MISSION CREEK/GARNET HILL

Water Management Plan
Final Report
January 2013

CV WATER DISTRICT

DESERT WATER

MSWD Mission Springs Water District

MWH

Mission Creek and Garnet Hill Subbasins Water Management Plan

Final Report

January 2013

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BACKGROUND

Water supply is critical to civilization especially in a desert region. 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 in Riverside County, California. These subbasins are located within the northwestern portion of the hot, arid Colorado Desert sub-region of the Sonoran Desert. The Mission Creek and Garnet Hill Subbasins have been important sources of potable water supply to the City of Desert Hot Springs and surrounding communities. Since the 1940s, the Desert Hot Springs region has been known as a tourist destination with its small spa hotels supplied by hot mineral water from the Desert Hot Springs Subbasin.

Continued pumping of the groundwater from the Coachella Valley in excess of natural recharge resulted in steadily declining groundwater levels since the 1950s. To control this water level decline, the Coachella Valley Water District (CVWD) and Desert Water Agency (DWA) with the support of the Mission Springs Water District (MSWD) embarked on a groundwater replenishment program in 2002 using imported water. Additional water management activities have been implemented since that time.

Participating Agencies

CVWD, DWA and MSWD are the principal water agencies in the Mission Creek and Garnet Hill subbasins. **Table ES-1** summarizes the statutory authority of each agency within its service area.

Table ES-1
Statutory Authority of Participating Agencies

Statutory Authority	CVWD	DWA	MSWD
SWP Contractor (imported water)	💧	💧	
Colorado River Contractor (imported water)	💧		
Groundwater Replenishment and Replenishment Assessments	💧	💧	
Retail Municipal Water Purveyor	💧	💧	💧
Irrigation Water Purveyor	💧		
Wastewater Management	💧	💧	💧
Recycled Water	💧	💧	💧
Flood Control and Drainage	💧		

Purpose and Need

Recognizing the need for additional water supplies, 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. To avoid the estimated $150 million cost to construct a pipeline to convey SWP water into the Valley in the 1970s (now about $1 billion), 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 Colorado River Aqueduct (CRA) in exchange for CVWD's and DWA's SWP water. Deliveries of SWP Exchange water to the Whitewater River subbasin commenced in 1973. Studies to deliver SWP water to the Whitewater River and Mission Creek subbasins were initially performed in the early 1960s. 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 CRA and water deliveries began.

In October 2003, MSWD filed action in the Superior Court of the State of California against DWA and CVWD seeking a writ of mandate, declaratory relief for prescriptive and appropriative water rights, declaratory and injunctive relief for a physical solution of a groundwater basin and challenging the validity of the replenishment assessment. In December 2004, MSWD, DWA and CVWD reached an agreement to settle the litigation. Among other things, the settlement agreement required the formation of a Management Committee consisting of the general managers of each agency and preparation of a water management plan for the Mission Creek and Garnet Hill subbasins. This WMP was prepared pursuant to that agreement. The purpose of this Water Management Plan (WMP) is to describe existing water management programs, evaluate potential alternative management strategies and recommend additional programs with the goal of ensuring that water resources of these subbasins are sustained and protected in the future.

Mission Statement

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

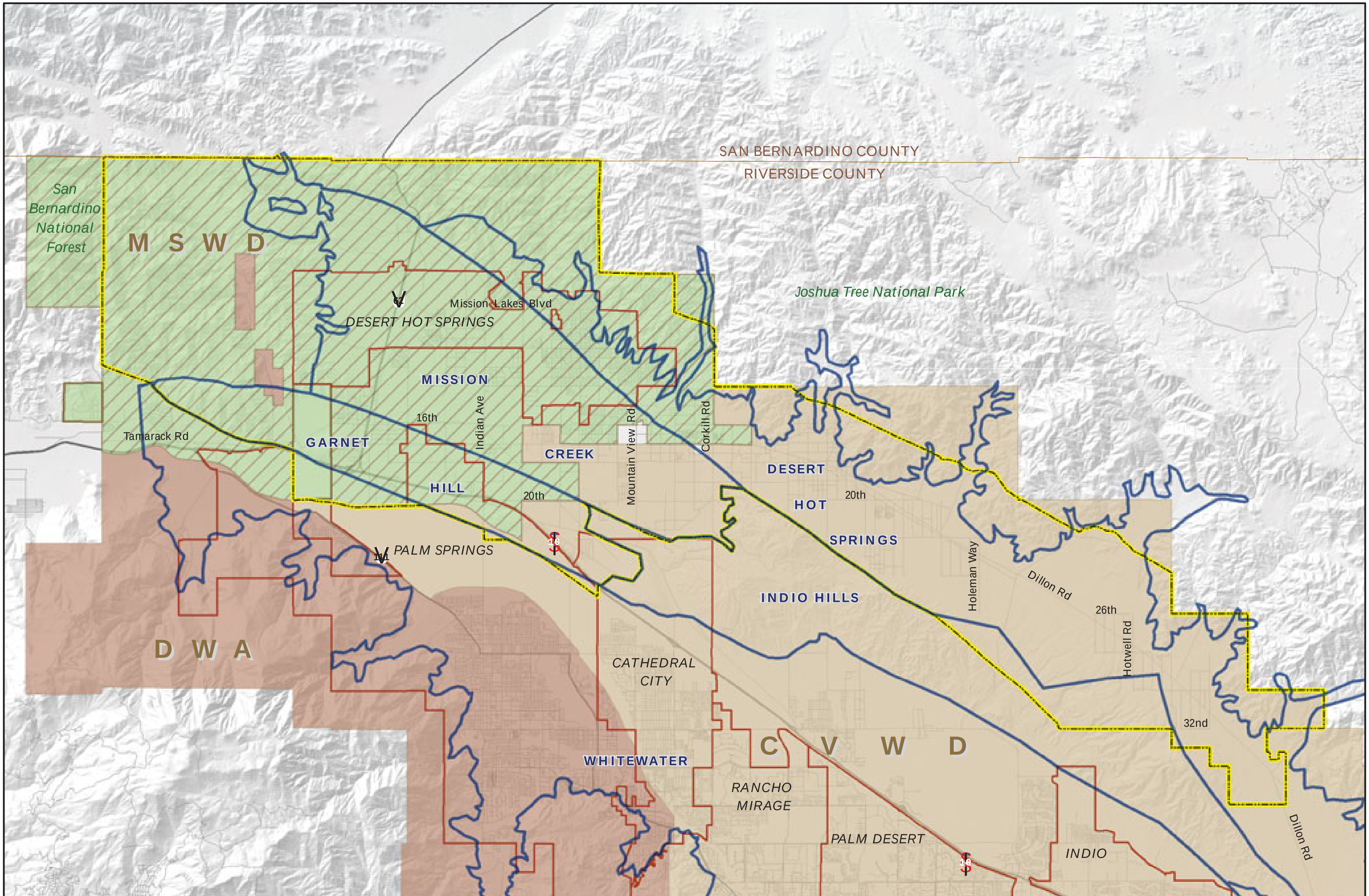
> *The purpose of the Mission Creek and Garnet Hill Water Management Plan is to manage the water resources to meet demands reliably and protect water quality in a sustainable and cost-effective manner.*

Description of Area

The Planning Area for this WMP consists of CVWD's and MSWD's service areas that receive groundwater from the Mission Creek and Garnet Hill subbasins and is shown on **Figure ES-1**. In addition to the above-mentioned areas, portions of MSWD and CVWD that are likely to use groundwater from the Mission Creek and Garnet Hill subbasins in the future are included in the Planning Area.

PLANNING ENVIRONMENT AND WATER DEMANDS

Population, land use and socio-economic trends in the Planning Area may affect water requirements in the Mission Creek and the Garnet Hill subbasins.



Key to Features

- Planning Area
- Roads
- Counties
- Groundwater Subbasin
- City Boundary
- DWA - Desert Water Agency
- CVWD - Coachella Valley Water District
- No Agency
- MSWD - Mission Springs Water District
- MSWD/DWA Joint Authority

0 1 2 4 Miles

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

Date: January 2013

Planning Area

Figure ES-1

MWH

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Population

The population of the Planning Area is estimated to be 44,600 based on the 2010 Census data. The Riverside County Center for Demographic Research (RCCDR) is tasked with developing growth forecasts for the County. The current growth forecast is designated the Riverside County Projects 2010 (RCP-10) growth forecast. This forecast covers the period of 2010 through 2035 and is linearly extrapolated to 2045 for this plan as shown on **Figure ES-2**.

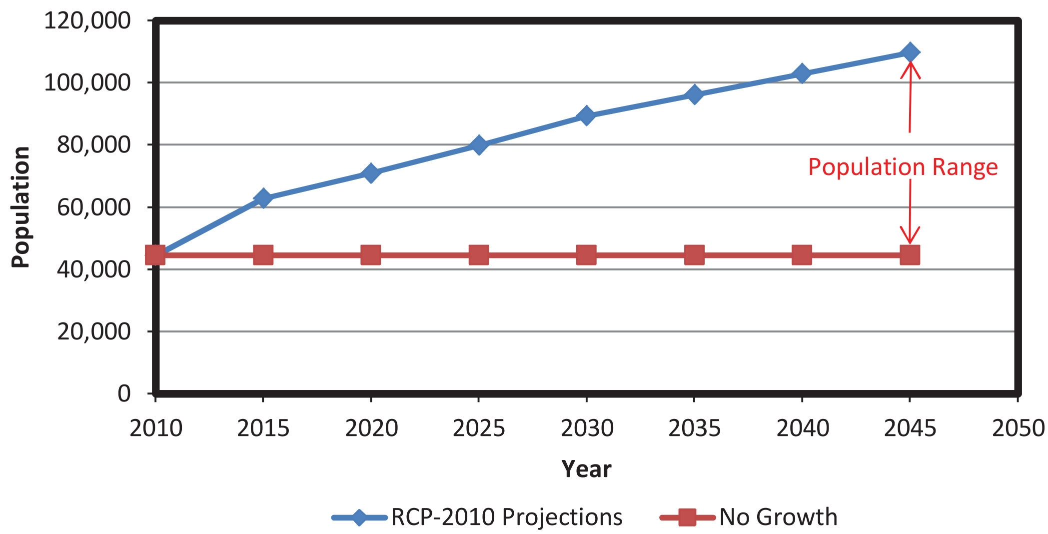

Figure ES-2
Projected Population for the Planning Area

Based on these projections, the Planning Area population is estimated to increase to approximately 110,000 people by 2045, an increase of 65,000 between 2010 and 2045. 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 four years. It is anticipated that the Planning Area will have a similar slow-paced recovery.

Land Use

Land use within the Planning Area is 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. Although the growth forecasts 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 and incorporated in their respective General Plans.

Water Demands

Water demands in the Planning Area have increased significantly over the past 35 years. Demand peaked in 2006 at 17,751 acre-ft/yr[1] and has since declined to 14,533 acre-ft/yr in 2011 because of the recession and conservation efforts. Water demand is projected to increase as shown on **Figure ES-3** due to several factors. Land development and population growth are expected to cause the greatest increase in water demand. This growth is expected to result in three additional golf courses in the planning area. In addition, water use for power plant cooling is expected to increase. All of these factors could result in water demands of 37,700 acre-ft/yr by 2045.

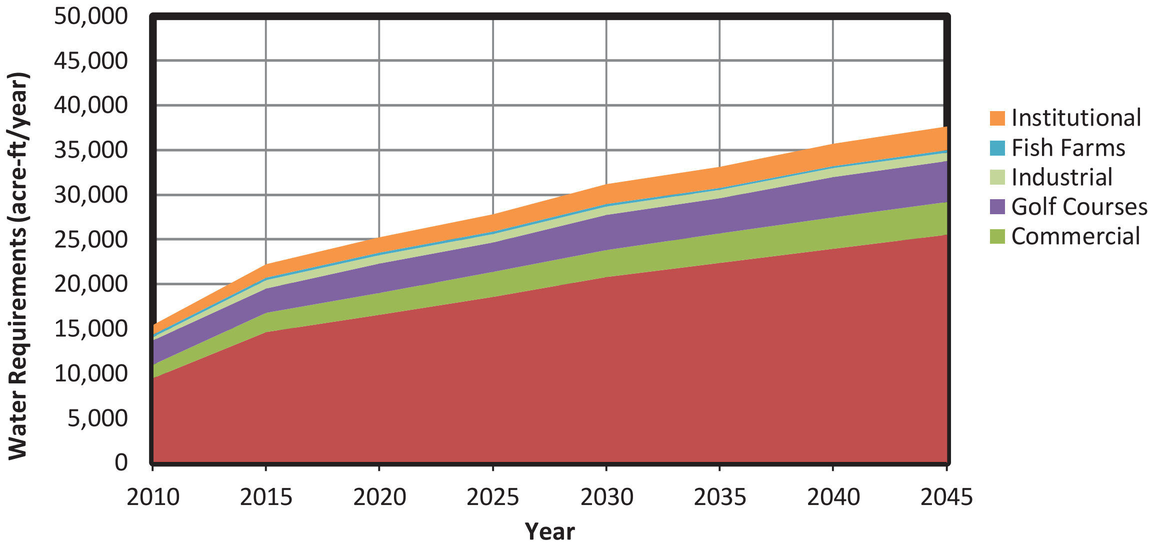

Figure ES-3
Projected Water Demand

WATER RESOURCES

Water supplies for the Planning Area consist of surface water that naturally replenishes the groundwater basins, groundwater extracted from wells and imported water from the State Water Project (SWP) that is exchanged for Colorado River water from the Metropolitan Water District of Southern California's (Metropolitan's) Colorado River Aqueduct (CRA). A detailed description of the water resources is presented in Section 4.

Surface Water

Surface water flow in the Planning Area consists of ephemeral or intermittent streams that originate in the San Bernardino and Little San Bernardino mountains. Mission Creek is the only stream that flows to the valley floor on a relatively consistent basis, but the stream usually disappears underground a short distance from its entrance into the Planning Area.

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

Groundwater

The Coachella Valley Groundwater Basin extends from San Gorgonio Pass on the north to the Mecca Hills and the Salton Sea on the south. The Basin is bounded on the east by the San Bernardino and Little San Bernardino Mountains and on the west by the Santa Rosa and San Jacinto Mountains. Geologic faults that cross the valley form partial barriers to groundwater flow and interrupt the overall flow of groundwater in the valley, which occurs from northwest to southeast. The Mission Creek and Garnet Hill subbasins are separated by these faults.

Mission Creek Subbasin

The Mission Creek subbasin (Basin No. 7-21.02 in DWR Bulletin 118, 2003) is located in the northwestern Coachella Valley in the north-central portion of Riverside County, California. The Mission Creek Fault and the Banning Fault form the northern and southern boundaries of the subbasin, respectively. Groundwater production from this subbasin is principal source of water supply for the Planning Area. Groundwater levels throughout the subbasin declined until about 2002 when imported water recharge commenced. Since that time, water levels near the recharge facility have increased significantly. Water level declines in wells farthest from the recharge facility began to stabilize around 2008 due to normal and advanced recharge water deliveries coupled with reduced pumping and are beginning to show slight increases.

Garnet Hill Subbasin

The area between the Garnet Hill Fault and the Banning Fault is named the Garnet Hill subbasin[2]. Groundwater production is relatively low in Garnet Hill subbasin and is not expected to increase significantly in the future due to relatively low well yields compared to those in the Mission Creek subbasin. Water levels in the western and central portion of the subbasin show response to recharge from the Whitewater River Recharge Facility while levels are relatively flat in the eastern portion of the subbasin. The lack of wells in the subbasin limits the geologic understanding of how this subbasin operates relative to the Mission Creek and Whitewater River subbasins.

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 Joshua Tree National Park. DWR Bulletin 118 (2003) has designated this subbasin as No. 7-21.03. The water from this subbasin is used for its thermal and mineral qualities but is not a suitable source of potable groundwater use due to high salinity. This WMP does not address water supplies from the Desert Hot Springs subbasin although parts of the Planning Area overlie the Desert Hot Springs subbasin.

[2] DWR Bulletin 118 (2003) considered the Garnet Hill subbasin to be part of the Whitewater River (Indio) subbasin.

Whitewater River (Indio) Subbasin

The Whitewater River subbasin, designated the Indio Subbasin (Basin No. 7-21.01) in DWR Bulletin No. 118 (2003), underlies the major portion of the Valley floor and encompasses approximately 400 square miles. The Whitewater River subbasin extends southeast approximately 70 miles to the Salton Sea. The Whitewater River subbasin is adjacent to the Garnet Hill subbasin, separated by the Garnet Hill Fault. This subbasin is the principal source of groundwater supply to most of the Coachella Valley with total production of about 328,000 acre-ft/yr in 2011[3]. This subbasin is the subject of a separate water management plan initially prepared by CVWD in 2002 and updated in 2012 (CVWD, 2012).

Imported Water

CVWD and DWA use imported water supplies to recharge groundwater supplies in the Planning Area by exchanging their SWP water allocations for CRA water. Initially, CVWD and DWA had SWP Table A Amounts[4] of 23,100 and 38,100 acre-ft/yr respectively. Since 2003, through a series of water transfers, the combined Table A Amount has increased to 194,100 acre-ft/yr effective in 2010. Average SWP delivery reliability is currently estimated to be 60 percent of Table A Amounts, or 116,460 acre-ft/yr. However, environmental requirements in the Delta, climate change and risk of levee failure could reduce reliability to 50 percent in the future. Development of the Bay-Delta Conservation Plan (BDCP) is expected to be completed in mid-2013. If the BDCP is successfully implemented, the water agencies anticipate average SWP reliability could increase to about 77 percent (the pre-environmental restrictions level).

Since there is no conveyance facility to deliver SWP water to the Coachella Valley, CVWD's and DWA's SWP water is delivered to Metropolitan at San Bernardino under the terms of separate exchange agreements whereby Metropolitan delivers an equal amount of CRA water to CVWD and DWA to be recharged at the Whitewater and Mission Creek subbasins. Metropolitan also has an advanced delivery agreement with CVWD and DWA that allows it to deliver water to the Coachella Valley in advance of SWP deliveries at no cost to the Valley. CVWD and DWA allocate available imported water between the Mission Creek and Whitewater River recharge facilities in proportion to pumping within the respective management areas. Since recharge commenced in 2002, an average of 12,000 acre-ft/yr has been recharge at the Mission Creek Recharge Facility.

Recycled Water

Recycled water is a relatively small source of supply within the Planning Area. MSWD operates two wastewater treatment facilities that have a combined capacity of 2.18 mgd. Treated wastewater is percolated into the Mission Creek subbasin. MSWD has been installing sewers within its service area since the early 1970s and expects to construct a third wastewater treatment facility and complete sewering of its service area in the future.

[3] In 2011, production in the Upper Whitewater River subbasin totaled 183,000 acre-ft; production in the Lower Whitewater River subbasin (south of Point Happy) totaled about 145,000 acre-ft.

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

ISSUES AND STRATEGIES

A clear understanding of the water management issues affecting the Planning Area is essential when developing a water management plan.

Issues

The water management issues identified in this WMP are broadly grouped into the following categories:

- **Water Supply** – climate change, impact of Whitewater River subbasin recharge on Garnet Hill subbasin, imported water recharge volumes, natural recharge, groundwater overdraft, recharge timing and volume, recharge/percolation pond operations and maintenance, source substitution via recycled water, supply reliability, transfers and exchanges, subsurface flows between the subbasins
- **Water Quality** – arsenic, emerging contaminants, fluoride, radionuclides, hexavalent chromium, nitrate, total dissolved solids (TDS), other water quality contaminants , hot water entering Mission Creek subbasin, water quality in the Mission Creek subbasin, salinity management and brine disposal, improperly constructed or abandoned wells
- **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 Multiple-Species Habitat Conservation Plan, Watershed protection, land use protection for basin recharge
- **Other** – data gaps, monitoring and reporting, stakeholders and regulatory agency coordination

Each of these issues is discussed in more detail in **Section 5** of this Plan.

Strategies

A wide range of strategies is considered for addressing the issues identified in the Planning Area:

- Maximizing the capture of natural recharge
- Increasing local groundwater production
- Increasing imported water recharge
- Participating in local and statewide desalination projects
- Developing a recycled water system
- Constructing 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

Many of the strategies require the development of infrastructure projects. The effect of these strategies on water management in the Planning Area is quantified in terms of the additional water supply provided and the cost of implementation in **Section 5**.

Plan Evaluation

The management plan alternatives 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. 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. The alternative plans considered are:

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

Five alternative management plans are evaluated in **Section 5**. A groundwater model was used to evaluate basin response to different groundwater management strategies.

Alternative Plan 1 appears to satisfy the overall objectives of the WMP. Not only is Alternative Plan 1 least costly among the management plans, it also meets the objective of eliminating long-term overdraft in the basin. While groundwater TDS concentrations associated with this plan are higher relative to Alternative Plans 4 and 5, the costs associated with implementing this alternative are significantly lower.

WATER MANAGEMENT OBJECTIVES

In order to meet the overall goal of the WMP as described in the Mission Statement for this WMP, the participating agencies (CVWD, MSWD, and DWA) developed the following water management objectives for the Mission Creek and Garnet Hill subbasins:

- Meet current and future water demands with a 10 percent supply buffer – This objective will be fully implemented by 2020.
- Eliminate long-term groundwater overdraft– This objective will be implemented by maintaining 2009 groundwater levels to the extent practicable based on water supply availability by 2015.
- Manage and protect water quality
- Minimize adverse environmental impacts

- Comply with state and federal laws and regulations
- Manage future costs

The water management objectives work together to provide improved supply reliability for the Planning Area. **Section 6** presents a more detailed discussion of each objective.

MANAGEMENT PLAN ACTIONS

Key components of the Management Plan that will be used to meet the Water Management Objectives are described below. Additional detail is presented in **Section 7** of this WMP.

Demand Management

CVWD, DWA and MSWD have already implemented significant water conservation programs in the Planning Area that have resulted in significant decreases in per capita water usage. 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. 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 (CVRWMG)[5] 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.

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 maximum use of feasible local supplies such as recycled water.

As growth occurs consistent with the 2010 Riverside County Projections (and future updates), 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 while meeting the needs of the water agency. During the development of this WMP, CVWD, DWA and MSWD agreed that overdraft in the Mission Creek subbasin should be eliminated with the goal of maintaining long-term average water levels at year 2009 levels to the extent practicable.

To eliminate overdraft in the groundwater basin and meet future water demands, additional water supplies may be required for the Planning Area. Average future imported water needs could range from essentially zero for no growth conditions with implementation of the BDCP to as much as 14,700 acre-ft/yr if SWP reliability declines to 50 percent. 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 because of need, availability and cost. Due to the lead-time

[5] The CVRWMG consists of CVWD, DWA, MSWD, City of Coachella and Indio Water Authority.

required to acquire or develop additional water supplies, CVWD, DWA and MSWD will closely coordinate their current and projected water demands.

MSWD prepared a recycled water feasibility report that identified several potential recycled water users, principally golf courses and landscape irrigation. 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.

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 supply buffer for the Planning Area should initially be capable of generating about 1,500 acre-ft/yr of water increasing to 3,700 acre-ft/yr by 2045.

Recharge

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 eliminate overdraft. Additional replenishment is needed to achieve the goal of stabilizing long-term groundwater levels based on 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.

CVWD and DWA jointly manage imported water replenishment operations in the Coachella Valley using SWP Exchange water. The goal of the imported water replenishment operations is to deliver as much SWP Exchange water to the Valley as possible given SWP contract and delivery constraints and Metropolitan's Colorado River Aqueduct (CRA) operations. As required by the 2004 Settlement Agreement, cumulative SWP recharge deliveries will be balanced between the two subbasins as determined by the Management Committee but not later than every 20 years. As part of this implementation plan, regardless of the 20-year balance between the Mission Creek and the Whitewater River subbasins, it is the intention of CVWD and DWA to continue annual recharge activities at the Mission Creek Recharge Facility provided SWP Exchange water is available to the Coachella Valley.

Water Quality Protection

The principal water quality parameters of concern for the Planning Area are nitrate, total dissolved solids (TDS) and radionuclides 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 hexavalent chromium have been identified as potential constituents of concern depending on future regulatory actions. 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.
- Continue to monitor nitrate concentrations in groundwater wells; and
- Perform additional investigations of nitrate fate and transport as required

The CVRWMG plans to undertake a valley-wide salt/nutrient management plan to meet the State Water Resources Control Board requirements. The CVRWMG 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. 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 California Department of Public Health and the United States Environmental Protection Agency 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 following programs/projects should be implemented to improve monitoring and data management in the Planning Area as described in Appendix E:

- Summarize precipitation data from available gauges in the surrounding watershed and report in the Engineer's Reports prepared by CVWD and DWA;
- Install a California Irrigation Management Information System (CIMIS) weather station in Desert Hot Springs area to provide improved data for irrigation scheduling;
- Update the existing canvasses of private wells in the Mission Creek and Garnet Hill subbasins to verify their location, operational status (active, inactive, abandoned, destroyed), whether a meter is installed, and whether production is being reported;
- Make arrangements to install meters on unmetered production wells to provide accurate production records for replenishment assessments and basin management;
- Continue to monitor public and private wells for groundwater levels and quality on a routine basis;
- Install data loggers on selected dedicated monitoring wells to provide more continuous groundwater level data;
- Report pertinent groundwater 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 groundwater level and quality;
- Evaluate potential locations to construct monitoring wells near the basin boundaries to document natural inflow to and outflow from the basins 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.

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: 1) Planning, 2) Implementation, 3) Monitoring, 4) Analysis and 5) Modification. The key to the adaptive management process is one of continual evaluation and program adjustment to meet the overall basin management objectives.

Implementation

CVWD, DWA and MSWD prioritized the water management programs and projects based on:

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

Table ES-2 presents the management programs including the contribution of each to achieving the Water Management Objectives, additional benefits and implementation category.

Costs

The implementation of the Mission Creek-Garnet Hill Water Management Plan will require significant capital and operating investments to achieve the goals of the plan. total capital costs for plan implementation are expected to be approximately $788 million between 2012 and 2045 averaging $23 million per year, assuming growth is consistent the 2010 CVAG/RCCDR projections. Implementation costs are expected to vary depending on the amount of growth in the study area. Costs are not presented for projects requiring further investigation and for potential future programs. **Figure ES-4** summarizes the total expenditures of existing and new programs over the planning period.

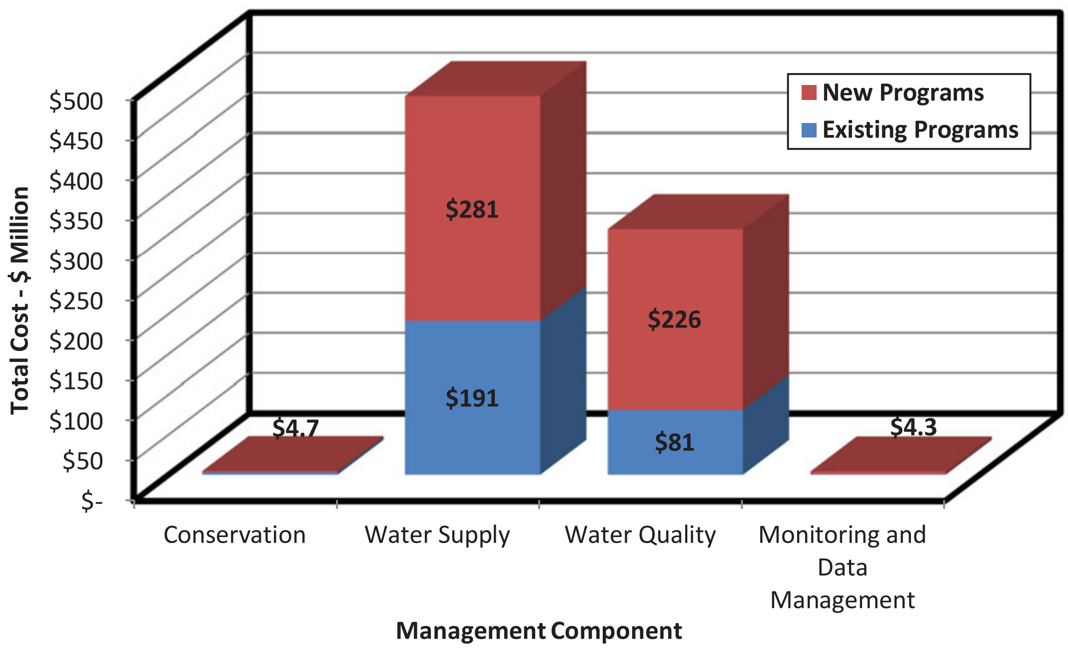

Figure ES-4
Total Projected Water Management Expenditures 2012-2045

Funding

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 may be used as presented in **Appendix F** and summarized below:

- Water rates – water purveyor charges to water customers for the purchase of water for urban or agricultural use

Table ES-2
Water Management Plan Projects and Programs

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

Table ES-3 (Continued)
Water Management Plan Projects and Programs

Project/Program	Category	Applicable Goal: Meet current and future demands with 10% buffer	Eliminate Long-term GW Overdraft	Manage & Protect Water Quality	Comply with State and Federal Laws and Regs	Manage Future Costs	Minimize Adverse Environ. Impacts	Additional Benefits	Provides Multiple Benefits	Readiness to Implement	Recom-mended Action
Evaluate conversion of septic to sewer in CVWD area	Water Quality Protection	x	x	x	x		x		Yes	Long-term	Pursue
Evaluate occurrence and risk of nitrate migration	Water Quality Protection			x	x				Yes	Mid-term	Agency Decision
Participate in valley-wide salt/nutrient management plan (SNMP)	Water Quality Protection	x		x	x		x		Yes	Near-term	Pursue
Develop and calibrate water quality model in conjunction with SNMP	Water Quality Protection			x	x			Need for salt/nutrient management plan	Yes	Near-term	Part of Salt-Nutrient Mgmt Plan
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
Evaluate occurrence and risk of uranium migration	Water Quality Protection	x		x					Yes	Near-term	Agency Decision
Track potential regulatory actions of CDPH and USEPA that could affect drinking water regulation compliance	Water Quality Protection			x					No	Near-term	Pursue
Coordinate with appropriate regulatory agencies responsible for preventing contaminating activities in well capture and recharge zones	Water Quality Protection			x					No	Near-term	Pursue
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.
Develop a cooperative program with Riverside County DEH to identify and cap/destroy unused wells	Water Quality Protection			x	x				Yes	Near-term	Pursue
Review and comment on development proposals, environmental documents and land use plans to protect water quality	Water Quality Protection										Continue
Support Groundwater Guardian Program to educate public on water quality	Water Quality Protection										Continue
Desalination of Colorado River recharge water	Water Quality Protection			x			x		Yes	Long-term	Defer
Desalination of East MC groundwater	Water Quality Protection			x					Yes	Long-term	Defer
Summarize precipitation data annually to estimate natural inflows to basins	Monitoring	x	x					Improved data on basin supply	Yes	Near-term	Pursue
Install a CIMIS station in DHS area	Monitoring	x	x			x		Improved irrigation scheduling	Yes	Near-term	Pursue

Table ES-4 (Continued)
Water Management Plan Projects and Programs

Project/Program	Category	Applicable Goal: Meet current and future demands with 10% buffer	Eliminate Long-term GW Overdraft	Manage & Protect Water Quality	Comply with State and Federal Laws and Regs	Manage Future Costs	Minimize Adverse Environ. Impacts	Additional Benefits	Provides Multiple Benefits	Readiness to Implement	Recommended Action
Update well canvass and determine well operational status	Monitoring		x	x				Improved monitoring	Yes	Near-term	Update Existing
Continue to monitor public and private wells for water level and quality	Monitoring		x	x				Improved monitoring	Yes	On-going	Continue
Incorporate additional private wells in routine water level and quality monitoring	Monitoring		x	x				Improved monitoring and reporting	Yes	Near-term	Pursue
Install production meters on private wells no having meters	Monitoring					x		Improved monitoring and reporting; cost recovery	Yes	Near-term	Pursue
Install water level dataloggers in 5-10 monitoring wells	Monitoring		x					Improved monitoring and reporting	Yes	Near-term	Pursue
Monitor local surface runoff quality	Monitoring			x				Improved monitoring and reporting	Yes	Near-term	Defer
Investigate viability of conducting geophysical survey near recharge basin	Monitoring		x			x		Improved basin understanding and groundwater modeling	Yes	Near-term	Investigate
Construct 1-2 new monitoring wells to document recharge activities	Monitoring		x					Improved monitoring and reporting	Yes	Near-term	Investigate
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
Conduct flow loss study on Whitewater River	Monitoring	x						Document recharge to GHSB	Yes	Near-term	Defer
Periodic groundwater model update and recalibration; combine with Whitewater model	Monitoring						x	Improved monitoring and operational planning	Yes	Near-term	Pursue
Conduct ground surface elevation surveys	Monitoring		x			x	x	Early subsidence documentation	Yes	Near-term	Defer
Construct 1-3 new monitoring wells to document basin inflows	Monitoring	x	x					Improved monitoring and reporting	Yes	Mid-term	Investigate
Investigate additional stream gauging in MCSB	Monitoring	x	x					Document recharge to MCSB	Yes	Mid-term	Defer
Improved reporting of water resources data in Engineers' reports	Data Management and Reporting							Improved reporting and data sharing	No	On-going	Pursue
Develop valley-wide water resources database	Data Management and Reporting	x	x					Improved reporting and data sharing	Yes	Near-term	Investigate, could be done by CVRWMG
Continue existing basin management committee structure	Other							Promote improved communications	No	Near-term	Continue
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

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- 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.

Opportunities may exist for joint agency participation in project implementation. Several guiding principles will be applied to project implementation:

1. Generally, each agency is responsible for implementation of projects that benefits its customers. However, projects that provide benefits to multiple agencies may be jointly funded if all participants agree.
2. The cost of jointly-funded projects will be allocated based on objectively quantifiable benefits.
3. Opportunities for external funding will be pursued when feasible.

CONCLUSION

Groundwater overdraft and water quality protection are important concern for the Planning Area. Critical drivers for water management in the Planning Area include growth and increased water demands, imported water supply reliability, the need for additional supplies, water quality protection, more stringent regulations, limited financial resources and climate change.

CVWD, DWA and MSWD developed the Mission Creek-Garnet Hill Water Management Plan with the goal of managing the water resources to meet demands reliably while protecting water quality in a sustainable and cost-effective manner. The plan recognizes that continued recharge, development or acquisition of additional water supplies, protection of water quality through wastewater management and other tools, monitoring and data management and continuous communication are vital for the cost-effective management of the water resources of the Planning Area.

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Section 1 Introduction

Water supply is critical to civilization, especially in a desert region. 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 in Riverside County, California. These subbasins are located within the northwestern portion of the hot, arid Colorado Desert sub-region of the Sonoran Desert. The Mission Creek and Garnet Hill Subbasins have been important sources of potable water supply to the City of Desert Hot Springs and surrounding communities. Since the 1940s, the Desert Hot Springs region has been known as a tourist destination with its small spa hotels supplied by hot mineral water from the Desert Hot Springs Subbasin. The Mission Creek and Garnet Hill Subbasins have been the primary potable water source to the area since that time.

Continued pumping of the potable supplies in excess of natural recharge resulted in steadily declining groundwater levels. To control this water level decline, the Coachella Valley Water District (CVWD) and Desert Water Agency (DWA) with the support of the Mission Springs Water District (MSWD) embarked on a groundwater replenishment program in 2002 using imported water. Additional water management activities have been implemented since that time. The purpose of this Water Management Plan is to describe existing water management programs, evaluate potential alternative management strategies and recommend additional programs with the goal of ensuring that water resources of these subbasins are sustained and protected in the future.

This section describes the factors that led to the development of this Water Management Plan (WMP) for the Mission Creek and Garnet Hill subbasins. Historical events related leading to the recharge of imported water in the Coachella Valley are briefly described in this section with details presented in the contents of the WMP. A discussion of how the Mission Creek and the Garnet Hill WMP relates to recent, compatible planning efforts initiated in the Coachella Valley and a comparison of the requirements of the California Water Code (AB 3030) for developing a groundwater management plan are also presented in this section.

BACKGROUND

To comprehend the need for a water management plan, an understanding of the planning area, the water agencies, and water management challenges is necessary.

Planning Area Overview

The Coachella Valley Groundwater Basin consists of five separate subbasins separated by faults or other geologic features that affect the flow of groundwater. These subbasins are the San Gorgonio Pass, Whitewater River (also known as Indio), Mission Creek, Garnet Hill and Desert Hot Springs subbasins. The location of these subbasins relative to the planning area for this WMP are shown on **Figure 1-1.**

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Regional Map

Figure 1-1

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The Planning Area for this WMP 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 1-1**. In addition to the above-mentioned areas, portions of the MSWD and the 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 and overlies the Whitewater Basin but receives groundwater supply from the Mission Creek and Garnet Hill subbasins. The Planning Area also includes approximately 460 acres south of Interstate 10 and west of the south projection of Little Morongo Road that was recently added to MSWD's sphere of influence, a portion of which is served by MSWD. The eastern portion of the Planning Area overlying the Desert Hot Springs subbasin, that is served by MSWD and CVWD, receives water supply from the Mission Creek subbasin and has been included. A more detailed discussion of the planning area is presented in Section 2.

Principal Water Agencies in the Planning Area

CVWD, DWA, and MSWD are the principal water agencies in the Mission Creek and Garnet Hill subbasins. CVWD, formed in 1918, is a public agency of the State of California organized and operating under the County Water District Law (California Water Code §30000 *et. seq.*) and the Coachella District Merger Law (California Water Code §33100-33162). CVWD is a State Water Project contractor and Colorado River contractor empowered to import water supplies to its service area. CVWD has statutory authority over retail municipal and irrigation water supply, groundwater replenishment, wastewater management, flood control and drainage within its service area. CVWD has statutory authority to replenish local groundwater supplies and collect assessments necessary to support a groundwater replenishment program as provided in the County Water District Law (California Water Code §31630-31639).

DWA was formed in 1961 as an independent special district created by a special act of California Legislature contained in Chapter 100 of the California Water Code Appendix. DWA is also a State Water Project contractor empowered to import water supplies to its service area. In addition, DWA has statutory authority to replenish local groundwater supplies and collect assessments necessary to support a groundwater replenishment program as provided for in the Desert Water Agency Law. DWA has statutory authority over water supply within its institutional boundary and provides retail municipal and recycled water service in addition to wastewater management within its Palm Springs service area.

MSWD was formed in 1953 as the Desert Hot Springs County Water District under the County Water District Law (California Water Code §30000 *et seq.*). MSWD has statutory authority over retail municipal water supply and wastewater management within its service area.

CVWD and MSWD produce groundwater from the Mission Creek and Garnet Hill subbasins and provide retail municipal water service within their respective service areas. DWA has provided retail municipal water service to customers in the cities of Palm Springs and Cathedral City since acquiring private water systems in 1968, but does not provide retail water service within MSWD's institutional boundary.

In addition to these agencies, the Riverside County Flood Control and Water Conservation District (RCFCWCD) plays an important water management role as the flood control and stormwater quality management agency for most of the planning area. The RCFCWCD is a special district created by the California Legislature in 1945 with a jurisdiction encompassing western Riverside County. Within the planning area, RCFCWCD's jurisdiction includes the Desert Hot Springs, North Palm Springs and Sky Valley communities. Only the portion of the planning area encompassing the Indio Hills community along Dillon Road is not currently included in either RCFCWCD's or CVWD's flood control authority.

Imported Water Recharge

Recognizing the need for additional water supplies, 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. All land owners within DWA and CVWD's institutional boundaries pay property tax assessments to cover the capital and certain fixed operating costs associated with SWP water. Variable operating costs of SWP water are recovered by replenishment assessments levied on groundwater pumpers that benefit from imported water recharge.

