tailed ground squirrel and Palm Springs pocket mouse. A complete list of species can be found in Section 4.3.6 of the CVMSHCP. Historically, this Conservation Area contains the only confirmed habitat for the arroyo toad. The natural communities include various desert sand fields, Sonoran creosote bush scrub and Sonoran mixed woody and succulent scrub. After connecting with the San Gorgonio River, the Whitewater River provides fluvial sand transport to the Whitewater Floodplain Preserve. However, when Colorado River water is diverted into the Whitewater River, sediment particles are trapped in the recharge basins and restrict the flow and affect sensitive habitat. This conservation area provides a biological corridor and linkage between the San Jacinto and Santa Rosa Mountains and the San Bernardino Mountains (CVMSHCP, 2009).

The major water related objectives for this conservation area are:

- Conserve Le Conte's thrasher nesting sites and burrowing owl burrows habitat.
- Conserve Sonoran cottonwood-will riparian forest and desert dry wash woodland for riparian birds.
- Conserve sand source areas in the San Bernardino Mountains for the blowsand ecosystem.
- Maintain Stubbe Canyon Wash's current capacity for fluvial sand transport.

Appendix D
Hot Water Maps

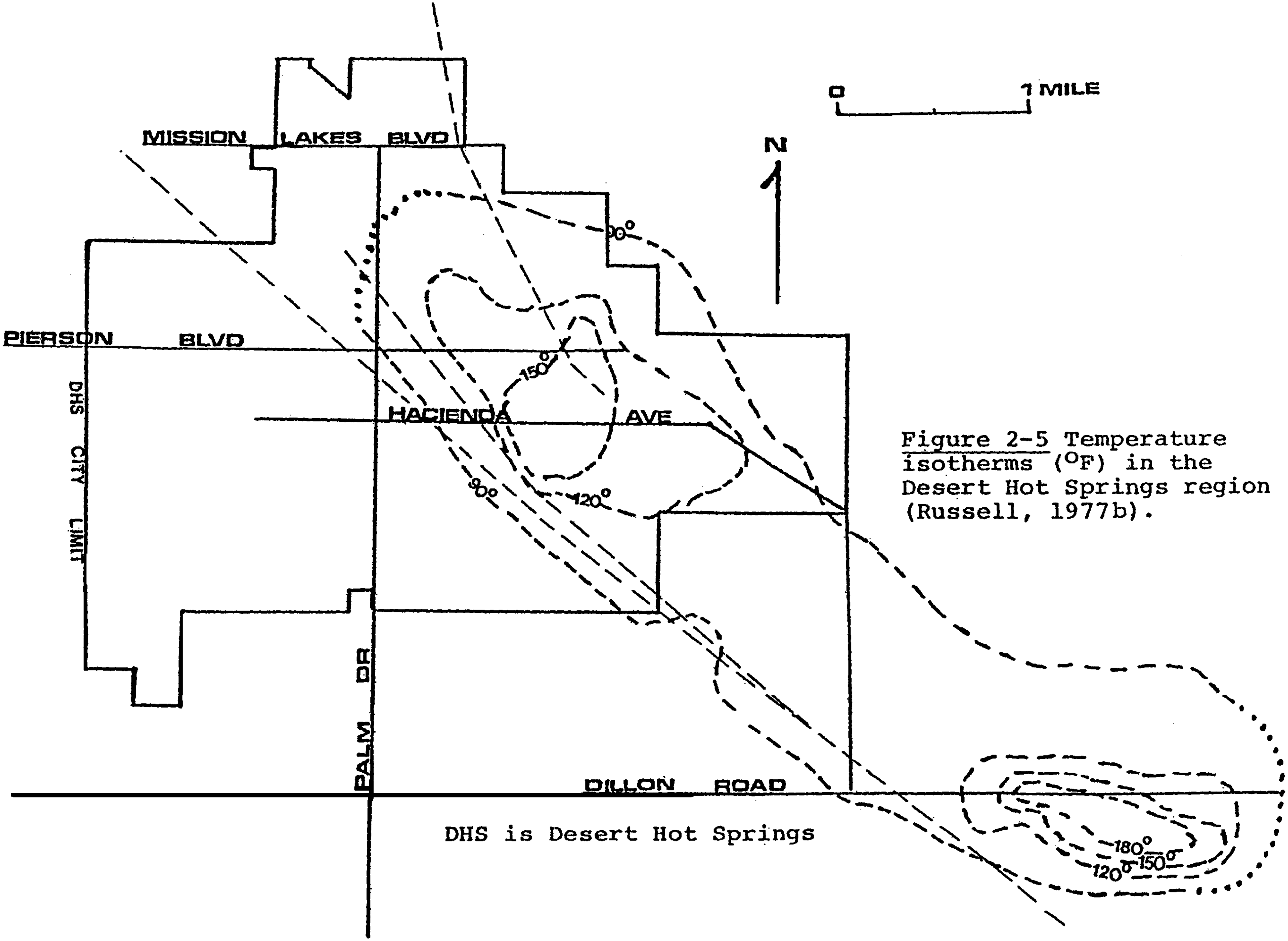
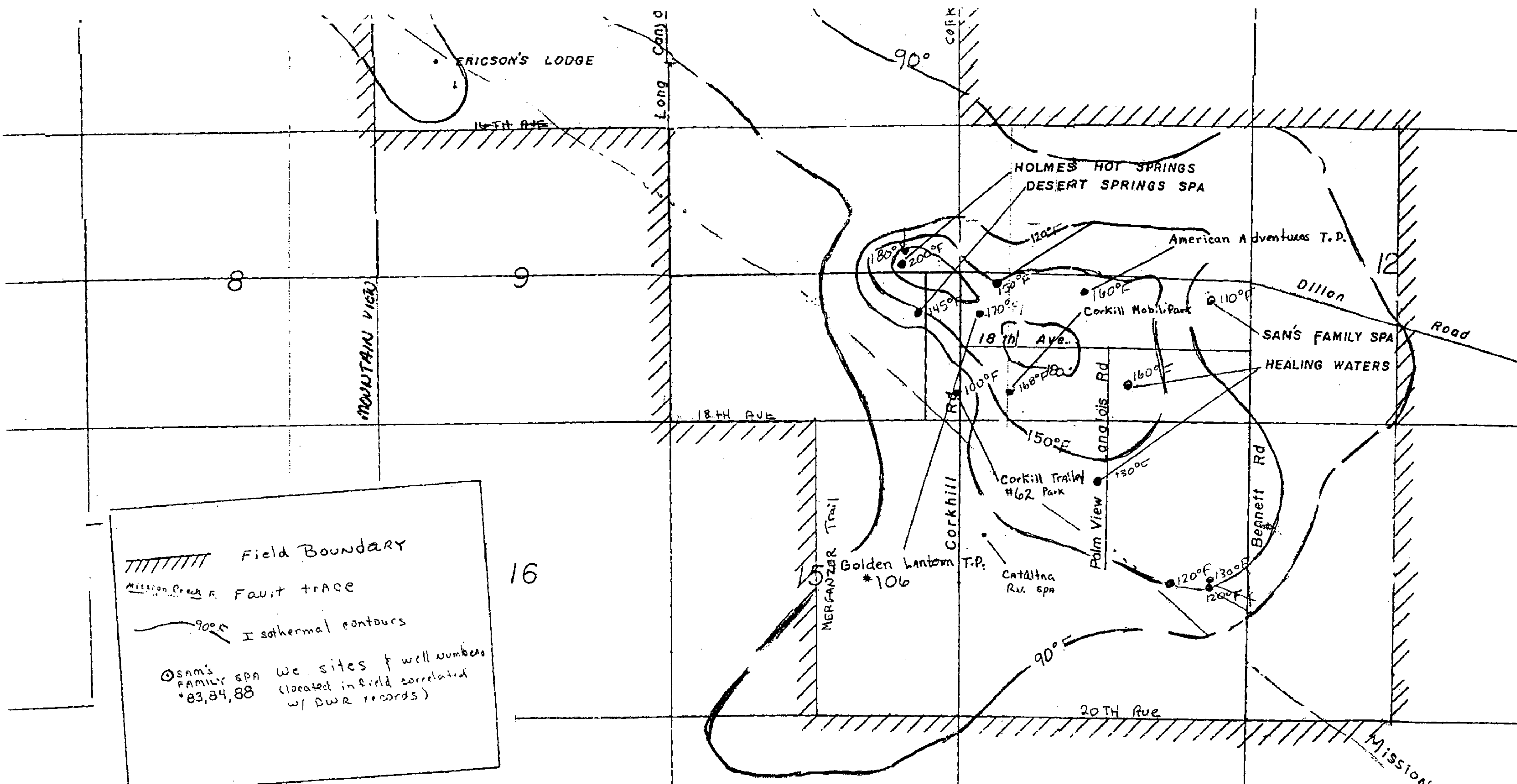


