Appendix 1C
Demand Management Measures

1C.1 Introduction

California is a diverse state where water supply and demand are often out of balance both in time and geography. Water conservation, water use efficiency, recycled water, water storage and other supply sources are measures that water users, local water suppliers and regional and state agencies use to adjust and make up for the deficit in supply. Even where or when there is an abundance of supply these water management measures are often useful in reducing costs, energy use and greenhouse gas emissions.

This appendix is included with the BDCP EIR/EIS to provide an overview of water use efficiency programs being implemented to reduce water demand throughout the state. Demand management is not being included as a project alternative in the EIR/EIS because it is implemented by local water suppliers and communities (see below), is outside the Plan Area and is not directly controlled by the state. Furthermore, demand management, which is expected to be a component of future actions, alone will not feasibly meet the environmental and water supply objectives of the BDCP or the legal objective of long-term ESA compliance. This appendix is not required by either CEQA or NEPA, but was prepared for informational purposes.

Demand management measures (DMM) are tools to reduce reliance on imported water. DMMs include urban best management practices (BMPs), agricultural efficient water management practices (EWMPs) and groundwater management. Water recycling, storm water management, and desalinization are considered alternative sources of water supply and are discussed in section 1C.4. The use and combination of these water management measures and alternative sources of supply help local and regional water suppliers reduce their reliance on water from the Delta. The focus of the Conservation Plan is to provide incidental "take" coverage of endangered species in the Delta (Plan Area). Implementation of these demand management measures statewide will make achieving the BDCP goals much more feasible

Demand Management is not a BDCP Alternative as it does not meet the Purpose and Need for the BDCP to develop improved habitat for at risk fish species and a more reliable water supply.

- California needs a comprehensive and integrated approach to secure water supply reliability. Such a comprehensive approach includes both DMMs and more reliable water supplies from inter-regional water systems including the SWP and CVP.
- Under SBX7-7, local agencies are already required to implement significant water conservation measures to achieve a 20% reduction in statewide urban per capita water use by 2020. Agricultural water suppliers that provide water to 10,000 or more irrigated acres must develop and adopt water management plans with specified components, and implement cost-effective efficient water management practices. Even with these savings, the need for BDCP is not diminished (Chapter 9 of the BDCP). For more information regarding assumptions for future demand used in modeling, please see Appendix 5A.
- Under SBX7-1, all agencies must reduce their future reliance on the Delta. They will achieve this through integrated regional water management (IRWM) approaches, including demand management. As such, water demand management is a complementary strategy that supports any BDCP alternative.
- BDCP and DMMs are complementary not mutually exclusive alternatives. BDCP assumes that even when DMM programs and alternative sources of local supply are implemented, very substantial amounts of water will continue to be conveyed from the Delta. BDCP is intended to comply with the federal and State endangered species laws.

but is not a substitute means for complying with the ESA. Demand management is a tool that will continue to be used by water agencies and individual water users as part of an integrated water management approach to water supply reliability regardless of whether and how the BDCP is implemented. Based on existing regulatory mandates as well as economic and environmental imperatives, State and regional/local efforts will continue to improve water use efficiency over that already achieved during the past few decades.

This appendix includes information regarding the existing and projected water deliveries and demands of several of the larger State Water Project (SWP) and Central Valley Project (CVP) contracting agencies, along with a description of the significant steps being taken by these agencies to manage future water demand within their service areas. In this appendix, the terms "demand management", "water conservation," and "water use efficiency" are used interchangeably when referring to programs to reduce water use and water waste. This Appendix will also provide a summary and references to statewide water management efforts.

This appendix is intended to provide information on the important contribution made by DMM towards reducing demand in areas served by water exported from the Delta. By reducing long-term water demand in areas served by the SWP and CVP contracting agencies, demand management efforts complement the environmental objectives of the BDCP. In addition to discussing the effectiveness of DMM as noted, the following analysis provides additional information to be used by lead agency decision-makers when evaluating BDCP alternatives, including the No Action/No Project Alternative (hereafter referred to as the No Action Alternative). While the DMMs are not proposed as part of any BDCP alternative, some alternatives may result in reduced water supply from the Delta. Effects associated with such reductions are described in resource chapters of the EIR/EIS. For additional background, see: *Response to Reduced Water Supplies, Appendix 5B.*

1C.1.1 Background

Evolution of Water Resource Management

For the first half of the 20th Century, water conservation was a response to temporary droughts or other water emergencies. Over the past several decades DMM have become recognized as tools that help make existing supply go further, save money, reduce environmental degradation, and provide flexibility to ensure that the state's limited and variable water supply is used as efficiently as possible.