To avoid the estimated $150 million cost to construct a pipeline to convey SWP water into the Valley in the 1970s (now about $1 billion), 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 Colorado River Aqueduct (CRA) in exchange for CVWD's and DWA's SWP water. Deliveries of SWP Exchange water to the Whitewater River subbasin commenced in 1973. Subsequently in 1984, CVWD, DWA and Metropolitan executed an advanced delivery agreement allowing Metropolitan to pre-deliver SWP Exchange water in the Coachella Valley with advanced deliveries commencing that year. Imported water deliveries to the Whitewater River subbasin improved groundwater levels in the western portion of Whitewater River subbasin. However, groundwater levels in the central and the eastern portions of the Whitewater River subbasin and the Mission Creek subbasin continued to decline.

Studies to deliver SWP water to the Mission Creek subbasin were initially performed in the early 1960s. DWA and CVWD prepared an environmental impact report on recharging the Upper Coachella Valley groundwater basins in 1973 (Jones & Stokes, 1973) (including Mission Creek subbasin). 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 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 upon and interest in the subbasin.

Settlement Agreement

In October 2003, MSWD filed action in the Superior Court of the State of California against DWA and CVWD 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, challenged the validity of the replenishment assessments in the Whitewater and Mission Creek subbasins and questioned the quality of the imported CRA water. Both CVWD and DWA filed responses challenging the complaint. In December 2004, MSWD, DWA and CVWD reached an agreement to settle the litigation.

The settlement agreement stated the agencies would work jointly to manage the subbasin. The agreement included provisions regarding payment of outstanding replenishment assessments, establishment of a three-party management committee consisting of CVWD, DWA and MSWD, shared costs for basin studies and development of a water management plan for the Mission Creek and Garnet Hill Subbasins. An addendum to the Settlement Agreement was incorporated to ensure the Mission Creek subbasin receives its proportionate share of SWP Exchange water with deliveries to be balanced between the Whitewater River and Mission Creek subbasins as determined by the Management Committee but no later than every twenty years.

A Memorandum of Understanding (MOU) among CVWD, DWA, and MSWD was executed on July 27, 2009 to prepare this Plan and develop a groundwater model of the Mission Creek and Garnet Hill subbasins.

Need for a Water Management Plan

Since groundwater production commenced in the Mission Creek subbasin, water demands comprising of urban, industrial, fish farm, and golf course uses have steadily increased. For several decades, annual water demand and groundwater extraction have exceeded the limited natural supplies, and the groundwater table in the Mission Creek subbasin has dropped steadily. DWR Bulletin 118 (2003) identified the Mission Creek subbasin to be in an overdraft condition. However, since the commencement of groundwater recharge program at the Mission Creek Spreading Facility, groundwater levels have increased in the Mission Creek subbasin. Continued operation of this replenishment program is critical to basin management.

The population of Desert Hot Springs and surrounding regions has grown significantly over the past thirty years and growth is expected to continue. Coupled with a growing population, a number of external factors have affected or may affect water supplies for the region:

- SWP supplies fluctuate annually due to hydrology and environmental needs in the Sacramento-San Joaquin Delta (Delta).
- Recent environmental rulings have restricted the State's ability to move water through the Delta to the SWP decreasing supply reliability. The degree to which the long term supply of the SWP will be affected is uncertain.
- Efforts are underway to advance the Bay-Delta Conservation Plan (BDCP), which is intended to restore the Delta's ecosystem and improve water supply reliability.
- Climate change could affect the long term reliability of imported water supplies.

Given the factors listed above, water resource management is required to reliably meet water demands, manage water quality and minimize environmental impacts, at an affordable cost.

CVWD, DWA, and MSWD recognize the need to address the water requirements associated with growth and this WMP will provide a framework for managing the water resources in the Mission Creek and Garnet Hill subbasins. To guide the planning and development of the Mission Creek and Garnet Hill WMP, the Management Committee developed the following mission statement:

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

In order to meet the stated purpose of the WMP as described in this Mission Statement, 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
- 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

STAKEHOLDER INVOLVEMENT

Stakeholder input and participation is described in the following paragraphs.

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 management of the Mission Creek and Garnet Hill subbasins. A Technical Committee was formed under the authority of the 2008 MOU 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. The Technical Committee met at more frequent intervals as needed to complete this WMP.

Public Meetings

A public meeting was held on April 21, 2010 to obtain input on the development of the WMP from water users and the general public within the Planning Area. The public meeting discussed the purpose and need for the plan, the study area, issues to be addressed, plan objectives and the schedule for completion. Questions and comments from the public focused on water levels, water quality changes, water conservation, costs of sewer construction and water rates.

RELATIONSHIP TO OTHER PLANNING EFFORTS

A number of recent related, compatible planning efforts have been initiated in the Coachella Valley.

Coachella Valley Water Management Plan

CVWD undertook the development of a water management plan for the eastern portion of the Coachella Valley in 1994. This planning effort was expanded to include the entire Whitewater River subbasin. CVWD completed the Coachella Valley Water Management Plan (CVWMP) in 2002 (CVWD, 2002) for water supplies throughout the Coachella Valley. The main focus of the 2002 WMP was to address overdraft in the Whitewater River Subbasin.

The 2002 WMP was updated in 2010 (CVWD, 2012) to respond to changing external and internal conditions. The Mission Creek subbasin was not included in the planning area of the 2002 WMP or the 2010 WMP Update. The water demands of users overlying the Garnet Hill subbasin were nominally included in these plans, but are addressed in more detail in this Mission Creek/Garnet Hill WMP.

The purpose of the 2010 WMP Update was to define projected water demands through 2045, and focused on 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 an implementation plan were developed.

The development of the Mission Creek/Garnet Hill WMP is closely coordinated with the 2010 WMP Update to ensure consistent planning assumptions and analyses. The updated plan was adopted by the CVWD Board of Directors in January 2012 following completion of a supplemental program environmental impact report.

Coachella Valley 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, the Coachella Water Authority (CWA), CVWD, DWA, Indio Water Authority (IWA), and MSWD formed the Coachella Valley Regional Water Management Group (CVRWMG) and signed a MOU for the development of a Coachella Valley Integrated Regional Water Management Plan (CVIRWMP). 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 CVIRWMP.

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, due by July 2011. The plans document projected water demands and plans for delivering water supplies to their respective water service areas. The UWMPs 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 is December 31, 2015.

COMPARISON TO AB 3030 REQUIREMENTS

Sections 10750-10756 of the California Water Code (AB 3030 as amended by SB 1938 (2002)) provide a systematic procedure for an existing local agency to develop a groundwater management plan. AB 3030 plans cannot be adopted in adjudicated basins or in basins where groundwater is managed under other sections of the Water Code without the permission of the court or the other agency. Since the Mission Creek/Garnet Hill area is subject to groundwater management under provisions of the County Water District Law and the Desert Water Agency Law, preparation of an AB 3030 plan for this area is not appropriate. While the Mission Creek/Garnet Hill Water Management Plan is not an AB 3030 plan, the technical components of an AB 3030 plan have been considered in the development of this Plan.

Groundwater management plans prepared under AB 3030 are required to contain certain components as listed in Water Code §10753.7. These components and the relevant WMP sections where these components are described are listed below:

- Basin management objectives for the groundwater basin that is subject to the plan.
- Plan to involve other agencies that enables the local agency to work cooperatively with other public entities whose service area or boundary overlies the groundwater basin.
- Map that details the area of the groundwater basin, as defined in the department's Bulletin No. 118, and the area of the local agency, that will be subject to the plan, as well as the boundaries of other local agencies that overlie the basin in which the agency is developing a groundwater management plan.
- Map identifying the current recharge areas that substantially contribute to the replenishment of the groundwater basin; provide the map to the appropriate local planning agencies after adoption of the groundwater management plan.
- Monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin. The monitoring protocols shall be designed to generate information that promotes efficient and effective groundwater management.

Water Code §10753.8 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**)

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Section 2
Plan Setting

This section describes the "Planning Area" for the Mission Creek and the Garnet Hill subbasins Water Management Plan (WMP). The Planning Area covers a larger land area than the groundwater basins because water from these basins is used to meet the water demands of the participating agencies beyond the basin boundaries. In addition, a larger planning area is needed to properly account for the effects of water management activities that occur outside the basin boundaries. 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 water demand and return flows are correctly accounted for.
- To account for all groundwater demands, the Planning Area includes all land that is currently or expected to be served by groundwater from the two subbasins.
- Areas that are currently or are projected to be served groundwater from the Whitewater River subbasin are excluded.

Therefore, 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 and overlies the Whitewater Basin but receives groundwater supply from the Mission Creek and Garnet Hill subbasins. The Planning Area also includes approximately 460 acres south of Interstate 10 and west of the southerly projection of Little Morongo Road that was added to MSWD's sphere of influence in 2011, a portion of which is served by MSWD.

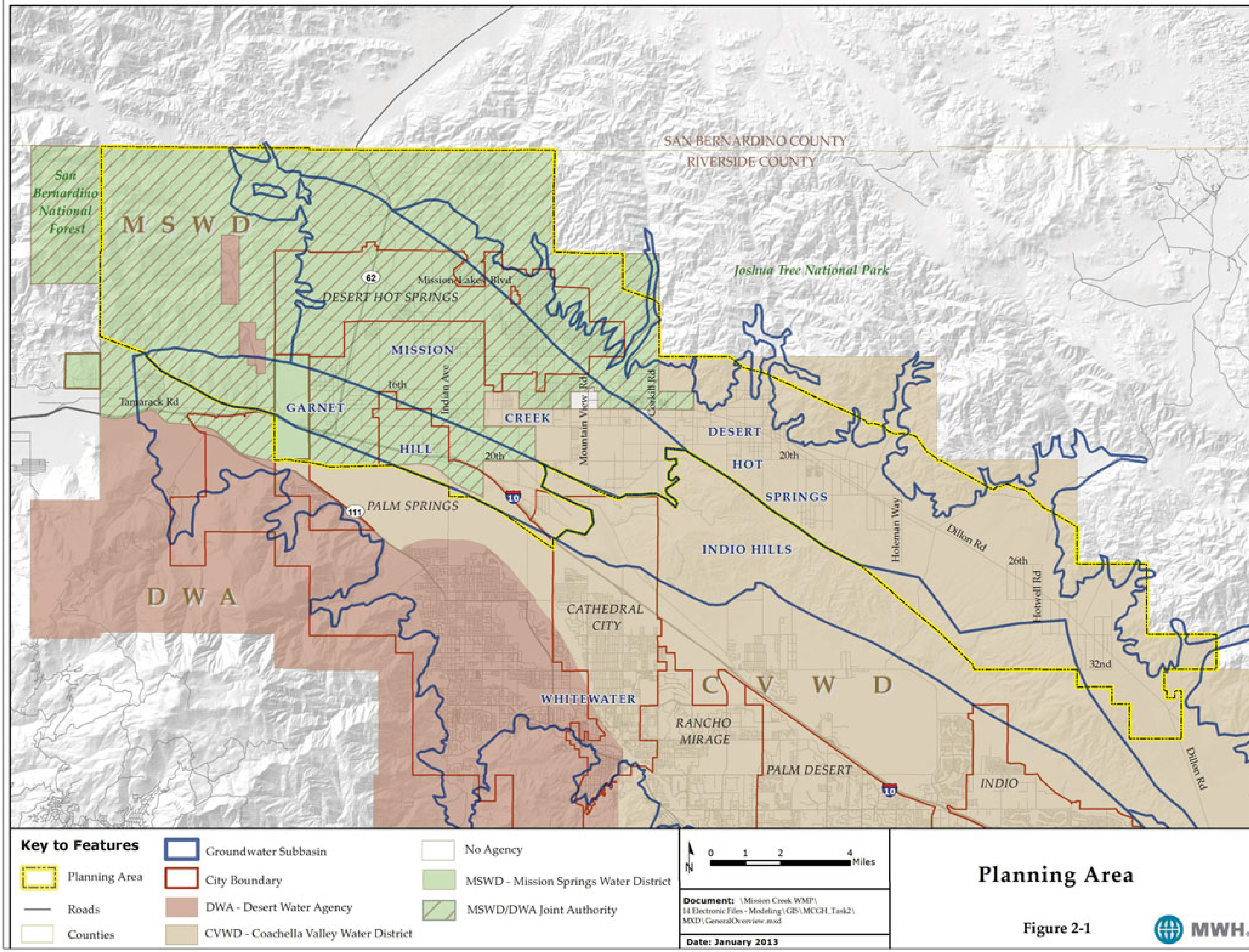
The eastern portion of the Planning Area overlying the Desert Hot Springs subbasin, served by MSWD and CVWD, receives water supply from the Mission Creek subbasin and has been included. Based on land use, the proximity to other sources of supply in the Coachella Valley, and the expected groundwater use 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 CVWD's water infrastructure is expected. This portion – south of 32nd Avenue, east of Monroe Street, and north of 36th Avenue – encompasses the proposed Inner Beauty/Indio Hills development.
- The portion of CVWD's service area within Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) conservation areas is not included in the Planning Area.
- Joshua Tree National Park and the San Bernardino National Forest are excluded from the Planning Area since development in these areas is highly unlikely.

Jurisdictional Boundaries – Water Districts, Cities, and County

The WMP Planning Area contains portions of the cities of Palm Springs, Desert Hot Springs, Cathedral City and unincorporated areas of Riverside County. The cities serve as the land use agencies within their jurisdictional boundaries; the County is the land use planning agency for unincorporated areas. Riverside County Flood Control and Water Conservation District (RCFCWCD) 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, as discussed in greater detail below. DWA does not have any retail service area within the Planning Area.

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) (exchanged with Metropolitan for Colorado River water through the Colorado River Aqueduct) and the Colorado River via the Coachella Canal. The Planning Area contains 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, flood control and stormwater management within most of the Planning Area is under the jurisdiction of the RCFCWCD.



Planning Area

Figure 2-1

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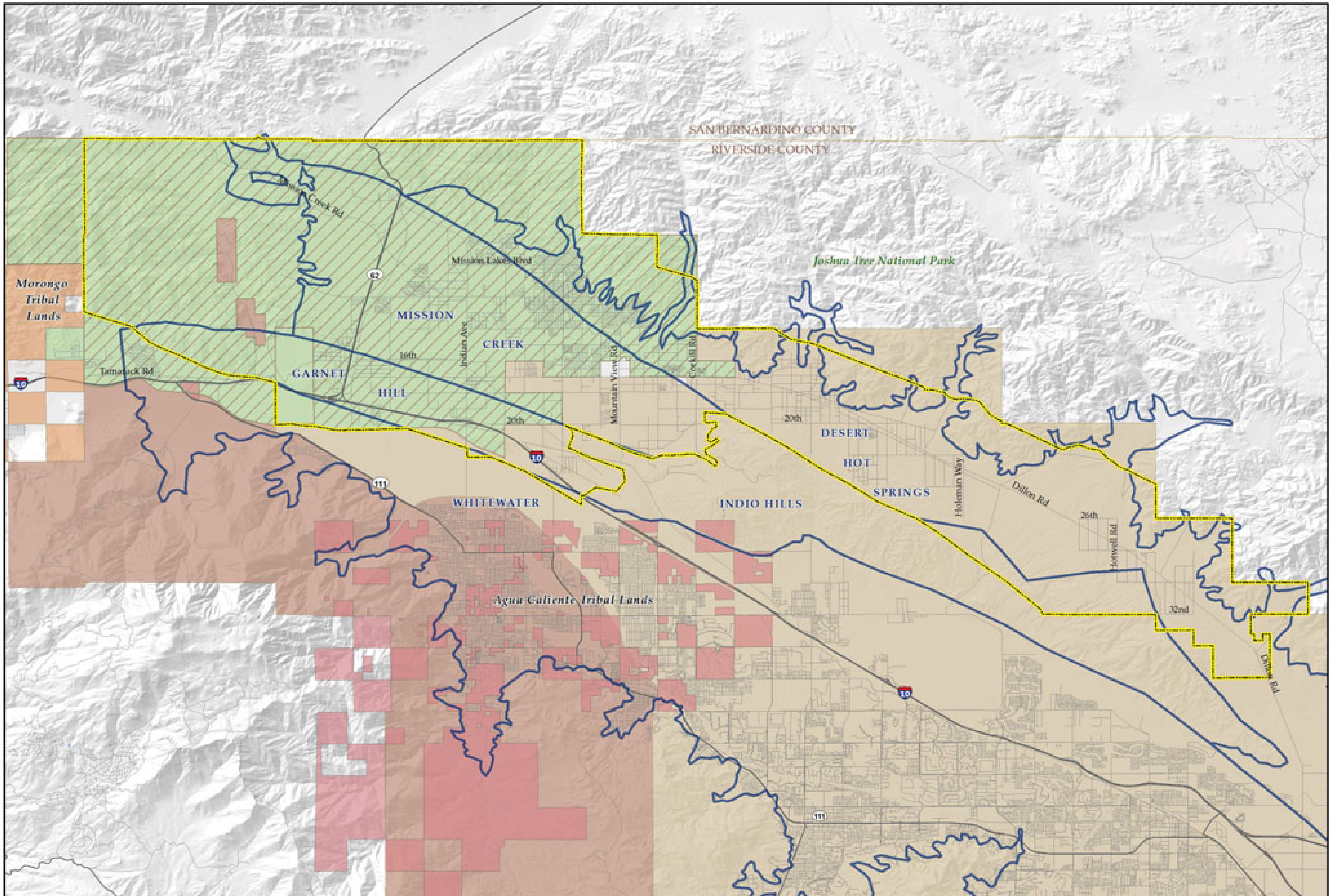

Key to Features

Planning Area

Roads

Agua Caliente Tribal Lands

Morongo Tribal Lands

Groundwater Subbasins

Counties

N 0 1.25 2.5 5 Miles

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Date: October 2012

Tribal Lands

Figure 2-2

MWH.

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DWA is an independent special district organized under the Desert Water Agency Law (California 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 does not provide any retail water or wastewater services within the Planning Area. DWA's institutional boundary as an imported water replenishment agency extends over approximately 115-square miles (DWA, 2005) includes portions of the cities of Desert Hot Springs, Palm Springs and Cathedral City and adjacent unincorporated land. Both DWA and CVWD have the authority to import water under contract from the SWP, 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 as the Desert Hot Springs County Water District, MSWD covers 135 square miles and serves approximately more than 12,500 retail water customers and 6,300 wastewater customers. MSWD's institutional boundary for its retail service area 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.

The Riverside County Flood Control and Water Conservation District (RCFCWCD) plays an important role as the flood control and stormwater management agency for most of the Planning Area. The RCFCWCD is a special district created by the California Legislature in 1945 with a jurisdiction encompassing western Riverside County. Within the planning area, RCFCWCD's jurisdiction includes the Desert Hot Springs, North Palm Springs and Sky Valley communities. Only the portion of the Planning Area encompassing the Indio Hills community along Dillon Road is not currently included in either RCFCWCD's or CVWD's flood control boundary.

Figure 2-1 shows each of the three agencies and their jurisdictional areas in relation to each other. DWA's jurisdictional boundary as an imported water replenishment agency 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 overlap with DWA's service area in two areas: west of Rushmore Avenue 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 with MSWD's service area.

Groundwater Basins Overview

The groundwater basins in the study, designated by the United States Geological Survey (USGS) and the California Department of Water Resources (DWR), are briefly described below and presented in **Figure 2-3**. 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 naturally 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 eroded 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 lens shaped 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).

The Mission Creek subbasin is considered an unconfined aquifer with a saturated thickness of 1,200 feet or more and an estimated total storage capacity of approximately 2.6 million acre-ft (DWR, 1964). The volume of groundwater estimated to be in storage for the subbasin is 1.4 million acre-ft (MSWD, 2006a). The subbasin is naturally recharged by surface and subsurface flow from the Mission Creek, Dry, and Big Morongo Washes, the Painted Hills, and surrounding mountain drainages. Subsurface flow also occurs across the Mission Creek Fault from the adjacent Desert Hot Springs subbasin. Return flow from applied water and discharges from municipal and individual subsurface wastewater disposal systems also contribute to recharge. The principal outflows from the subbasin are groundwater production for municipal and private uses, evapotranspiration and subsurface outflow across the Banning Fault. Groundwater generally flows from the northwest to the southeast until about mid-basin where the contour lines curve indicating a southerly flow on the eastern side of the subbasin.

Garnet Hill Subbasin

The area between the Garnet Hill Fault and the Banning Fault is named the Garnet Hill subbasin. The Garnet Hill Fault is a branch of the San Andreas Fault system consisting of a series of northwest-trending right-lateral faults with active folds at each stepover. These folds are exhibited a series of small hills (West Whitewater Hill, East Whitewater Hill Garnet Hill, Edom Hill and several small unnamed hills) between each fault segment (Yule & Sieh, 2003). The subbasin was considered a subarea of the Whitewater River (Indio) subbasin by DWR (1964) and it was considered a distinct subbasin by the USGS for the effectiveness of the Banning and Garnet Hill Faults as barriers to groundwater movement (Tyley, 1974). This was 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). DWR observed that limited data existed to characterize the hydrogeology of this subbasin (DWR, 1964).

The Garnet Hill Subbasin is considered an unconfined aquifer with a saturated thickness of 1,000 feet or more and an estimated total storage capacity on the order of 1.0 million acre-ft. The subbasin is naturally recharged by subsurface flow from the Mission Creek Subbasin and runoff from the Whitewater River watershed on the west. Irrigation return flow and discharges from municipal and individual subsurface wastewater disposal systems also contribute to recharge but is considered very small.

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 are channel infiltration and subsurface flow in the Whitewater River, subsurface flow through the semi-permeable deposits which underlie Whitewater Hill and from subsurface flow across the Banning Fault from the Mission Creek subbasin. In general, there is subsurface flow from the Garnet Hill subbasin to the Whitewater River subbasin.

Desert Hot Springs Subbasin

This WMP does not address water supplies from the Desert Hot Springs subbasin although parts of the Planning Area overlie the 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 Joshua Tree National Park. DWR Bulletin 118 (2003) has designated this subbasin as No. 7-21.03. The subbasin is bounded on the southwest by the Banning and Mission Creek faults 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. No specific WMP exists for the Desert Hot Springs subbasin.

Whitewater River Subbasin

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

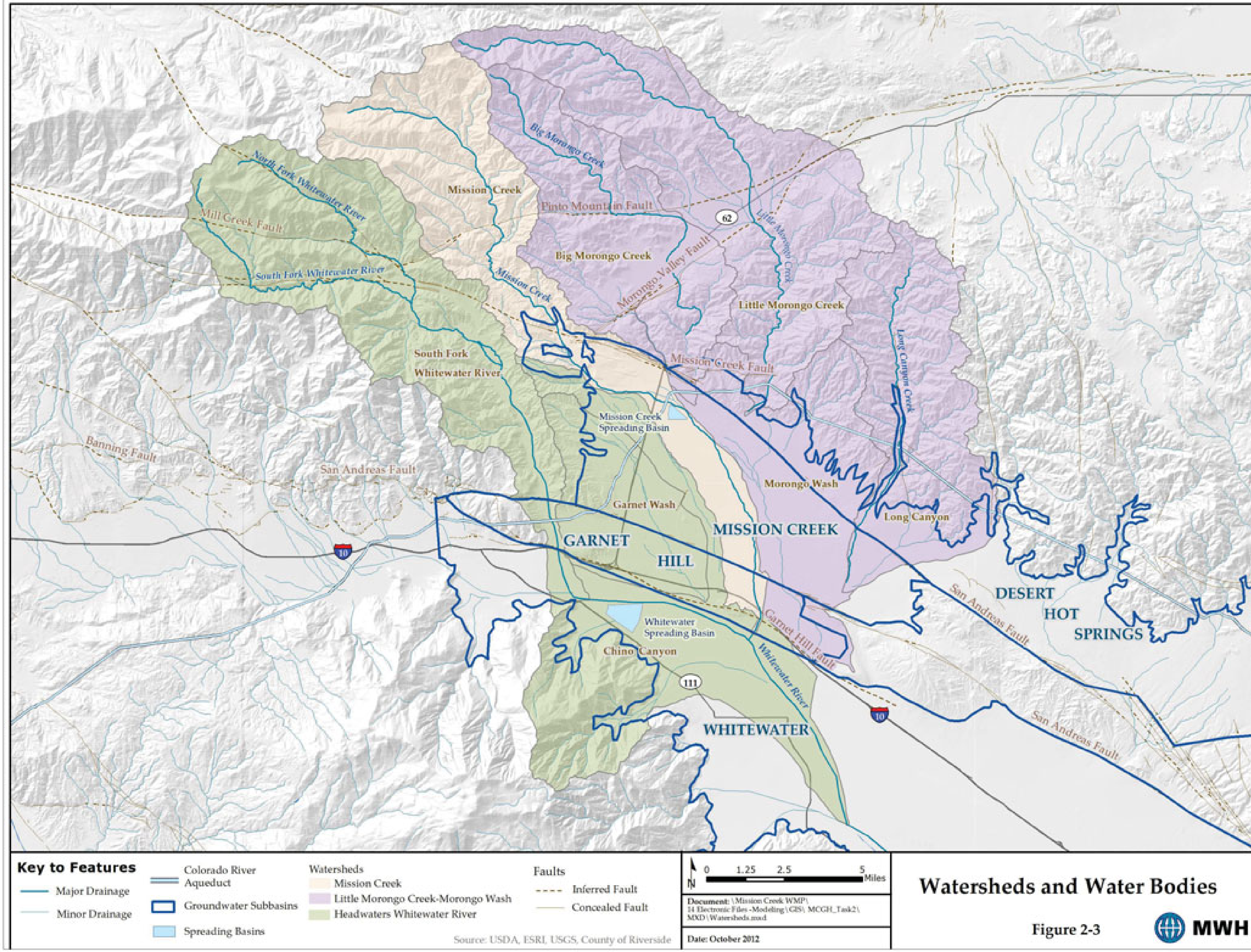
Surface Water Overview

Surface water flow in the Planning Area consists of ephemeral or intermittent streams that originate in the San Bernardino and Little San Bernardino mountains. Mission Creek is the only stream that flows to the valley floor on a consistent basis, but the stream usually disappears underground a short distance from its entrance into the Planning Area. Streams flowing through Morongo Valley, Big Morongo, Little Morongo and Long Canyon periodically reach the valley floor for short periods when there are localized, intense storms in the mountains (MTU, 1998). None of the surface flow from the local watercourses is used directly for municipal, industrial or agricultural uses in the Planning Area.

The principal surface water features that contribute to groundwater recharge in the Mission Creek subbasin are Mission Creek, Dry Morongo Wash, Little Morongo Wash, and Big Morongo Canyon. The lower reaches of Mission Creek and Morongo Wash flow across the Garnet Hill subbasin and are believed to contribute to recharge primarily through subsurface flows. Long Canyon Creek and the Little Morongo Creek provide recharge in the Desert Hot Springs subbasin. Other tributaries including those from the Painted Hills, White House Canyon, Midway Canyon, Blind Canyon, Long Canyon, and North Short Canyon appear to contribute much smaller amounts of water to the Planning Area. The Whitewater River appears to contribute to recharge of the Garnet Hill subbasin through subsurface flow in the alluvial channel across the Banning fault and through the semi-permeable deposits that underlie the Whitewater Hill (GSi/water, 2005).

Figure 2-3 presents the location of the groundwater subbasins, the watersheds that drain into the subbasins, and major streams. Psomas (2012) estimated that the total recharge to the Mission Creek subbasin from mountain-front precipitation under average conditions would be approximately 7,500 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 9,800 acre-ft/yr to 14,300 acre-ft/yr to both the Mission Creek and Desert Hot Springs subbasins (GSi/water, 2005).

The Whitewater River flows across the Garnet Hill subbasin before reaching the Whitewater River subbasin. Whitewater River flows reach the valley floor on a consistent basis. GSi/water (2005) estimated recharge into the Garnet Hill subbasin from the Whitewater River at a range of 7,000 acre-ft/yr to 70,000 acre-ft/yr (GSi/water, 2005). MWH (2002) estimated Whitewater River recharge to be about 8,600 acre-ft/yr. Psomas (2012) estimated recharge into the Garnet Hill subbasin from the Whitewater River at a range of 16,800 to 17,500 acre-ft/yr.



Watersheds and Water Bodies

Figure 2-3

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PLANNING AREA DEMOGRAPHICS

The historical and projected population and employment patterns of the Planning Area are important factors in assessing future water demands.

Population

U.S. Census Bureau decennial population counts are used to estimate the historical population within the Planning Area. This was accomplished by prorating the population for each census tract census based on the percentage land within the Planning Area (Table 2-1). Between 1960 and 2000, the northern Valley experienced an average annual growth rate 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: US Census Bureau, 2010

During the last decade, the population of 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 has slowed population growth.

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 21st Century. Within the last half decade, the Planning Area's economic development has focused primarily on tourism (resort/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 (US Census Bureau, 2010). 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 (US Census Bureau, 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) or $48,706. Based on this definition, all three Planning Area 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 **Employment Projections**

The 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** 2-3.

Table 2-2 for the period 2010 through 2045. The projections incorporate the 2010 US Census data and are developed by the Riverside CCDR. Population estimates have been calculated for each census tract located within the Planning Area. For census tracts partially located within the Planning Area, the estimated population has been adjusted based on the percentage of land for each census tract. Based on these projections, the Planning Area population is estimated to increase to approximately 110,000 people by 2045, an increase of 65,000 between 2010 and 2045.

Employment Projections

The 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 2-3**.

Table 2-2
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

Table 2-3
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 21st 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 would be 4 percent 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. Economists and real estate professionals studying the effects of the recession on the County have predicted that economic recovery will be very slow (Husing, 2009).

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 recover, 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 future growth occurs in the Planning Area, 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.

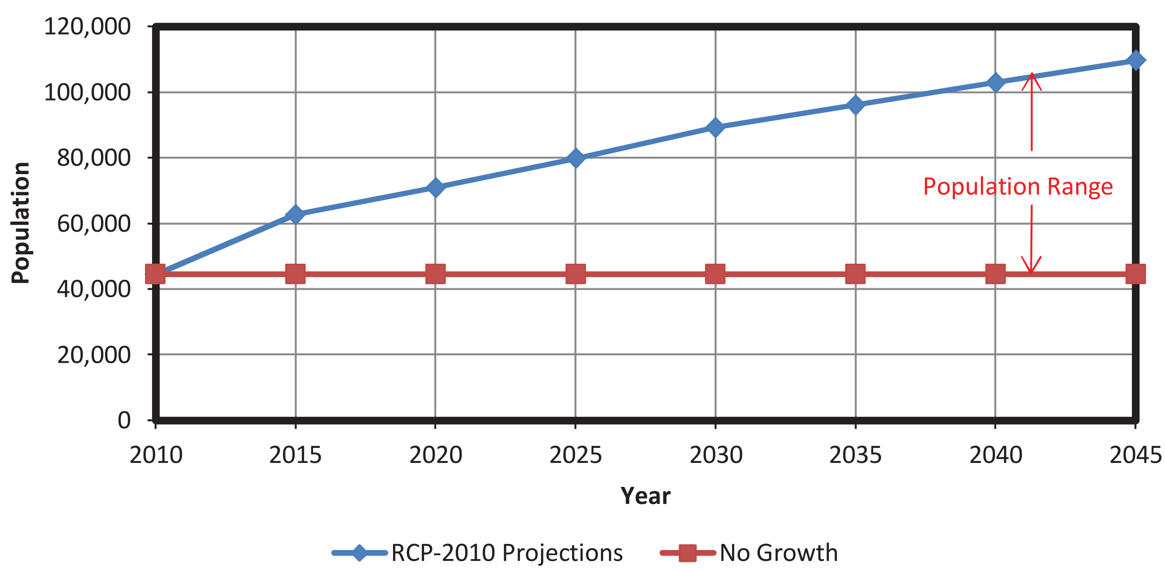

Figure 2-4
Population Projections for the Planning Area

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. Land uses were divided 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-CVMSHCP, developable open space within the Planning Area. These areas are subject to significant development pressure as they transition to urban land uses.

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 Update 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 CVMSHCP. Any WMP adjustments related to growth in light of General Plan updates would be reflected in projected water demands in future updates to this WMP.

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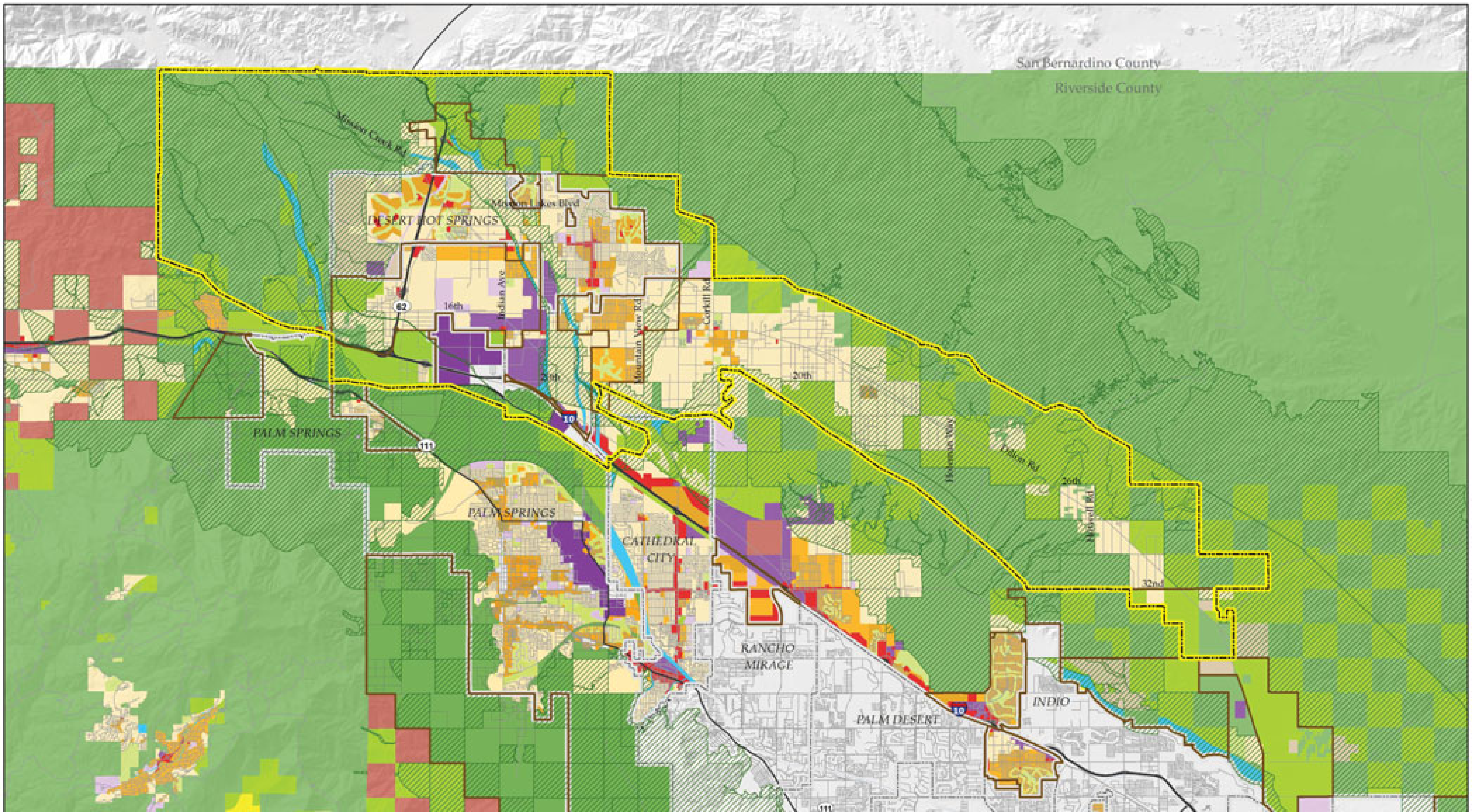

Key to Features

- Planning Area
- City Sphere of Influence
- Habitat Conservation Plan (HCP)

General Plan Land Use

- Agriculture
- Tribal Jurisdiction
- Commercial
- Freeway/Railroad
- Industrial
- Mixed Use Planning Area
- Open Space - Mineral Resources
- Open Space - Conservation
- Open Space - Non-irrigated
- Open Space - Irrigated
- Public Facilities
- Residential - High Density
- Residential - Medium Density
- Residential - Low Density
- Water

Source: Riverside County General Land Use Plan (2003), City of Desert Hot Springs General Land Use Plan (2007), City of Cathedral City General Land Use Plan (2009)

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Date: April 2012

General Plan Land Use

Figure 2-5

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SOCIAL AND CULTURAL SETTING

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 two retail water purveyors in the Planning Area, MSWD has the highest groundwater production from the Mission Creek and the Garnet Hill subbasins. MSWD'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 subbasins, 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 there 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, this WMP assumes that private residential wells produce 1 acre-ft/yr.

Recharge Infrastructure

The DWA owns, operates and maintains an imported water recharge 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, since the Metropolitan's Colorado River Aqueduct (CRA) passes through the valley, CVWD and DWA entered into an agreement with Metropolitan to exchange their SWP water allocations for CRA water. In 1997, Metropolitan 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. A portion of the capital and fixed operations and maintenance costs associated with the delivery of imported water is recovered by property taxes. The remaining portion of the imported water costs is recovered via replenishment assessments levied on groundwater extraction exceeding certain minimum amounts (25 AFY in CVWD and 10 AFY in DWA).

Wastewater Collection and Treatment Infrastructure

The Planning Area has two separate wastewater collection systems and treatment plants (WWTP) both operated by the MSWD. The 2.3 mgd capacity Horton WWTP is located on Verbena Drive about one-half mile south of Two Bunch Palms Trail. The permitted capacity of the Horton WWTP is 2.0 mgd. The 0.18 mgd capacity Desert Crest Treatment Plant is located about one-half mile southeast of the intersection of Dillon Road and Long Canyon Road. 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 plants is disposed by percolation/evaporation ponds located within the plants. These ponds are located on the southwest side of the Mission Creek Fault. In addition, treated effluent is used for irrigation and wash-down at the plants (Psomas, 2007).

Approximately half of the customers in the MSWD service area are connected to wastewater collection and treatment systems; the other half use septic tanks for wastewater treatment and disposal. All of the domestic customers in CVWD's service area within the Planning Area use septic tanks, as no municipal wastewater collection and treatment systems exist in this portion of 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 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).

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 dwelling unit/20 acres) of about 22,400 acres within designated conservation areas. CVWD is currently a signatory (Local Permittee) to the CVMSHCP; MSWD in the process of becoming a signatory to the CVMSHCP. DWA is not a signatory to the plan. As signatories to the CVMSHCP, covered CVWD (and MSWD) water management activities both within and outside of conservation areas are determined to satisfy the legal requirements for the issuance of permits that allow the incidental take of covered species under the federal and state endangered species acts over a 75 year period. **Appendix C – Conservation Areas** 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).