Figure 2-5 Temperature isotherms (°F) in the Desert Hot Springs region (Russell, 1977b).

DHS is Desert Hot Springs

The resource temperature is higher in the Dillon Road area than those in Desert Hot Springs.

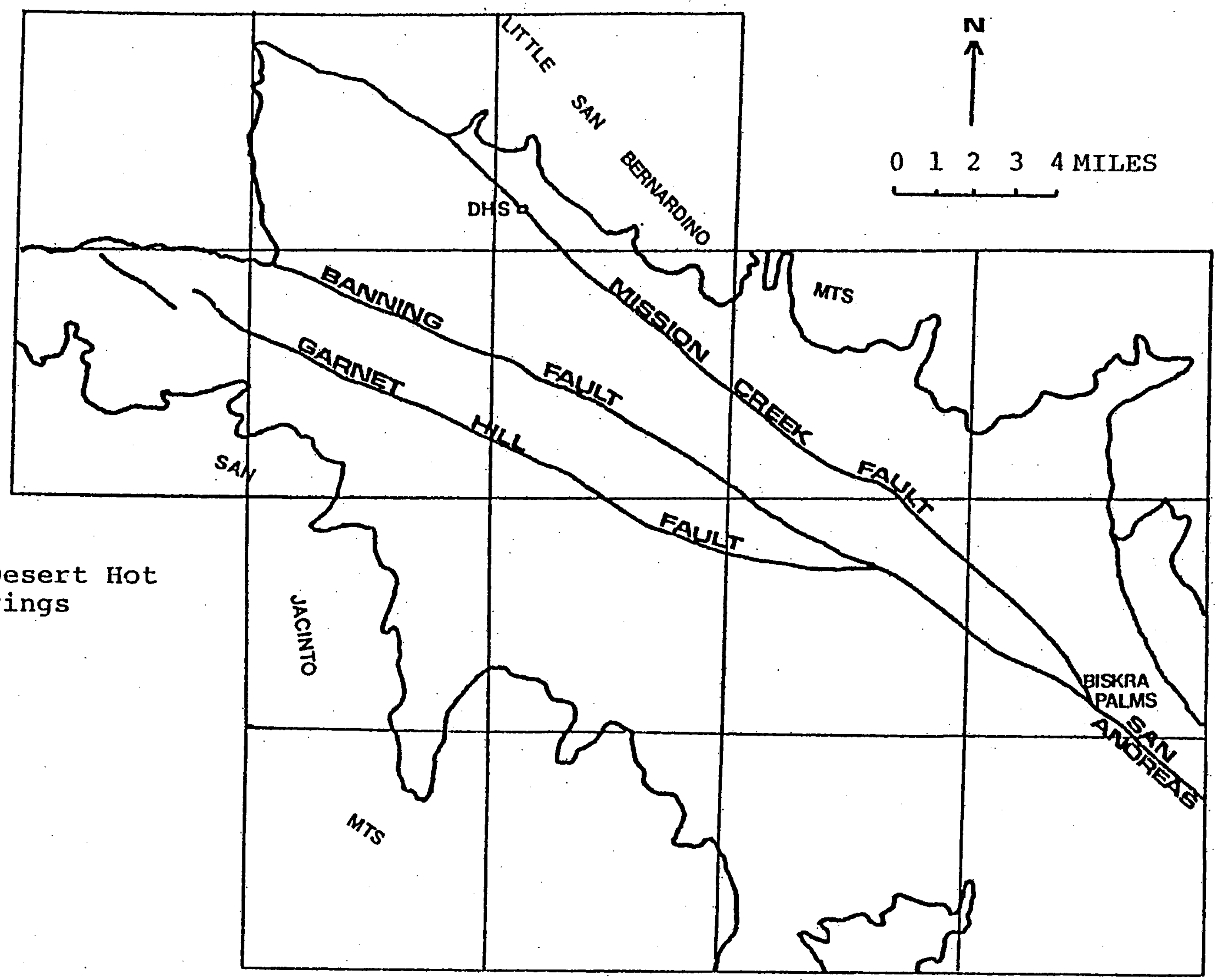


This area is shown outlined in yellow on the attached map. Faults are shown as dashed green lines and isothermal contours of the productive zone are shown as red lines. Well sites are approximately located on this map and are shown as red dots. Corresponding well numbers are also shown. This area is contained within the U.S.G.S. Desert Hot Springs and Seven Palms Valley 15-minute Quadrangles.

22 23 24

Desert Hot Springs

C.C. 5/21/87



DHS is Desert Hot Springs

Figure 2-2 Structure of the upper Coachella Valley (DWR, 1964).

Appendix F
Financing Options

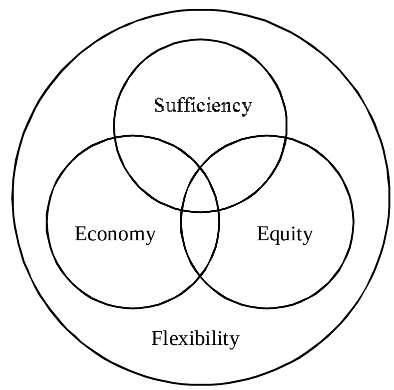
This section describes various financing sources available for the implementation of the Mission Springs/Garnet Hill Water Management Plan (WMP). The purpose of this section is to identify potential options for financing capital projects identified in the WMP that might be pursued by one of the three agencies, either as an individual agency, or jointly, to fund capital projects. No prioritization, ranking, or economic evaluation has been performed for any of these financing options.

FINANCE OBJECTIVES

Successful financing of large capital programs consistently depends on optimizing three financing objectives:

- Produce capital in sufficient amounts when needed;
- Produce capital at lowest cost; and
- Produce capital with greatest equity among customers, including the principle that growth-pay-for-growth.

Because the implementation of the Water Management Plan will involve program refinement over the years, financial planning should also have flexibility to accommodate changes in law, system requirements, capital requirements, constituency requirements, and the methodologies available to the water management group to generate funds.



Financing Objectives

FUNDING SOURCES

There are several possible funding sources available for the successful implementation of the WMP, including pay-as-you-go, Drinking Water State Revolving Fund Loan Program, general obligation bonds, revenue bonds, Certificates of Participation, commercial paper (short term notes), assessment bonds, Mello-Roos Community Facilities Act, developer impact or connection fees, replenishment assessment, and other state grants and loans. These methods are further described below.