In the early 2000s, water management was expanded beyond conservation to include a portfolio of approaches to improving water supply reliability often from a regional perspective. This multi tool approach is called integrated regional water management (IRWM) and is a collaborative effort to manage all aspects of water resources in a region. IRWM crosses jurisdictional, watershed, and political boundaries; involves multiple agencies, stakeholders, individuals, and groups; and attempts to address the issues and differing perspectives of all the entities involved through mutually beneficial management of water resources.

With IRWM, regions have been able to take advantage of opportunities that are not always available to individual water suppliers: reduce dependence on imported water and make better use of local supplies; enhance use of groundwater with greater ability to limit groundwater overdraft; increase supply reliability and security; and improve water quality. The extent to which regions have carried these out has been driven by economics, environment, engineering, and institutional feasibility considerations

Some key milestones in the development of IRWM include:

2002 - Senate Bill 1672 creates the Integrated Regional Water Management Act to encourage local agencies to work cooperatively to manage local and imported water supplies to improve the quality, quantity, and reliability.

2002 - California voters pass Proposition 50, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002, which provides $500,000,000 (CWC §79560-79565) to fund competitive grants for projects consistent with an adopted IRWM plan.

2006 - California voters pass Proposition 84, the Safe Drinking Water, Water Quality, and Supply, Flood Control, River and Coastal Protection Bond Act, which provides $1,000,000,000 (PRC §75001-75130) for IRWM Planning and Implementation.

2006 - California voters pass Proposition 1E, the Disaster Preparedness and Flood Prevention Bond Act, which provides $300,000,000 (PRC §5096.800-5096.967) for IRWM Stormwater Flood Management.

These bills and voter propositions demonstrate that the State of California and its citizens are committed to promoting improved water management. DWR's California Water Plan Update 2013 presents many management strategies for reducing water demand (including options for both agricultural and urban water management).

Saving Water Has Multiple Benefits.

Water use efficiency has improved substantially over the past 25 years. Without past efforts, current challenges would be much worse - demands on our limited and unreliable water supply would be much higher and ecosystem degradation would be more widespread. But saving water does not only equate to reducing water consumption. In some cases, the water saved from efficiency measures is used to serve more people or to grow more crops. In other cases, saving water reduces the amount of water needed from various water sources, such as needing to pump less ground water. Water saved by water use efficiency measures can be carried over for use at another time if storage is available. Reduced water demand from increased water use efficiency can also reduce the amount and change the timing of water diversions from surface water bodies for human use, thereby benefitting aquatic life (including endangered and threatened species).

Over the last four decades, California's crop yields have increased at an average rate of 1.42% per year while water use has decreased (Hanak, et. al. 2009). As farmers have shifted to higher value horticultural and orchard crops, they have adopted more efficient irrigation technologies. Surface irrigation use decreased by about thirty percent from 1972 to 2001 and the use of drip/microsystem irrigation increased from a small percentage of fields in 1972 to over 30% by 2001. Much of the increase coincided with the move away from field crops toward orchard and vineyard planting. Figure 1C-1 documents the shift to efficient irrigation systems over time. It is estimated that water use declined from an average of 3.5 acre-feet[1] per acre in the 1960s–1980s to 3.2 acre-feet per acre from 1990 to 2005 (Hanak et.al. (2009), using DWR data on applied water use and irrigated acreage). Agricultural water suppliers can continue to improve water management through flow regulatory reservoirs, canal automation, and modernized delivery systems.

[1] One acre-foot is the amount of water needed to cover an area of one acre to a depth of one foot, and equals approximately 326,000 gallons.