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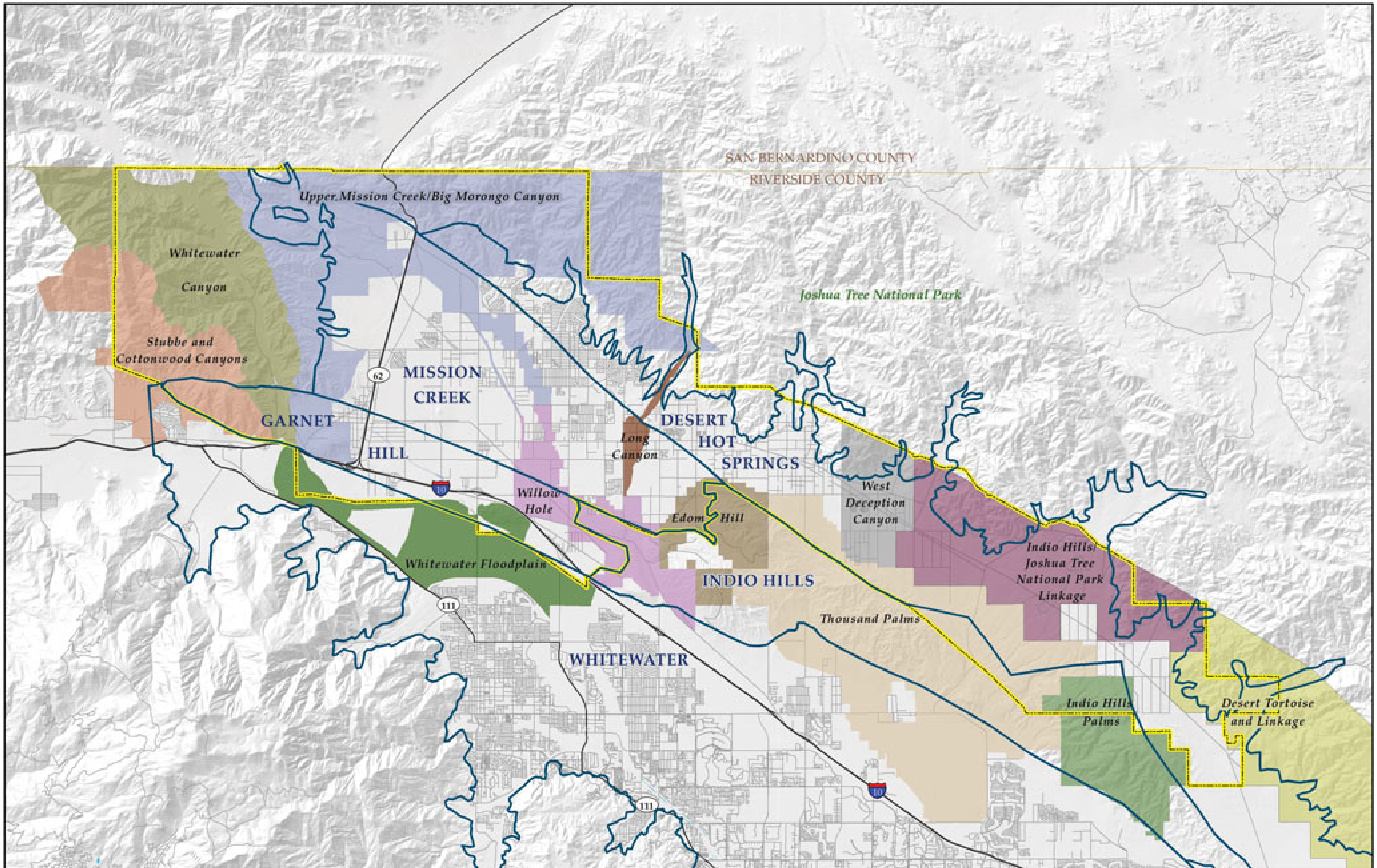

Coachella Valley Multi-Species Habitat Conservation Plan Conservation Areas

Figure 2-6

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Section 3
Water Requirements

Water resources planning requires reasonable estimates of the future water needs of the planning area. A number of factors affect future water needs including climate, existing use patterns, population, employment, economic trends, environmental needs and water conservation efforts. This section discusses historical water usage and 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 uses in the Planning Area are described in this section. 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 effects of currently implemented and future water conservation measures on water demands are also presented.

HISTORICAL WATER REQUIREMENTS

An understanding of historical water use is important for establishing current and future water usage patterns as those patterns affect groundwater extraction. Reasonable groundwater production estimates are also essential for accurate calibration of a groundwater model. Although development of Mission Creek and Garnet Hill subbasins groundwater model is described in more detail in Section 4, the model calibration period commences with the year 1936 for consistency with the Whitewater River subbasin groundwater model. Therefore, water usage for the period of 1936 to the present is necessary.

Historical water use is documented in a number of data sources: water agency billing and production data, Engineer's Reports on Water Supply and Replenishment Assessment for the Mission Creek Subbasin Area of Benefit prepared by CVWD and DWA, water 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. The available data from these sources do not fully cover the desired 1936-2008 calibration period. Therefore, production and return flows are estimated for the Planning Area for periods where historical data are not available.

Water use in the Planning Area is predominantly urban in nature and consists of domestic and commercial uses. Golf courses and fish farms are other existing major water use types. There is no agricultural water use within the Planning Area. Existing 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 production data for the Planning Area are summarized in **Table 3-1**.

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

Year	CVWD Production (acre-ft/yr)	MSWD Production (acre-ft/yr)	Private Production[1] (acre-ft/yr)	Total (acre-ft/yr)
1999	1,946	7,627	1,401	10,974
2000	2,375	7,854	1,609	11,838
2001	2,871	7,843	1,636	12,350
2002	3,313	8,102	2,553	13,968
2003	3,450	8,567	1,751	13,768
2004	3,528	10,039	3,130	16,697
2005	2,957	11,721	1,637	16,315
2006	3,235	11,158	3,358	17,751
2007	3,119	10,919	2,969	17,007
2008	3,098	10,130	3,042	16,270
2009	3,580	9,511	3,699	16,790
2010	3,109	8,665	3,437	15,211
2011	2,906	8,151[2]	3,476	14,533

Note: Production data presented in Table 3-1 are obtained from CVWD's and DWA's Engineer's Report on Water Supply and Replenishment Assessment.

(1) Production values are only reported for those wells that were assessed for groundwater replenishment. Minimal pumpers (< 25 acre-ft/yr for CVWD's Area of Benefit, < 10 acre-ft/yr for DWA's Area of Benefit which includes MSWD's service area) are excluded.

(2) MSWD production (7,864 acre-ft/year) from the Mission Creek subbasin is obtained from DWA's Engineer's Report on Water Supply and Replenishment Assessment for the 2012-2013 period. MSWD production from the Garnet Hill subbasin is estimated to be 287 acre-ft/year based on production data for 2010.

Water requirements for each water use type are briefly discussed below.

Municipal and Domestic Use

Municipal and domestic water requirements in the planning area are served by local water purveyors Mission Springs Water District (MSWD) and Coachella Valley Water District (CVWD), mutual water companies, or private wells. Water consumption is defined as the amount of water billed to each customer. Municipal and domestic water uses consist of residential, commercial, institutional and other similar uses. Water production is the amount of water obtained from a water source (such as groundwater pumping) or combination of sources that enters a water system. The production amount is typically greater than the billed water consumption but it can be less than consumption in some years due to timing differences when meters are read. The difference between water production and water consumption (water billed to customers) is defined as unaccounted-for-water. For planning purposes, water production is always used since that is the amount that a water purveyor must acquire to meet all of its demands including unaccounted-for-water. Per capita water usage is a metric that is used to assess average usage and is the total annual amount of water produced divided by the population served.

MSWD Water Use

Historical water consumption and production data for MSWD's water system are presented in **Table 3-2**. A review of MSWD's consumption and production data for the 19921-20110 period indicates an average annual unaccounted-for-water of nine percent.

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 MSWD water use. Single-Family Residential (SFR) water use increased approximately 70 percent and Multiple-Family Residential (MFR) water use increased approximately 32 percent between year 1991 and year 2010. Overall residential water use increased by approximately 59 percent for the same period.

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	8,918	8,665
2011	4,562	1,251	482	1,284	7,579	8,151

Note: Data provided by MSWD. Unaccounted-for-water is approximately 9 percent for the period 1991-2010.
(1) SFR = Single-Family Residential
(2) MFR = Multiple-Family Residential
(3) Other consumption data include 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.

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

The most significant increase in water use is in the "Other" category, which increased by approximately 186 percent during the 1992-2010 period. This category includes water consumption from schools, irrigation, and tract construction. In particular, water use for this category increased by over 50 percent between year 2003 and year 2004. A majority of 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 SFR category, water use across all categories experienced a significant increase in 2010 for MSWD's service area.

MSWD's per capita water use has declined from approximately 324 gallons per capita per day (gpcd) in 2006 to approximately 222.5 gpcd in 2010. MSWD's 2010 per capita water use of 222.5 gpcd is below its per capita water use target of 264.9 gpcd (Psomas, 2011).

CVWD Water Use

Historical water consumption data for the CVWD water system are presented in **Table 3-3**.

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

Year	SFR (acre-ft/yr)	MFR(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	768	325	32	27	1,151	1,946
2000	1,692	819	76	46	2,632	2,375
2001	1,672	796	75	55	2,598	2,871
2002	1,741	1,071	74	68	2,953	3,313
2003	1,671	1,128	75	56	2,929	3,450
2004	1,722	1,099	75	57	2,953	3,528
2005	1,736	1,049	76	49	2,910	2,957
2006	2,114	1,157	105	82	3,458	3,235
2007	2,160	1,144	135	86	3,525	3,119
2008	1,955	1,044	116	81	3,196	3,098
2009	1,686	942	86	66	2,780	3,580
2010	1,436	802	74	56	2,647	3,109
2011	1,410	788	111	39	2,348	2,906

Note: Data provided by CVWD. Unaccounted-for-water is approximately 10.9 percent for the period 1999-2011.
(1) Multi-family residential use includes water requirements at mobile homes/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 3-3 reflect water consumption and production from the Mission Creek subbasin for CVWD's potable water system.

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

Unaccounted-for-water in the CVWD system varies from year to year but averages about 10.9 percent annually.

A review of water consumption data for CVWD's service area within the Planning Area 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 increased approximately 104 percent between year 1999 and year 2010. A decline of approximately 10 percent is observed in the residential water use between years 2007 and 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 years 2007 and 2008.

CVWD's 2010 per capita water use for the portion of its service area within the Planning Area is estimated to be 402.1 gpcd which is below its per capita water use target of 473 gpcd.

Other Domestic Use

There are independent water systems within the Planning Area that produce groundwater from the Mission Creek and Garnet Hill subbasins for domestic use. There are 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, as is summarized in **Table 3-4**.

Table 3-4
Independent Water Systems within the Planning 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, April 14th, 2010.

Water use for the Desert Dunes Golf Course is based on data obtained 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 pumps its water from the Mission Creek subbasin and the water is used to supply the headquarters and group campground. Jack in the Box and the Palm Gas Mart/ARCO pump groundwater from the Garnet Hill subbasin.

In addition to these independent water systems, some municipal and domestic use may be served by private wells. It is assumed that all private wells use groundwater for residential purposes and production for each private well is assumed to be acre-ft/yr. Details regarding the number of private wells in the Planning Area are discussed in **Section 2 - Plan Setting**.

Golf Course Water Use

There are over 100 golf courses within the Coachella Valley and irrigation of these golf courses represents a significant water use. However, there are only six golf courses within the Planning Area. These golf courses are listed in **Table 3-5** along with the year the course was established and its number of holes and length.

Table 3-5
Golf Courses in the Planning Area

Name	Address	Year Established	Number of Holes/Length	Source of Water 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 the other golf course (Desert Dunes) is located within CVWD's service area. The following golf courses produce groundwater (via private production wells) 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 3-6**. An increase of over 20 percent was observed in golf course water use between years 2003 and 2004. Thereafter, an overall increase of two percent in water use is observed between year 2004 and year 2011.

Table 3-6
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**
2011	1,127	275	1,082	328	**2,812**

Note: Data obtained from 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 two active fish farms within the Planning Area. The historical water use for these farms is presented in **Table 3-7**. Information in when these fish farms began operations in the Planning Area is not available. Groundwater use at Bluebeyond Fisheries has increased significantly since 2010 compared to prior years. Prior to 2011, Bluebeyond Fisheries was self-reporting its groundwater production; however, its water use is now measured via a water meter at the groundwater well.

Table 3-7
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**
2011		489	130	-	**619**

Note: Data obtained from 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 that draws water from the Garnet Hill subbasin is 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 facility is located in North Palm Springs near the intersection of 19th Avenue 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 air emissions. In order to avoid impacting the local infrastructure, the zero-discharge facility draws and purifies 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, 2010).

Summary of Recent Water Use for the Planning Area

Historical water use (2003-2010 period) for the Planning Area is summarized in **Table 3-8** and based on the data presented in **Table 3-2** and **Table 3-3**. The impact of the current economic downturn on water requirements is evident from year 2011 water use, in which residential and commercial water uses have decreased approximately 32 percent and 35 percent, respectively, from year 2007 levels. Overall, water use in the Planning Area has decreased approximately 22 percent since year 2007.

Table 3-8
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)	2011 (acre-ft/yr)
Residential(1)	8,585	9,312	9,596	11,141	11,631	10,183	9,392	8,346	8,011
Commercial(2)	765	790	750	823	902	776	702	1,351	593
Industrial(3)	387	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	1,323
Golf Courses(5)	2,236	2,753	2,730	2,686	2,880	2,899	2,303	2,699	2,812
Fish Farms(6)	200	184	309.4	309	288	308	266	262	619
Total	**13,325**	**15,131**	**15,793**	**17,173**	**17,555**	**15,781**	**14,199**	**14,039**	**13,745**

(1) Residential use includes single and multiple-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 trends and estimates documented in other published reports, combined with growth forecasts are frequently used to estimate future water requirements. Estimates of future water requirements are necessary to identify amounts and sources of supply needed to satisfy those requirements. A discussion of future water use requirements for the Planning Area, including assumptions and methodologies, are presented in the following paragraphs. These estimates consider the effects of existing and future conservation programs in the Planning Area.

Assumptions

The following assumptions are made to estimate water use requirements for the Planning Area through 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 (without considering conservation) for the Planning Area is 232 gallons per capita per day (gpcd), which is the average of years 2000 and 2005 residential water use factors. Current data shows a slight decrease in per capita usage from this amount.

Assumptions for Commercial Water Requirements

It is assumed that commercial water use requirements will increase in direct proportion to 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 (located west of the intersection of Highway 62 and Pierson Boulevard) and one 18-hole golf course is proposed as part of the Tuscan Hills development (located north of Pierson Boulevard, west of Foxdale Drive). There is no information available regarding the timing of these developments. It is assumed that these proposed golf courses will become active between years 2020 and 2040 with one course becoming active in years 2020, 2030, and 2040, respectively. The current average annual water use of an 18-hole golf course in the Planning Area is approximately 1,100 acre-ft/yr based on the consumption at existing courses. The Coachella Valley Association of Governments (CVAG) Valley-wide model water conservation ordinance (2009) restricts future golf course turf areas. New golf courses have a turf limit of 4 acres per hole and 10 acres for practice areas. 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 1,100 acre-ft/yr. Water requirements for proposed golf courses in the Planning Area are estimated based upon the water conservation ordinance from year 2009.

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 (to be convert to 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 in the Planning Area. It is also assumed that the water use at existing fish farms will not increase in the future.

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 constructing a nominally rated 850-MW power generating facility on 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 in 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. In order to offset its future groundwater use, CPV Sentinel has purchased and delivered 8,350 acre-ft of imported water to DWA for groundwater recharge in the Mission Creek subbasin as of December 31, 2011 (DWA, 2012). The amount of purchased water for groundwater recharge is 108 percent of its groundwater production in the Mission Creek subbasin. In addition, CPV Sentinel is required to pay the replenishment assessment and finance a recycled water system extension in the DWA service area.

Assumptions for Institutional Water Requirements

Water use in this category constitutes water requirements for public facilities 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 CVMSHCP suggests monitoring and tracking the effects of lowering groundwater levels on mesquite hummocks. A monitoring program increases the probability of early detection of a substantial lowering of the water table. Early detection improves the chances of successfully addressing any threat posed by a substantial lowering of the water table. Should monitoring detect a substantial lowering or a decline in mesquite health, the CVMSHCP proposed the following actions be taken:

- Evaluate the results of the monitoring
- Prepare a damage assessment report
- Develop feasible measures to ameliorate the effects of substantial lowering of the water table on mesquite hummocks and associated covered species
- Implement measures through adaptive management (CVMSHCP, 2007)

The impacts of varying groundwater levels (increases and decreases) in the Mission Creek subbasin on the mesquite hummocks over the planning horizon of this WMP are unknown at this time. In the event that groundwater levels significantly decline in the Mission Creek subbasin, then the environmental restoration of the hummocks could represent a potential additional water requirement for 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 indicates a production of 516 acre-ft/yr in year 2007. Thereafter, the production in this well dropped to approximately 350 acre-ft/yr, which could reflect 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. The WMP assumes that the ratio between commercial and residential water requirements will remain constant in the future.

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.** Assumptions for water conservation associated with this scenario are listed below:
  - Per capita water use in the Planning Area for CVWD's and MSWD's customers is below their water use target as estimated in their 2010 Urban Water Management Plans. While the potential for additional conservation in the Planning Area is limited, this scenario is representative of the lower end of the potential water demands in the Planning Area. The residential water use factor adjusted for 20 percent 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 10 percent by 2020.
  - Water use for fish farms is assumed to decrease 10 percent by 2020.
- **Growth occurs in the Planning Area consistent with the Riverside County Center for Demographics Research (RCCDR) projections**. Assumptions for water conservation associated with this scenario are listed below:
  - 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 existing golf courses is assumed to remain constant. Water use for new golf courses is assumed to be consistent with the requirements listed in CVWD's and MSWD's landscape ordinances.
  - Water use for fish farms is assumed to remain constant over the planning period.

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 the Planning Area will experience no growth 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 3-9** and shown on **Figure 3-1**.

Projected Growth Scenario

Population projections for the Planning Area developed by RCCDR represent 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 for commercial, golf courses, fish farms, and institutional uses. In this scenario, the year 2045 water requirements for the Planning Area are approximately 150 percent higher than the year 2010 water uses. Water use projections developed for the Projected Growth scenario are presented in **Table 3-10** and shown on **Figure 3-2.**

Table 3-9
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**

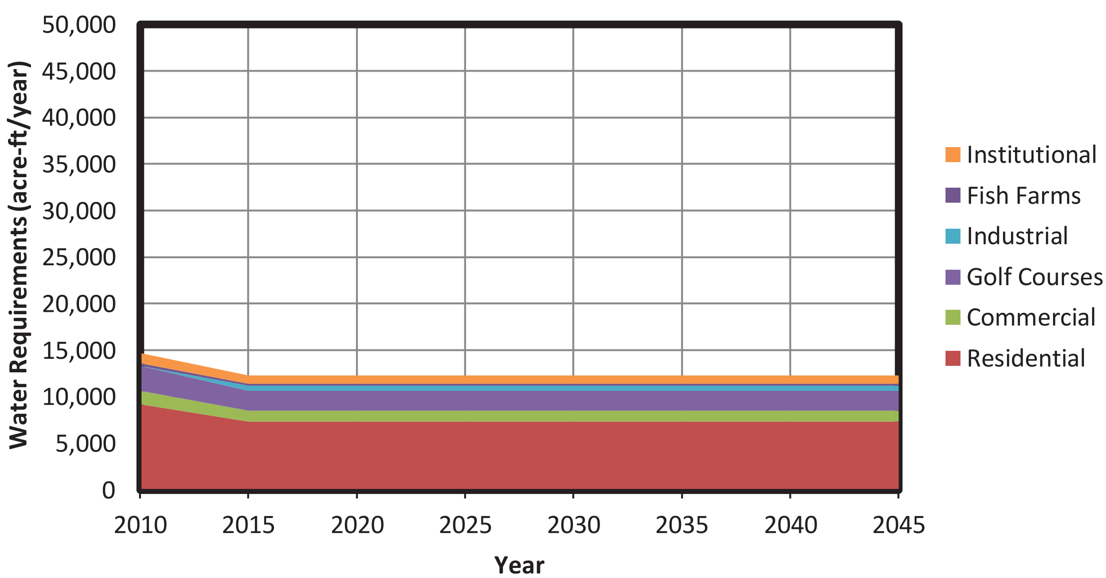

Figure 3-1
Water Requirement Projections for the Planning Area – No Growth Scenario

Table 3-10
Summary of Water Use Projections (Projected 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**

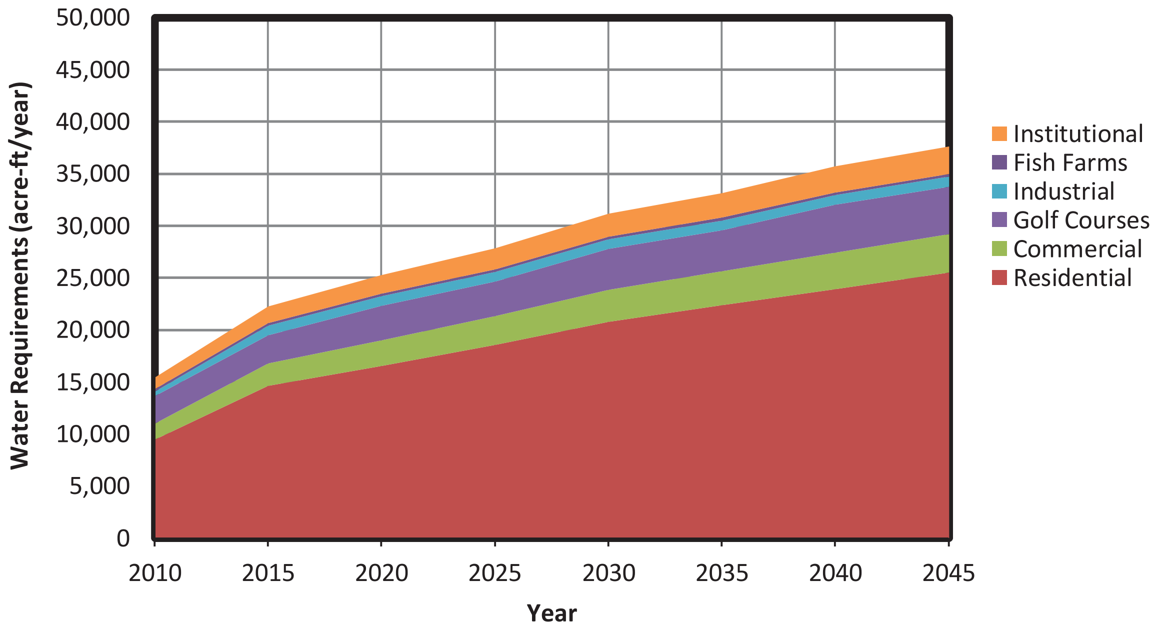

Figure 3-2
Water Requirement Projections for the Planning Area – Projected Growth Scenario

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 3-11**. Additionally, the build out water requirements include the Inner Beauty development, located in the City of Indio's sphere of influence along Dillon Road, 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.

Table 3-11
Assumptions for Estimating Build Out Water Requirements

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

(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.

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.

Estimated build out water requirements for the Planning Area are presented in **Table 3-12**.

Table 3-12
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**

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

Uncertainty In Future Water Projections

The effects of the on-going recession on future growth cannot be accurately quantified. Although the current slowdown in the economy will affect growth in the Planning Area in the short-term (next five to ten years), it is likely that growth will resume and steadily continue in the Planning Area during the 35-year planning horizon of the WMP. If 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 Projected 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 supplies and the need for additional water supply sources be evaluated under the Projected 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 Resources

Water supplies for the Planning Area consist of surface water that naturally replenishes the groundwater basins, groundwater extracted from wells and imported water from the State Water Project (SWP) that is exchanged for Colorado River water from the Metropolitan Water District of Southern California's (Metropolitan's) Colorado River Aqueduct (CRA). This section describes these supply sources and the water management agreements pertaining to them. 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 basin is presented in this section which highlights future water needs for the Planning Area. The conclusions presented in this section are based on available data; additional data collected as part of monitoring activities within the Planning Area may affect these conclusions.

SURFACE WATER

Average precipitation in the Planning Area varies from 4 inches on the valley floor to more than 30 inches in the nearby mountain regions annually (DWR, 1964). Precipitation predominantly occurs during the December through March period, with occasional intense precipitation events during the summer months resulting from subtropical thunderstorms. The precipitation that occurs within the tributary watersheds of the Planning Area either evaporates, is consumed by native vegetation, percolates into underlying alluvium and fractured rock or becomes runoff. A portion of the flow percolating into the mountain watersheds eventually becomes subsurface inflow to the groundwater basins.

Surface water flow in the Planning Area consists of ephemeral or intermittent streams that originate in the San Bernardino and Little San Bernardino mountains. Mission Creek is the only stream that flows to the valley floor on a consistent basis, but the stream usually disappears underground a short distance from its entrance into the Planning Area. The only stream gauge currently operated by the United States Geological Survey (USGS) in the Planning Area is on Mission Creek. Based on 44 years of record (1967-2011), this creek has an average annual streamflow of 2,160 acre-ft/yr. Streams flowing through Morongo Valley, Big Morongo, Little Morongo and Long Canyon periodically reach the valley floor for short periods when there are localized, intense storms in the mountains (MTU, 1998). None of the surface flow from the local watercourses is sufficiently reliable to be used directly for municipal, industrial or agricultural uses in the Planning Area.

Natural recharge in the Planning Area occurs as a combination of surface and subsurface flow. Due to the relatively high evapotranspiration rates compared to precipitation, recharge from direct precipitation on the valley floor is considered to be negligible (DWR, 1964). The principal surface water features that directly contribute to groundwater recharge in the Mission Creek subbasin are Mission Creek, Dry Morongo Wash, and Big Morongo Canyon. The Little

Morongo Creek drainage provides recharge to the Desert Hot Springs subbasin and a portion may flow across the Mission Creek Fault into the Mission Creek subbasin. The Painted Hills catchment to the west of Highway 62 also contributes a small amount of water. Geothermal Surveys, Inc. (GSi/water) estimated that these sources may contribute approximately 10,000 acre-ft/yr to the Mission Creek and the Desert Hot Springs subbasins (GSi/water, 2005). The lower reaches of Mission Creek and Morongo Wash flow across the Garnet Hill subbasin and are believed to contribute to recharge primarily through subsurface flows. The Whitewater River appears to contribute to recharge of the Garnet Hill subbasin through subsurface flow in the alluvial channel across the Banning fault and through the semi-permeable deposits that underlie the Whitewater Hill (GSi/water, 2005).

Other tributaries including those from White House Canyon, Midway Canyon, Blind Canyon, Long Canyon, and North Short Canyon appear to contribute much smaller amounts of water to the Planning Area, principally to the Desert Hot Springs subbasin. Previous investigations indicated the amount of recharge contributed through these canyons is negligible compared to the recharge from the major canyons (Tyley, 1974). GSi/water (2005) estimated that these additional canyons may provide up to 2,200 acre-ft/yr in groundwater recharge to the Desert Hot Springs subbasin.

Psomas (2012) estimated that the total recharge to the Mission Creek subbasin from mountain-front precipitation and runoff under average conditions is approximately 7,500 acre-ft/year using the Maxey-Eakin method (1949) and adjusted based on groundwater model calibration. 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 9,800 acre-ft/yr to 14,300 acre-ft/yr to both the Mission Creek and Desert Hot Springs subbasins (GSi/water, 2005). GSi/water (2005) estimated recharge into the Garnet Hill subbasin from the Whitewater River at a range of 7,000 acre-ft/yr to 70,000 acre-ft/yr based on uncertain hydrogeologic parameters (GSi/water, 2005). MWH (2002) estimated Whitewater River recharge to the Garnet Hill and Whitewater River subbasins be about 8,600 acre-ft/yr. Psomas (2012) estimated recharge into the Garnet Hill subbasin from the Whitewater River drainage at a range of 16,800 to 17,500 acre-ft/yr.

GROUNDWATER

The Coachella Valley Groundwater Basin (CVGB) extends from San Gorgonio Pass on the north to the Mecca Hills and the Salton Sea on the south. The CVGB is bounded on the east by the non-water bearing crystalline rocks of the San Bernardino and Little San Bernardino Mountains and on the west by the crystalline rocks of the Santa Rosa and San Jacinto Mountains. Geologic faults that cross the valley form partial barriers to groundwater flow and interrupt the overall flow of groundwater in the valley, which occurs from northwest to southeast. Groundwater in the Planning Area occurs in the alluvium, terrace deposits, and older sedimentary units that fill the valley.

Groundwater subbasins in the Planning Area consist of the Mission Creek subbasin (DWR Basin No. 7-21-02), the Garnet Hill subbasin (part of DWR Basin No. 7-21-01), 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. Adjacent to the Garnet Hill subbasin is the Whitewater River (Indio) subbasin (DWR Basin No. 7-21-01) which is the principal groundwater basin for the remainder of the Coachella Valley. 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 locations of the groundwater basins within the Planning Area as well as other key features such as production wells, recharge basins and wastewater treatment facilities.

The hydrogeology of the CVGB and its subbasins have been described in numerous publications by the U.S. Geological Survey (USGS) (e.g., Tyley, 1974; Reichard and Meadows, 1992), Department of Water Resources (DWR) (1964), in consultants' studies for the water districts in the area (Slade, 2000; GSi/water, 2006; MWH, 2002 and 2005; Psomas, 2004 and 2006), and by other parties. The following paragraphs summarize the physical characteristics and conceptual hydrogeologic model of the basins, the water budget, 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 reader is referred to **Appendix B** (under separate cover) for more detailed descriptions of the groundwater basins, the conceptual hydrogeologic model and the development and calibration of the numerical model.

Mission Creek Subbasin

Physical Characteristics and Conceptual Model

The Mission Creek subbasin is bounded on the south by the Banning Fault and on the north and east by the Mission Creek Fault. Both faults are branches of the San Andreas Fault zone. The subbasin is bordered on the west by non-water bearing rocks of the San Bernardino Mountains and on the southeast by the semi-water bearing Indio Hills. The subbasin has a surface area of about 76 square miles.

The Mission Creek Subbasin is filled with Holocene and late Pleistocene unconsolidated sediments eroded from the San Bernardino and Little San Bernardino Mountains. There are three significant water bearing sedimentary deposits recognized in the subbasin: Pleistocene Cabazon Fanglomerate and Pleistocene to Holocene Older alluvium and Recent alluvial deposits. These deposits are generally coarse sand and gravel, poorly sorted alluvial fan and pediment deposits that coalesce with one another.

The Mission Creek subbasin is considered an unconfined aquifer with a saturated thickness of 1,200 feet or more and an estimated total storage capacity of approximately 2.6 million acre-ft (DWR, 1964). The volume of groundwater estimated to be in storage for the subbasin is 1.4 million acre-ft (DWR, 1964). The subbasin is naturally recharged by surface and subsurface flow from the Mission Creek, Dry, and Big Morongo Washes, the Painted Hills, and surrounding mountain drainages. Subsurface inflow occurs across the Mission Creek Fault from the adjacent Desert Hot Springs subbasin. Percolation of return flow from applied water and discharges from municipal and individual subsurface wastewater disposal systems also contribute to recharge.

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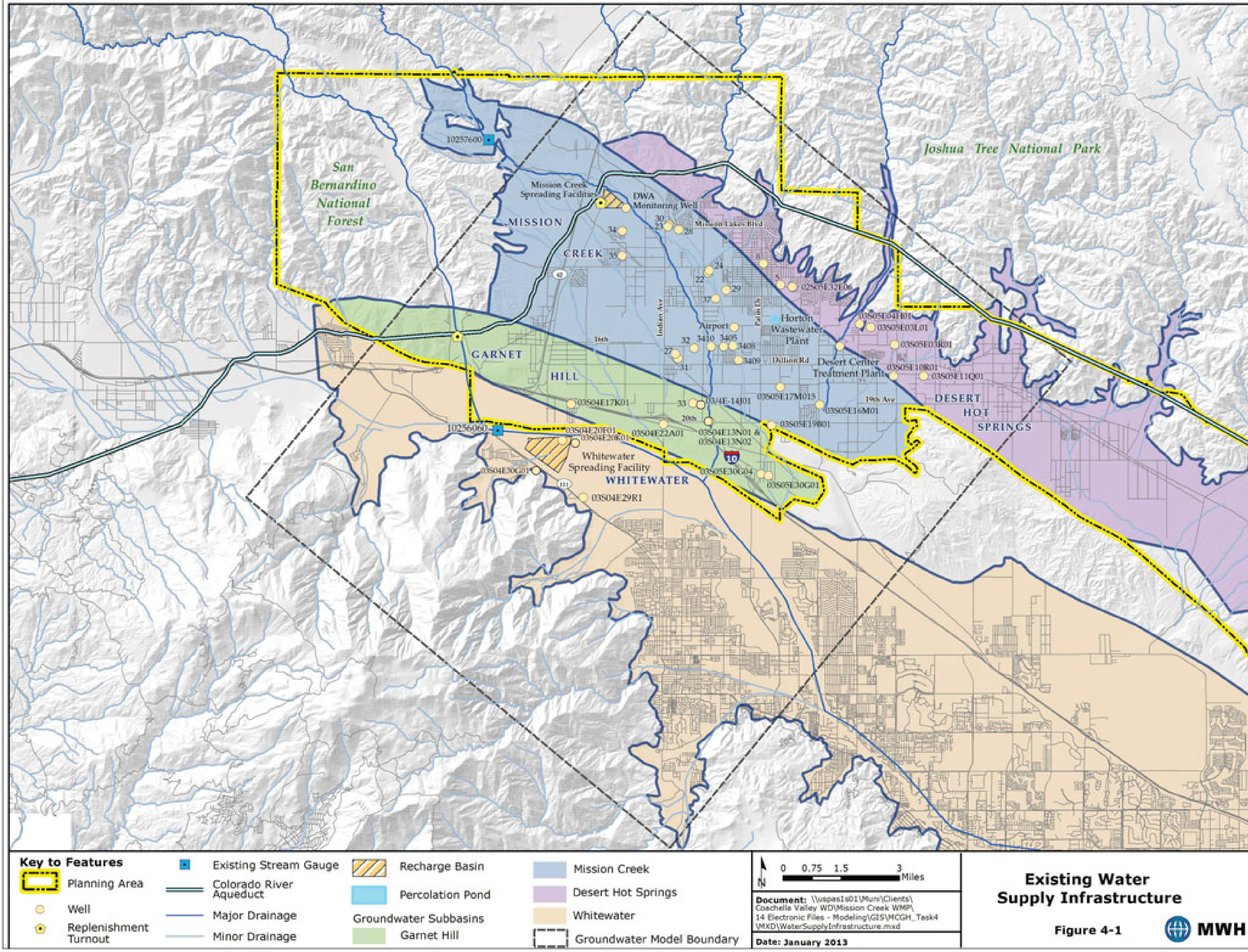

Existing Water Supply Infrastructure

Figure 4-1

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The principal outflows from the subbasin are groundwater production for municipal and private uses, evapotranspiration and subsurface outflow across the Banning Fault. Groundwater generally flows from the northwest to the southeast until about mid-basin where the contour lines curve indicating a southerly flow on the eastern side of the subbasin.

The Mission Creek Fault and the Banning Fault form partially effective barriers to groundwater movement, as evidenced by offset water levels, fault springs, and changes in vegetation (DWR, 1964; Proctor, 1968; Tyley, 1974; Swain, 1977). Both faults exhibit multiple "traces" and are considered seismologically active (Proctor, 1968). 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). Recent monitoring data by MSWD and CVWD confirm this relationship. Similar water level differences exist across the Mission Creek Fault between the Mission Creek and Desert Hot Springs subbasins (DWR, 1964; Catchings, *et al.*, 2009).

To the southeast of the Mission Creek subbasin are the Indio Hills, which consist of the semi-water bearing Palm Springs Formation. 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). However, based on USGS topographic contours on the Seven Palms Valley and Cathedral City 7.5 minute quadrangles, GSi/water (2005) interpreted groundwater flow to cross from the Desert Hot Springs subbasin south through the Indio Hills between Flat Top Mountain and Edom Hill near Willow Hole (GSi/water, 2012).

Water Budget

The groundwater budget analysis for the Mission Creek subbasin accounts for the 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
- Subsurface flows into the basin
- Deep percolation of applied water (e.g.: return flows from irrigation, treated wastewater percolation, septic tank infiltration)
- Artificial recharge with imported water

Outflows
- Groundwater pumping
- Flow to surface water (rising groundwater)
- Subsurface flows from the basin
- Evapotranspiration

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

$$\sum \text{Annual Inflows} - \sum \text{Annual Outflows} = \text{Annual Change in Storage}$$

The water balance components for the Mission Creek subbasin is described below.

Inflows

The predominant inflows that contribute to groundwater within the Mission Creek subbasin are natural recharge from streamflow and mountain-front runoff, sub-surface flow from adjacent groundwater basins, deep percolation of applied water and artificial recharge. The inflow components are described in detail for the water balance.

Natural Recharge

Due to low annual rainfall, recharge from direct precipitation is considered negligible. The majority of natural recharge comes from mountain-front runoff from precipitation and snowmelt. DWR (1964) estimated that approximately 6,000 acre-ft/yr of recharge was attributable to stream runoff and mountain-front infiltration for the Mission Creek subbasin. A study conducted for MSWD indicated natural recharge to the Desert Hot Springs and Mission Creek subbasins could range from 9,400 to 14,400 acre-ft/yr (GSi/water, 2005). 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 where subsurface flows might occur. However, for this plan, subsurface stream flow is considered part of the mountain-front recharge and not included as a separate recharge component. 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 (2012) developed a conceptual hydrogeologic model that provides the foundation for the development of a numerical model for the Mission Creek and Garnet Hill subbasins (see Appendix B). As part of the conceptual model development process, Psomas evaluated the sources of natural groundwater recharge to the Mission Creek subbasin and concluded that the recharge to the Mission Creek subbasin from mountain-front precipitation and runoff under average conditions is approximately equal 7,500 acre-ft/yr.

Subsurface Flow 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 subsurface flow occurs across the Mission Creek Fault from the Desert Hot Springs subbasin. Mayer (1998) used a flow rate of approximately 1,700 acre-feet/yr for subsurface flow across the Mission Creek Fault while Psomas estimated approximately 1,840 acre-ft/yr for subsurface flows across the Mission Creek Fault based on groundwater model calibration (Psomas, 2012).

Deep Percolation of Applied Water (Return Flows)

Return flows are the amount of water applied for irrigation (either agricultural, golf course, or urban) not used by plants to satisfy their evapotranspiration (ET) requirements and water returned to the groundwater basin following domestic usage (septic tank flow or treated wastewater percolation) or other non-consumptive returns such as fish farm effluent.

The following assumptions are used in developing return flows 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 about 40 percent of the total demand for both historical use as well as future projections. Not accounting for the indoor consumptive use, all of the indoor water use overlying the groundwater basin returns as either septic flows or wastewater flows. It is assumed that this ratio has remained constant historically and will remain constant throughout the planning period. All urban water use that is not an indoor use is assumed to be outdoor use (assumed to be 60 percent of the total demand).
- **Indoor Consumptive Use** – It is assumed that 3 percent of indoor domestic use is consumed and the remaining 97 percent becomes septic or wastewater flows (Templin, *et al*., 2010, Table 2).
- **Treated Wastewater Percolation** – MSWD operates two wastewater treatment plants, the effluent of which is disposed via percolation ponds. Historical wastewater plant effluent flows are used which accounts for water used over the Desert Hot Springs Subbasin that is returned through the sewer system. Based on seasonal evapotranspiration data from the DWR 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 into the groundwater basin.
- **Septic Flows for CVWD** – Using CVWD's billing data for the period 1998 to 2009, customers are identified as either overlying or outside the Mission Creek subbasin (CVWD, 2009a). About 14-19 percent of CVWD's water demand overlies the Mission Creek subbasin. The septic flows overlying the Mission Creek subbasin are assumed to be equal to the indoor demands of these customers less 3 percent consumptive use and the septic flows for these customers are returned to the basin. Therefore, septic flows for CVWD customer overlying the Mission Creek subbasin are about 7 percent of the total water pumped by CVWD.
- **Septic Flows for MSWD** – Total septic flows for MSWD are calculated as the difference between the indoor flows (40 percent of total demand less 3 percent consumptive use) and the measured wastewater flows. Since water usage and wastewater flow data for MSWD customers overlying the Mission Creek subbasin was not available, overlying water use is based on the relative percentages of water pipeline installed (annual running averages) overlying (about 52 percent) and outside the subbasin (about 48 percent) (MSWD, 2009). These percentages are then used to prorate the septic flows to the Mission Creek subbasin. Based on discussions with MSWD, it is assumed that about 500 MSWD customers will remain on a septic system at the end of the planning horizon.
- **Urban Outdoor Use** – As noted above, it is estimated that 60 percent of urban water is used for landscape irrigation. Outdoor use is prorated between subbasins using the same percentage values as for wastewater. It is assumed that 75 percent of the applied irrigation water is consumed by plant evapotranspiration based on the CVWD and MSWD landscape guidelines (75 percent irrigation efficiency). Of the remaining applied water, 5 percent is assumed lost to evaporation and 20 percent returns to the groundwater basin.