Pay-As-You-Go

Pay-as-you-go funding requires that an agency (or group of agencies) have adequate revenue generation or reserves to fund capital improvements and would be funded by water rates or more of one the Plan participants. Reserves can be built up in advance to pay for future facility requirements by raising fees prior to the need for capital facilities. The funds can provide for either all or part of the capital costs. Using pay-as-you-go funding reduces the overall costs of capital facilities by avoiding the costs associated with arranging financing (bond issue costs, legal and financial advisers, etc.) as well as interest on borrowed money.

Pay-as-you-go funding often leads to inequities since customers today are paying the full costs for facilities that will provide benefits to future customers. To achieve a more equitable sharing of the cost burden, other funding sources usually are utilized in addition to pay-as-you-go, due to the differences in timing between accumulation of reserves and the capital spending requirements.

Drinking Water State Revolving Fund Loan Program

Through a jointly financed program between the federal EPA and the State of California, the Drinking Water State Revolving Fund (DWSRF) Loan Program can provide low interest loans to water utilities to help pay for improvements and are loaned to a single water agency. Under the program, loans are issued for up to 20 years at a fixed interest rate equal to 50 percent of the State's average interest rate paid on general obligation bonds sold during the previous calendar year. Repayment under the program must begin within six months after completion of the project.

Generally, loans are limited to $20 million for any one project, with a cap of $30 million available to a single water utility in a single fiscal year. These amounts may be modified if it is determined that excess funds are available that cannot otherwise be obligated before the EPA obligation deadline.

Loans are granted based on a set of ranking criteria that give highest priority to projects that resolve deficiencies having direct health implications. Also high on the priority list is insufficient water source capacity that results in water outages. Funds are allocated to applicants based on the priority categories until all funds are obligated. Since the program began in May 1998 through March 30, 2010, 2010 CDPH has closed 207 loans totaling $895 million cumulatively (USEPA, 2010).

General Obligation Bonds

General Obligation (G.O.) bonds are backed by the full faith and credit of the issuer. As such, they also carry the pledge of the issuer to use its taxing authority to guarantee payment of interest and principal. The issuer's general obligation pledge is usually regarded by both investors and ratings agencies as the highest form of security for bond issues.
Because G.O. bonds are viewed as having lower risk than other types of bonds, they are usually issued at lower interest rates, have fewer costs for marketing and issuance, and do not require the restrictive covenants, special reserves, and higher debt service coverages typical of other types of bond issues. However, issuance of G.O. bonds requires electoral approval by two-thirds of the voters, and election campaigns can be very expensive.

The ultimate security for G.O. bonds is the pledge to impose a property tax to pay for debt service. G.O. bonds are typically issued by a single water agency. Use of property taxes, assessed on the value of property, may not fairly distribute the cost burden in line with the benefits received by the customers. While the ability to use the taxing authority exists, the water agency seeking G.O. bonds could choose to fund the debt service from other sources of revenues, such as water rates or from development impact fees. Use of development impact fees to pay the debt service would provide the most equitable matching of benefits with costs, since debt service on projects that benefit primarily new customers would be paid from fees collected from those new customers.

G.O. bonds are attractive due to lower interest rates, fewer restrictions, greater market acceptance, and lower issuing costs. However, the difficulties in securing a two-thirds majority of the qualified electorate make them less attractive than other alternatives, such as revenue bonds and certificates of participation.

Revenue Bonds

Revenue bonds are long-term debt obligations for which the revenue stream of the issuer is pledged for payment of principal and interest. Because revenue bonds are not secured by the full credit or taxing authority of the issuing agency, they are not perceived as being as secure as general obligation (G. O.) bonds. Since revenue bonds are perceived to have less security and are therefore considered riskier, they are typically sold at a slightly higher interest rate (frequently in the range of 0.5 percent to 1.0 percent higher) than the G.O. bonds. The security pledged is that the system will be operated in such a way that sufficient revenues will be generated to meet debt service obligations.