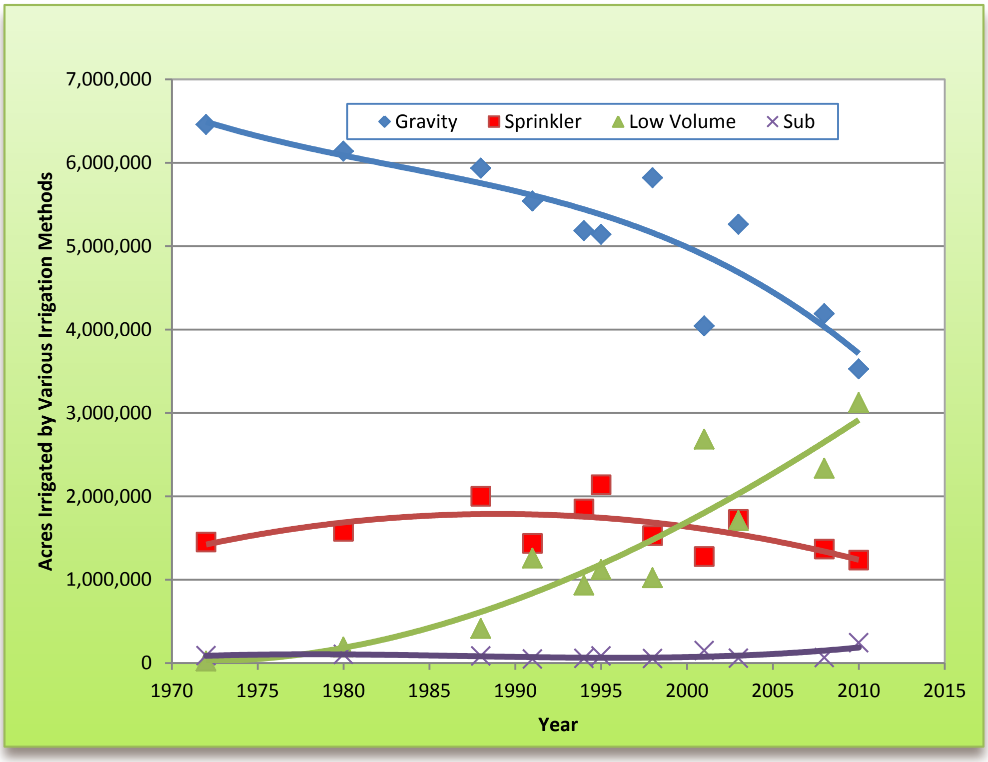

Figure 1C-1: California Agricultural Acres Irrigated by Irrigation System

Among the indicators of agricultural water use efficiency improvement is that the inflation-adjusted gross revenue for California agriculture increased about 84 percent between 1967 and 2007 from $19.9 billion (in 2007 dollars) to $36.6 billion. During that period the total California crop applied water use fell by 14.6 percent, from 31.2 million acre-feet in 1967, to 26.66 million acre-feet in 2007 (Figure 1C-2).

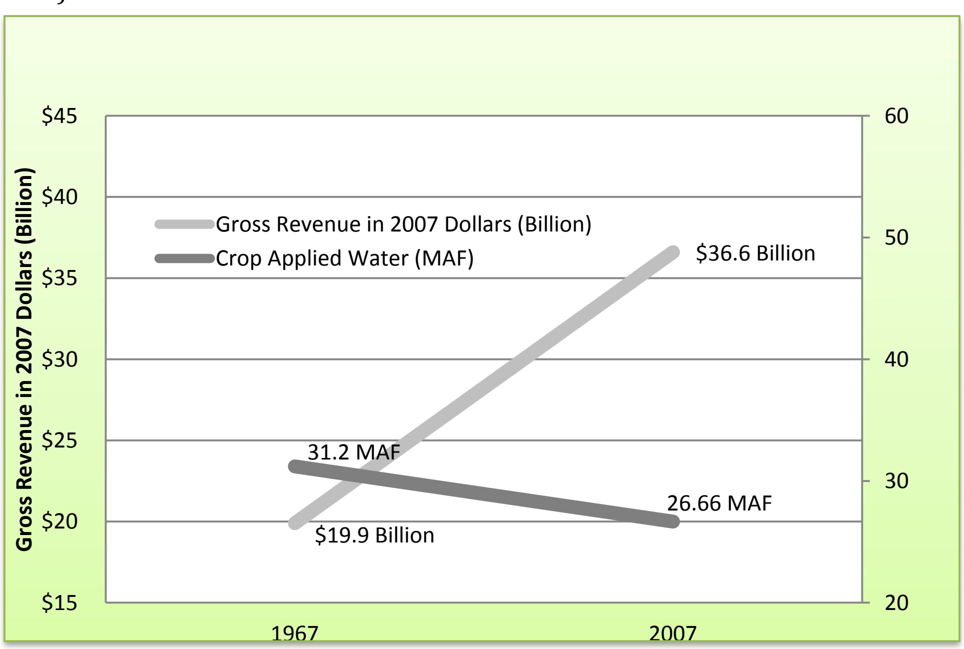

Figure 1C-2: California Agricultural Water and Productivity

Urban use has followed a similar trend. Following several decades of increases in per capita use spurred by rising incomes and increased home and lot sizes, many urban water agencies began implementing conservation programs during the early 1990s drought. Per capita use fell in both coastal and inland regions of California as a result. The South Coast hydrologic region used nearly 450,000 acre-feet less water in 2005 than a decade earlier, despite having 2 million additional residents.