- **Golf Course Use** – It is assumed that golf course irrigators achieve an average irrigation efficiency of 75 percent (while this is lower than landscape ordinances for recreational turf irrigation (85 percent), this is likely reflective of existing practices), 5 percent is lost to evaporation, and 20 percent of all water pumped returns to the groundwater basin. Production data (prior to 2002) for golf courses with private wells are based on a report published by the Michigan Technical University (MTU, 1998).
- **Fish Farm Use** – 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.
- **Industrial Use** – It is assumed that the power plants (Indigo Wildwood and future 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 1978-2010. Total return flows ranged from 782 acre-ft/year in 1978 to over 3,922 acre-ft/year in 2010. **Table 4-1** presents a summary of the estimated return flows to the Mission Creek subbasin.

<u>Artificial Recharge</u>

Deliveries of SWP Exchange water from the CRA (CVWD and DWA's SWP water through an exchange agreement with Metropolitan) to the Whitewater River subbasin commenced in 1973 and SWP Exchange water from the CRA has been recharged into the Mission Creek subbasin since 2002. The spreading facilities consist of 57 acres of percolation ponds (47 acres wetted bottom area). Since the commencement of recharge activities in 2002, an average of approximately 12,007 acre-ft/yr of water has been recharged in the basin with recharge ranging from 100 to 33,210 acre-ft/yr. A portion of the recharge represents advanced delivery of SWP Exchange water (see discussion later in this section). **Table 4-2** summarizes the total volume of water delivered to each of the artificial recharge areas. Based on evaluation of CIMIS seasonal evapotranspiration data, it is conservatively estimated that 2 percent of the recharged water is evaporated from the spreading facilities and 98 percent of the water reaches the groundwater basin.

Outflows

Production from groundwater wells, subsurface flow 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.

<u>Groundwater Production</u>

The principal groundwater outflow from the Mission Creek subbasin is pumping from production wells. Tyley (1974) estimated that net groundwater production (groundwater pumping less return flows) for the Mission Creek subbasin for the period 1936 through 1967 was 4,370 acre-feet. For the period between years 1947 and 1967, 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. Production data compiled for groundwater modeling are presented in **Appendix B** (under separate cover).

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

Year	MSWD Supplied Water		Other Return Flows (acre-ft/yr)(1)	MSWD Wastewater Percolation (acre-ft/yr)	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	61	352	137	57	18	0	782
1979	208	84	352	190	67	21	0	922
1980	232	95	352	224	74	23	0	1,000
1981	225	96	352	267	95	30	0	1,065
1982	205	92	352	296	87	27	0	1,059
1983	237	115	352	397	97	30	0	1,228
1984	321	142	352	413	128	40	0	1,396
1985	333	144	352	381	144	45	0	1,399
1986	424	169	352	346	145	45	0	1,481
1987	504	209	420	416	150	47	0	1,746
1988	587	245	342	458	83	26	212	1,953
1989	695	291	342	541	104	32	212	2,217
1990	670	307	342	692	97	30	212	2,350
1991	608	294	342	726	83	26	212	2,291
1992	684	318	663	761	76	24	212	2,738
1993	697	341	313	858	98	31	212	2,550
1994	856	390	313	801	121	38	212	2,731
1995	877	387	313	756	121	38	212	2,704
1996	958	414	313	755	119	37	212	2,808
1997	919	408	313	799	70	22	212	2,743
1998	934	425	313	859	114	36	212	2,893
1999	973	446	313	907	130	41	212	3,022
2000	974	462	313	1,004	159	50	212	3,174
2001	960	461	313	1,028	192	60	212	3,226
2002	996	479	313	1,063	222	69	212	3,354
2003	997	506	316	1,233	231	72	315	3,670
2004	1,247	594	391	1,296	236	71	331	4,166
2005	1,549	707	337	1,385	198	63	480	4,719
2006	1,366	673	318	1,528	217	77	490	4,669
2007	1,285	651	371	1,493	209	77	458	4,544
2008	1,192	613	376	1,442	207	70	474	4,374
2009	1,156	595	275	1,399	240	80	421	4,166
2010	1,054	542	341	1,275	208	70	432	3,922

(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).

Table 4-2
Imported Water 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
2011	232,214	26,238
Total	**2,600,813**	**120,073**

Source: DWA, 2011 and CVWD, 2011. Note that the flows presented in Table 4-2 only consist of SWP Exchange Water and do not include flows due to natural recharge or evaporation losses.

<u>*Subsurface Flow to Adjacent Groundwater Basins*</u>

Estimated outflows from the Mission Creek subbasin over the Banning Fault to the Garnet Hill subbasin have ranged from 2,000 acre-ft/year (Tyley, 1974) to 8,250 acre-ft/yr (Psomas, 2010 – steady state (pre-development) conditions). This flow was generally assumed to be uniform along the fault zone. Based on groundwater model calibration, Psomas estimated current outflow across the Banning Fault to be about 4,000 acre-ft yr with the outflow declining as water levels dropped (Psomas, 2012).

Previous investigators have indicated flow through the semi-water bearing rocks at the southeastern end of the basin was inconsequential (Psomas, 2012). However, based on examination of groundwater contours and water balance calculations, Psomas initially estimated outflow from the basin could occur at a rate of up to 3, 000 acre-ft/yr at this location under steady state (pre-development) conditions (Psomas, 2012). Model calibration resulted in refined estimates of about 1,100 acre-ft/yr under current conditions (Psomas, 2012).

<u>*Evapotranspiration*</u>

Mesquite is the dominant phreatophyte found along the Mission Creek and Banning Faults. Mayer and May (1998) estimated the total area populated by phreatophytes to be 1,123 acres. The amount of water extracted from the aquifer by phreatophytes was estimated using the approach of Lines and Billhorn (1996), who estimated transpiration losses from phreatophytes in the Mojave Desert to be 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 up to 1,400 acre-feet/year of groundwater has been lost from the Mission Creek subbasin due to evapotranspiration (Psomas, 2010). Based on groundwater modeling, evapotranspiration is currently estimated to be about 900 acre-ft/yr (Psomas, 2012).

Change in Storage

Based on the estimated inflows and outflows discussed above, the historical cumulative change in storage for the Mission Creek subbasin is presented on **Figure 4-2**. It is observed that groundwater storage declined from 1936 until imported water recharge activities were started in the Mission Creek subbasin in 2003. Increasing values are reflective of additions to total groundwater storage (due to higher recharge than pumping), and declining values are reflective of decreases in total groundwater storage (pumping greater than recharge). The effect of imported water recharge is clearly seen for the Mission Creek subbasin since 2003. During periods of relatively high recharge (2005-2006 and 2010-2011), groundwater storage increased whereas in periods of lower recharge (2003-2004 and 2007-2009), groundwater storage declined. As of 2010, about 160,000 acre-ft of water has been lost from storage since 1936.

The groundwater model for the Mission Creek and Garnet Hill subbasins is used to estimate the historical change in storage. Groundwater model runs are also performed to estimate the impacts of alternative water management plans on the groundwater basins in the Planning Area. Results from these model runs are presented in **Section 5** and **Appendix B**.

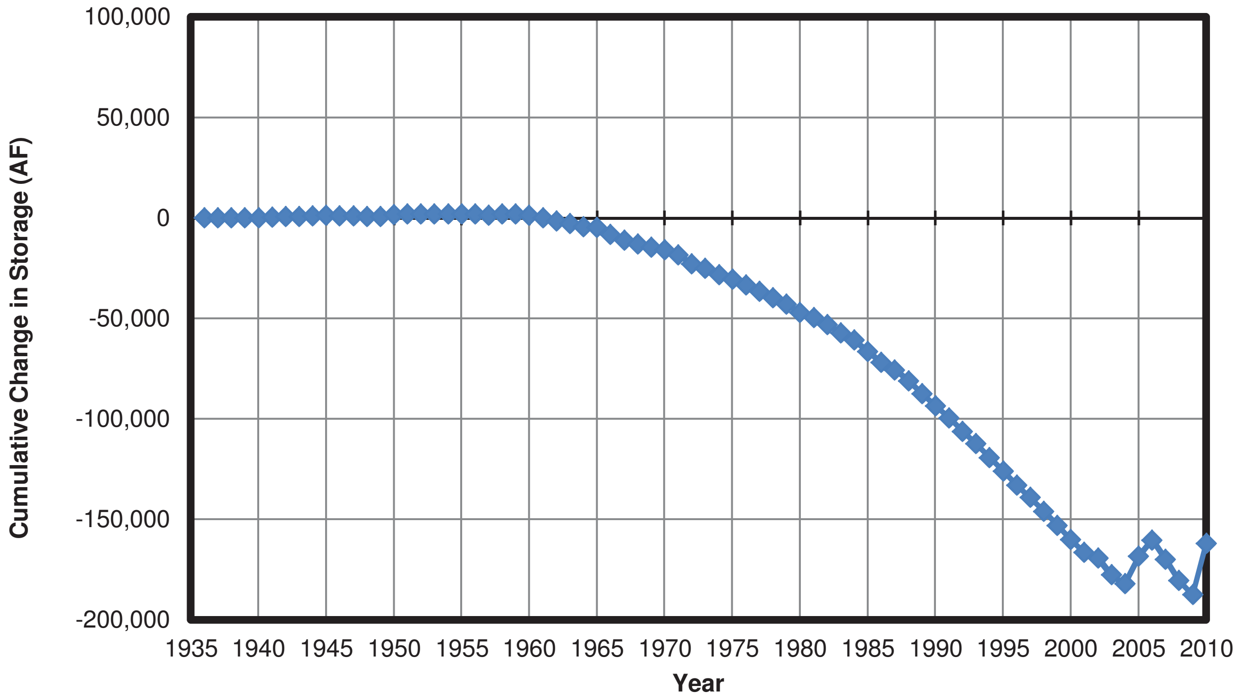

Figure 4-2
Cumulative Change in Groundwater Storage – Mission Creek Subbasin
1936-2010

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. DWR Bulletin 118 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, groundwater levels have generally stabilized in the Mission Creek subbasin. Groundwater level increases in the Mission Creek subbasin are observed in areas closer to the Mission Creek Recharge Facility as compared to the locations of the groundwater production wells. The following discussion focuses on historical groundwater levels in the Mission Creek subbasin.

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 partially 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 (GSi/water, 2005; URS, 2006).

In 1936, groundwater pumping in the valley was significantly lower than current conditions and groundwater is believed to have flowed under generally natural conditions. **Figure 4-3** shows the 1936 groundwater elevation contour map developed by Tyley (1974). Due to scarce water level data at that time, Tyley extrapolated water levels were based on long-term term hydrographs. Water levels in the Mission Creek subbasin have been declining since the early 1950s due to scarce annual precipitation and groundwater extractions (DWR, 2003). Valley-wide 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). MSWD monitoring data indicates a rate of decline of about 3 ft per yr between 1999 and 2007.

Groundwater flow in the Mission Creek subbasin occurs in a southeasterly direction until about mid-basin where the contour lines curve indicating a southerly flow direction on the eastern side of the subbasin. **Figure 4-4**, presents the groundwater elevation contours for 1951 as interpreted by Tyley (1974). It should be noted that the groundwater contour elevation maps developed by Tyley are based on limited data and extrapolations of long-term hydrographs. Conclusions derived from these maps should be reviewed in conjunction with analyses performed by Krieger and Stewart (2007) and Psomas (2010).

Figure 4-5 presents the groundwater elevation contours for 1992 as interpreted by Krieger and Stewart (2007). **Figure 4-6** presents the groundwater elevation contours for 2003 as interpreted by Krieger and Stewart (2007). By 2003, groundwater development had continued and groundwater depressions were formed in the Mission Creek subbasin around areas with major production wells.

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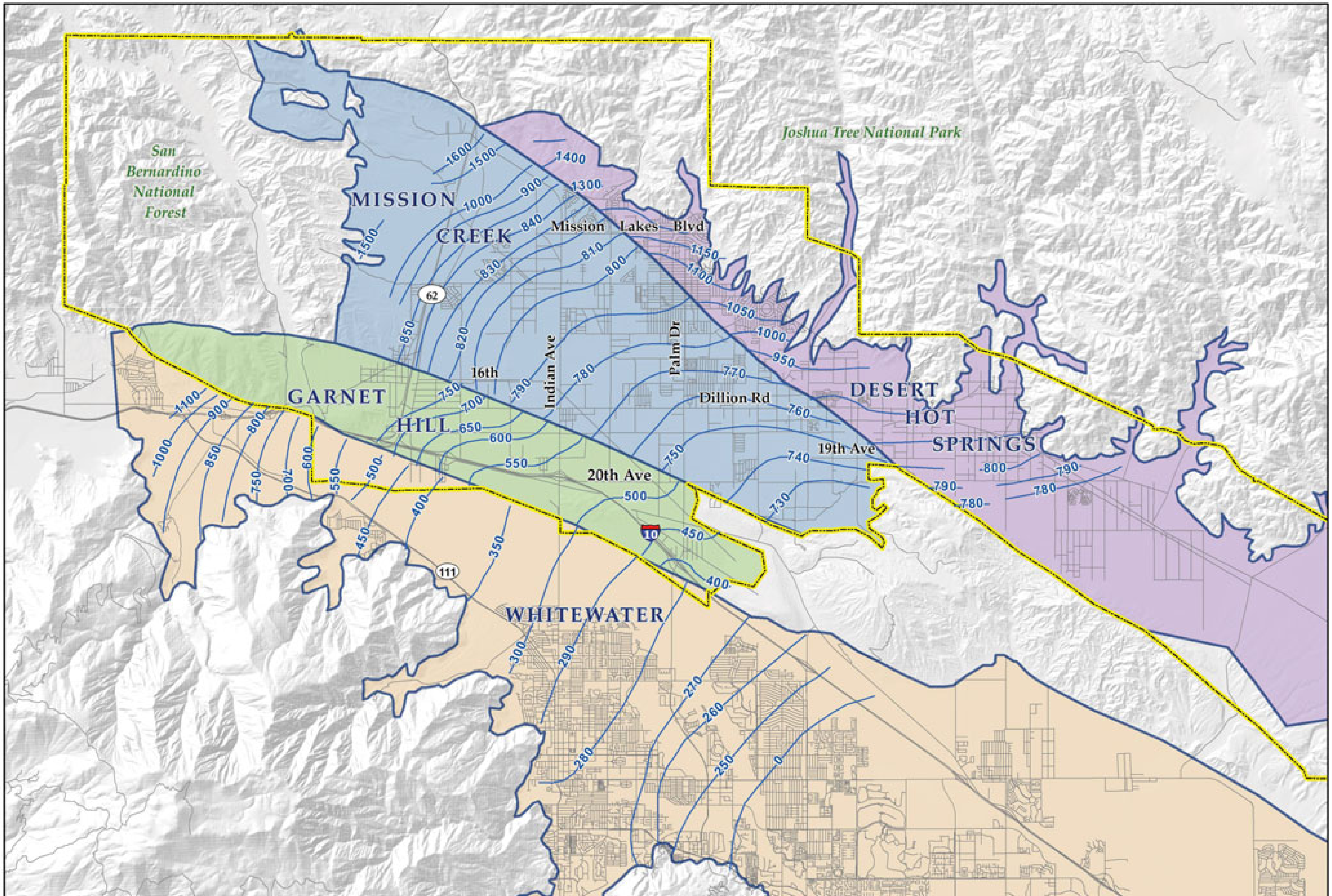

Groundwater Contours - 1936

Figure 4-3

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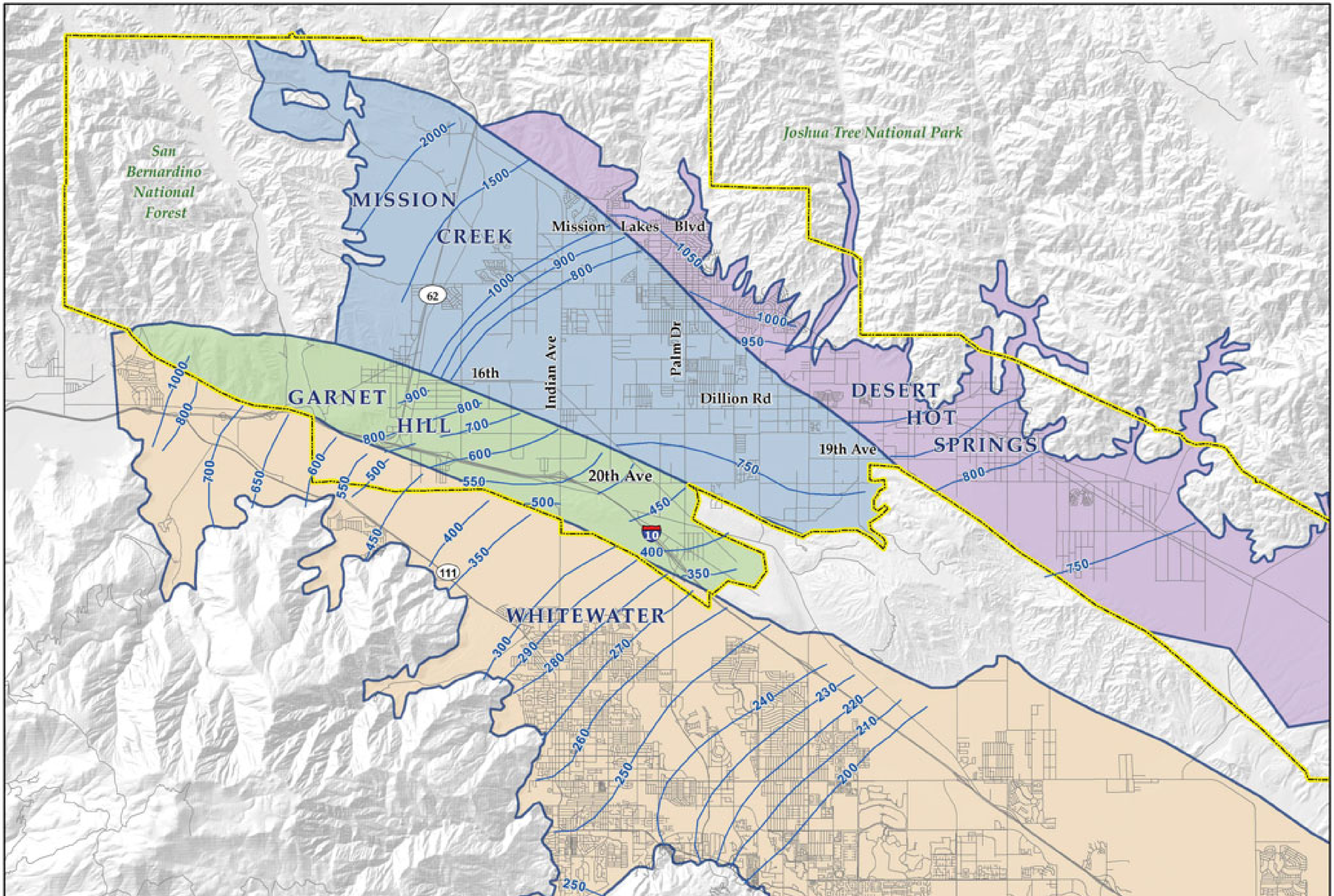

Key to Features

Planning Area

Groundwater Subbasins

Garnet Hill

Mission Creek

Desert Hot Springs

Whitewater

Groundwater Contours in Feet (1951)

Source: Tyley, 1974

0 0.5 1 2 Miles

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Date: January 2013

Groundwater Contours - 1951

Figure 4-4

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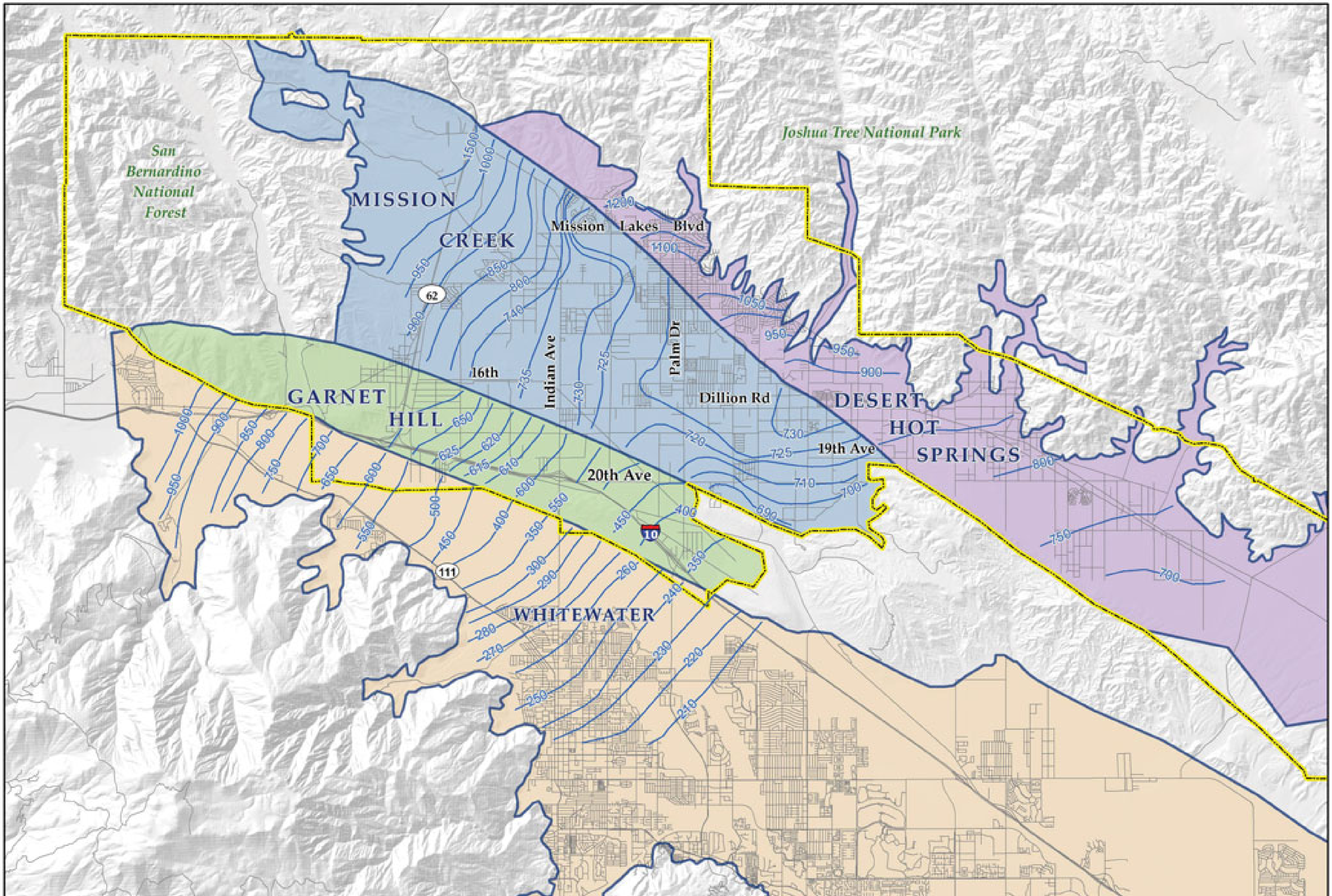

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Date: January 2013

Groundwater Contours - 1992

Figure 4-5

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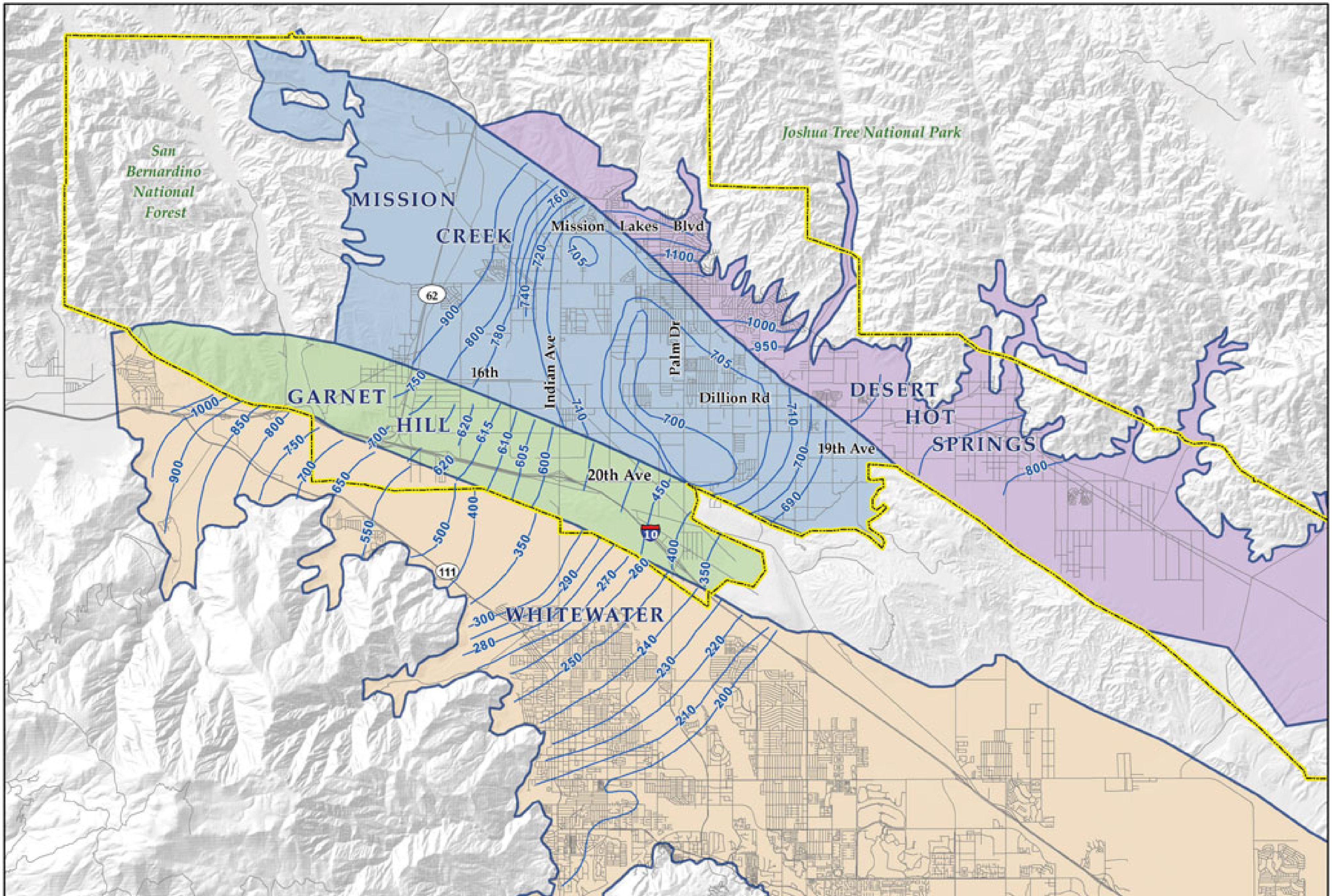

Key to Features

Planning Area

Groundwater Subbasins

Garnet Hill

Mission Creek

Desert Hot Springs

Whitewater

Groundwater Contours in Feet (2003)

Source: Krieger and Stewart, 2007

N 0 0.5 1 2 Miles

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Date: January 2013

Groundwater Contours - 2003

Figure 4-6

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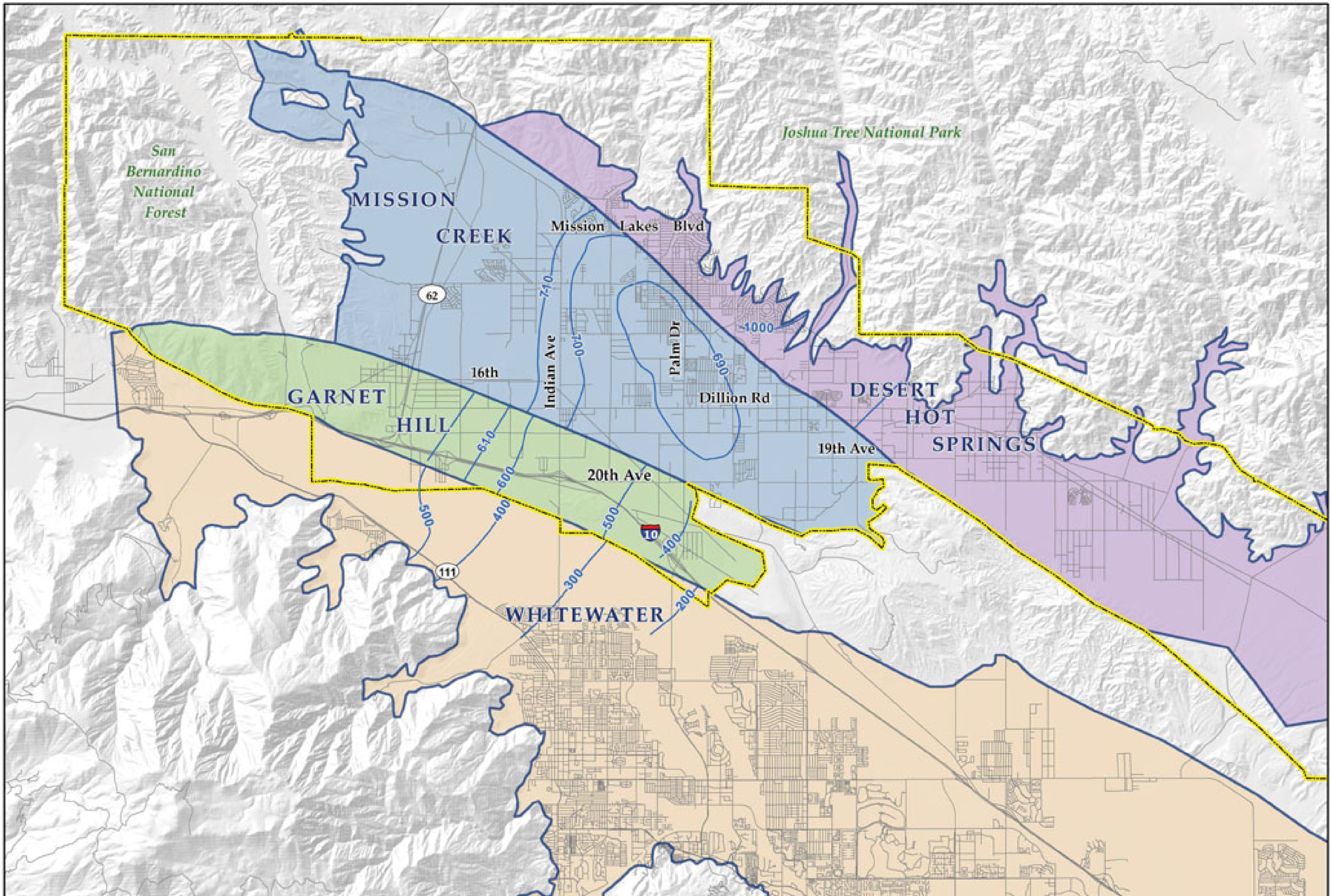

Key to Features

Planning Area

Groundwater Subbasins

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

Groundwater Contours in Feet (2009)

Source: Psomas, 2010

0 0.5 1 2 Miles

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Date: January 2013

Groundwater Contours - 2009

Figure 4-7

MWH

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Psomas (2010) presents the groundwater elevation contours based on readings measured in 2009 (**Figure 4-7**). These contours are similar to the contours developed in 2007 for the year 2003. Groundwater development has created depressions in the Mission Creek subbasin in the central and the southern portions of the subbasin.

Groundwater levels in the subbasin have increased since 2003as a result of the artificial recharge activities (including normal and advanced deliveries) coupled with reduced pumping. As shown on **Figure 4-8**, wells in the subbasin have shown varying responses to recharge. Water levels in a MSWD well located 0.5 mile south of the recharge facility responds similarly to the DWA monitoring well located at the recharge facility, increasing as much as 250 ft since 2004. However, MSWD wells located 1.2 miles south and 1.1 miles to the southeast show 20 and 50 ft increases, respectively. Prior to recharge, water levels in these two wells were 200 ft lower than levels near the recharge facility. The difference in level is now more than 400 ft. These differences in basin response may be the result of mounding near the recharge facility, a previously unknown geologic structure (fault or change in bedrock depth), insufficient transmissivity near the recharge facility or a combination of these factors (Psomas, 2012). Water levels in a CVWD well located 4.4 miles southeast of the recharge facility shows a 4 ft increase since 2004. Continued monitoring and investigation near the recharge facility may explain these observations.

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 subbasin is discussed in detail in the following paragraphs.

Historical groundwater quality data for the Mission Creek subbasin were evaluated by Slade (2000) from samples taken from MSWD and CVWD wells between 1961 and 1998 and are 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.

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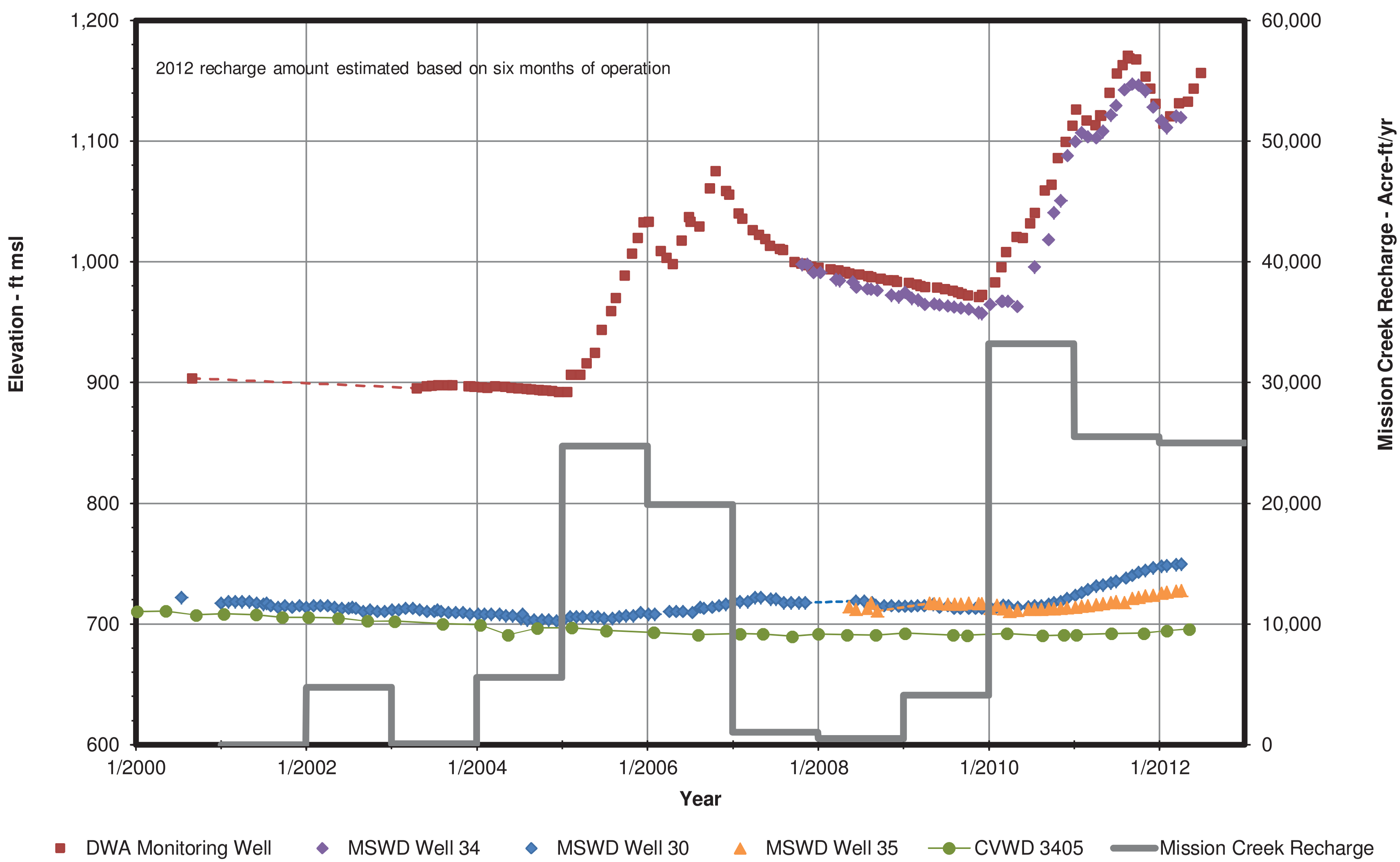

Figure 4-8
Comparison of Recharge and Water Level Response – Mission Creek Subbasin

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- 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. In addition, all samples analyzed were below the State of California recommended Secondary MCL (for aesthetics) of 500 mg/L.
- Total hardness has historically ranged from 56 mg/L to 252 mg/L as $CaCO_3$ in municipal wells. The pH concentration of groundwater in the Mission Creek subbasin has ranged from 7.2 to 8.3.
- Nitrate as NO_3 concentrations have ranged from not detected (ND) to 42.3 mg/L (or 9.4 mg/L if nitrate concentrations are expressed as N) 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.

Based on data obtained for the Mission Creek 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, and radionuclides.

TDS and Salt Balance

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 500 mg/L based on customer acceptance, while the upper MCL is 1,000 mg/L if more suitable quality water is not available or feasible. TDS concentrations range from 240 mg/L to 570 mg/L in the Mission Creek subbasin. In general, TDS concentrations in groundwater improve 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. Wells in the southeastern portion of the subbasin show TDS concentrations ranging from 500 mg/L and over 900 mg/L, probably due to the flow of mineralized water from Desert Hot Springs subbasin. In general, based on the monitoring data, no trends are observed with regards to TDS concentrations over time. **Figure 4-9** presents the temporal variations in the TDS concentrations for selected wells in the Mission Creek subbasin.

A salt balance is an accounting of the amount of salt added to and removed from a groundwater basin over a specified time period. The net salt load is the difference between the salt added and removed from the basin, expressed in tons per year. Salt is added to a groundwater basin through natural surface and subsurface inflows, dissolution of soil, rock, and organic matter, imported water deliveries, and additions through use like fertilizers, detergents and water softeners. Salt is removed from a basin through groundwater pumping for export and natural surface or subsurface outflows. Evaporation and transpiration concentrates the salt in groundwater but does not add salt to the basin. Consequently, the salt in groundwater pumped and used within the basin has no effect on the salt balance.