Typically, issuers provide the necessary assurances to bondholders that funds will be available to meet debt service requirements through two mechanisms. The first is provision of a debt service reserve fund or a surety. The debt service reserve fund is usually established from the proceeds of the bond issue. The amount held in reserve in most cases is based on either the maximum debt service due in any one year during the term of the bonds or the average annual debt service over the term. The funds are deposited with a trustee to be available in the event the issuer is otherwise incapable of meeting its debt service obligations in any year. The issuer pledges that any funds withdrawn from the reserve will be replenished within a short period, usually within a year.

The second assurance made by the borrower is a pledge to maintain a specified minimum coverage ratio on its outstanding revenue bond debt. The coverage ratio is determined by dividing the net revenues of the borrower by the annual revenue bond debt service for the year, where net revenues are defined as gross revenues less operation and maintenance expenses. Based on this, the perceived risk minimum coverage ratios are usually within the range of 1.1 to 1.3, meaning that net revenues would have to be from 110 percent to 130 percent of the amount of revenue bond debt service. To the extent that the borrower can demonstrate achievement of coverage ratios higher than required, the marketability and interest rates on new issues may be more favorable.

Issuance of revenue bonds may be authorized pursuant to the provisions of the Revenue Bond Law of 1941. Specific authority to issue a specified amount in revenue bonds requires approval by a simple majority of voters casting ballots, and would typically be limited to a single agency seeking a revenue bond. To limit costs (and risks) associated with seeking approval through elections, authorization is typically sought for the maximum amount of bonds that will be needed over the planning period. Upon receiving authorization, the agency actually issues bonds as needed, up to the authorized amount.

Certificates of Participation

Certificates of Participation (COPs) are a form of lease-purchase financing that has the same basic features of revenue bonds except they do not require an election. COPs represent participation in an installment purchase agreement through marketable notes, with ownership remaining with the agency. COPs typically involve four different parties — the public agency as the lessee, a private leasing company as the lessor, a bank as trustee and an underwriter who markets the certificates. Because there are more parties involved, the initial cost of issuance for the COP and level of administrative effort may be greater than for bond issues. Due to the widespread acceptance of COPs in financial markets, COPs are usually easier to issue than other forms of lease purchase financing, such as lease revenue bonds.

The certificates are usually issued in $5,000 denominations, with the revenue stream from lease payments as the source of payment to the certificate holders. From the standpoint of the agency as the lessee, any and all revenue sources can be applied to payment of the obligation, not just revenues from the projects financed, thereby providing more flexibility. Unlike revenue bonds, COPs do not require a vote of the electorate and have no bond reserve requirements, although establishing a reserve may enhance marketability. In addition, since they are not technically debt instruments, COP issues do not count against debt limitations for the agency.

While interest costs may be marginally higher than for revenue bonds, a COP transaction is a flexible and useful form of financing that should be considered for financing of the WMP projects. COP transactions would be typically limited to a single water agency obtaining a COP for a specific project.

Commercial Paper (Short Term Notes)

To smooth out capital spending flows without the costs of frequent bond issues, many public agencies have moved to use of short-term commercial paper debt. As with bonds issued by the public agencies, commercial paper instruments are typically tax-exempt debt, thus providing a lower interest cost to the agency than would prevail if the commercial paper were taxable. Commercial paper is usually issued for terms ranging from as short as a few days to as long as a year depending on market conditions. As the paper matures, it is resold (“rolled over”) at the then prevailing market rate. Consequently, the paper can in effect “float” over an extended time, being constantly renewed. The short-term rates paid on commercial paper are frequently much lower than those on longer term debt.