Opportunities for net savings from indoor water conservation depend on location. Most indoor water use remains available for reuse as treated wastewater. Thus, in coastal areas that discharge wastewater to the sea, indoor conservation produces substantial net water savings. Even in inland areas, water conservation can produce a host of benefits including lower evapotranspiration (resulting in net water savings), reduced stream diversions, energy savings, reduced runoff which might have to be given treatment, and reduced excessive groundwater buildup.

Most DMM are implemented at the local and regional level. Water suppliers and regional agencies generally are the lead agencies implementing water conservation and water management actions. These local agencies have direct contact with retail customers and know the local situation and are best suited to design and implement effective conservation programs. DWR is and has been involved in several statewide water conservation and water management programs including urban and agricultural water management plans and the water conservation provisions of SBx7-7 and AB1420. Yet these far reaching programs do not give DWR authority to mandate or impose conservation requirements on suppliers or regional agencies. No penalties attach for non-compliance with State conservation requirements, but suppliers may become ineligible for state water management grant funds. DWR encourages and incentivizes water conservation and improved water management through grant funding and by providing technical assistance.

Additional savings are possible in California's urban and agricultural sectors to at least partially meet the water supply needs of the state. In some geographic areas, improvements to water use efficiency will be made more easily than in others because much progress has already been made. In other areas, substantial additional conservation is possible and planned, and in fact legislated. Water use efficiency can improve BDCP's success by providing more flexibility for water users, better management of water resources, and satisfying current and future demand under existing export levels. Nonetheless, BDCP is vital to providing sufficient exports to meet the water supply needs of the state, while complying with the federal and state endangered species laws. Opportunities for water recycling and water desalination are analyzed in section 1C.4.

1C.1.2 Organization of Appendix

Section 1C.2 presents an overview of water supply in California including a summary of the SWP and CVP systems, as well as each Project's water delivery history and primary contracting agencies. Section 1C.3 addresses DMM legislation and implementation at the state level. Section 1C.4 provides an overview of alternative sources of water supply (recycling and desalination). Section 1C-5 shows examples of water management implementation by the primary SWP and CVP contracting agencies. Section 1C.6 provides the conclusions of the report, followed by a list of references (Section 1C.7).

1C.2 Water Supply and Reliability

The total amount of water available each year in California for dedicated uses varies from about 65 million acre-feet (MAF) in dry years to about 95 MAF in wet years (California Department of Water Resources 2009). Allocation of water among urban, agricultural, and environmental uses also varies greatly between wet and dry years. The State Water Project (SWP) and the Central Valley Project (CVP) were developed to help address this high variability in supply and demand, growth projections, and the need for reliable water supply.

The importance of a reliable water supply to the California economy cannot be overstated. California's economy is the eighth largest economy in the world (2011) when ranked against the economies of other countries. California is the world's fifth largest supplier of food and agriculture commodities (including fruit, vegetables, dairy, and wine production). The state's 2010 gross state product (GSP) of $1.9 trillion was 13% of the United States' gross domestic product (GDP) in that same year. According to the California Department of Food and Agriculture (2010), "California agriculture is nearly a $36.6 billion dollar industry that generates $100 billion in related economic activity." In 2004, sales of California agricultural products exceeded $30 billion - more than twice that of any other state. California continues to hold that dominant position.

Population growth is a major factor influencing current and future urban water demand. From 1990 to 2005, California's population increased from about 30 million to about 36.5 million (California Department of Water Resources 2009). By 2050 that figure is expected to increase to 50.4 million, with the South Coast Hydrologic Region adding approximately 6 million people - a 35% increase relative to its 2010 population and the largest net population growth among regions receiving water from the Delta (California Department of Finance 2013; California Department of Water Resources 2009).