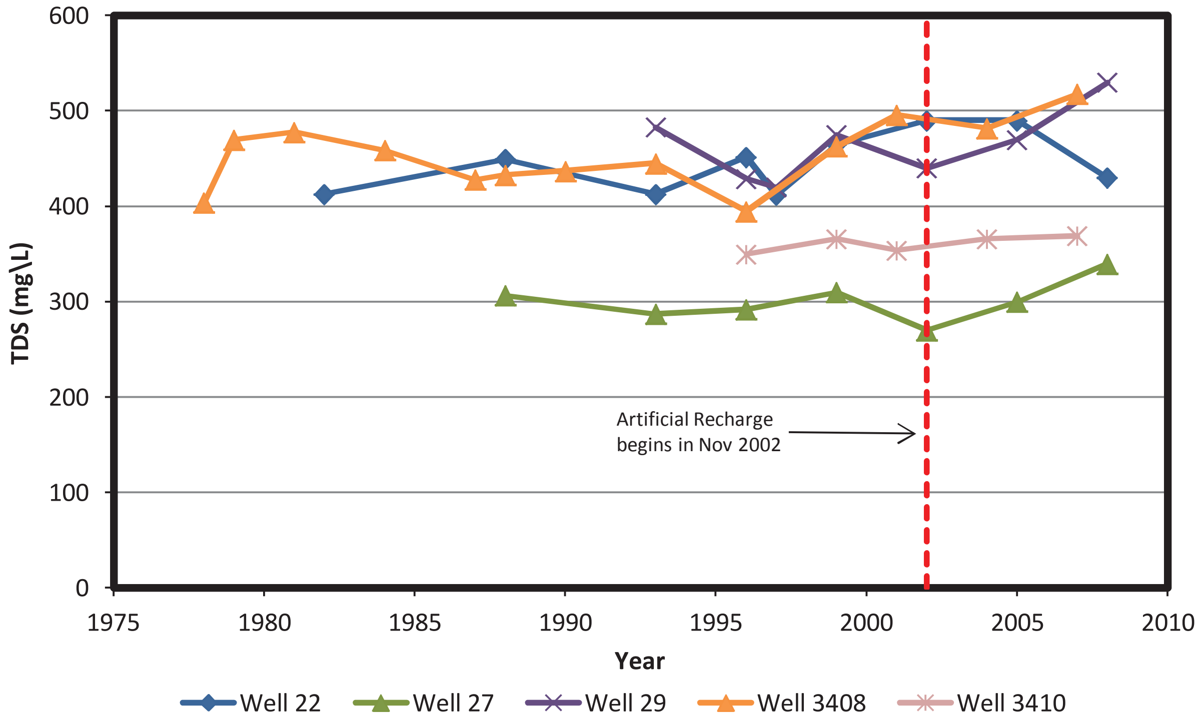

Figure 4-9
Temporal Variations in TDS Concentrations in the Mission Creek Subbasin

A historical salt balance is developed for the Mission Creek subbasin based on the water balance presented earlier using the WEAP (Water Evaluation and Planning) model. The following assumptions apply to the salt balance:

- TDS in natural recharge is 201 mg/L (DWR, 1964).
- TDS in subsurface inflow from the Desert Hot Springs subbasin averages 750 mg/L based on measured values.
- TDS in imported water for artificial recharge is based on historical concentrations in the CRA reported by Metropolitan.
- 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 approximately 0.147 tons/acre/year (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 salt transport process within a groundwater basin.

Figure 4-10 summarizes the historical net total change in TDS for the Mission Creek subbasin. Prior to the commencement of significant imported recharge in 2005, there generally existed a net export of salt from the groundwater basin. This was the result of groundwater pumped and used outside the basin and the subsurface outflow of mineralized groundwater. During periods of high imported water recharge such as in years 2005 and 2006, approximately 39,000 tons of salt was added to the Mission Creek subbasin. For every acre-foot of SWP Exchange water recharged at the Mission Creek Spreading Facility, approximately 0.9 tons of salt is added to the basin.

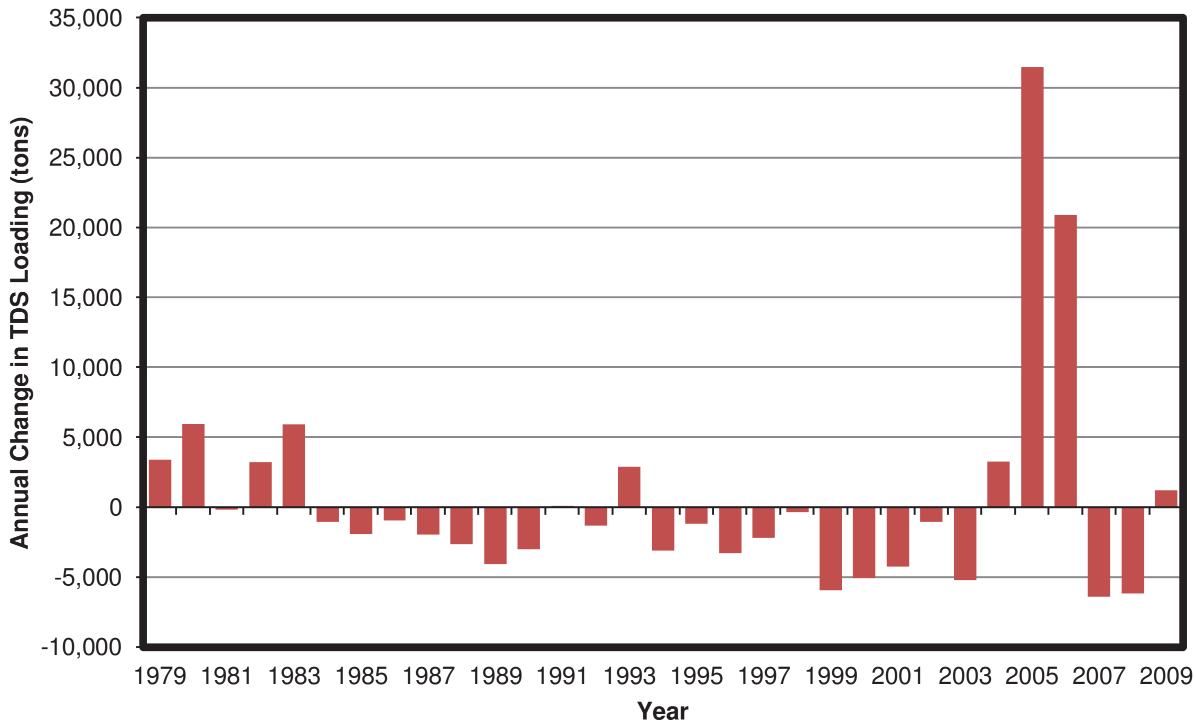

Figure 4-10
Historical Net Salt Load to the Mission Creek Subbasin

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 desalting Colorado River water prior to recharge. These alternatives are discussed further in Section 5. .

Nitrate

The California primary MCL for nitrate (as NO_3) is 45 mg/L and 10 mg/L when expressed as nitrogen (N). 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/water, 2011). Generally, nitrates exist in the unsaturated and shallow aquifer zones above

300 to 400 feet below ground surface, 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 for all recorded public water supply samples in the Mission Creek subbasin. Nitrate concentrations (as NO_3) range from a low of 1.1 mg/L (observed at CVWD Well 3410 in 2002) to a high of 9.4 mg/L (observed at CVWD Well 3405 in 1978). However, several private wells have recorded nitrate exceeding the MCL. 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. Of these wells, MSWD Well 29 (shown in purple), which is downgradient from an area of long-term septic tank usage, shows an statistically significant increasing trend in nitrate concentration but is well below the MCL. Two other MSWD wells (not plotted) may also show a slightly increasing trend (GSi/water, 2011a).

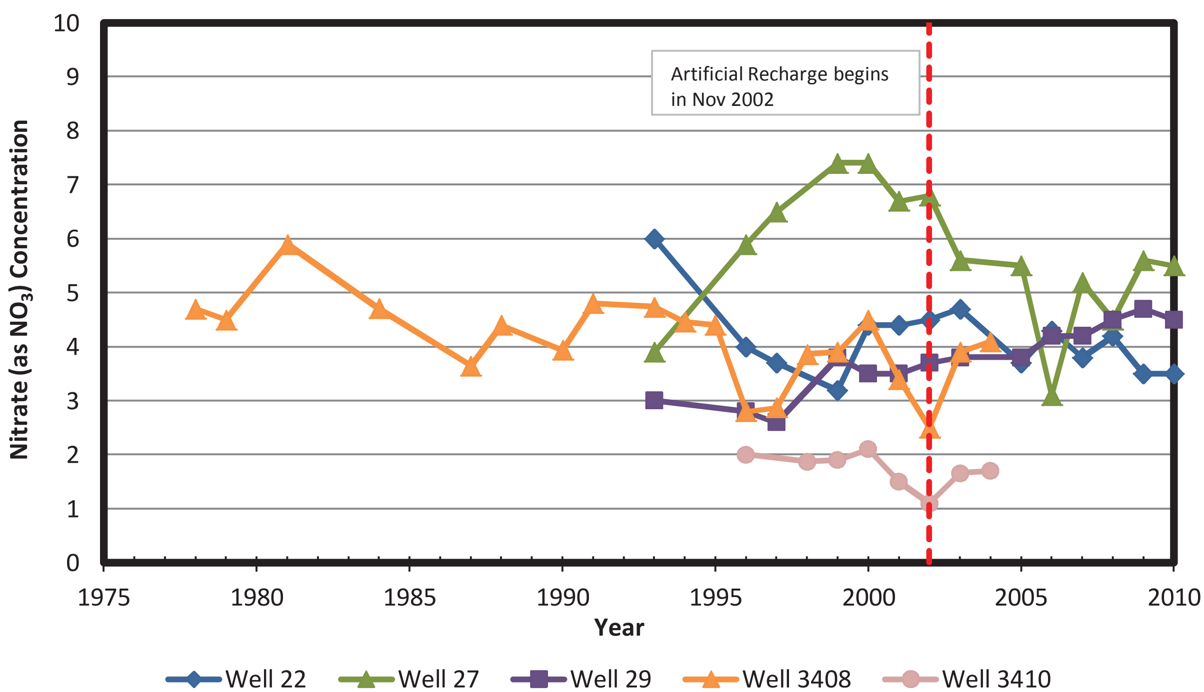

Figure 4-11
Temporal Variations in Nitrate Concentrations in the Mission Creek Subbasin

Chromium

Chromium is a heavy metal that occurs throughout the environment. The soluble hexavalent form is relatively toxic, while the less-soluble trivalent form has very low toxicity and is a required nutrient. Currently, there is no MCL for hexavalent chromium (Chromium VI); however, the MCL for total chromium is 0.05 mg/L (50 microgram per liter (µg/L)), which includes Chromium VI. California DPH is expected to set a MCL for Chromium VI in the July

2014 to July 2015 timeframe (CDPH, 2012). A PHG of 0.02 µg/L was established in July 2011 (OEHHA, 2011).

Total chromium is detected in several groundwater wells in the Mission Creek subbasin. Total chromium has been detected in MSWD wells 22, 24, 27, 29, and 31; however, the concentrations are lower than the MCL. Total 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. 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 the presence of arsenic.

Radionuclides

Radionuclides are elements that emit radioactivity and may be naturally-occurring or artificially produced. The principal radionuclides of concern for the Planning Area are uranium and gross alpha.

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. 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 was removed from service. Wells 34 and 28 have well-head treatment for uranium removal. Uranium was 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, since it is 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. For groundwater samples obtained in 2008, Well 30 and Well 34 exceeded 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 at this time.

Garnet Hill Subbasin

Physical Characteristics and Conceptual Model

The area between the Garnet Hill Fault and the Banning Fault is named the Garnet Hill subbasin. The Garnet Hill Fault is a branch of the San Andreas Fault system consisting of a series of left-stepping northwest-trending right-lateral faults with active folds at each stepover. These folds are exhibited a series of small hills (West Whitewater Hill, East Whitewater Hill Garnet Hill, Edom Hill and several small unnamed hills) between each fault segment (Yule & Sieh, 2003). The subbasin was considered a subarea of the Whitewater River (Indio) subbasin by DWR (1964) and it was considered a distinct subbasin by the USGS for the effectiveness of the Banning and Garnet Hill Faults as barriers to groundwater movement (Tyley, 1974). This was 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). DWR observed that limited data existed to characterize the hydrogeology of this subbasin (DWR, 1964). Little has changed since that time as well logs are available for only six out of 14 known wells in the subbasin.

The Garnet Hill Subbasin is considered an unconfined aquifer with a saturated thickness of 1,000 feet or more and an estimated total storage capacity on the order of 1.0 million acre-ft. The subbasin is naturally recharged by subsurface flow from the Mission Creek Subbasin and percolation of runoff and subsurface flow from the Whitewater River watershed on the west. Irrigation return flow and discharges from municipal and individual subsurface wastewater disposal systems also contribute to recharge but are considered very small.

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 are channel infiltration and subsurface flow in the Whitewater River, subsurface flow through the semi-permeable deposits which underlie Whitewater Hill and from subsurface flow across the Banning Fault from the Mission Creek subbasin. In general, there is subsurface flow from the Garnet Hill subbasin across the Garnet Hill Fault to the Whitewater River subbasin westerly of the Garnet Hill outcrop.

The Garnet Hill and Banning faults form partially effective barriers to groundwater flow based on water level differences across the faults (DWR, 1964; Tyley, 1974; Psomas, 2010). DWR indicated the Garnet Hill fault does not reach the ground surface and is probably effective as a barrier to groundwater movement only below a depth of 100 ft (DWR, 1964). The effectiveness of the Garnet Hill Fault as a barrier is believed to diminish east of Garnet Hill (Tyley, 1974). DWR (1964) noted a constriction in the alluvial cross section near Garnet Hill has caused a small groundwater cascade. This is inferred from current water level data.

Water Budget

The groundwater budget analysis for the Garnet Hill subbasin accounts for the inflow and outflow components of the basin as were described previously for the Mission Creek subbasin. The water balance components for the Garnet Hill subbasin are described below.

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 little surface runoff making it to surface drainages south of the Banning Fault (Mayer and May, 1998). Consequently, for estimation purposes, it is assumed that the only mountain-front recharge reaching the Garnet Hill subbasin is 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.

Deep Percolation of Applied Water (Return Flows)

The predominant return flow components in the Garnet Hill Subbasin are septic tank infiltration and irrigation return. An estimate of the infiltration of septic systems along with the irrigation return flow was calculated for the Garnet Hill subbasin for the period 1936-2010. 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 2010. **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. Inflow associated with recharge occurring in adjacent basins is addressed as subsurface inflow.

Subsurface Inflows from Adjacent Groundwater Basins

The Garnet Hill subbasin receives subsurface inflow from both the Mission Creek subbasin (across the Banning Fault) and from the Whitewater River subbasin (across the Garnet Hill Fault). 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 14,000 acre-ft/yr (GSi/water, 2005). Psomas estimated outflows from the Mission Creek subbasin across the Banning Fault into the Garnet Hill subbasin at 8,250 acre-ft/yr for steady-state (pre-development) conditions (Psomas, 2012). As described previously, groundwater model calibration resulted in refinement of this estimate to about 4,000 acre-ft/yr under current conditions.

Artificial recharge in the Whitewater River subbasin causes subsurface flow into the Garnet Hill subbasin if groundwater levels in the Whitewater River subbasin are sufficiently high (see subsequent discussion under Ground Water Levels). This is observed by reviewing groundwater level measurements for well 03S04E17K01S in the Garnet Hill subbasin upon recharge in the Whitewater River subbasin. Whether the response of the basin is due to infiltration in the Whitewater River channel, subsurface inflow across the Garnet Hill Fault or a temporary reduced groundwater gradient across the Garnet Hill Fault is unclear at this time. The effects of recharge are less pronounced towards the southeastern areas in the Garnet Hill subbasin than the northwestern areas or the middle areas of the subbasin. Additional discussion of the water level differences are presented in the next section.

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

Year	MSWD Supplied Water		Total Return Flows (acre-ft/yr)
	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

Outflows

Production from groundwater wells and subsurface flows 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/yr in 1949 to less than 100 acre-ft/year in the 1980s and 1990s. Production data for the wells are presented in Appendix B.

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 outflow associated with phreatophytes has been assumed (Psomas, 2010).

Subsurface Flow to Adjacent Basins

Subsurface flow across the Garnet Hill Fault to the Whitewater Subbasin is inferred based on water level differences across the fault. Previous studies did not directly estimate flow across the Garnet Hill Fault. Tyley (1974) stated that flow through the Garnet Hill subbasin was small, perhaps 5,500 acre-ft/yr. Modeling performed for the Coachella Valley WMP did not specifically compute an outflow across the Garnet Hill Fault; instead, flow was included with the Whitewater River subbasin water balance (MWH, 2002). Psomas (2010) estimated a steady-state (pre-development) outflow across the Garnet Hill Fault of about 25,000 acre-ft/yr. Groundwater model calibration results indicated that outflow for 2009 conditions was comparable (Psomas, 2012).

Change in Storage

Based on the estimated inflows and outflows discussed above, the historical cumulative change in storage for the Garnet Hill subbasin since 1936 is presented on **Figure 4-12**. As shown in the figure, cumulative groundwater storage in the Garnet Hill subbasin declined from 1945 to 1977 due to a prolonged drought except for wet periods in 1958-59 and 1966-1970. From 1977-1983, storage increased due to a series of wet years that increased runoff from San Bernardino Mountains. The beginning of the recharge program at the Whitewater River Spreading Facility in 1973 also contributed to higher storage in Garnet Hill by reducing subsurface outflow from the subbasin as a result of a reduced groundwater gradient across the Garnet Hill Fault. Based on water level data and groundwater modeling, it appears that high amounts of artificial recharge in the Whitewater River subbasin as occurred in 1984-86, 1996-2000, 2005 and 2010-2012 may result in subsurface flows into the Garnet Hill subbasin, especially when groundwater levels in the Whitewater River subbasin are high. Groundwater levels in the Whitewater River subbasin decline during periods of reduced recharge at the Whitewater facility resulting in increased subsurface outflow from the Garnet Hill subbasin as seen during the 1987-1991 period.

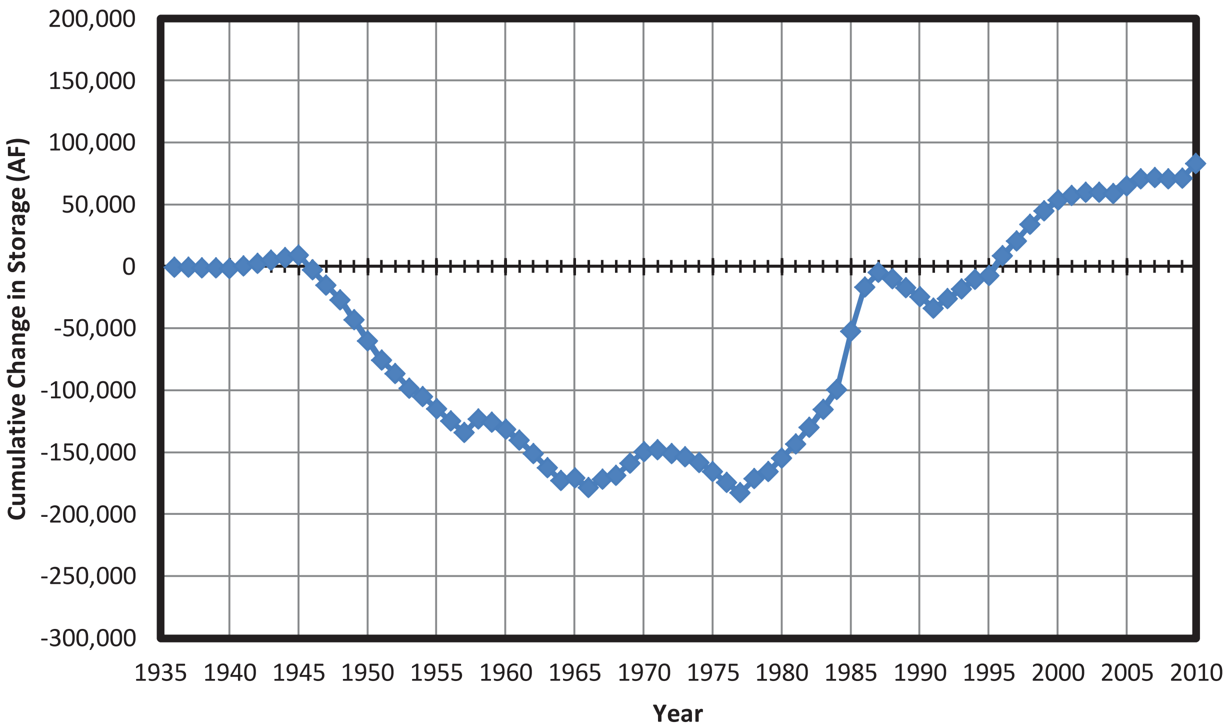

Figure 4-12
Historical Change in Groundwater Storage – Garnet Hill Subbasin

Groundwater Levels

The Garnet Hill subbasin has groundwater elevations approximately 200 to 250 feet lower than the Mission Creek subbasin along the Banning Fault indicating that the groundwater flow is partially restricted by the Banning Fault (DWR, 1964). Groundwater 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 Whitewater River subbasin across the Garnet Hill Fault.

The Upper Whitewater River 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 4-4 presents the groundwater elevation contours for 1951 as interpreted by Tyley (1974). By 1951, 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 those observed in 1936 (Psomas, 2010).

Figure 4-6 presents the groundwater elevation contours for 2003 as interpreted by Krieger and Stewart (2007). The Garnet Hill subbasin had observed a decline in water levels in the upper part of the subbasin and the Upper Whitewater River subbasin had observed an almost 100 feet increase in elevation from the 1951 levels, 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 (**Figure 4-7**). 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. In general, the lack of sufficient wells being monitored for water levels inhibits the ability to understand flow patterns in the subbasin. Monitoring for water levels of additional wells is recommended.

Measured groundwater levels in portions of the Garnet Hill subbasin show a response to recharge activities in the Whitewater River subbasin as shown on **Figure 4-13**. The location of these wells is shown on **Figure 4-1**. Water levels in Whitewater River subbasin wells near the recharge basins (03S04E20K01S and 03S04E29R01S) show rapid response to increased recharge (gray line). Wells in the western portion the Garnet Hill subbasin ((03S04E17K01S and 03S04E22A01S) also show response to larger recharge events as in 1984-86, 1996-2001, 2005-06 and 2010-12). Water levels in the central portion of the subbasin (03S04E13N01S/N02S and 03S04E14J01S) show a more muted and delayed response to the largest recharge events; while the well in the eastern portion of the subbasin (03S04E30G01S) shows minimal response. These data show a 250 ft gradient between the northwest and southeast portions of the subbasin. Monitoring of additional wells would provide a better picture of basin response and long-term water level trends.

Groundwater Quality

Information available on groundwater quality for the Garnet Hill subbasin is limited. In several cases, for a given year data is available only 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. This is a significant data gap for the Garnet Hill subbasin.

TDS and Salt Balance

Historically, recorded TDS concentrations at different groundwater wells in the Garnet Hill subbasin have ranged from a low of 156 mg/L (1999) to a high of 792 mg/L (1969). Samples analyzed in 2008 indicate a TDS concentration of 230 mg/L at MSWD Well 33 (which came online in 2003).

Based on the water balance and salt load assumptions presented earlier and the existing TDS concentrations, the WEAP (Water Evaluation and Planning) model is used to develop a salt balance for the Garnet Hill subbasin. Results from the salt balance indicate that each year the amount of salt being added to the subbasin is greater than the amount of salt leaving the subbasin as shown on **Figure 4-14**. While the current TDS concentrations in the basin are approximately 250 mg/L, the TDS concentrations are expected to increase over the course of time if this trend continues.

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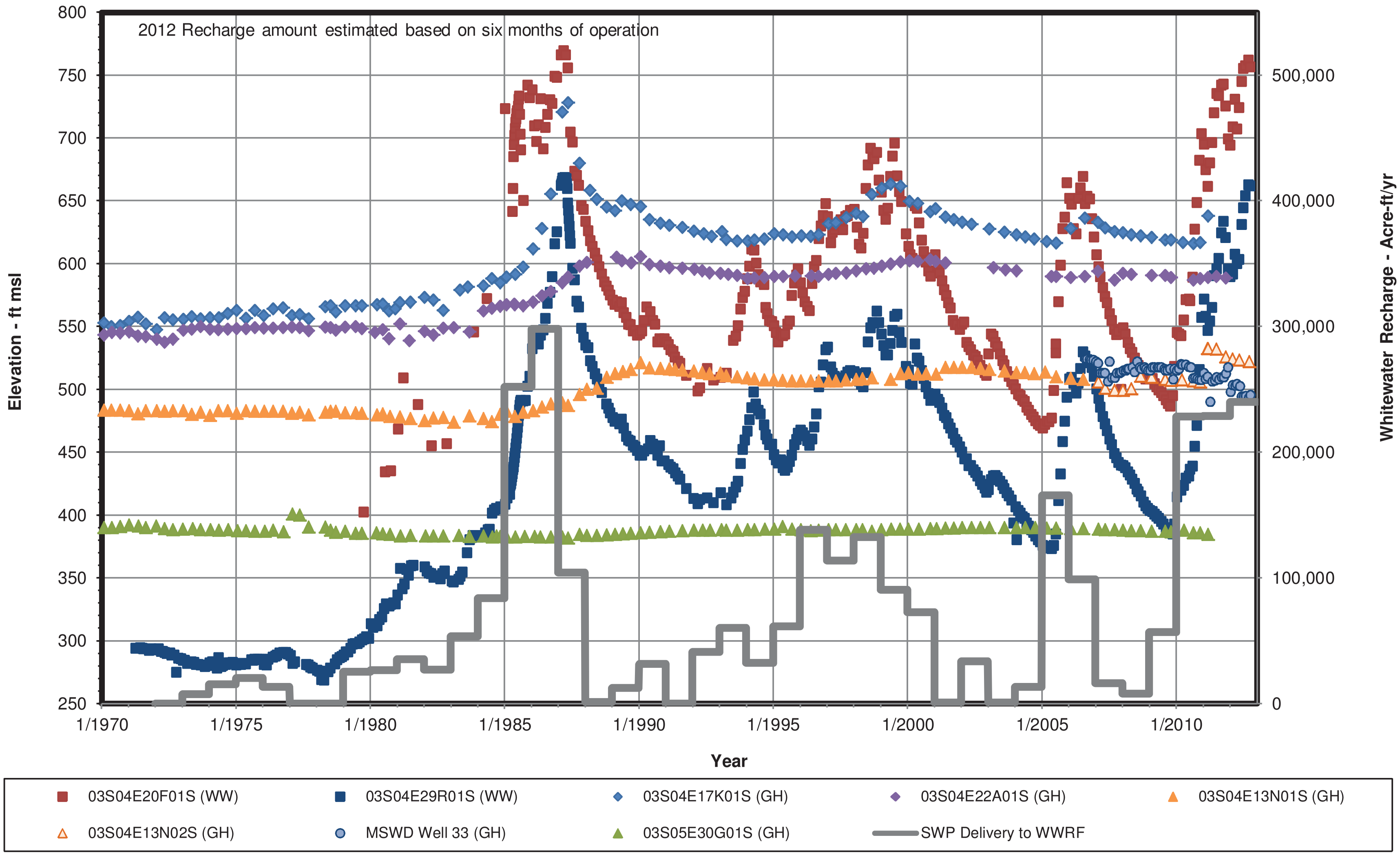

Figure 4-13
Comparison of Whitewater Recharge and Groundwater Level Response in Whitewater and Garnet Hill Subbasins

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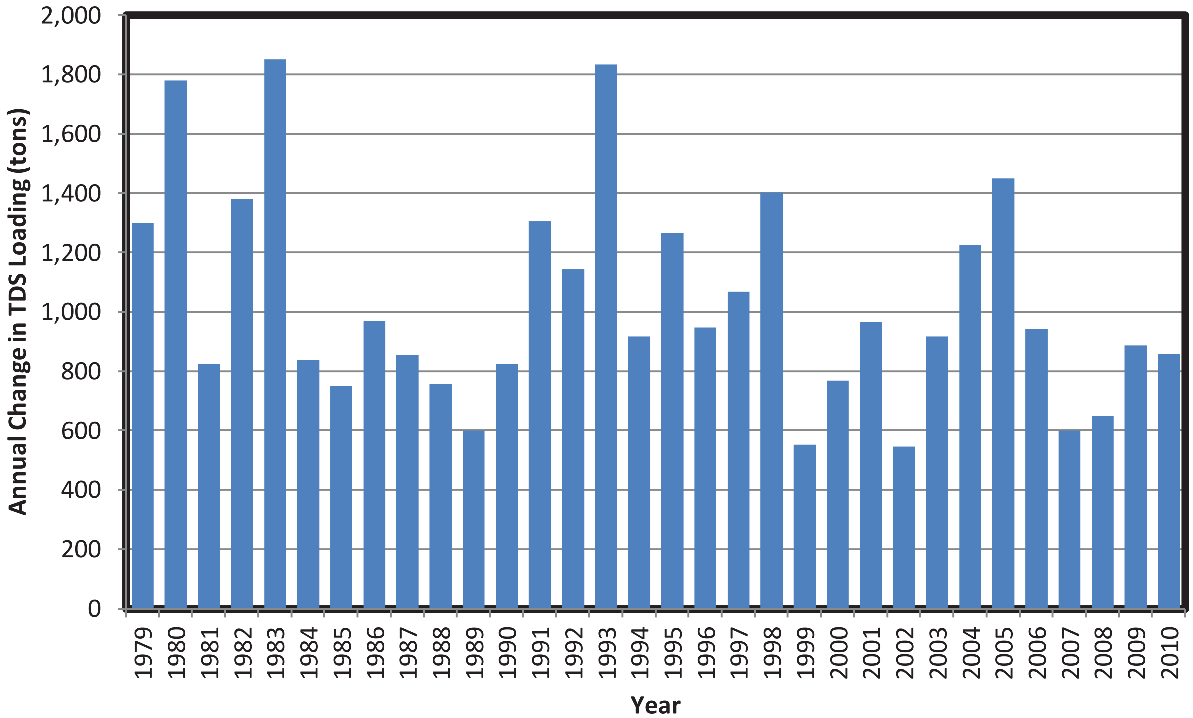

Figure 4-14
Historical Net Salt Load to the Garnet Hill Subbasin

Other Constituents

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 MSWD's Well 33 for samples collected in 2008. For the collected samples, nitrate concentrations (expressed as NO_3) have ranged between 1 mg/L and 7 mg/L in the basin. Collection and analysis of additional water quality samples would provide a better picture of how these constituents vary both temporally and spatially.

Desert Hot Springs Subbasin

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

The Desert Hot Springs subbasin is not extensively developed except in the area of Desert Hot Springs. Relatively poor groundwater quality has limited the use of this subbasin for potable groundwater supply. The Miracle Hill subarea underlies portions of the City of Desert Hot Springs and is characterized by hot mineralized groundwater, which supplies a number of spas in that area. The Fargo Canyon subarea underlies a portion of the Planning Area along Dillon Road east of the Indio Hills. This subarea is characterized by coarse alluvial fans and stream channels flowing out of Joshua Tree National Park. Based on limited groundwater data for this area, flow is generally to the southeast. Water quality is relatively poor with salinities in the range of 700 to over 1,000 mg/L (CVWD, 2009c). Recent seismic investigations of the Mission Creek Fault at Long Canyon found a groundwater level offset of as much as 200 ft over a 650 ft wide zone (Catchings, *et al.*, 2009).

Whitewater River Subbasin

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

Groundwater Model Development and Calibration

A numerical groundwater model of the Mission Creek, Garnet Hill subbasins developed by Psomas (2010) is calibrated for steady-state (pre-development) 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

To recharge groundwater supplies, CVWD and DWA obtain imported water supplies by exchanging SWP water allocations for CRA water. The SWP is owned by the State of California and operated and maintained by the DWR. 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 (Reclamation). Six pumping stations lift the water more than 3,000 feet and energy is recovered at power plants along the aqueduct.

CVWD and DWA are two of 29 agencies holding long-term water supply contracts with the State of California for SWP water. 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 2011.

The cost to construct and operate the SWP is recovered through a series of annual charges to SWP contractors:

1) Delta Water Charge that recovers the capital and operating cost of specified project conservation and storage facilities and is based on Table A Amounts;
2) Transportation Charge – Capital Cost Component that recovers the cost of constructing the conveyance facilities based on each contractor's relative share of project conveyance capacity and location;
3) Transportation Charge – Minimum Operations, Maintenance, Power and Replacement (OMP&R) Component that recovers certain fixed operating costs like labor, materials and other costs that do not vary with water deliveries based on each contractor's relative share of project conveyance capacity and location;
4) Transportation Charge – Minimum OMP&R Component for Off-Aqueduct Power to recover the cost of certain DWR power generation facilities based on amount of water delivered to each contractor;
5) Transportation Charge – Variable OMP&R Component that recovers the cost of power purchases for aqueduct pumping and power recovery credits based on amount of water delivered to each contractor;
6) East Branch Enlargement Transportation Charge – Capital and Minimum OMP&R Components to recover the cost of enlarging the East Branch for sever Southern California SWP contractors including CVWD and DWA based on share of requested enlargement capacity;
7) Water System Revenue Bond Surcharge to recover the difference in cost between the Capital Cost Component and the actual cost of bonds.

The costs are adjusted annually to ensure that all costs incurred between 1952 and 2035 are fully repaid with interest by 2035, the current term of the SWP contracts.

Relevant Contracts and Agreements

The operations and costs associated with obtaining SWP water are governed by a series of contracts as described below.

SWP Contracts

The State originally executed long-term water supply contracts with 32 agencies or districts. As a result of annexations, purchases and assignments, there are currently 29 SWP contractors. These contracts, which run until 2035, form the basis for the construction and operation of the SWP. In return for the State financing, constructing, operating and maintaining the facilities, the agencies contractually agreed to repay all associated SWP capital and operating costs. DWR delivers water to SWP water contractors in accordance with their long-term water supply contracts. These contracts set forth Table A amounts, which determine the maximum water a contractor may request each year from DWR. Table A amounts may also be used as a factor to allocate other available water supplies to each contractor. SWP contracts can be found at http://www.water.ca.gov/swpao/wsc.cfm (DWR, 2012).

DWA and CVWD contracted for SWP water in 1962 and 1963, respectively. Since they were originally signed, CVWD's contract has been amended 21 times and DWA's has been amended 20 times. The SWP contracts include provisions identifying annual Table A Amounts, the methods for allocating costs, computation of the various charges and charge components listed previously, and points of delivery. Articles 33 and 34 of the contracts state that each SWP contractor is obligated to make payments to the State for the SWP and, if it fails or is unable to raise the necessary funds by other means, shall levy property taxes on all property with the agency boundary. Taxes so levied shall be kept in a separate fund and the State may levy such assessment if the agency fails to do so. Refusal or failure to take delivery of SWP water does not relieve the agency of this obligation (CVWD, 1963; DWA, 1962). Since 1963, all land owners within DWA's and CVWD's boundaries have paid a tax assessment for the capital and certain fixed operating costs of the SWP as required by the SWP contracts.

Metropolitan Exchange Agreements

Since there is no conveyance facility to deliver SWP water to the Coachella Valley, CVWD and DWA cannot directly receive SWP water. Instead, their SWP water is delivered to Metropolitan at San Bernardino under the terms of separate exchange agreements (CVWD-Metropolitan, 1967; DWA-Metropolitan, 1967). These agreements provided for Metropolitan to deliver an equal amount of CRA water to CVWD and DWA to be recharged at the Whitewater and Mission Creek subbasins. CVWD and DWA are required to pay for their respective SWP costs and MWD is required to pay for its CRA costs. The 1967 agreements remained in effect through January 1, 1990. In 1983, DWA and CVWD amended their water exchange agreements with Metropolitan. Among other things, the 1983 exchange agreements extended the term until January 1, 2035 (CVWD-Metropolitan, 1983; DWA-Metropolitan, 1983). The 2003 Exchange Agreement between DWA, CVWD and Metropolitan provided for CVWD and DWA to acquire 100,000 acre-ft/yr of Metropolitan's SWP Table A water as a permanent transfer, commencing in 2005 (see **Metropolitan Transfer** below).

Water Management Agreements

In 1973, CVWD and DWA jointly commenced a program to artificially recharge the Whitewater River 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. A water management agreement between CVWD and DWA was executed in 1976 that provided for the operation of the Whitewater Spreading Facility, payment of each agency's fixed SWP transportation costs, and pooling and allocating the Delta Water Charge and variable transportation costs on the basis of total water production within each agency's area. The Water Management Agreement (1976) was amended in 1992 to update a number of provisions based on amendments to the SWP contract, Metropolitan exchange and advanced delivery agreements, as well as CVWD payment for all Whitewater recharge facility operations.

A water replenishment agreement was executed between DWA and CVWD in 2003 for implementing and sharing the costs of a replenishment program in the Mission Creek subbasin. The agreement provides for the allocation of the initial construction costs for the Mission Creek spreading grounds based on the amount of water produced within each agency's portion of the Mission Creek subbasin. In addition, the agreement provides that delivery of SWP exchange water and relevant SWP costs (Variable Transportation, Off-Aqueduct Power and Delta Water Charge) be allocated between CVWD and DWA based on the total water production within each agency's Whitewater River and Mission Creek management areas. Both agencies would continue to pay their separate SWP Capital and Minimum Transportation charges. The replenishment agreement is subject to the provisions of the SWP contracts, the Exchange and Advanced Delivery Agreements and applicable laws and regulations.

The agreement requires the two agencies to allocate the amount of SWP Exchange water available each year between the Mission Creek and Whitewater River recharge facilities based on the relative percentages of water pumped or diverted from the Mission Creek Management Area and the Whitewater River Management Area (CVWD and DWA, 2003). This formula was later adjusted through an addendum to the Mission Creek Settlement Agreement to include production from other management areas that benefit from SWP Exchange water recharge in the allocation, delivery of recharge water in proportion to production except as constrained by operational limitations, adjustment to deliveries between management areas as needed to maximize imported water deliveries to the Valley, and balancing the total recharge water deliveries between management areas in proportion to pumping as determined by the Mission Creek-Garnet Hill Management Committee, but not later than 20 years after recharge commenced, and every 20 years thereafter (CVWD, DWA, and MSWD, 2004). As part of this water management plan, regardless of the 20-year balance between the Mission Creek and the Whitewater River subbasins, it is the intention of CVWD and DWA to continue annual recharge activities at the Mission Creek Recharge Facility provided SWP Exchange water is available to the Coachella Valley.

Advanced Delivery Agreement

In 1984, CVWD and DWA entered into advance delivery agreements with Metropolitan that permit Metropolitan to pre-deliver up to 600,000 acre-ft of SWP Exchange water to the Coachella Valley (CVWD, DWA and Metropolitan, 1984). Under the agreement, Metropolitan has the option to deliver CVWD's and DWA's SWP Table A allocation either directly from the CRA or from water previously delivered in advance to the Valley. The advanced delivery agreement provides that title to the pre-delivered water resides with CVWD and DWA. However, payment for pre-delivered water is not made until water is allocated by DWR. If the amount of water in the Advanced Delivery account is depleted, Metropolitan is required to make direct deliveries of Exchange water. The agreement required CVWD to improve the Whitewater Spreading Facility to take at least 400 cubic feet per second with Metropolitan paying up to $4 million for those improvements. CVWD and DWA were required to amend their SWP contracts to change their SWP delivery point from Hesperia to Devil Canyon near San Bernardino.

The Advanced Delivery Agreement was amended by the 2003 Water Exchange Agreement (see next section) that provided for the transfer of 100,000 acre-ft/yr of Metropolitan's SWP Table A Amount to CVWD and DWA. The 2003 Exchange Agreement also provides for maximum delivery of 216,000 acre-ft/yr (165,000 acre-ft/yr if the call-back option is exercised) to the Valley unless approved by Metropolitan. This Advanced Delivery Agreement was subsequently amended to increase the pre-delivery amount to a maximum of 800,000 acre-ft. As of December 31, 2011, there was 203,267 acre-ft in the Advanced Delivery account.

The Advanced Delivery Agreement is an important component of water management for both the Coachella Valley and for Metropolitan. The agreement maximizes the Valley's ability to obtain its SWP Exchange water and provides assurance that the water will be available for use when SWP supplies are low. Valley groundwater producers benefit from advanced-delivery water through increased water levels and reduced energy costs and do not pay for pre-delivered water until it is actually provided from the advanced delivery account. Due to the cyclic nature of water deliveries, groundwater levels may fluctuate slightly more than would occur without the agreement. Metropolitan has access to additional supplies (CVWD's and DWA's SWP allocation) during dry years and receives improved water quality in all years. The agreement provides Metropolitan easy access to a massive groundwater storage reservoir where it can easily deliver water when surplus water is available. For example, in the mid-1980s when flood threatened the Colorado River system, this agreement allowed Metropolitan to maximize its CRA diversions to reduce flooding and store the water for future use.