The primary advantage in using commercial paper is to provide interim funding of capital projects when revenues and reserves are insufficient to fund capital projects fully. In this scenario either (1) the total amount needed is too small to justify a bond issue or (2) the funds are not currently available, but will be building up (within two to five years) to a level sufficient to repay the borrowing. Commercial paper funding can provide the “bridge” to smooth out the fund flows. As with other forms of debt funding, there are costs associated with commercial paper issuance. Many of the costs are similar to those of issuing bonds. With commercial paper, however, there is often a requirement that a line of credit be established that will guarantee payment of the commercial paper should it not be possible to roll the paper over at any given maturity date. The cost of the credit line is usually based on the full amount of commercial paper authorized, whether issued or not, so the total commercial paper authorization must be carefully determined to maximize the benefit while minimizing costs.

While the interest rate for a particular commercial paper issue is fixed until its maturity, the short maturities and frequent rollovers of the debt effectively make commercial paper much like a long-term variable rate bond. Consequently, there is some exposure to interest rate risk in using commercial paper as a funding mechanism. However, unless inflationary pressure is great, the risk is relatively low.

The strategy now being used by a number of water agencies is to issue commercial paper up to the authorized limit, then pay-off the commercial paper outstanding through a revenue bond issue. The water agency gets the benefit of low short-term interest rates while still being able to convert to long term fixed rates through the bond issue. This is an appropriate strategy during relatively stable interest rate environments, but not when interest rates are rising or expected to rise substantially.

Commercial paper programs are typically limited to a single water agency, and the agency pursuing commercial paper will need to confer with their legal and financial advisors to determine if sufficient authorization currently exists to implement a commercial paper program.

Property Related Debt

For many years, California has allowed a form of financing where the properties that benefit from projects pay debt service in proportion to the benefit received. The California Streets and Highways Code allows bonds to be sold under the 1911 Improvement Act or 1913 Municipal Improvement Act, under the procedure of the 1913 Act and the 1931 Majority Protest Act. Mello Roos Community Facilities District Act (1982) financing is a variation of this theme. Assessment financing, as the method was called, is useful for allocating shares of cost and debt service to properties within specific areas (called assessment districts) within which all of the financed project’s benefit accrued and is typically used for smaller areas to finance specific projects. Although the methods still are legal, the voting requirement of the Tax Payers’ Right to Vote Act (Proposition 218) has made the procedure less attractive.

Private Sector Equity

Some utilities find it convenient to enter into agreements with a private sector service provider to perform a certain well-defined functions. The service provider provides the assets as well as human resources, materials, supplies and other costs of business and includes those costs in the amount charged to the utility. This procedure becomes, *de facto*, a financing technique for the utility in that the capital cost of the assets are financed by the private sector service provider since the assets are owned by it. The financing is not always less expensive—the private firm may finance under different terms, including paying income taxes. The specifics can depend much on the firm’s other portfolio aspects–but the method does reduce the capital requirement to be financed by the utility and may for greater flexibility and creativity than other financing options.

Specific projects for engaging a private sector equity participant have not been identified. Further, any cost savings associated with this approach might depend on the specific projects, so this approach is not considered further in this financing plan. Again, this method can be a valuable tool for application in certain situations and should be considered when appropriate.

Developer Impact or Connection Fees

Developer impact fees or connection fees are commonly used to finance water system extensions and to recover previous facility costs that benefit future growth. The use of the developer fees to recover facility costs, already incurred or planned, that are necessary to serve new customers is appropriate. The level for the developer fees is determined by the overall cost level necessary to support growth, the allocation of these costs to the various benefit zones, the amount of fees already collected from new connections, and the number of new connections expected in each of the benefit zones. Each individual water agency can set connection fees for various components of new water connections such as water supply, storage, transmission and distribution pipelines.