Table A Allocation

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. The combined Table A Amount was initially set at 14,800 acre-ft/yr and reached the original full amount in 1990. Since that time, several water transfers have been implemented that have increased the Valley's total Table A Amounts to 194,100 acre-ft/yr.

Metropolitan Transfer

Metropolitan historically has not made full use of its SWP Table A Amounts in normal and wet years. The 2003 Exchange Agreement between DWA, CVWD, and Metropolitan provided for CVWD and DWA to acquire 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. This split was intended to balance the total Table A Amounts closer to production within each agency. 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 transferred 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-foot blocks. To estimate conservatively the average supply from this transfer, two scenarios are considered – without and with call-back. Without call-back, CVWD and DWA would receive SWP Exchange water based on the estimated DWR reliability. With call-back, 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 and the amount of water called back would be deducted from average SWP Exchange deliveries. The actual frequency of callback would depend on the availability of Metropolitan's water supplies to meet its demands, the price of the callback water, and the ability of Metropolitan to store or use the callback water. Since 2005, Metropolitan has exercised its call-back option only once in 2005. A comparison of water deliveries with and without call-back is presented later in **Table 4-6**.

Other Permanent Table A Transfers

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 SWP Table A Amount 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 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, making the Coachella Valley the third largest SWP contracting entity. **Table 4-4** summarizes CVWD and DWA total allocations of Table A SWP water.

Table 4-4
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 is subject to call-back in two 50,000 acre-ft/yr increments as discussed in the text.

Interruptible Water Purchases

As SWP contractors, CVWD and DWA have the ability to purchase water on an interruptible basis as the opportunity presents. The SWP contracts provide for the sale of unused Table A allocations between interested contractors, designated Turnback Pool water. When available, this water can be purchase for 50 percent (Pool A) or 25 percent (Pool B) of the Delta Water Charge plus the Variable OMP&R Transportation and Off-Aqueduct Power Charges. The first significant purchases occurred from 1996 through 1999 when large amounts of Turnback Pool water were available. Available Turnback Pool water is allocated between interested parties based on their Table A Amounts. During that period, CVWD and DWA purchased 276,000 acre-ft of water for recharge at Whitewater. CVWD and DWA also purchased 47,300 acre-ft of Kern River flood water in 1997 and 1998.

SWP contractors may also receive water under Article 21 of their contracts. Article 21 water is excess to the needs of all contractors and is typically available only in wet years and when aqueduct capacity is available. The water must be put to immediate use or stored in the contractor's system. The cost of water is the Variable OMP&R Transportation and Off-Aqueduct Power Charges and any incremental DWR power costs. CVWD and DWA purchased 35,600 acre-ft of Article 21 water in 2000 and 800 acre-ft in 2002 and 2003.

Periodically, water is also available through the Lower Yuba River Accord. In March 2008, CVWD and DWA entered into separate agreements with DWR for the purchase and conveyance of supplemental SWP water under the Yuba River Accord Dry Year Water Purchase Program. This program provides dry year supplies. The amount of water available for purchase in a given year varies and will be based on DWR's determination of the Water Year Classification. The available water is allocated among participating SWP contractors based on their Table A Amounts. CVWD and DWA may be able to purchase up to 5,600 AFY, and 1,820 AFY, respectively. These agreements provide for the exchange of these supplies with Metropolitan for Colorado River water in accordance with the existing exchange agreements. CVWD and DWA received a combined total of 5,300 acre-ft of water from this source in 2008 and 2009.

SWP Delivery Reliability

SWP water contractors submit annual requests to 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, SWP allocation/delivery estimates are updated. **Table 4-5** presents the historical reliability of SWP deliveries, including their initial and final allocations for the past 24 years (1988 through 2011).

Although the SWP historically provided 76 percent of Table A Amounts, the long-term SWP reliability factor for Table A water, according to the 2011 Final SWP Reliability Report (DWR, 2012), has been reduced to approximately 60 percent as a result of legal, regulatory and environmental restrictions in the Sacramento-San Joaquin Delta (Delta) and climate change impacts. The factors that could further reduce SWP reliability considered in this WMP include:

Table 4-5
Historical SWP Table A Allocations (1988-2011)

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:		**46%**	**76%**

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).

- 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

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 **Section 5** of the WMP to estimate the SWP reliability for the WMP planning horizon. The existing availability of SWP Table A Amounts for CVWD and DWA is presented in **Table 4-6.**

Table 4-6
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 –Assumes call-back 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.

Other Water Transfers and Purchases

Additionally, CVWD and DWA have acquired or facilitated non-SWP water supplies using one-time transfers. These transfers have included supplies from Palo Verde Irrigation District (2006 to 2008, to CVWD), Rosedale-Rio Bravo (2008 to 2009, to CVWD), CPV Sentinel (starting from 2009, to DWA) and Metropolitan (2011, to CVWD). Except for the CPV Sentinel water, all of this water was delivered to Whitewater and did not affect recharge or replenishment assessments in the Mission Creek subbasin.

CPV Sentinel is required to mitigate fully the potential impacts of groundwater pumping by its proposed power plant in the Mission Creek subbasin. Per an agreement between CPV Sentinel and DWA, DWA cooperates with CPV Sentinel to acquire and deliver sufficient imported water for replenishment in advance of CPV Sentinel pumping groundwater for power plant cooling, including 8 percent that is retained by DWA. CPV Sentinel is required to meter its groundwater production, pay all costs for the acquired water, connect a golf course to the DWA recycled water system, install ET-based irrigation controllers and pay the replenishment assessment. Water stored in the basin on behalf of CPV Sentinel is maintained in a separate storage account.

Colorado River Water Quality

A review of water quality data at San Jacinto along the CRA (downstream of the Mission Creek Spreading Facility turnout) for the January 1999 to July 2009 period indicates an average TDS concentration of 614 mg/L, with a range 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 as NO_3. On average, the TDS concentration of CRA water is approximately 200 mg/L higher than the natural groundwater TDS concentrations in the Planning Area.

As shown in Table 4-7, future TDS concentrations for CRA water are expected to range from 618 to 650 mg/L based on Reclamation projections developed for final environmental impact statement for the interim guidelines for Lower Colorado River operations (Reclamation, 2007).

Table 4-7
Projected Salinity in Colorado River Water Supplies

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

Source: Reclamation, 2007. Final EIS, Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead - Preferred Alternative Downstream of Parker Dam.

Mission Creek Subbasin Groundwater Recharge

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 CRA 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. 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. Water was first delivered to the basins in November 2002.

On average, approximately 12,000 acre-ft/yr (shown in **Table 4-2**) 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 obtained through the Exchange Agreement (Metropolitan, CVWD and DWA, 2003), water recharged into the Mission Creek subbasin became part of the Advanced Delivery Agreement (CVWD, DWA and Metropolitan, 1984).

DATA GAPS

A number of data sources are used from which conclusions are drawn regarding water management in the Planning Area: 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 USGS (Tyley, 1974) for modeling the Upper Coachella Valley, municipal water quality data from CVWD and MSWD, private well water quality data compiled by CVWD, and estimates of natural recharged developed by Tyley (1974), GSi/water (2005), and Psomas (2012). During the development of this plan, gaps have been identified in the data collected and compiled for this WMP that could enhance basin management.

The items identified as having missing data or incomplete data and the actions taken are:

- Groundwater elevation canvass – not all wells reporting water levels have surveyed reference points. Surveys to establish reference point elevations are recommended.
- Private well canvass – the location and status of small production wells (generally less than 10 acre-ft/yr) are not well known. An updated private well canvass could collect this information.
- Garnet Hill subbasin monitoring wells – an insufficient number of wells are monitored for water levels to develop reasonably accurate contours. Additional wells should be monitored for water levels.
- Precipitation monitoring in the Mission Creek watershed – reporting of available precipitation data within the Planning Area watersheds would provide additional information for estimating the volumes of natural recharge.
- Consistency between CVWD and DWA Engineer's Reports on groundwater recharge – DWA and CVWD have improved their methods to coordinate information reported in their respective Engineer's Reports.
- Methodology for tracking balance in Metropolitan Advanced Delivery Account – CVWD prepares quarterly summary reports to the Management Committee of the amounts of CVWD and DWA SWP water delivered to Metropolitan and water delivered by Metropolitan to the recharge facilities.
- Discussion of on-going water management activities – CVWD, DWA and MSWD have been meeting quarterly since 2009 to discuss water management issues within the Planning Area.

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

SUMMARY

This section presents an overview of the natural and imported water resources currently available to meet the needs of the Planning Area. Over the past fifty years, development within the Planning Area has depended on groundwater pumping to meet water demands. The accumulated effect of this pumping has been a reduction in groundwater levels in the Mission Creek subbasin and a decline in flow across the Banning and Garnet Hill faults. The commencement of artificial recharge with imported water in 2002 at the Mission Creek Recharge Facility appears to have halted this decline provided sufficient water is available for recharge. Wells nearest the recharge facility show increases of more than 50 ft; while water levels in wells in the central and southern portions of the basin have shown increases of about 4 ft compared to previous low levels. However, the overall effect of recharge has been a steeper groundwater gradient across the basin.

Water levels in the Garnet Hill subbasin experienced similar declines prior to the early 1980s. As a result of significant recharge activities at the Whitewater River Recharge Facility, water levels in the western and central portions of the basin have increased by as much as 90 ft and 50 ft, respectively, compared to historical low levels. Whether this increase is the result of groundwater flowing northeast across the fault when water levels near the recharge facility are high or due to reduced groundwater gradient across the fault, the effect is increased water levels. Water levels in the southeastern portion of the basin (southeast of Garnet Hill) have been relatively stable showing about ±4 ft variation over the past 40 years. However, water level increases of 4 to 6 ft are observed 5 to 6 years following large recharge events at Whitewater.

Whether the water level improvements continue in the future will largely be a function of the amount of imported water available for recharge and the level of growth experienced in this area. The combined SWP Table A Amount of CVWD and DWA (194,100 acre-ft/yr) is the third highest amount among all SWP contractors. Under current SWP delivery reliability estimates, this supply can provide about 116,500 acre-ft/yr of water on average to the Valley. SWP supplies could either decline or increase in reliability depending on the outcome of the BDCP and Delta Conveyance Program as discussed in **Section 5**.

Since this supply is allocated between the Whitewater and Mission Creek recharge facilities based on pumping in these subbasin, growth will have influence how much water is available in the future. If the Desert Hot Springs area grows as projected by CVAG, the water allocation could shift from the current 93 percent for Whitewater – 7 percent for Mission Creek to 85 percent Whitewater – 15 percent Mission Creek. Similarly, groundwater basin management goals could affect the need to acquire and recharge additional water.

The challenges facing CVWD, DWA and MSWD on how best to manage the available water resources and possible solutions are the subjects of **Section 5**.

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Section 5
Issues, Strategies and Plan Evaluation

A clear understanding of the water management issues affecting the Planning Area is essential when developing a water management plan. This section describes the issues that may affect water management in the Planning Area. 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 overall 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. Following evaluation of the alternative plans, the water management objectives are refined based on the trade-offs between cost, water levels, and water quality. The refined objectives are described in **Section 6 – Water Management Objectives**.

ISSUES AFFECTING WATER MANAGEMENT

The water management issues identified in this WMP are broadly grouped into the following categories:

- Water Supply
- Water Quality
- Costs and Economics
- Water Demand
- Environmental
- Plan Implementation
- Other

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. Each issue has a differing level of importance relative to one another.

Water Supply Issues

Water supply issues generally relate to those factors that may impact the availability or reliability of water supplies serving the Planning Area.

Table 5-1
Water Management Issues

Category	Issue
Water Supply	Climate Change
	Impact of Whitewater River Subbasin recharge on Garnet Hill Subbasin
	Imported Water Recharge Volumes
	Natural Recharge
	Groundwater Overdraft
	Recharge Timing and Volume
	Recharge/Percolation pond operations and maintenance
	Source Substitution via Recycled Water
	Supply Reliability
	Transfers and Exchanges
	Subsurface Flows between the subbasins
Water Quality	Arsenic
	Emerging Contaminants
	Fluoride
	Radionuclides
	Hexavalent Chromium
	Nitrate
	Total dissolved solids (TDS)
	Brine Disposal
	Salinity Management Plan
	Other Water Quality Contaminants
	Hot water entering Mission Creek subbasin
	Water Quality in the Mission Creek Subbasin
	Improperly Constructed or Abandoned Wells
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 Multiple Species Habitat Conservation Plan
	Watershed protection
Other	Data Gaps
	Land use protection for basin recharge
	Monitoring and Reporting
Plan Implementation	Stakeholders and Regulatory Agency Coordination

Climate Change

Climate change has the potential to affect the reliability of both local and imported water supplies and also increase water demand. Higher temperatures and reduced precipitation may increase evapotranspiration and irrigation water demands; however, higher temperature may also result in increased humidity which could offset a portion of the demand increase. Climate change is expected to impact the timing and volume of snowmelt from the Sierra Nevada mountains, with more precipitation falling as rain and peak snowmelt runoff occurring earlier in the year over a shorter period of time. Increased variability of floods and droughts coupled with effects of increased sea level on Delta water quality are additional potential effects of climate change (DWR, 2011).

No formal studies have been conducted to evaluate the impacts of climate change on the Coachella Valley. However, the results of several studies that 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 0.2º to 3.8º F average 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 could increase by 1º to 2º F by 2050, and by 4º F above current levels by 2100 (SCAG, 2009). As part of the 2009 California Water Plan Update, the California Department of Water Resources (DWR) evaluated the potential effects of 12 future climate scenarios on water demand and supply. For the Colorado River Region, DWR estimate that future water demands with climate change could range from -1 to +4 percent of those without climate change (DWR, 2009).

Reliability estimates developed by DWR for the State Water Project (SWP) supplies account for the impacts of climate change (DWR, 2011). This study indicated that average SWP deliveries could be as much as 8 percent lower in the future with climate change, reducing the amount of water available to the Coachella Valley.

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. DWR has identified Integrated Regional Water Management (IRWM) as one of the key initiatives for incorporating climate change improving water supply reliability. DWR, in cooperation with USEPA, US Army Corps of Engineers and the Resources Legacy Fund developed a handbook that outlines a process for integrating climate change in regional water planning (DWR, et al., 2011).

Impact of Whitewater River Subbasin Recharge on Garnet Hill Subbasin

The Garnet Hill subbasin is located up-gradient of the Whitewater River subbasin; subsurface outflow typically occurs from the Garnet Hill subbasin into the Whitewater River subbasin. Imported water is released into the Whitewater River channel just upstream of the Garnet Hill subbasin and a portion of the released water is believed to percolate into the Garnet Hill subbasin as it flows down the channel. Following large recharge events, high groundwater levels in the

Whitewater River subbasin may reduce subsurface outflow from the Garnet Hill subbasin to the Whitewater River subbasin or even cause subsurface flow into the Garnet Hill subbasin. This has been observed by 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 subsurface outflow from the Whitewater River subbasin into the Garnet Hill subbasin may occur during periods of high volumes of imported water recharge in the Whitewater River subbasin. This issue is important because groundwater production from the Garnet Hill subbasin is not currently subject to a replenishment assessment.

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

In accordance with the 2003 Mission Creek Replenishment Agreement between DWA and CVWD, the two agencies recharge the Mission Creek subbasin with SWP Exchange water (exchanged for Colorado River water with Metropolitan) at the Mission Creek Spreading Grounds. The volume of water recharged at the Mission Creek Spreading Grounds is currently 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 relative recharge volumes would be balanced between the two subbasins no later than 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. Concerns have been expressed that significant amounts of recharge to the Mission Creek subbasin in excess of the relative production percentages could result in a future reduction in deliveries to balance the amount of recharge between the two subbasins. As part of the implementation plan for this WMP (discussed in **Section 7**), regardless of the 20-year balance between the Mission Creek and the Whitewater River subbasins, it is the intention of CVWD and DWA to continue annual recharge activities at the Mission Creek Recharge Facility provided SWP Exchange water is available to the Coachella Valley.

Natural Recharge

Currently, all natural recharge generated by storms of low intensities is captured within the Planning Area. Natural recharge is lost from the Planning Area only during infrequent high intensity storms when sufficient runoff is generated to flow across the Garnet Hill fault into the Whitewater River subbasin.

The average volume of natural recharge in the Mission Creek and Garnet Hill subbasins has been estimated by various sources as presented in **Section 4** of this WMP. Natural recharge can be enhanced by increasing percolation of storm water into the Mission Creek and Garnet Hill subbasins. Riverside County Flood Control and Water Conservation District (RCFCWCD) is developing a Master Drainage Plan for Desert Hot Springs area that presents several flood control alternatives including new recharge basins to capture natural recharge (PACE, 2011). While flood control within the Planning Area does not fall within their direct purview, CVWD, DWA, and MSWD will continue to work with RCFCWCD on flood control issues so that capture of local runoff is maximized.

Groundwater Overdraft

Groundwater storage in the Mission Creek subbasin has declined continuously from about 1960 until significant recharge activities commenced in 2005 as shown previously on **Figure 4-2**. Under existing conditions, groundwater pumping is about 4,000 acre-feet per year (acre-ft/yr) greater than estimated natural recharge and current artificial recharge activities. Continued extraction in excess of natural and artificial recharge activities could result in increased energy consumption, water quality degradation, and reduced supply reliability.

An approach to address overdraft is to set a long-term average groundwater level target as part of the management plan. Potential basin management targets discussed by the Management and Technical Committees 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.** Because none of these targets results in an ideal balance of costs and benefits, these options were evaluated in more detail during the development of the WMP.

Table 5-2
Potential Groundwater Level Targets

Potential Groundwater Level Target	Advantages	Disadvantages
Raise Levels to Historical Levels (15 feet above 2009 Levels)	• Reduces pumping costs • May support mesquite growth • May reduce land subsidence potential • Increases supply reliability (increases ability to sustain reductions in imported water supplies)	• Requires extra water to re-fill basin • May entrain nitrate into groundwater currently in the vadose zone • May increase subsurface outflow to lower subbasins and decrease subsurface outflow from higher subbasins
Maintain Long Term Levels at 2009 Levels	• Maintains existing storage space for groundwater banking • Maintains existing pumping costs • May maintain mesquite growth	• Requires additional water to maintain levels
Allow Levels to Decrease below 2009 Levels	• Creates storage space for groundwater banking • Reduces need for external supply sources • May increase subsurface outflow from up-gradient subbasins and decrease subsurface outflow to down-gradient 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 conduct recharge activities in the Mission Creek subbasin. The timing and the amount of water available for recharge is affected by SWP supply availability and 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 required due to several factors, such as water supply reliability, advanced deliveries of imported water, and the allocation of imported water recharge between the Whitewater and the Mission Creek Subbasins.

Recharge/Percolation Pond Operations and Maintenance

The goal of any recharge facility is to maximize the amount of water percolating into the groundwater basin. Some water is lost due to evaporation at the artificial recharge site and the wastewater treatment plant percolation ponds. Based on a review of California Irrigation Management Information System (CIMIS) data for the Planning Area, it is estimated that evaporation losses may range from less than 1 percent to more than 3 percent of percolated water depending on the average infiltration rate.

Because facilities with low infiltration rates tend to have higher evaporation losses than facilities with high infiltration rates, regular maintenance of spreading basins and percolation ponds for silt removal is essential to maintain infiltration rates and minimize evaporation loss. DWA performs regular maintenance at the Mission Creek Spreading Facility and there are no reported problems due to silt deposition because Colorado River water has low turbidity and the water is piped from the CRA to the spreading facility. Wastewater ponds percolating secondary effluent tend to clog more frequently due to the higher suspended solids load and require more frequent maintenance.

Source Substitution via Recycled Water

Source substitution is the delivery of an alternate source of water to users that currently pump groundwater. The substitution of an alternate water source reduces groundwater extraction and allows the groundwater to remain in storage, thus reducing overdraft. The use of recycled water for irrigation is the only practical source substitution alternative in the Planning Area. The use of SWP Exchange water for source substitution is not considered viable because deliveries would be highly variable as a result of both SWP hydrology and Metropolitan's operation needs.

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 were constructed at the wastewater treatment plants, then the wastewater would meet California Department of Public Health (CDPH) standards for landscape 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 affected by seasonal variations, there may also be recycled water supply and demand imbalances. Demand may exceed available recycled water supplies during summer months when evapotranspiration is highest. During winter months when the irrigation demands are low, wastewater that is not recycled would be disposed to percolation-evaporation ponds where most of the percolated water enters the groundwater basin. The use of recycled water for irrigation may reduce some of the evaporative losses that occur in the percolation ponds.

Another challenge associated with recycled water use is the need for a separate delivery system. CDPH regulations require recycled water be conveyed in a completely separate pipeline system that has no direct connections to potable water systems.

From a water quality point of view, recycled water contains nutrients like nitrogen that can adversely affect groundwater quality. When recycled water is used for irrigation, 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 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 average reliability of 60 percent of Table A (DWR, 2012); it is projected that the reliability will drop to 50 percent by 2030 (MWH, 2010). If the Bay Delta Conservation Plan is implemented, then SWP supply reliability could potentially increase to 77 percent of Table A (MWH, 2010).

In addition, Metropolitan callback options may affect water supplies in the Planning Area. Metropolitan has the option to call back 100,000 acre-ft/yr of SWP Table A water in years when needed. Metropolitan's callback options are to be exercised in two 50,000 acre-foot blocks. The actual frequency of callback would depend on the availability of Metropolitan's water supplies to meet its demands, the price of the callback water, and the ability of Metropolitan to store or use the callback water. Since 2005, Metropolitan has exercised its call-back option only once in 2005.

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 CRA are the only current sources of water supply. New water transfer and exchanges could bring additional supplies to the Planning Area. Depending on availability, additional imported water could be acquired through transfers from other water contractors 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.

Subsurface Flow between the Subbasins

Subsurface flows between the subbasins in the Planning Area cannot be directly measured. The magnitude of subsurface flows into and out of the Mission Creek and Garnet Hill subbasins has been estimated through groundwater modeling. The impacts of alternative management plans on subsurface outflow are evaluated as part of the groundwater modeling for this WMP.

Water Quality Issues

The principal water quality issues facing the Planning Area relate to natural and anthropogenic processes that may degrade the quality of water supplies in the groundwater subbasins for beneficial use and are presented below.

Arsenic

Arsenic occurs naturally in the groundwater of the Planning Area. As discussed in Section 4 – Water Resources of this WMP, arsenic concentrations in the Planning Area exceeded the current 10 micrograms per liter (µg/L) state and federal MCL in two wells, one time more than 30 years ago. Currently, no municipal wells exceed the MCL. While the MCL is currently 10 µg/L, California's Public Health Goal (PHG) for arsenic is 0.004 µg/L (OEHHA, 2004) and USEPA's MCL Goal is 0 µg/L. When USEPA adopted the current MCL, it also considered alternative MCLs of 2 and 5 µg/L. If the MCL is reduced below 10 µg/L, there is an increased likelihood of exceedance and the possible need for treatment. Monitoring the regulatory processes for arsenic is recommended.

Emerging Contaminants

Emerging contaminants (ECs) are unregulated compounds that may have potential health or environmental effects. ECs may be present in water at very low concentrations or have not been detected with current analytical technology. Among the ECs are pharmaceuticals and personal care products, industrial chemicals, disinfection byproducts, pesticides/herbicides and chemicals that may affect hormone status, referred to as "endocrine disruptors." Research into the effects of ECs on human health and the environmental is rapidly evolving. Additional monitoring and improved detection methods may result in regulation of some of these compounds in the future. At present, the effects of ECs on water resources management in the Planning Area is uncertain and requires continued evaluation by the water agencies.

Fluoride

The presence of fluoride in drinking water at optimum levels (0.7 milligrams per liter (mg/L) for the Coachella Valley based on climate) is considered essential in promoting oral health and preventing tooth decay. The State MCL for fluoride is 2 mg/L. State law requires water agencies with more than 10,000 connections and natural fluoride levels less than optimum levels to install fluoride treatment at water supply sources contingent upon the availability of funds. Currently, fluoride is not added at any drinking water wells in the Coachella Valley.

Data collected from 1978 to 2009 indicate that fluoride concentrations in the Mission Creek and Garnet Hill subbasins for CVWD's and MSWD's domestic water supply wells range from 0.3 mg/L to 1.5 mg/L. Fluoride concentrations are below the MCL for the domestic water supply wells.

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). In addition, monitoring of private wells in the southeast portion of the Mission Creek subbasin indicates fluoride levels ranging from 0.5 to 8 mg/L, with the highest values near the Mission Creek fault.

Radionuclides

Radionuclides are elements that emit radioactivity and may be naturally-occurring or artificially produced. The principal radionuclides of concern for the Planning Area are uranium and gross alpha, both of which occur naturally in the Mission Creek subbasin. A discussion on radionuclides in the Planning Area is presented in **Section 4 – Water Supplies** of this WMP. MSWD's Well 28 and Well 34 are equipped with well-head treatment for removing uranium. Well 30 is currently out of service due to high uranium concentrations. Other wells in the subbasin have detectable uranium levels that are below the MCL. Concern has been expressed that radionuclide concentrations may increase in the future requiring additional treatment.

GSi/water conducted an initial investigation of uranium sources in MSWD wells and observed that potential sources of uranium may include the Dry Morongo and Big Morongo Creeks watersheds and the southern base of the San Bernardino Mountains based on geomorphology (GSi/water, 2011). Other potential sources that were not extensively investigated include: localized source(s) buried at depth, possibly above the water table; shallow bedrock; rising fluids along major faults; leakage from the CRA; or anthropogenic source(s) (GSi/water, 2011).

Hexavalent Chromium

Chromium is a heavy metal that occurs throughout the environment. The soluble hexavalent form is relatively toxic, while the less-soluble trivalent form has very low toxicity and is a required nutrient. Currently, there is no MCL for hexavalent chromium (Chromium VI);

however, the MCL for total chromium is 0.05 mg/L, which includes Chromium VI. California DPH is expected to set a MCL for Chromium VI in the July 2014 to July 2015 timeframe (CDPH, 2012). A PHG of 0.02 microgram per liter (µg/L) was established in July 2011 (OEHHA, 2011). If the MCL for Chromium VI is established at a low level, treatment to remove chromium may be required on some wells.

A discussion on chromium concentrations in the Planning Area is presented in **Section 4 – Water Resources** of this WMP. As noted in **Section 4 – Water Resources**, 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.

Nitrate

Nitrate concentrations (expressed as NO_3) are below the 45 mg/L MCL for all recorded samples for domestic groundwater production wells in the Mission Creek subbasin and range from a low of 1.1 mg/L (observed at CVWD Well 3410 in 2002) to a high of 9.4 mg/L (observed at CVWD Well 3405 in 1978). A study conducted for 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/water, 2011). Nitrogen concentrations in septage have been observed to range from 90 to 360 mg/L as NO_3 (Nishikawa, Densmore, Martin, & Matti, 2003). Migration of water and soluble salts through soil macropores into shallow aquifers has been documented in field studies (Carter, et al., 1992). Studies have been conducted by the United States Geological Survey (USGS) to evaluate the source and transport of high nitrate concentrations in groundwater basins in California.

Due to nitrate deposition from septage over time, it is likely that nitrate concentrations in the vadose (unsaturated) zone are higher than in the underlying groundwater. Based on observations in other desert groundwater basins, a significant increase in groundwater levels in the Planning Area due to artificial recharge might intercept nitrate trapped in the vadose zone and could result in elevated nitrate concentrations in groundwater (USGS, 2004). Colorado River water exhibits very low nitrate concentrations compared to concentrations observed at groundwater wells in the Mission Creek subbasin (GSi/water, 2011). Recharge via SWP Exchange water may help dilute existing nitrate concentrations in the groundwater basin.

Total Dissolved Solids

Total dissolved solids (TDS) is a measure of the combined amount of inorganic and organic compounds dissolved in water. Primary contributors of TDS to groundwater are septage from waste disposal, saline subsurface flow from the Desert Hot Springs subbasin, imported water recharge at the Mission Creek Spreading Facility, and percolation of treated wastewater. Based on a review of TDS concentrations in the eastern portions of the Mission Creek subbasin, it is estimated that subsurface outflows from the Desert Hot Springs subbasin have concentrations in excess of 750 mg/L. These concentrations are higher than the concentrations of naturally-occurring TDS in the Mission Creek subbasin. Similarly, TDS concentration in the SWP

Exchange water is higher than naturally occurring TDS in the Mission Creek subbasin. If salinity concentrations exceed acceptable levels, then it might be necessary to treat for salinity which is expensive and requires brine disposal.

Several policies and regulations affect TDS concentrations in local groundwater:

- The California State Water Resources Control Board (SWRCB) adopted an anti-degradation policy (Policy No. 68-16), 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 (a) a pollution of or nuisance will not occur and (b) that the highest water quality consistent with maximum benefit to the people of the State will be maintained."
- In the Colorado River Basin Water Quality Control Plan (Basin Plan), the Regional Water Quality Control Board, Colorado Basin Region (Regional Board) states that studies will be required before specific groundwater quality objectives are set. Before these studies are completed, the Regional Board's goal is to minimize the increase in mineral concentrations reaching groundwater basins where feasible (Regional Board, 2011).
- The California Department of Public Health has established secondary MCLs for TDS delivered to potable water customers. The recommended MCL for aesthetic purposes is 500 mg/L, which is desirable for a higher level of consumer acceptance. The upper MCL is 1,000 mg/L, where it is 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.
- The SWRCB adopted a Recycled Water Policy in 2009 that established goals to increase the use of recycled water throughout the State and requires every region of the State to develop salt/nutrient management plans that manage all sources of salt and nutrients on a basin- or watershed-wide basis to ensure water quality objectives are achieved.

The Anti-degradation Policy has been applied in other regions to limit the amount of salinity that may be discharged to groundwater basins. Historically, the Regional Board has recognized the importance of groundwater recharge with imported water to control overdraft in spite of its elevated salinity as being for the maximum benefit of the people of the State. The Coachella Valley Regional Water Management Group is initiating steps to develop a valley-wide salt/nutrient management plan.

Brine Disposal

Any strategy that involves implementing desalination of groundwater or imported water supplies will require a plan for the treatment and ultimate 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.

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. At present there is no recycled water use in the Planning Area. There are no established numeric 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 from 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.

Other Water Quality Contaminants

Contaminants that are not currently found in the groundwater in the Planning Area, but whose presence in the groundwater may affect water supply reliability are discussed below.

Perchlorate is a salt 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 consistently below the State MCL of 6 µg/L since 2002 and less than 2 µg/L since 2008. Because the source of perchlorate contamination in Colorado River water has been effectively controlled since 2004, perchlorate is not expected to be a concern for the Planning Area in the future.

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 (DPH) identifies pharmaceuticals and personal care products and industrial chemicals present at low concentrations as some examples of emerging contaminants.

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 mg/L and temperatures ranging from 77º F to 200º F (Proctor, 1968). Subsurface outflows from the Desert Hot Springs subbasin cross the Mission Creek fault affecting salinity and temperature levels in the eastern portion of the Mission Creek subbasin and may limit where potable groundwater can be produced. Management activities in the Mission Creek subbasin have the potential to affect the subsurface outflow from the Desert Hot Springs subbasin and the area influenced by the quality of these outflows. Estimates of subsurface outflows between the basins have been made in previous studies by Tyley (1974) and GSi (2005) in the Planning Area. The magnitudes of the subsurface outflows between the subbasins are also evaluated under different alternative management plans.

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 subsurface flows from the Desert Hot Springs subbasin, and nitrates from septic tanks might affect the water quality in the basin over time.

Improperly Constructed or Abandoned Wells

Improperly constructed or unused wells may be sources of contamination to the groundwater basin by providing a pathway for pollutants to enter the aquifer. Inactive or improperly abandoned wells can also present a physical danger to the public. Development of a groundwater protection program 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 to remove salinity increases the unit cost of water. Similarly, declining groundwater levels result in increasing energy costs, which increase the unit cost of water. Power costs have also been increasing annually over the past decade (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

Both CVWD and DWA are authorized by the relevant provisions of the California Water Code to collect water replenishment assessments from any groundwater extractor or surface water diverter (aside from exempt producers) within their jurisdictions who benefits from the replenishment of groundwater (CWC §31630-31639; CWC App. §100-15.4). The two agencies are not required to implement assessment procedures jointly or identically (CVWD, 2000). The replenishment assessment is charged to recover certain costs associated with importing SWP water to the Coachella Valley. For CVWD, any producer who produces 25 or fewer acre-feet of groundwater in any year is exempt from the replenishment assessment charge. For DWA, any producer who produces 10 or fewer acre-feet of groundwater in any year is exempt from the replenishment assessment charge.

Currently, replenishment assessments are levied on groundwater pumping in the Whitewater River and Mission Creek subbasins, but not for pumping from the Garnet Hill subbasin. MSWD challenged the validity and payment of replenishment assessments in its 2003 litigation. While the validity and payment was addressed in the Settlement Agreement, the basis for the assessment continues to be an issue between the agencies. The agencies are working on methods to resolve their differences outside of the WMP.

Demand Issues

Demand issues generally relate to those affecting the amount of water needed to serve current and future customers in the Planning Area. Climate change also 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 provisions of Senate Bill SB X7-7 which established a statewide goal to achieve a 20 percent reduction in urban per capita water use by the year 2020. Urban water purveyors are required to develop urban water use targets that meet this target. Purveyors with low water usage must achieve at least a 5 percent usage reduction unless their current usage is less than 100 gpcd.

CVWD, MSWD, and DWA have developed Urban Water Management Plans to meet the goals of SB X7-7 (CVWD, 2011) (MSWD, 2011) (DWA, 2011). The goals of SB X7-7 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 X7-7 . MSWD's 2010 per capita water use is 222.5 gallons per capita per day (gpcd) which is below its per capita water use target of 264.9 gpcd. CVWD's 2010 per capita water use for the portion of its service area within the Planning Area is estimated to be 402.1 gpcd which is below its per capita water use target of 473 gpcd. Per capita consumption varies between the agencies due to differences in lot sizes, demographics, density, outdoor water demand, and seasonal population. A detailed discussion of the per capita consumption within each agency's service area can be found in their UWMPs (CVWD, 2011; MSWD, 2011; DWA, 2011).

Population Growth

The Planning Area has significant potential for growth, as the current population is estimated to be only 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 eventually 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 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, total 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 environmental review process. Water importation, groundwater production, pumped conveyance, and treatment of water and wastewater will result in direct or indirect GHG production. Declining groundwater levels in the Mission Creek subbasin will increase the energy required to pump groundwater and will increase GHG emissions. The use of locally available water may reduce the dependence on imported water and could assist in the reduction of GHG emissions.

Mesquite Hummocks

Honey mesquite (*Prosopis glandulosa*) forms hummock areas over sand dunes providing important habitat for several special status species in the Coachella Valley including Coachella Valley round-tailed ground squirrel, Palm Springs pocket mouse, Le Conte's thrasher, and crissal thrasher (CVMSHCP, 2007). Mesquite hummocks are typically associated with high soil moisture, often associated with fault areas or springs (CVMSHCP, 2007). Within the Planning Area, mesquite is only located in the southeast portion of the Mission Creek subbasin near Willow Hole.

Section 10.2.7.4 of the CVMSHCP states that mesquite are tolerant of adverse conditions yet relatively moderate groundwater decreases will substantially stress or kill adult mesquite individuals. The CVMSHCP states that mesquite hummocks are well equipped to tap groundwater with taproots that can exceed 140 feet but the deep taproot plays a significant role in water uptake only during extended droughts. Based on review of multiple references, the CVMSHCP stated that no evidence could be found indicating an effective ability of mesquite individuals to adapt to groundwater artificially lowered to more than 49 feet of the ground surface (CVMSHCP, 2007). 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 (CVMSHCP, 2007). Other factors such as disturbance by development, predation by domestic animals, and the presence of invasive weeds and other live perennial shrubs may also affect mesquite growth (CVMSHCP, 2007).

Land Subsidence

Overdraft conditions in groundwater basins can cause land subsidence in aquifer systems containing significant amounts of fine-grained sediments. Land surface subsidence has occurred in other parts of the Coachella Valley (USGS, 2007). Due to the absence of a clay layer in the groundwater basin hydrostratigraphy, 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. CVWD is a local permittee under the CVMSHCP and MSWD is in the process of becoming a local permittee. Local permittees agree to conserve identified land within the CVMSHCP reserve system, fund an endowment form monitoring and mitigation programs and comply with other terms of the CVMSHCP. As local permittees, their covered water management activities are determined to satisfy the legal requirements for the issuance of Permits that will allow the incidental take of covered species under the federal and state endangered species acts over a 75 year period. The impacts of future projects implemented under this WMP on sensitive species and habitats identified in the CVMSHCP need to be evaluated. DWA is not a signatory to the CVMSHCP and will need to evaluate the impacts of any proposed projects it implements resulting from the WMP in accordance with the requirements of the federal and state Endangered Species Acts as well as 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 significant 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 may be necessary to maintain watershed protection in the Planning Area.

Other Issues

Data Gaps

Several gaps have been observed in the data collected and compiled for this WMP. This is discussed in **Section 4 – Water Resources** of the WMP. Recommendations for monitoring, collect, report, and share data are presented in **Appendix E – Monitoring, Data Management, and Reporting**.

Land Use Protection for Basin Recharge

Recharge areas are those areas that provide the primary means of replenishing groundwater. Protection of recharge areas is predicated on two primary goals: 1) ensuring that areas suitable for recharge continue to be capable of adequate recharge rather than covered by urban infrastructure, such as buildings and roads; and 2) preventing pollutants from entering groundwater to avoid expensive treatment that may be needed prior to potable, agricultural, or industrial beneficial uses. Recent legislation (AB 359 -2011) requires mapping of principal recharge areas maps that substantially contribute to the replenishment of the groundwater basin.

In addition to protection of existing recharge areas, land may be required for developing additional spreading basins in the future if the amount of water available for artificial recharge exceeds the capacity of the existing recharge facilities. It is possible 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. It should be noted that land use protection does not fall under the purview of CVWD, MSWD or DWA; coordination with other stakeholders may be necessary to achieve appropriate 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. In 2009, the California Legislature passed SB X7-7 , which establishes, for the first time in California, collaboration between local monitoring parties and DWR to collect groundwater elevations statewide and that this information be made available to the public. The agencies participate in the California Statewide Groundwater Elevation Monitoring Program

(CASGEM). The goal of the CASGEM program is to establish a permanent, locally-managed program of regular and systematic monitoring in all of California's alluvial groundwater basins. Under current practices, each agency monitors its own wells. CVWD also has a monitoring program in which they measure water levels (three times a year) at a number of private wells (if CVWD has access to the well) throughout the Planning Area. In addition, the Coachella Valley Regional Water Management Group (CVRWMG) has proposed a regional groundwater elevation monitoring project in the Coachella Valley Integrated Regional Water Management Plan (CVIRWMP) that would include a shared database among the agencies.

Plan Implementation

A Recommended Plan is presented in **Section 7 – Recommended Plan** of this WMP and discusses projects to be implemented as part of the WMP. The implementation plan presented in **Section 7 – Recommended Plan** 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, the Riverside County Department of Environmental Health, and the RCFCWCD. 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.

WATER MANAGEMENT STRATEGIES

In order to address the issues identified in this section, 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 is considered for addressing the issues identified in the Planning Area:

- 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

Many of the strategies require the development of infrastructure projects. The effect 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 are estimated for the implementation of the projects.

Management Strategies

Some of the strategies identified in this WMP are not projects that would be performed by one of the three agencies developing this Plan. Instead, they are management strategies. The management 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 environmental impacts of various water management activities
- Establish basin operating parameters (establish operating levels, timing/volume of recharge and the basin to be recharged)
- Maintain groundwater level at 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
- Developing fees and/or assessments to pay for new water
- Evaluate the use of the replenishment assessment program to fund additional supply projects

A financial plan may also be required to allocate project costs to those who benefit from the programs. Opportunities may exist for joint agency participation in project implementation. Guiding principles for such opportunities are discussed in **Section 7** of this WMP. 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 potential 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 could 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 could result in additional recharge into the Mission Creek subbasin. This strategy could 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 envisions constructing a spreading basin to capture stormwater flows from Mission Creek and recharging the water into the Mission Creek subbasin. This project could involve the construction of one or more 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)

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 Metropolitan. Delivery amounts as a percentage of Table A will vary from year-to-year based on precipitation, runoff, storage in SWP reservoirs, operational constraints in the Delta and SWP contractor demands. 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 of Exchange water delivered via the CRA are higher than the concentrations in the groundwater basin. A discussion on TDS concentrations in the Colorado River water is presented in **Section 4** (see Table 4-7) of this WMP.

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 to the Valley through the SWP and Metropolitan Exchange Agreement. This strategy does not reduce groundwater pumping and increases reliance on imported water supplies. Purchased water is typically more expensive than locally available groundwater. In addition, water obtained on a contractual basis may be available only for a fixed period of time.

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

As SWP contractors, CVWD and DWA are participating in and encouraging the construction of a cross-Delta canal or tunnel as part of the Bay Delta Conservation Plan. The canal/tunnel would potentially increase reliability of the SWP supplies and amount of water available for the Planning Area. The total capital cost of constructing the Delta Conveyance Facilities is estimated to be $12 billion based on the information presented to the Bay Delta Steering Committee in July 2012. This cost would likely be allocated between state (SWP) and federal (CVP) water contractors based on their contracted amount of water.

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. This local supply source 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 TDS. TDS concentrations range from 500 to 800 mg/L (GTC, 1979) and the extracted groundwater may require costly membrane treatment systems for salt removal if used for potable purposes. Brine disposal will also be an issue. In addition, the groundwater is hot (>100º F) in this subbasin. Groundwater extraction will require both treatment and cooling, making groundwater utilization an expensive option. Use of this groundwater could adversely affect the hot spring water flows that support the Desert Hot Springs resort community. Groundwater treatment may not be required if the extracted water is used for irrigation (non-potable) uses.

Pump Groundwater from the Garnet Hill Subbasin

This strategy would involve new groundwater wells constructed in the Garnet Hill subbasin. This local supply source 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, wells yields in this basin have historically been low compared to wells in the adjacent basins. In addition, the unit cost of producing water from the Garnet Hill subbasin is higher compared to the unit cost of producing groundwater from adjacent basins.

Pump Groundwater from the Whitewater River Subbasin

This strategy would involve new groundwater wells constructed in the Whitewater River subbasin. This local supply source would reduce dependence on imported water supplies. The Whitewater River subbasin contains approximately 28.8 million acre-feet of water in storage (DWR, 1964). However, similar to the Mission Creek subbasin, the Whitewater River subbasin is also overdrafted. Consequently, shifting future pumping from the Mission Creek subbasin to the Whitewater River subbasin would only transfer the problem without generating a new supply.

Pump Additional Groundwater from the Mission Creek Subbasin

This strategy would involve constructing new groundwater wells in the Mission Creek subbasin. 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 reduce 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 East Valley Drain Water Desalination proposed in the CVWMP could offset some of the water supply needs for the Planning Area. The produced water could be exchanged for Colorado River water, conveyed through Metropolitan's 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. Increased drain water desalination would reduce the amount of water flowing into the Salton Sea.

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 requires significant capital and operational investment. In addition, seawater desalination may have significant environmental impacts associated with energy usage and the method of intake used. 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. However, 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 expansion and upgrade would reduce nitrate contamination of the groundwater basin, maximize the use of an existing facility to its planned capacity, and defer 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 additional wastewater flows via an expanded sewer system and a new Regional WWTP (4.5 mgd) which includes nitrogen removal. The first phase of the Regional WWTP is expected to treat up to 1 mgd of wastewater flows. As part of subsequent phases, the WWTP will be expanded to treat up to 20 mgd of wastewater flows. These facilities would reduce nitrate contamination of the groundwater basin and return a portion of the water pumped from the Mission Creek subbasin back to the basin. This WWTP could potentially 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 Wastewater Collection System in Unsewered CVWD Areas in Planning Area

CVWD could capture and treat wastewater 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 and return a portion of the water pumped from the Mission Creek subbasin back to the basin. Treatment of wastewater flows could occur at a new CVWD WWTP or at MSWD's proposed Regional WWTP.

Develop Conservation Programs to Meet "20 by 2020" Requirement

This strategy aims to reduce existing water demands by 20 percent by implementing conservation strategies to meet the requirements of SB X7-7 . CVWD, MSWD, and DWA have developed UWMPs that meet the requirements of SB X7-7 (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 water use in the Planning Area, there may be limited potential for additional conservation.

Develop Conservation Programs for Private Producers

While the potential scope for achieving additional municipal water conservation in the Planning Area may be limited, conservation programs could be extended to water users in the region that are not covered by SB X7-7 . Although the requirements of SB X7-7 do not apply to private producers, the water agencies could coordinate with the largest 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. Such reductions could reduce the need for replenishment water.

Construct SWP Extension to the Coachella Valley

Delivery of SWP water to the Coachella Valley was not constructed when SWP first became available due to the high cost of facilities. 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 amount of water recharged. In addition, it offers an increased access to 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 has capital costs expected to be in excess of $1 billion (GEI, 2011).

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

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

Treat Extracted Groundwater for TDS/Nitrates

If groundwater wells have high nitrate concentrations, then wellhead ion exchange treatment plants could be constructed to remove 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 a significant capital investment. In addition, this option also has associated high costs for energy, brine management and disposal.

Avoid Drilling Wells in Areas with Water Quality Contaminants

This strategy would avoid construction of groundwater wells in contaminated areas of the groundwater basin. This would minimize or eliminate treatment costs associated with groundwater production and reduce the unit cost of 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. It also opens the door to exploration of potential groundwater injection options. In addition, it also allows for basin recovery in other areas without groundwater recharge. The significant capital investment required for water treatment, storage and transmission infrastructure might make this option cost prohibitive. In addition, Exchange water deliveries to the Coachella Valley vary widely annually and may not be sufficiently reliable which may impact treatment operations and cost.

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 water delivered for recharge. Desalination of recharge water would reduce salt loading to the Mission Creek subbasin. This option requires significant capital investment. This option also has associated high costs for brine management and disposal. In addition, Exchange water deliveries to the Coachella Valley vary widely annually impacting treatment operations and requiring investment in treatment capacity that is not fully utilized.

Pump and Treat Poor Quality Groundwater from Eastern Mission Creek Subbasin

Poor quality groundwater flows from the Desert Hot Springs subbasin into the eastern portion of the Mission Creek subbasin. By constructing a line of extraction wells east of Palm Drive, a hydraulic trough can be created to intercept this poor quality groundwater. This extracted water can then be used either for non-potable purposes or treated for potable use. This project could reduce water quality degradation of potable wells near Palm Drive and Dillon Road. Desalination treatment would 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. This option would potentially reduce subsurface flow across the Banning fault to the Garnet Hill subbasin, but may exacerbate overdraft in the Mission Creek subbasin in the absence of additional recharge.

Treat Extracted Groundwater for Contaminants of Concern

If wells have high arsenic, uranium, gross alpha, or other water quality contaminants at high concentrations, then appropriate treatment could be installed 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 in a given year 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. A down side of constructing additional basins is that the investment may not be fully utilized due to variable water deliveries.

Enhance Regular Maintenance of Spreading Basins

DWA conducts regular maintenance at the recharge basins to remove silt and reduce clogging. Regular maintenance increases existing percolation rates and reduces the volume of water lost due to evaporation. Since DWA experiences few problems with clogging, the benefit of increased maintenance may be limited.

Enhance Regular Maintenance of the Wastewater Percolation Ponds

MSWD could conduct enhanced maintenance at its wastewater percolation ponds to remove silt and reduce clogging. Regular maintenance would increase existing percolation rates by approximately 2 percent and reduce the volume of water lost due to evaporation (estimated to be 3 percent).

Install Monitoring Wells and Monitor Water Quality and Levels

Installation of dedicated 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:

- Enhanced water levels and quality monitoring in areas where no data is previously available
- Improved understanding of subsurface flows between the subbasins
- Improved understanding of the movement of contaminants in the different subbasins within the Planning Area

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

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 could increase natural recharge in to the Mission Creek subbasin. It is recommended that the agencies coordinate with the RCFCWCD on the implementation of low impact development (LID) for the Planning Area. RCFCWCD requires LID in project designs as part of the Municipal Separate Storm Sewer System Permit (MS4) permit.

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.

Work with Riverside County to Develop a Local Well Construction and Abandonment Policy

CVWD, DWA and MSWD could work with Riverside County to develop a well construction and abandonment policy that 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. Riverside County Department of Environmental Health has worked with several agencies to implement local well construction and abandonment policies.

Work with the City of Desert Hot Springs and 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 City of Desert Hot Springs and Riverside County.

Encourage Land Use Policies that Minimize Development in Watersheds and Recharge Areas

Although outside their legal purview, CVWD, DWA, and MSWD could encourage the cities and Riverside County to adopt land use policies that minimize development in the upper watersheds and principal recharge areas of the Planning Area. This would reduce the risk of contamination of natural recharge contributing to the Mission Creek and Garnet Hill subbasins.

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
Issues and Strategies

		Issue	Supply											Water Quality													Cost and Economics				Demand			Environmental						Other			
Number	Category	Strategy	Climate Change	Impact of Whitewater River Subbasin recharge on Garnet Hill basin	Imported Water Recharge Volumes	Natural Recharge	Overdraft	Recharge Operations	Recharge/Percolation pond operations and mainteneance	Recycled Water	Reliability	Transfers and Exchanges	Underflows between the subbasins	Brine Disposal	Arsenic	Fluoride	Gross Alpha	Hexavalent Chromium	Nitrates	Hot water entering MC subbasin	Mission Creek Water Quality	TDS	Uranium	Water Quality Contaminants	Well abandonment program	Salinity Management	Cost of water	Funding	Replenishment Assessment	Pumping Costs	Conservation	Population growth	Socioeconomic issues	Greenhouse gas emissions	Mesquite Hummocks	Land subsidence	MSHCP	Relationship with stakeholders and regulatory agencies	Watershed protection	Data Gaps	Land use protection for basin recharge	Monitoring and Reporting	Plan Implementation
1	Supply	Divert Little Morongo Creek recharge to MC subbasin (new diversion pipeline and recharge basin)				•																																•			•		
2	Supply	Divert Long Canyon Creek recharge to MC subbasin (new diversion pipeline and recharge basin)				•																																•			•		
3	Supply	Divert Little Morongo Creek recharge to MC subbasin (line channel crossing DHS subbasin)				•																																•					
4	Supply	Divert Long Canyon Creek recharge to MC subbasin (line channel crossing DHS subbasin)				•																																•					
5	Supply	Increase capture of local stormwater into the MC subbasin during high intensity storms				•			•																													•			•		
6	Supply	Obtain additional SWP water supplies (Table A)			•		•				•										•	•					•	•				•											
7	Supply	Obtain additional SWP water supplies (wet water)			•		•				•										•	•					•	•				•											
8	Supply	Obtain non-SWP water supplies			•		•				•										•	•					•	•				•											
9	Supply	Delta conveyance facilities (Existing Table A)			•		•				•										•	•					•	•				•											
10	Supply	Pump groundwater from the DHS subbasin for potable use					•				•		•							•		•					•	•				•	•										
11	Supply	Pump groundwater from the DHS subbasin for irrigation use					•				•									•		•					•	•				•	•										
12	Supply	Pump groundwater from the GH subbasin					•				•		•																			•											
13	Supply	Pump additional groundwater from MC subbasin					•				•		•																			•											
14	Supply	Participate in desalination of drain water in the East Valley					•				•			•								•					•	•				•						•					
15	Supply	Participate in seawater desalination projects in the State					•				•			•								•					•	•				•						•					
16	Supply	Expand the existing Horton WWTP to 3.8 mgd				•													•		•						•	•															
17	Supply	Construct a MSWD wastewater collection system to return indoor flows and a new Regional WWTP in Mission Creek (5.2 mgd)				•													•		•						•	•															
18	Supply	Construct a MSWD wastewater collection system to return indoor flows and a new Regional WWTP in Mission Creek (3.7 mgd)				•													•		•						•	•															
19	Supply	Construct a MSWD wastewater collection system to return indoor flows and a new Regional WWTP in Garnet Hill (5.2 mgd)				•													•		•						•	•															
20	Supply	Construct a MSWD wastewater collection system to return indoor flows and a new Regional WWTP in Garnet Hill (3.7 mgd)				•													•		•						•	•															
21	Supply	Construct a CVWD wastewater collection system to return indoor flows from regions overlying the DHS subbasin to the MC subbasin (3.5 mgd)				•													•		•						•	•															
22	Supply	Explore water transfers/exchange opportunities					•				•	•															•	•				•						•					
23	Supply	Develop conservation program only to extent required by law (20 percent by 2020)																													•												
24	Supply	Develop conservation programs greater than those required by law (update landscape ordinances for new residential construction/golf courses to be more stringent)				•																						•			•	•	•										
25	Supply	Construct new recharge basins for additional imported water			•	•																																	•		•		
26	Supply	Enhance maintenance of spreading basins to maintain or increase existing recharge/percolation rates and minimize evaporation loss			•				•																																		
27	Supply	Enhance maintenance of percolation ponds to maintain or increase existing recharge/percolation rates and minimze evaporation loss			•				•																																		
28	Supply	Install monitoring wells and monitor groundwater level and water quality across basin boundaries																			•																			•			
29	Supply	Require all new developments to have stormwater capture and recharge infrastructure (e: gutters leading to localized spreading ponds).				•																																•					
30	Water Quality	Construct SWP Extension to the Coachella Valley																			•	•					•	•										•					
31	Water Quality	Install tertiary treatment at WWTPs and develop a recycled water distribution system								•	•								•								•	•															
32	Water Quality	Install nitrogen removal at WWTPs																	•		•																						
33	Water Quality	Pump and treat for nitrates												•					•		•						•			•													
34	Water Quality	Avoid drilling wells in areas with water quality contaminants									•													•			•																
35	Water Quality	Implement direct delivery of imported water for potable use (requires surface water treatment)					•														•	•					•	•						•									
36	Water Quality	Treat imported water prior to groundwater recharge using RO					•							•							•	•					•	•		•													
37	Water Quality	Treat extracted groundwater for TDS using RO if concentrations are beyond acceptable levels												•								•					•	•		•													
38	Water Quality	Pump and Treat Poor Quality Groundwater from Eastern Mission Creek Subbasin																		•	•	•					•	•															
39	Water Quality	Treat for other constituents of concern (arsenic, gross alpha, uranium, hexavalent chromium, fluoride) when detected												•	•	•	•	•					•																				
40	Other	Equalize the benefits of imported water recharge between the MC and WW subbasins			•			•																																		•	
41	Other	Do not approve new developments if sufficient water is not available																																				•					

Table 5-3
Issues and Strategies

		Issue	Supply											Water Quality														Cost and Economics				Demand			Environmental						Other			
Number	Category	Strategy	Climate Change	Impact of Whitewater River Subbasin recharge on Garnet Hill basin	Imported Water Recharge Volumes	Natural Recharge	Overdraft	Recharge Operations	Recharge/Percolation pond operations and mainteneance	Recycled Water	Reliability	Transfers and Exchanges	Underflows between the subbasins	Brine Disposal	Arsenic	Fluoride	Gross Alpha	Hexavalent Chromium	Nitrates	Hot water entering MC subbasin	Mission Creek Water Quality	TDS	Uranium	Water Quality Contaminants	Well abandonment program	Salinity Management	Cost of water	Funding	Replenishment Assessment	Pumping Costs	Conservation	Population growth	Socioeconomic issues	Greenhouse gas emissions	Mesquite Hummocks	Land subsidence	MSHCP	Relationship with stakeholders and regulatory agencies	Watershed protection	Data Gaps	Land use protection for basin recharge	Monitoring and Reporting	Plan Implementation
42	Other	Monitor and encourage remediation activities required by the RWQCB																			•			•																			
43	Other	Develop a well abandonment and construction policy																							•													•					
44	Other	Work with Riverside County DEH to enforce state well abandonment policies for groundwater protection																							•													•					
45	Other	Work with Riverside County to acquire land and designate it appropriately in the General Plan for basin recharge			•	•															•																	•	•		•		
46	Other	Encourage land use policies that minimize development in the watersheds																			•																•		•		•		
47	Other	Implement drinking water source protection program																			•			•															•				
48	Evaluation Criteria	Include a supply buffer to deal with the uncertain effects (uncertain growth, climate change, reliability, economic changes)	•								•																					•											
49	Evaluation Criteria	Plan for different growth scenarios	•								•																				•	•											
50	Evaluation Criteria	Select plans with greater supply reliability (dry years and emergencies)	•								•																					•											
51	Evaluation Criteria	Consider effects of water management on the hummocks			•			•											•																•		•						
52	Evaluation Criteria	Develop a methodology for data sharing and to address data gaps																																						•		•	•
53	Evaluation Criteria	Consider other environmental impacts of various water management activities																																									
54	Evaluation Criteria	Limit pumping to estimated natural recharge					•																											•									
55	Evaluation Criteria	Limit pumping to artificial recharge					•																																				
56	Evaluation Criteria	Establish basin operating parameters (establish operating levels, timing/volume of recharge and the basin to be recharged)			•		•	•																											•								
57	Evaluation Criteria	Maintain groundwater level to current groundwater levels			•		•	•											•		•														•								
58	Evaluation Criteria	Restore groundwater levels 15 feet above 2010 levels			•		•	•											•		•													•	•								
59	Evaluation Criteria	Allow groundwater levels in the basins to decline further					•				•		•								•									•					•	•				•			
60	Funding	Establish replenishment assessment for GH subbasin		•									•																•	•										•			
61	Funding	Identify grants																									•	•															
62	Funding	Identify zero/low interest loans																									•	•															
63	Funding	Explore public-private partnerships																									•	•															
64	Funding	Identify bonds/COPs/other borrowing																									•	•															
65	Funding	Explore funding from rate base																									•	•															
66	Funding	Explore funding from connection fees																									•	•															
67	Funding	Implement conservation strategies that include incentives																										•			•		•										

Strategies Excluded from Further Consideration in this WMP

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 elements were excluded from further consideration in the WMP. These elements may be revisited as part of future WMP updates.

- 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 that would only be used during high intensity storms 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 high expected cost and the minimal potential benefit (low recharge) offered by this project, this project is excluded from further consideration.

- Projects that use groundwater from the Desert Hot Springs subbasin are also excluded based on concerns about depleting the hot water resources, which provide 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 because of high levels of salinity and high temperature of the groundwater (Harding Lawson and Associates, 1985).

ALTERNATIVE PLAN DEVELOPMENT

The management plan alternatives 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 are common to all alternative plans. Moreover, some of these common elements can be modified 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 section discussed the projects used in the development of the alternative plans.

Common Projects

A number of common projects are included in all of the alternative plans:

- 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 WWTP for collecting and treating indoor return flows in MSWD's service area
- Achieve 20 percent urban water conservation by 2020 (20 by 2020) – This is a statewide goal for municipal water retailers as specified in SB X7-7 as a condition for obtaining grant funding
- 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 a drinking water source protection program
- Work with the cities and Riverside County to require stormwater capture in new developments to meet low-impact development (LID) requirements
- Install dedicated monitoring wells to monitor groundwater quality and levels
- Perform regular maintenance of percolation basins and spreading basins to maintain recharge rates

Projects that Vary Among Alternative Plans

Categories of projects included in each of the alternative plans, but which vary among plans are the following.

- Water conservation measures
- Imported water supplies
- Collection, treatment, 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 goals of Senate Bill SB X7-7 which requires urban water purveyors to reduce water use by 20 percent by the year 2020 as a condition for obtaining grant funding. However, considering the existing low water use in the Planning Area, the potential scope for achieving additional water conservation may be limited, but may be extended to water users in the region that are not covered by SB X7-7 .

Although the requirements of SB X7-7 do not apply to private producers, the water agencies can coordinate with the larger private producers in the Planning Area, assess their water use practices, and offer programs to reduce their water use. Enforcement of CVWD's and MSWD's stringent landscape ordinance for new developments throughout the Planning Area may help achieve additional conservation. Some of the alternative plans require additional conservation. Water conservation could be encouraged beyond the 20 by 2020 requirements (for grant funding) 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 and subsurface flow from the surrounding watersheds, return flows from use, and SWP Exchange water delivered via the CRA are the only current sources of water replenishing the basins. The amount of imported water supplies available for recharge is affected by the reliability of the SWP and the water management activities of 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. The SWP supply currently has an estimated reliability of 60 percent of Table A Amounts (DWR, 2012). 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. For conservative planning purposes, it is assumed that SWP delivery reliability could decrease to 50 percent of Table A Amounts by 2030 and remain at that level for the rest of the planning period. If the Bay Delta Conservation Plan (BDCP) and Delta Conveyance is successfully implemented, then SWP supply reliability could potentially increase to 77 percent of Table A (BDCP Steering Committee Presentation, 2010).

Taking these factors into consideration, each alternative plan assumes different future SWP Table A reliability and different volumes of Metropolitan callback. The impacts of varying reliability on the imported water requirements for the Planning Area are presented in **Table 5-4**. The amount of imported water supply required for the Planning Area to stabilize groundwater levels 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 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
No Growth and Growth Scenarios

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. Riverside County Center for Demographics Research (RCCDR), 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 the source of additional imported water:

- Additional SWP water (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.

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

Collection, Treatment, Disposal and Reuse of Wastewater

Currently, approximately 1.5 million gallons per day (mgd) of wastewater 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 in the Planning Area) utilize private septic systems.

MSWD wastewater flows are projected to be approximately 7.5 mgd (8,400 AFY) by 2045. MSWD plans to expand the Horton WWTP from 2.3 mgd to 3.0 mgd average capacity or 3,400 AFY. MSWD also is planning to construct a Regional WWTP 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 Interstate 10 and Indian Avenue interchange. CVWD wastewater in the Planning Area is currently disposed via private septic systems. CVWD wastewater flows could be treated at MSWD's Regional WWTP, a new CVWD WWTP, or at CVWD's existing Water Reclamation Plant No. 7 (WRP-7) in north Indio. The current MSWD WWTPs are not designed to remove nitrogen compounds, but it is expected that any new WWTP or any WWTP expansion will include 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

The alternative plans consider some or a combination of the following water quality protection measures listed below.

Projects to address the concentration of total dissolved solids (TDS) in recharge water 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 CRA.
- Treatment of the SWP Exchange water prior to recharge which would reduce the concentration of total TDS in the recharge water.

Projects to address the concentration 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

Growth also 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 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 actually occur in the Planning Area. **Section 3 – Water Requirements** considers two growth scenarios. These scenarios are listed below:

- No Growth
- Projected Growth

Considering different growth scenarios helps gauge the effects of different levels of growth on the water resources in the Planning Area. Currently, all 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 directly 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: Maintain Status Quo in the Groundwater Basin
- Alternative Plan 1: Maintain Groundwater Levels at 2009 Levels
- Alternative Plan 2: Increase Groundwater Levels to 15 Feet Above 2009 Levels
- Alternative Plan 3: Maintain Groundwater Levels at 2009 Levels and Minimize Imported Water
- Alternative Plan 4: Maintain Groundwater Levels at 2009 Levels and Maximize Water Quality
- Alternative Plan 5: Maintain Groundwater Levels at 2009 Levels, Minimize Imported Water, and Maximize Water Quality

While each management plan alternative 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 alternative plan is developed to gauge the effects 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 alternative 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 X7-7 . 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 proposed 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 or address other water quality parameters.

Alternative Plan 1 – Maintain Water Levels at 2009 Levels

The goal of this alternative plan is to maintain groundwater levels in the Mission Creek and Garnet Hill subbasin at 2009 levels during the Planning Period for average hydrologic conditions. 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 recharge to maintain groundwater levels at 2009 levels while meeting future growth. Recycled water for non-potable use is not a component of this alternative plan. Wastewater treated at the proposed Regional Plant is percolated in the Mission Creek subbasin. No treatment measures are implemented to reduce TDS concentrations in imported water, reduce nitrate concentrations in the groundwater or address other water quality parameters.

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

The goal of this alternative plan is to increase groundwater 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 assumed to be available to the Planning Area under existing Table A Amounts at 77 percent reliability based on implementation of the BDCP and Delta Conveyance.

This alternative plan requires additional imported water recharge to restore and maintain groundwater levels at 2000 levels while meeting future growth. Since the goal of this alternative plan is to maintain higher groundwater levels in the basin, the amount of imported water required in this alternative plan is higher than the amount of imported water required in Alternative Plan 1 due to increased subsurface outflow across the Banning fault. Recycled water for non-potable use is not a component of this alternative plan. Wastewater treated at the proposed 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 or address other water quality parameters.

Alternative Plan 3 – Maintain Groundwater Levels at 2009 Levels and Minimize Imported Water

In addition to stabilizing groundwater levels, the goal of this alternative plan is to maximize the use of local water supplies. This alternative assumes that the Growth scenario will occur in the Planning Area. Reduction in 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 proposed 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 or address other water quality parameters.

Alternative Plan 4 – Maintain Groundwater Levels at 2009 Levels and Maximize Water Quality

The goal of this alternative 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 assumed to be available to the Planning Area under existing Table A conditions at 77 percent reliability based on implementation of the BDCP and Delta Conveyance. This plan requires additional imported water recharge to stabilize groundwater levels and 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 direct use of SWP water for groundwater recharge improves groundwater quality due to its reduced salinity (average TDS for East Branch SWP is 250 mg/L). Recycled water for non-potable 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 groundwater extracted from the Mission Creek subbasin. This alternative 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 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 – Maintain Groundwater Levels at 2009 Levels, Minimize Imported Water, and Maximize Water Quality

The goal of this alternative plan is to stabilize groundwater 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 future reliability. This plan requires additional imported water recharge to stabilize groundwater levels and meet future growth.

This alternative plan assumes that the imported water delivered to the Planning Area via the CRA will be desalted (effluent TDS will be 325 mg/L) prior to recharge. The use of desalted CRA water for groundwater recharge improves groundwater quality. Recycled water for non-potable use 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 proposed Regional WWTPs will be percolated in the Mission Creek subbasin. Production from groundwater wells contaminated by nitrate will be treated for nitrate removal. Presently, nitrate concentrations for all municipal wells in the Planning Area are below the MCL for nitrate.

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
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

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
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 alternative plans are evaluated against a set of evaluation criteria using several tools and techniques. 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 of 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. Each criterion selected for evaluation and the evaluation process are described in the following paragraphs.

Evaluation Criteria

Each management alternative is evaluated using the following criteria:

- Present Value of Capital and Operational and Maintenance (O&M) Costs
- Water Quality (as represented by average annual TDS concentrations)
- Groundwater Levels
- Amount of Imported Water Supplies

Present Value of Capital and O&M Costs

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 as the present value of total costs (capital costs and annual O&M costs). 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 mg/L. Annual average TDS concentrations are estimated using the WEAP model by performing a TDS mass balance for the groundwater basins.

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 storage and water level changes 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.

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[1] WEAP is an integrated water management planning tool developed by Stockholm Environment Institute. WEAP can simulate a broad range of natural and engineered components of these systems, including rainfall runoff, baseflow, and groundwater recharge from precipitation; sectoral demand analyses; water conservation; water rights and allocation priorities, reservoir operations; hydropower generation; pollution tracking and water quality; vulnerability assessments; and ecosystem requirements.

Amount of Imported Water Supplies

Imported water is the principal source of supplemental water supply for the Planning Area. 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 Environment Institute, to simulate the groundwater balance and long term trends in TDS concentrations and groundwater storage.

WEAP estimates of the groundwater budgets for the different alternative plans are consistent with the groundwater modeling results for the basin conditions simulated. Results from the WEAP modeling are summarized in **Table 5-6**.

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 runs indicate that TDS levels increase in all alternative plans except for Alternative Plan 4 (Maintain Water Levels at 2010 Levels and Maximize Water Quality), where SWP Exchange water delivered via the CRA is desalted. 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 increased TDS concentrations over time. This is caused by the addition of salt through urban 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 of additional supply under 2045 conditions; however, it also adds salinity to the basin. Desalination 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 additional management actions, net groundwater storage declines for Alternative Plan 0 (No Management Action). For the other alternative plans, to stabilize or raise groundwater levels, the volume of imported water recharged must increase to account for higher subsurface outflows leaving the basin. In addition, there must be an increase in the amount of water in storage to account for both higher levels and mounding near the recharge site. For Alternative Plans 1 (Maintain Water Levels at 2010 Levels), 3 (Maintain Water Levels at 2010 Levels and Minimize Imported Water), 4 (Maintain Water Levels at 2010 Levels and Maximize Water Quality), and 5 (Maintain Water Levels at 2010 Levels, Minimize Imported Water Use, and Maximize Water Quality), the WEAP results indicate that the groundwater storage in the Mission Creek subbasin stabilize over the planning period. For Alternative Plan 2, groundwater levels increase by 15 feet over 2009 levels.

It should be noted that while WEAP is a useful tool for evaluating the general impacts of different management plans, its ability to simulate specific groundwater quality and level trends is limited compared to more sophisticated groundwater modeling tools such as MODFLOW. For example, the WEAP model assumes completely mixed subbasins. This assumption significantly simplifies the actual mixing process within a groundwater basin. In the Whitewater River subbasin, after 37 years of recharge operation, TDS levels in wells near the Whitewater River Recharge Facility have increased from a range of 150-300 mg/L to 350-600 mg/L, with the TDS varying from year with the amount of recharge. Wells located more than about 8 miles away from the Whitewater facility have shown little change in quality. A model that assumes a completely mixed basin would show the same concentrations throughout the basin.

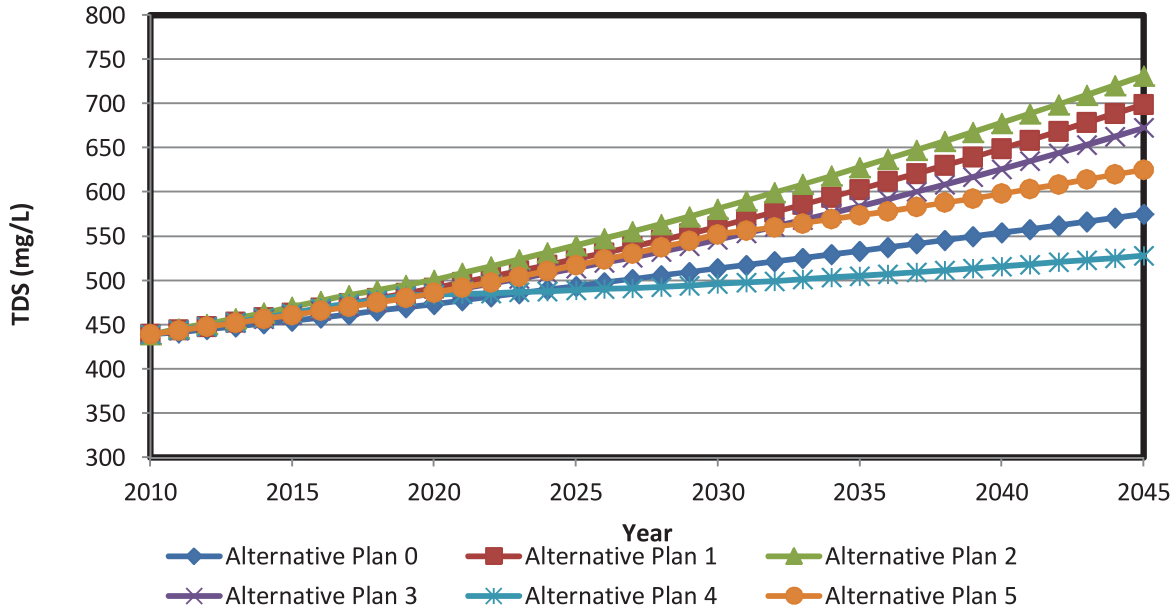

Figure 5-1
Average TDS Concentrations in the Mission Creek Subbasin

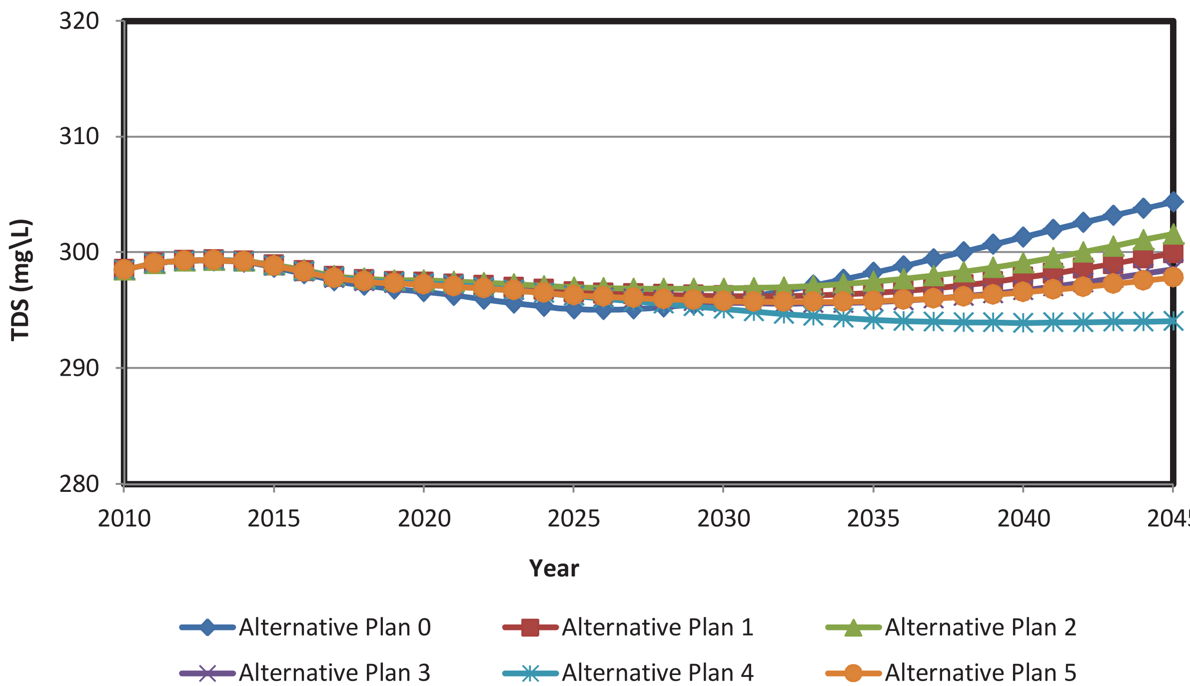

Figure 5-2
Average TDS Concentrations in the Garnet Hill Subbasin

Groundwater Modeling

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. A groundwater model utilizing the USGS MODFLOW code 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 basins.

The groundwater model developed for the Mission Creek and Garnet Hill subbasins is based on a model developed by CVWD for the Whitewater River subbasin. The Mission Creek-Garnet Hill model includes a portion (to Row 78) of the groundwater model developed for the Whitewater River subbasin. This area was included in order to model the interactions between the Mission Creek/Garnet Hill subbasins and the Whitewater River subbasin.

Following calibration against historical conditions, the groundwater model was used to simulate the response of the subbasins to different management actions. Four groundwater model runs were performed and the assumptions associated with each are presented in **Table 5-7.**

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

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:

- The Growth scenario will occur in the Planning Area
- 20 percent reduction in urban demand will be achieved by 2020 per SB X7-7

- New wells are included in the model to meet future demand requirements
- In the MSWD service area, all customers currently connected to a 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. 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. Outflows across the Banning fault and the Garnet Hill fault are presented in **Figure 5-6** and **Figure 5-7** respectively. A detailed report describing the groundwater modeling process and its results is presented in **Appendix B**.

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 (No Management Action). 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-ft/yr in 2045. Wastewater treated at the MSWD 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 will decline by approximately 70 feet in 2045 compared to 2010 levels. This corresponds to a reduction of approximately 162,000 acre-ft in groundwater storage by 2045. Groundwater storage in the Garnet Hill subbasin increases by approximately 50,000 acre-ft by 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 is 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 the MSWD 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-ft in groundwater storage in 2045. Groundwater storage in the Garnet Hill subbasin increases by approximately 45,000 acre-ft 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. The following variable hydrology condition applies to both the Mission Creek and Garnet Hill subbasins and the Whitewater River subbasin:

- Wet years from 2011 to 2018
- No recharge from 2019 to 2028
- Dry years from 2029 to 2037
- Wet years from 2038 to 2045

This run is intended to indicate a possible maximum range in groundwater levels under extremely variable hydrologic 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.

Groundwater storage increases by 200,000 acre-ft between 2010 and 2018 and decreases by approximately 40,000 acre-ft between 2018 and 2038. The fluctuation in groundwater levels between 2018 and 2038 in the Mission Creek subbasin is approximately 70 feet. Groundwater storage in the Garnet Hill subbasin increases by approximately 45,000 acre-ft 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. A decrease in groundwater levels in the Whitewater River subbasin increases 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. The following variable hydrology condition applies to the Mission Creek and Garnet Hill subbasins:

- Wet years from 2011 to 2015
- No recharge from 2016 to 2040
- 600 acre-ft/yr from 2029 to 2037

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. The hydrologic cycle for the Whitewater River subbasin is the same as that for Groundwater Run 3.

Due to the increased recharge during the initial years of the planning period, groundwater storage increases by approximately 154,300 acre-ft in the Mission Creek subbasin between 2010 and 2015. However, since there is little to no recharge in the remaining years, groundwater storage decreases to approximately -2,000 acre-ft between 2015 and 2045. Between 2015 and 2045, groundwater levels decline throughout the basin. Groundwater storage in the Garnet Hill subbasin increases by approximately 38,000 acre-ft between 2010 and 2045. Outflows across the Banning fault reduce from approximately 4,100 acre-ft/yr in 2010 to 3,800 acre-ft/yr in 2045.

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. Outflows across the Garnet Hill fault are approximately 15,000 acre-ft/yr in 2045. A decrease in groundwater levels in the Whitewater River subbasin during periods of no recharge results in increased outflow 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 caused 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 rise due to increased storage, outflow across the faults to downstream basins also increases. The relationship between total 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 (including Advance 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 proposed Regional Plant in either the Mission Creek subbasin or the Garnet Hill subbasin does not have a significant effect on groundwater levels in either basin.