Replenishment Assessment Charge

Sections 31630 to 31639 of the California Water Code (Code) authorize CVWD to levy and collect a Replenishment Assessment Charge (RAC) for the purpose of replenishing groundwater supplies within its areas of jurisdiction. DWA's enabling legislation has essentially the same language (California Water Code Appendix Chapter 100 – Desert Water Agency Law). The RAC is a monetary charge that is uniformly applied to extractions of groundwater within certain specified geographic boundaries (areas of benefit) for repayments of an imported or recycled water supply purchased to supplement naturally existing water supplies. Charges for the water supply are limited to certain specified costs. DWA currents collects the RAC from all pumpers within its defined area of benefit of the Mission Creek subbasin who pump greater than 10 acre-ft. CVWD currents collects the RAC from all pumpers within its area of benefit of the Mission Creek subbasin who pump greater than 25 acre-ft. The RAC is based on the amount of water produced per year. The RAC might be a viable option for funding some of the projects identified in the MSGH WMP and would be implemented by DWA and CVWD.

Water Recycling Funding Program

Water Recycling Funding Program of the State Water Resources Control Board (SWRCB) provides funding assistance for the planning, design and construction of water recycling projects that will help alleviate the demand on state or local potable water supplies. The mission of the Water Recycling Funding Program (WRFP) is "to promote the beneficial use of treated municipal wastewater (water recycling) in order to augment fresh water supplies in California by providing technical and financial assistance to agencies and other stakeholders in support of water recycling projects and research." The WRFP is funded through Proposition 50, Proposition 13, and the State Revolving Fund (SRF) Loan Program.

It is understood that the funds for the Proposition 50 program are currently fully subscribed to but applications are still being accepted in anticipation of the 2012 Water Bond. Funding is currently available from the SWRCB for Recycled Water Planning Grants for recycled water planning studies for a 50 percent matching grant, up to $75,000. WRFP funding assistance would be obtained by a single water agency.

Integrated Regional Water Management Plan (IRWMP) Grants

California DWR has a number of IRWM grant program funding opportunities. Current IRWM grant programs include: planning, implementation, and stormwater flood management. DWR's IRWM Grant Programs are managed within DWR's Division of IRWM by the Financial Assistance Branch with assistance from the Regional Planning Branch and regional offices (IRWMP website). The funding provided under this program is through Proposition 50, Proposition 84, and Proposition 1E. The agencies participating in this Plan currently are pursuing IRWM grants through the Coachella Valley Regional Water Management Group (CVRWMG); the likelihood of obtaining grants improve for regional projects benefitting multiple stakeholders.

Federal Funding

Federal funding for recycled water projects is available through the U. S. Bureau of Reclamation, Title XVI Program. The Title XVI Program makes funds available to eligible projects (water reclamation and reuse of municipal, industrial, domestic and agricultural wastewater, and naturally impaired ground and surface waters, and for design and construction of demonstration and permanent facilities to reclaim and reuse wastewater) in the form of grants. The Program funds up to 25 percent of the total project cost. U. S. Army Corp of Engineers (USACE) funding is available, for flood damage reduction, aquatic system restoration, and certain eligible municipal & industrial water supply projects. This funding is through USACE's Civil Works Program and projects under this program are financed upfront by the Federal government with 100 percent of the cost to be repaid with interest over a period of 30-50 years. USACE funding is also available to certain rural and small communities to fund water supply projects via USACE's Environmental Infrastructure authorizations. Projects covered under this program are typically design and construction of drinking water and wastewater infrastructure, surface water protection and development. Financing under the environmental infrastructure authorizations is typically 75 percent federal and 25 percent non-federal.

2012 Water Bond

Potential future funding might be available through other state implemented bond measures such as the 2012 California Water Bond. The measure, also known as the Safe, Clean, and Reliable Drinking Water Supply Act of 2012 is on the November 6, 2012 ballot in California as a legislatively-referred bond act. The bond measure if passed will allow the state government to borrow $11.1 Billion to overhaul the state's water system and includes funding for drought relief projects, disadvantaged communities, integrated regional water management projects, water storage projects, groundwater protection and cleanup, ecosystem restoration, and water recycling and advanced treatment technology projects. The water management group should explore the possibility of securing funding through this measure if it is passed in 2012.