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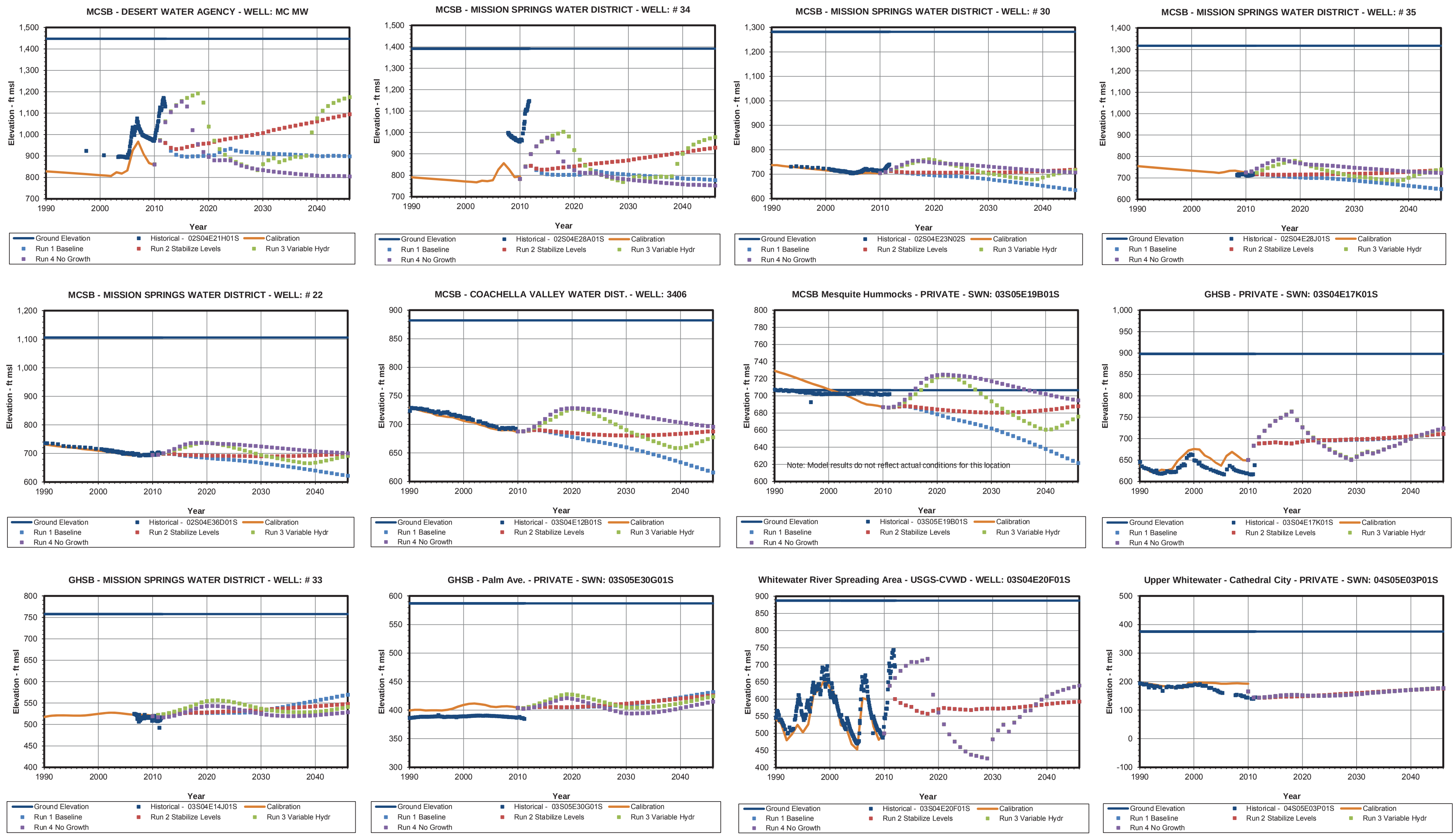

Figure 5-3

Mission Creek - Garnet Hill Water Management Plan
Well Hydrographs
Model Runs No. 1, 2, 3 and 4

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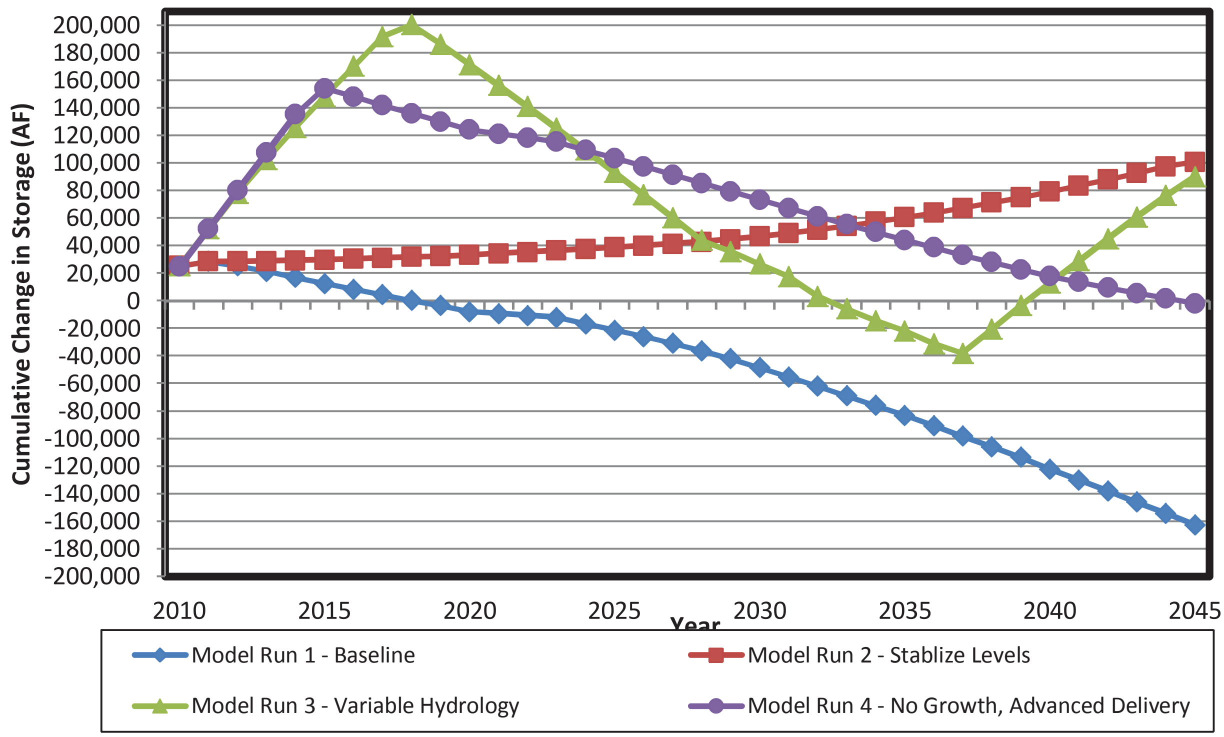

Figure 5-4
Cumulative Change in Storage – Mission Creek Subbasin

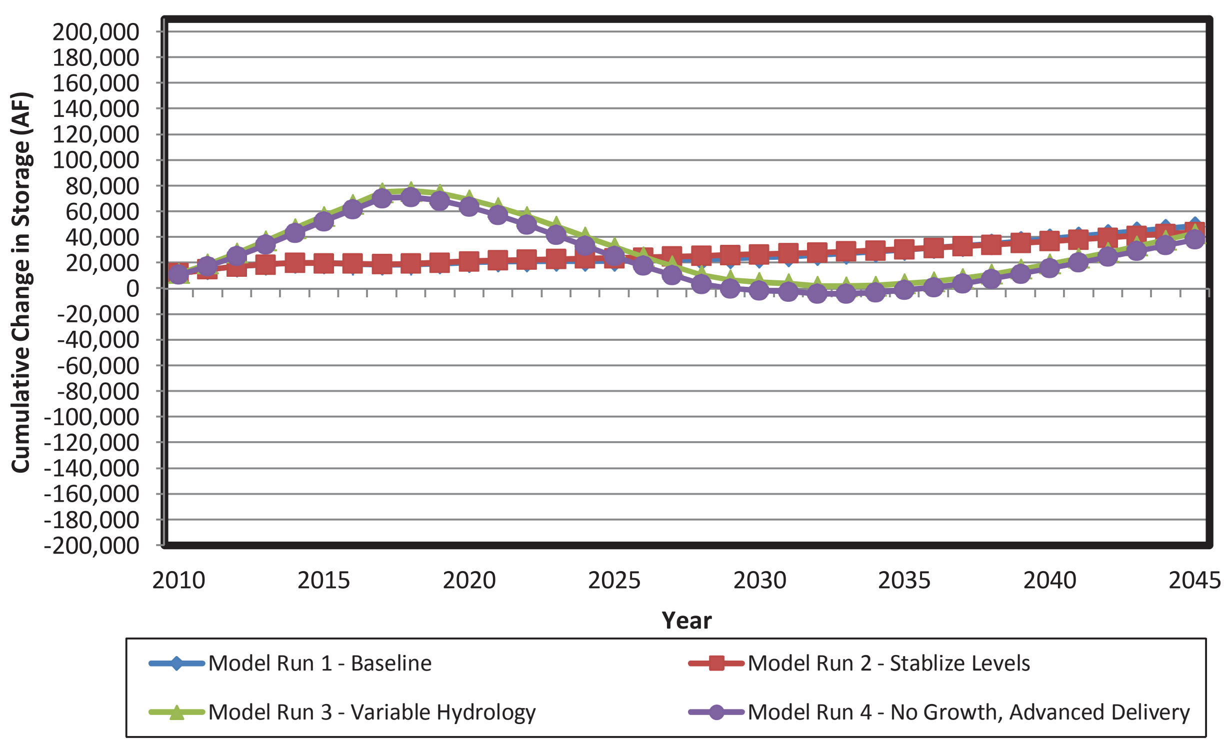

Figure 5-5
Cumulative Change in Storage – Garnet Hill Subbasin

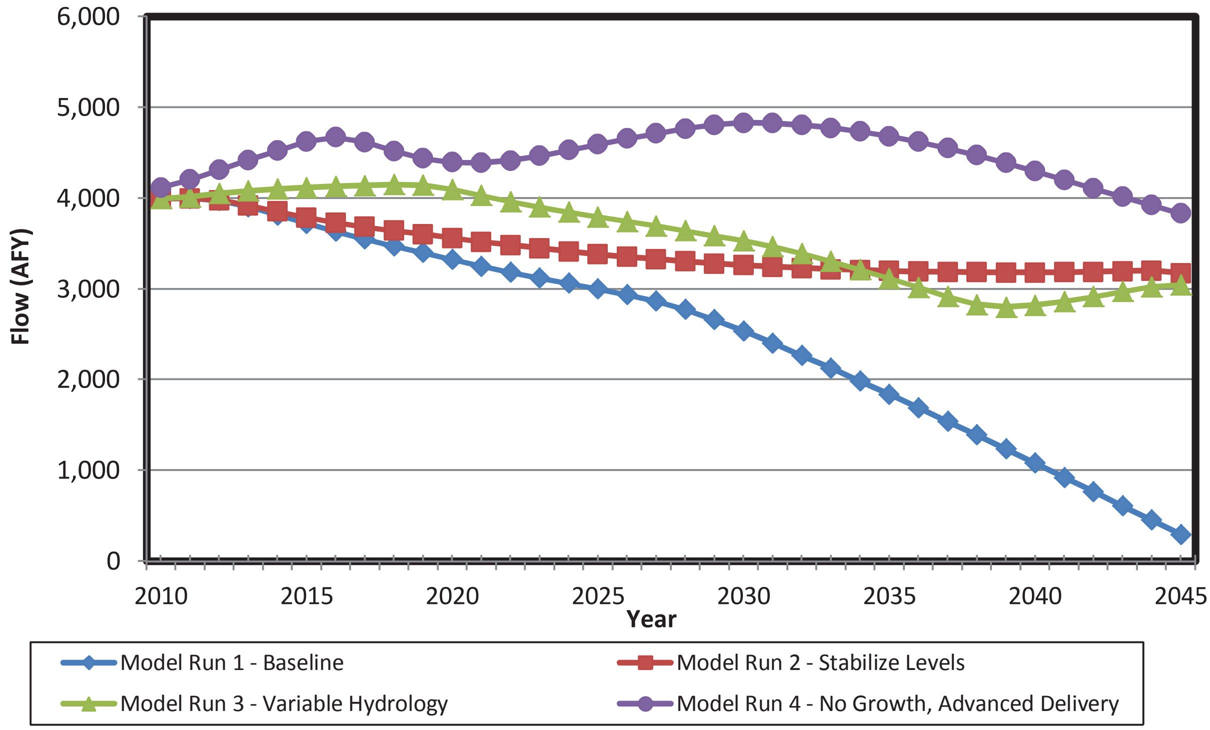

Figure 5-6
Outflows Across the Banning Fault

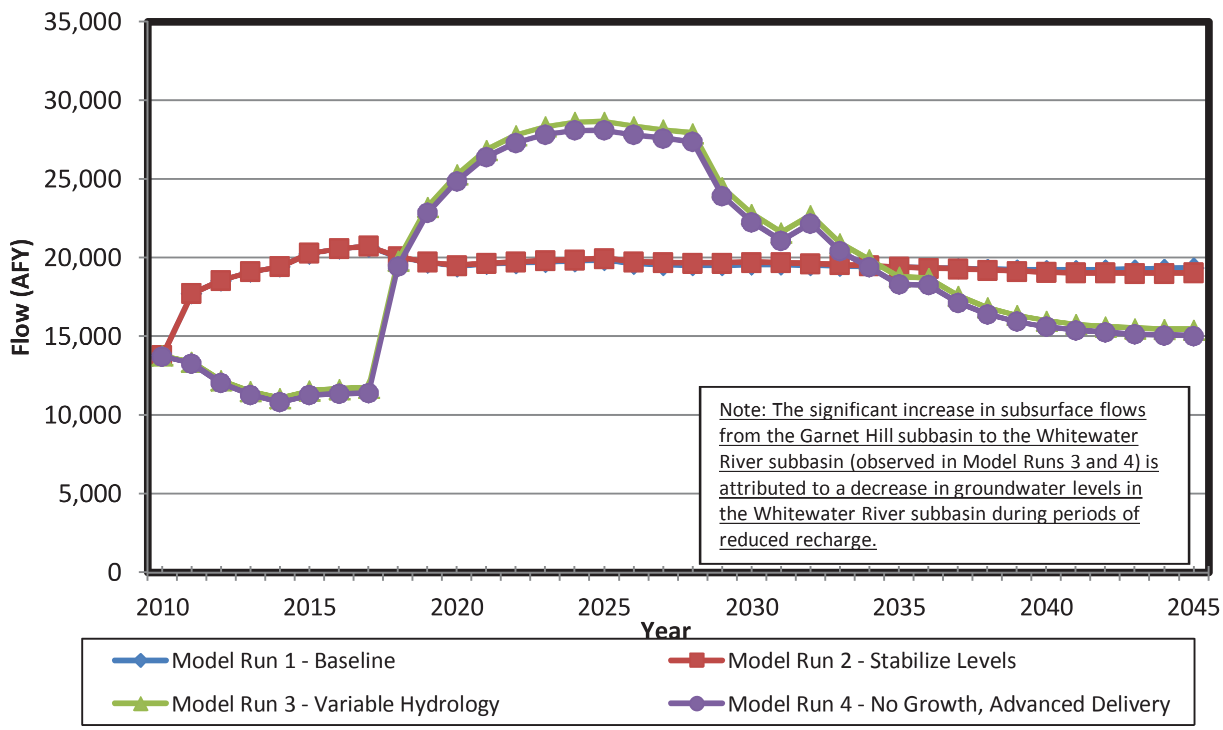

Figure 5-7
Outflows Across the Garnet Hill Fault

Plan Evaluation

The alternative plans are evaluated against the criteria discussed. **Table 5-8** compares the performance of the alternative plans. 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 differ.

Table 5-8
Comparison of Alternative Plans

Alternative	Alt 0	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Present Value of Total Costs (in millions of dollars)	$353	$417	$458	$471	$774	$554
Projected Average TDS in 2045 (mg/L)	575	699	732	673	528	626
Change in Groundwater Levels from 2010- to 2045	–	0	+	0	0	0
Volume of Imported Water (acre-ft/yr) - Annual Average 2010-2045	9,750	18,200	21,600	15,500	18,300	15,500

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. To prevent the consequences of declining groundwater levels such as low production yields and high pumping costs, 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. For its implementation, Alternative Plan 1 requires an additional $44 million (to stabilize groundwater levels) 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.

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. For its implementation, this alternative requires an additional $41 million investment compared (to increase groundwater levels) to Alternative Plan 1. 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 among the alternatives considered.

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 is the least cost efficient among all alternatives. In addition, in comparison to Alternative Plan 1, Alternative Plan 4 requires an additional $358 million for implementing 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 Valley water agencies. For example, other key stakeholders in implementing the SWP extension may include Southern California Edison, San Gorgonio Pass Water Agency, Mojave Water Agency, Metropolitan Water District of Southern California, Hi-Desert Water District, Joshua Basin Water District, Big Horn Desert View Water Agency, and the Morongo Band of Mission Indians. In addition, a federal lead agency is required for National Environmental Policy Act (NEPA) documentation.

Alternative Plans 3 and 5 are variations of Alternative Plans 1 and 4. Both Plans 3 and 5 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. The cost of implementing Alternative Plan 5 is approximately $220 million lower than the cost of implementing Alternative Plan 4.

The present value of the total costs required for each alternative plan is presented on **Figure 5-8**. Alternative Plan 1 is the most cost effective to implement among all alternatives. Alternative Plan 2 is more expensive than Alternative Plan 1 due to the costs of purchasing additional imported water to raise groundwater levels by 15 feet from 2009 levels. The increased cost of implementing Alternative Plan 3 relative to Alternative Plan 1 is due to aggressive conservation measures that are a part of Alternative Plan 3. Alternative Plans 4 and 5 are significantly more expensive than Alternative Plan 1 due to the capital and operating expenses associated with water quality improvements.

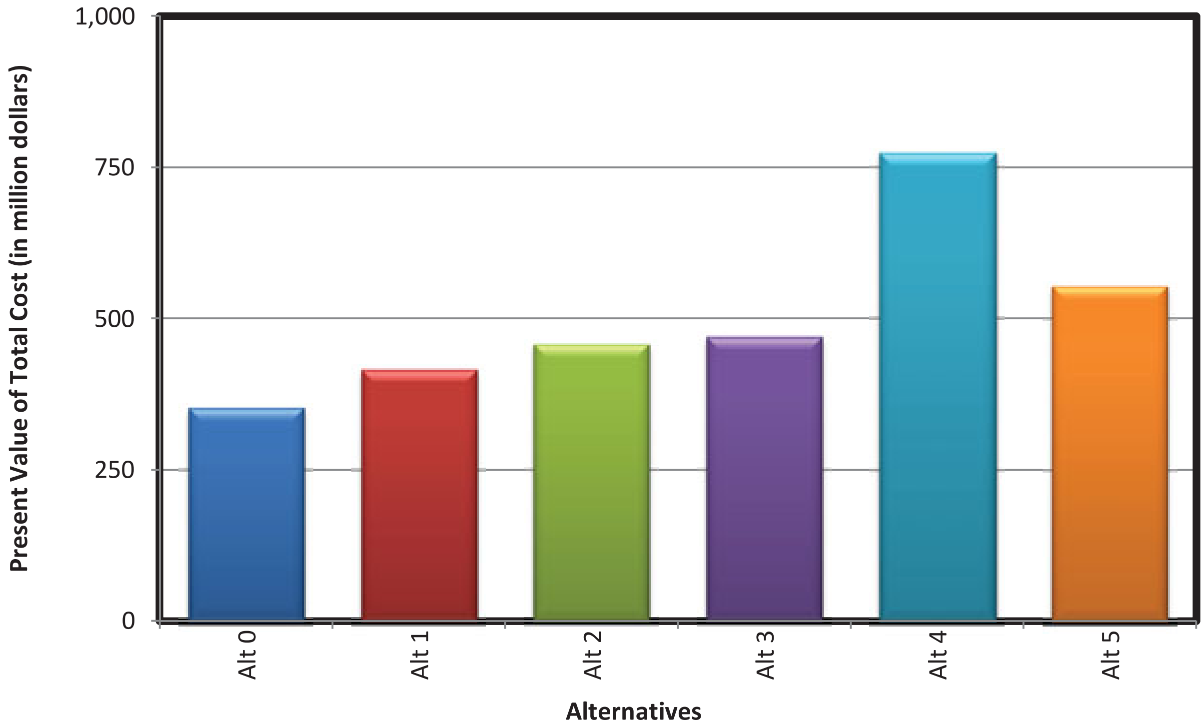

Figure 5-8
Present Value Cost of Alternative Plans

Notes: SWP costs presented above in Alt 4 only include Mission Creek subbasin share of the total costs. The total cost of the SWP Extension Project is expected to range from approximately $878 M - $1,180 M, depending on the route selected and capacity of the project.

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

CONCLUSIONS

The objectives of the WMP are:

- Meet current and future water demands with a 10 percent supply buffer
- 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

Each alternative plan discussed above attempts to meet the overall objectives of the WMP. The performance of the alternative plans varies when a singular objective is considered. For example, if groundwater quality is considered as the sole criterion for evaluating the performance of an alternative plan, then Alternative Plan 4 outperforms the other alternatives. Similarly, for eliminating groundwater overdraft, Alternative Plan 2 outperforms the other alternatives. However, if cost were to be considered as the sole criterion, then Alternative Plan 4 ranks last. The alternative evaluation process highlights the cost tradeoffs associated with improving water quality or increasing groundwater levels. While 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 saline inflows from the Desert Hot Springs subbasin assist in meeting individual objectives of the WMP, they will increase the cost of water for customers within the Planning Area. CVWD, DWA, and MSWD are conscious of managing future costs for the customers within the Planning Area.

Alternative Plan 1 appears to satisfy the overall objectives of the WMP. 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 groundwater TDS concentrations associated with this plan are higher relative to Alternative Plans 4 and 5, the costs associated with implementing this alternative are significantly lower.

The Recommended Plan is a variation of Alternative Plan 1. The Recommended Plan discussed in **Section 7** of this WMP attempts to incorporate key elements from each alternative plan in order to meet the overall objectives of the WMP. 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. The Recommended Plan will be flexible to respond to uncertainty in growth as well as water supply conditions. Since the agencies will continue to work cooperatively on plan implementation, the plan objectives will be achieved. Details of the Recommended Plan and the associated implementation costs will be discussed in **Section 7** of this WMP.

Section 6
Water Management Objectives

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

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 meet demands reliably and protect water quality in a sustainable and cost-effective manner.*

WATER MANAGEMENT OBJECTIVES

In order to meet the overall goal of the WMP as described in the Mission Statement for this WMP, the participating agencies (CVWD, MSWD, and DWA) developed the following water management objectives for the Mission Creek and Garnet Hill subbasins:

- Meet current and future water demands with a 10 percent supply buffer
- 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 Water Management Objectives (WMO) is presented below. In some cases, these WMOs are refined as a result of the evaluations presented in Section 5.

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

The intent of this WMO 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 changes in demands, reductions in existing supplies or difficulties in developing new supplies. In its simplest form, supply reliability is the 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 for dry or shortage periods. The storage capacity of the groundwater basins 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 an on-going analysis of projected demands and supplies. The supply buffer should initially be capable of generating about 1,500 acre-ft/yr of water increasing to 3,700 acre-ft/yr by 2045. Since it may require several years to fully implement the buffer, this objective will be fully implemented by 2020.

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 further lowering of the groundwater levels can have adverse impacts ranging from increased energy costs to the need to deepen existing private and public wells. While groundwater level declines may not be avoidable during very dry years when recharge water deliveries are reduced and groundwater production is required to meet the needs of the Planning Area, the intent of this WMO is to manage the basin such that long-term average groundwater levels do not significantly decline from their present condition (year 2009). For planning purposes, it is assumed this objective will be fully implemented by 2015.

It is recognized that groundwater levels will vary based on year-to-year changes in imported water deliveries and local hydrology. Therefore, groundwater 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 required 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 supply reliability. 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.

The evaluations presented in **Section 5** indicated that salinity management will result in significant costs for the Planning Area. Therefore, the Management Committee will continue to evaluate salinity management strategies in conjunction with the Coachella Valley Regional Water Management Group to determine the most appropriate course of action for the Valley as a whole.

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 WMO 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 create significant unmitigable adverse impacts to the environment in the Planning Area. Some areas within the Planning Area are designated conservation areas as part of the Coachella Valley Multiple-Species Habitat Conservation Plan (CVMSHCP). 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. Since 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. Although participation in the CVMSHCP provides endangered species coverage for plan signatories, it does not relieve the water agencies from avoiding or mitigating significant adverse impacts of their discretionary actions.

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) to secure grant funding
- Well construction standards and permits
- CalGreen Building Code
- State and federal water supply contracts

The participating agencies in the WMP (CVWD, DWA, and MSWD) 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 WMOs 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 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 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 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
- 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 Management Plan, as 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 Management Plan include measures for reducing demand, managing water supply sources, eliminating 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 Management 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 Management Plan are listed below and discussed 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 available water supplies through the implementation of conservation programs. Since 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 water 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 (CVRWMG) developed the Regional Water Conservation Program 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 variability in imported water exchange delivery from the Colorado River Aqueduct. Consequently, groundwater pumping is expected to remain 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 Riverside County Projections (and future updates), 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 each 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 eliminated 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 eliminate 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. Based on historical operations, Metropolitan callback is considered an unlikely possibility. 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 exercises 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 purchases (Turnback Pool, Article 21 (Interruptible), or other “wet” water transfers);

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

- Additional long-term SWP water (Table A) acquisitions;
- Non-SWP water supply acquisitions;
- Delta conveyance facilities through the 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 may endeavor 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 other entities 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 retail 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 meet California Title 22 recycled water regulations 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 report 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 supply buffer should initially be capable of generating about 1,500 acre-ft/yr of water increasing to 3,700 acre-ft/yr by 2045.

The buffer could be provided through several approaches. Purchase option agreements with other water agencies could be established that can be exercised 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. The buffer could also be provided through groundwater storage where sufficient water is retained in storage in excess of water demands to generate the yield required by the buffer. Assuming current SWP reliability, this volume would be up to five times annual buffer requirement. To provide a 1,500 acre-ft/yr buffer, about 7,500 acre-ft of storage could be required. Water for buffer storage could be purchased on an as-available basis.

Ideally, a combination of these three options should be developed to avoid excessive reliance on any one approach. Since it may require several years to fully implement the buffer, this objective will be fully implemented by 2020.

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 from implementing low impact development practices that 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 should work with the planning departments of the City of Desert Hot Springs and Riverside County and with the Riverside County Flood Control and Water Conservation District (RCFCWCD) to encourage implementation of 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 eliminate overdraft. Nearly 120,000 acre-ft of imported water has been recharged into the Mission Creek subbasin since 2002, with more than 20,000 acre-ft expected to be recharged in 2012. 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 eliminate long-term overdraft. As discussed under **Imported Water Supply Needs** above and in **Section 5**, additional replenishment is needed to achieve the goal of stabilizing long-term groundwater levels based on 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 up to 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. Alternatively, the water allocation between Whitewater and Mission Creek could be adjusted to accommodate the existing capacity limitation. 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.

CVWD and DWA jointly manage imported water replenishment operations in the Coachella Valley using SWP Exchange water. The goal of the imported water replenishment operations is to deliver as much SWP Exchange water to the Coachella Valley as possible given SWP contract and delivery constraints and Metropolitan's Colorado River Aqueduct (CRA) operations. The Mission Creek Settlement Agreement Addendum states that CVWD and DWA will endeavor to recharge the available water to the Mission Creek and Whitewater River subbasins in proportion to the production from the two basins; however, over or under delivery from year to year may occur as needed to maximize total deliveries to the Valley. Cumulative SWP recharge deliveries are to be balanced between the two subbasins as determined by the Management Committee but not later than every 20 years. As part of this implementation plan, regardless of the 20-year balance between the Mission Creek and the Whitewater River subbasins, it is the intention of CVWD and DWA to continue annual recharge activities at the Mission Creek Recharge Facility provided SWP Exchange water is available to the Coachella Valley.

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 hexavalent chromium 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 Horton and Desert Crest wastewater treatment plants (WWTP). 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 1.0 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/water, 2011). Concentrations exceeding the MCL (45 mg/L as nitrate) have not been observed in the deeper aquifers. Although not observed in the Mission Creek subbasin, imported water recharge activities provide low nitrate water that may help dilute nitrate concentrations.

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 and support septic to sewer conversions within MSWD's and CVWD's service areas;
- Continue to monitor nitrate concentrations 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 wastewater and other return flows through use and evapotranspiration from landscaping. Options such as desalting SWP Exchange water delivered via the CRA, building an extension of the SWP aqueduct to the Coachella Valley and desalting 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 have high costs associated with their implementation. Managing groundwater levels in the Mission Creek subbasin may 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 intent of a salt/nutrient management plan is that all sources contributing salt and nutrients be managed on a basin-wide or watershed basis to ensure that water quality objectives are achieved and beneficial uses are protected. 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/water, 2011). Generally, MSWD stops pumping from wells when uranium above the 20 picocurie per liter 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/water, 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 California Department of Public Health and the United States Environmental Protection Agency 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 detail in **Appendix E**. The following programs/projects should be implemented to improve monitoring and data management in the Planning Area:

- Summarize precipitation data from available gauges in the surrounding watershed and report in the Engineer's Reports prepared by CVWD and DWA;
- Install a California Irrigation Management Information System (CIMIS) weather station in Desert Hot Springs area to provide improved data for irrigation scheduling;
- Update the existing canvasses of private wells in the Mission Creek and Garnet Hill subbasins to verify their location, operational status (active, inactive, abandoned, destroyed), whether a meter is installed, and whether production is being reported;
- Make arrangements to install meters on unmetered production wells to provide accurate production records for replenishment assessments and basin management;
- Continue to monitor public and private wells for groundwater levels and quality;
- Install data loggers on selected wells to provide more continuous groundwater level data;
- Report pertinent groundwater 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 groundwater level and quality;
- Evaluate potential locations to construct monitoring wells near the basin boundaries to document natural inflow to and outflow from the basins 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."

As set forth in the Settlement Agreement, the Management Committee shall meet each quarter unless agreed upon collectively 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;
- Financing of projects and programs; and
- Other activities as determined necessary by the Committee.

The Management Committee may seek input from affected private pumpers as appropriate. The Management Committee may 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 periodically 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 goals of the CVIRWMP are:

- Optimize water supply reliability
- Protect water quality
- Provide stewardship of water-related natural resources
- Coordinate and integrate water resources management
- Ensure cultural, social, and economic sustainability of water in the Coachella Valley

The objectives of the CVIRWMP are:

- Provide reliable water supply
- Manage groundwater levels to reduce overdraft
- Secure reliable imported water supply
- Maximize local supply opportunities, including water conservation, water recycling and source substitution
- Protect groundwater quality (septic to sewer)
- Preserve and improve surface water quality
- Preserve the water-related local environment
- Manage flood risks,
- Optimize conjunctive use of
- Maximize stakeholder involvement
- Address water-related needs of local Native American culture
- Address water and sanitation needs of disadvantaged communities
- Maintain affordability of water

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 CVIRWMP 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. An additional $0.5 million in funding was also obtained for a Disadvantaged Communities Outreach Pilot Project.

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 by 20 percent by the year 2020 to qualify for grant funding, 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

CVWD undertook the development of a water management plan for the eastern portion of the Coachella Valley in 1994. This planning effort was expanded to include the entire Whitewater River subbasin. CVWD completed the Coachella Valley Water Management Plan (CVWMP) in 2002 (CVWD, 2002) for water supplies throughout the Coachella Valley. The main focus of the 2002 WMP was to address overdraft in the Whitewater River Subbasin.

The 2002 WMP was updated in 2010 (CVWD, 2012) to respond to changing external and internal conditions. The Mission Creek subbasin was not included in the planning area of the 2002 WMP or the 2010 WMP Update. The water demands of users overlying the Garnet Hill subbasin were nominally included in these plans, but are addressed in more detail in this Mission Creek/Garnet Hill WMP.

The purpose of the 2010 WMP Update was to define projected water demands through 2045, and focused on 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 an implementation plan were developed.

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. The CVMSHCP designates about 78,000 acres of land within 13 conservation areas throughout the Planning Area.

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 7-1** 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.

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

Table 7-1
Water Management Plan Projects and Programs

List	Project/Program	Category	Applicable Goal						Additional Benefits	Provides Multiple Benefits	Readiness to Implement	Recommended 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	Continue
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	x	x			x			Yes	Mid-term	Pursue
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

Table 7-1 (Continued)
Water Management Plan Projects and Programs

List	Project/Program	Category	Applicable Goal						Additional Benefits	Provides Multiple Benefits	Readiness to Implement	Recommended 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				
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	Part of Salt-Nutrient Management Plan
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	Summarize 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

Table 7-1 (Continued)
Water Management Plan Projects and Programs

List	Project/Program	Category	Applicable Goal						Additional Benefits	Provides Multiple Benefits	Readiness to Implement	Recommended 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				
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	Investigate
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	Investigate, could be done by CVRWMG
G-1	Continue existing basin management committee structure	Other							Promote improved communications	No	Near-term	Continue

Table 7-1 (Continued)
Water Management Plan Projects and Programs

List	Project/Program	Category	Applicable Goal						Additional Benefits	Provides Multiple Benefits	Readiness to Implement	Recommended 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				
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

- 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 selected existing wells to improve water level monitoring
- Summarize watershed precipitation annually and report in Engineers' reports
- Include precipitation, stream flow and additional hydrographs in existing Engineers' reports
- Periodically review and update the groundwater model and combine with Whitewater model
- Develop adaptive management procedures to monitor basin management progress and adjust as needed.
- Acquire additional imported water supplies – amount depends on growth, BDCP and other actions
- Develop water resources database – could be implemented by CVRWMG for the entire Coachella Valley

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:

- 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 availability of funding and results of on-going water level monitoring of recharge activities
- Construct monitoring wells in the basin uplands to document inflows – depends on availability of funding and 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 implementation of the Mission Creek-Garnet Hill Water Management Plan will require significant capital and operating investments to achieve the goals of the plan. **Table 7-2** presents a summary of the costs for plan implementation for continuation of existing programs and proposed new programs. **Table 7-2** presents short term (year 2015) costs as well as total costs (year 2045) for this WMP. Implementation costs are expected to vary depending on the amount of growth in the study area. Costs are not presented for projects requiring further investigation and for potential future programs.

Short-term costs for plan implementation are expected to be approximately $86 million between 2012 and 2015 averaging $21.5 million per year, assuming growth is consistent the 2010 CVAG/RCCDR projections.

Total capital costs for plan implementation are expected to be approximately $788 million between 2012 and 2045 averaging $23.1 million per year, assuming growth is consistent the 2010 CVAG/RCCDR projections.

It should be noted that the total capital costs (2012-2045) presented in **Table 7-2** also include the short term costs (2012-2015).

Table 7-2
Implementation Plan Costs

Programs	Short Term Implementation Costs (2012-2015)			Total Implementation Costs (2012-2045)		
	Capital ($M)	O&M ($M)	Total ($M)	Capital ($M)	O&M ($M)	Total ($M)
Continuation of Existing Programs						
Municipal water conservation and track effectiveness of conservation measures(1)	0.0	0.4	**0.4**	0.0	3.0	**3.0**
Imported water replenishment program (Existing, No MWD Callback)	0.0	22.2	**22.2**	0.0	187.4	**187.4**
Conversion of septic systems to sewers in MSWD service area(2)	34.0	1.4	**35.4**	34.0	11.6	**45.6**
Expansion and Nitrogen removal at Horton WWTP(3)	17.5	2.1	**19.6**	17.5	17.9	**35.4**
Monitoring of existing public and private wells(4)	0.0	0.1	**0.1**	0.0	0.9	**0.9**
Operation and maintenance of existing recharge basins	0.0	0.5	**0.5**	0.0	4.1	**4.1**
New Programs	0.0	0.0	**0.0**	0.0	0.0	**0.0**
Offer water conservation services to private pumpers(5)	0.0	0.2	**0.2**	0.0	1.6	**1.6**
Imported water replenishment program (Due to future growth, No MWD Callback)	0.0	4.9	**4.9**	0.0	129.5	**129.5**
Develop recycled water for non-potable use to offset pumping(6)	0.0	0.0	**0.0**	3.5	1.2	**4.7**
Implement cooperative program with Riverside County Environmental Health to locate and cap or destroy unused wells(7)	0.0	0.0	**0.0**	0.0	0.3	**0.3**
Develop valley-wide salt/nutrient management plan with CVRWMG(8)	0.1	0.0	**0.1**	0.1	0.0	**0.1**
Construct Regional WWTP and percolate effluent in Mission Creek subbasin at a suitable location that does not adversely affect existing production wells(9)	0.0	0.0	**0.0**	62.5	63.8	**126.3**
Incorporate additional wells in water level and quality monitoring program(10)	0.0	0.0	**0.0**	0.0	0.3	**0.3**
Install production meters on any existing unmetered private wells(11)	0.0	0.0	**0.1**	0.0	0.2	**0.3**
Install data loggers on selected existing wells to improve water level monitoring(12)	0.0	0.0	**0.0**	0.0	0.2	**0.2**
Review and update the groundwater model and combine with Whitewater model	1.0	0.0	**1.0**	1.0	0.0	**1.0**
Participate in the construction of Bay Delta Conveyance Facilities(13)	-	-	**-**	25.0	40.8	**65.8**
Costs to acquire additional imported water supplies to stabilize water levels (Growth conditions, No MWD Callback)(14)	0.0	1.5	**1.5**	0.0	80.8	**80.8**
Costs for future collection system expansion(15)	-	-	**-**	74.0	25.1	**99.1**
Costs for monitoring wells(16)				1.6	0.0	**1.6**
Total Costs	**52.6**	**33.3**	**85.9**	**219.2**	**568.6**	**787.8**

Notes: All costs are expressed in millions of dollars in 2012 dollars.
(1) Annual conservation budgets provided by MSWD and CVWD. CVWD's conservation budget was pro-rated based on CVWD's demands in the Mission Creek and the Whitewater River subbasins.
(2) Collection system costs were provided by MSWD (March, 2012). O&M costs are assumed to be 1 percent of the total capital costs.
(3) Costs provided by MSWD for the expansion of the Horton WWTP based on estimates developed by AECOM. O&M costs are assumed to be 3 percent of the total capital costs.
(4) Assumed $32,000 annually for existing monitoring activities.
(5) Based on a unit cost of $80 per acre-foot; assumes 20 percent reduction in private pumper demands (Unit costs developed by JM Lord Inc for the Coachella Valley WMP)
(6) Recycled water costs are based on cost assumptions presented in MSWD's Water Recycling Feasibility Study (Psomas, 2007). Costs presented include costs for delivering recycled water supply to the Mission Lakes Golf Course.
(7) Assumed $10,000 annually for coordination activities such as meetings, identification of wells, and outreach.
(8) The cost for the salt/nutrient management plan is pro-rated based on the demands in the Mission Creek and the Whitewater River subbasins.
(9) Regional WWTP costs were provided by MSWD for a 1 mgd plant (peak flow 2.5 mgd) based on estimates developed by AECOM. O&M costs are assumed to be 1 percent of the total capital costs.
(10) Assumed $1,000 annually for identification of new well sites for monitoring.
(11) Assumed $5,000 per meter at 8 additional wells.
(12) Assumed $1,500 per logger at 8 additional wells.
(13) Bay Delta Conveyance Project costs are obtained from a presentation to the BDCP Steering Committee on 7/1/2010. Costs are pro-rated between the Mission Creek and the Whitewater Subbasin based on production in the subbasins.
(14) Costs associated with purchasing additional imported water to stabilize water levels.
(15) Future collection system costs were provided by MSWD based on estimates developed by AECOM. O&M costs are assumed to be 1 percent of the total capital costs.
(16) Assumed 8 monitoring wells over the Planning Period. Capital cost for each well is assumed to be $200,000.

Cost Sharing Opportunities

Opportunities may exist for joint agency participation in project implementation. Several guiding principles will be applied to project implementation:

1. Generally, each agency is responsible for implementation of projects that benefits its customers. However, projects that provide benefits to multiple agencies may be jointly funded if all participants agree.
2. The cost of jointly-funded projects will be allocated based on objectively quantifiable benefits.
3. Opportunities for external funding will be pursued when feasible.

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 F** 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.

CONCLUSION

Groundwater overdraft and water quality protection are important concern for the Planning Area. Critical drivers for water management in the Planning Area include growth and increased water demands, imported water supply reliability, the need for additional supplies, water quality protection, more stringent regulations, limited financial resources and climate change.

CVWD, DWA and MSWD developed the Mission Creek-Garnet Hill Water Management Plan with the goal of managing the water resources to meet demands reliably while protecting water quality in a sustainable and cost-effective manner. The plan recognizes that continued recharge, development or acquisition of additional water supplies, protection of water quality through wastewater management and other tools, monitoring and data management and continuous communication are vital for the cost-effective management of the water resources of the Planning Area.