The SWP and the CVP are California's two largest water storage and delivery systems. The SWP and CVP both include major reservoirs upstream of the Delta and transport water via natural watercourses and canal systems to areas south and west of the Delta. The CVP also Friant Dam on the San Joaquin River and New Melones Dam on the Stanislaus. Both projects operate pursuant to water right permits and licenses issued by the State Water Resources Control Board (SWRCB). The permits allow the projects to store water during wet periods, divert surplus water that reaches the Delta, and re-divert SWP and CVP water that has been stored in upstream reservoirs. As conditions of the projects' water right permits and licenses, the SWRCB requires the SWP and CVP to meet specific water quality, quantity, and operational criteria within the Delta. DWR and Reclamation closely coordinate the SWP and CVP operations to meet these conditions.

1C.2.1 State Water Project Supply Reliability

In the *California Draft Water Plan Update* (2013), DWR defines water supply reliability to be the occurrence of water supplies of sufficient quality and certainty to enhance or sustain a diverse portfolio of economic activity and ecosystem health to maintain quality of life. Water supply reliability of Delta water has been decreasing both in terms of quantity, certainty and as a measure of ecosystem health.

The water reliably available for SWP Delta exports and Table A deliveries estimated in the DWR *Final Delivery Reliability Report 2011* (published June 2012) has been reduced as a result of Biological Opinions (BiOps) issued by the USFWS in December 2008 and the NMFS in June 2009.

Estimated average annual Delta exports and SWP Table A water deliveries have generally decreased since 2005, when rules affecting SWP pumping operations began to become more restrictive. Average exports have declined 11.9% from the period 2000-2005 compared to 2006-2011. When modeling water supply deliveries 20 years in the future, the unknowns are considerable and many assumptions must be made. Modeling of 2031 SWP deliveries take into account current Delta water quality regulations and the requirements of the USFWS and NMFS BiOps. Climate change as well as changes to water uses in the upstream watersheds (i.e., source watersheds) are also taken into account when modeling water supply deliveries under future conditions. Future demands for SWP Table A water, as calculated for the 2012 Report, were assumed to be the maximum possible annual amount of 4,133 TAF. DWR also modeled SWP Table A water delivery in the future conditions scenario that assumed no new facilities to convey water through or around the Delta are in place, potential effects of climate change, elements of the 2008 USFWS and 2009 NMFS BiOps, and D-1641. These are similar to the assumptions used to describe the No Action Alternative in the BDCP EIR/EIS. Based on these assumptions, DWR found that, on average (depending on the type of water year), the SWP can deliver about 61% percent of contracted Table A water under existing conditions. This falls to about 60% percent under future conditions (2031)(California Department of Water Resources 2012a)[2].

1C.2.2 State Water Project Contracting Agencies

During the 1960s, as the SWP was created, long-term contracts were signed by DWR and urban and agricultural water suppliers throughout California. The contracts' terms are substantially uniform. Urban and agricultural water suppliers that receive water from the SWP are referred to in this appendix as the "SWP contractors" or "contractors." The contractors are cities, counties, urban water agencies, and agricultural irrigation districts. The majority of SWP contractors provide water for municipal uses.

For most SWP Contractors project water supplements local supplies, including groundwater, or other imported water. The 29 SWP contractors and their service areas shown in Figure 1C-3.

[2] BDCP Appendix 9. A (Economic Benefits of the BDCP and Take Alternatives) and BDCP EIR/EIS Chapter 5 (Water Supply) also include SWP Table A water delivery estimates under future conditions. Modeling in BDCP Appendix 9.A incorporates the 26 Metropolitan Water District water agencies along with 10 other water agencies/districts to estimate future SWP Table A water deliveries in 2020. Water delivery estimates for each BDCP take alternative (similar to but different than the BDCP EIR/EIS alternatives) and existing conveyance high- (Existing conveyance with Fall X2, enhanced spring outflow, Scenario 6 Old and Middle River, without San Joaquin River inflow/export ratio) and low-outflow (Existing conveyance facilities with Scenario 6 operations and no Fall X2 or spring outflow) scenarios are provided. In contrast, modeling in BDCP EIR/EIS Chapter 5 incorporates all SWP Table A contractors while accounting for climate change and sea level rise that could potentially occur in the year 2060 (late long-term). Water delivery estimates for each BDCP EIR/EIS alternative (including a No Action Alternative in the late long-term) and existing conditions are provided.

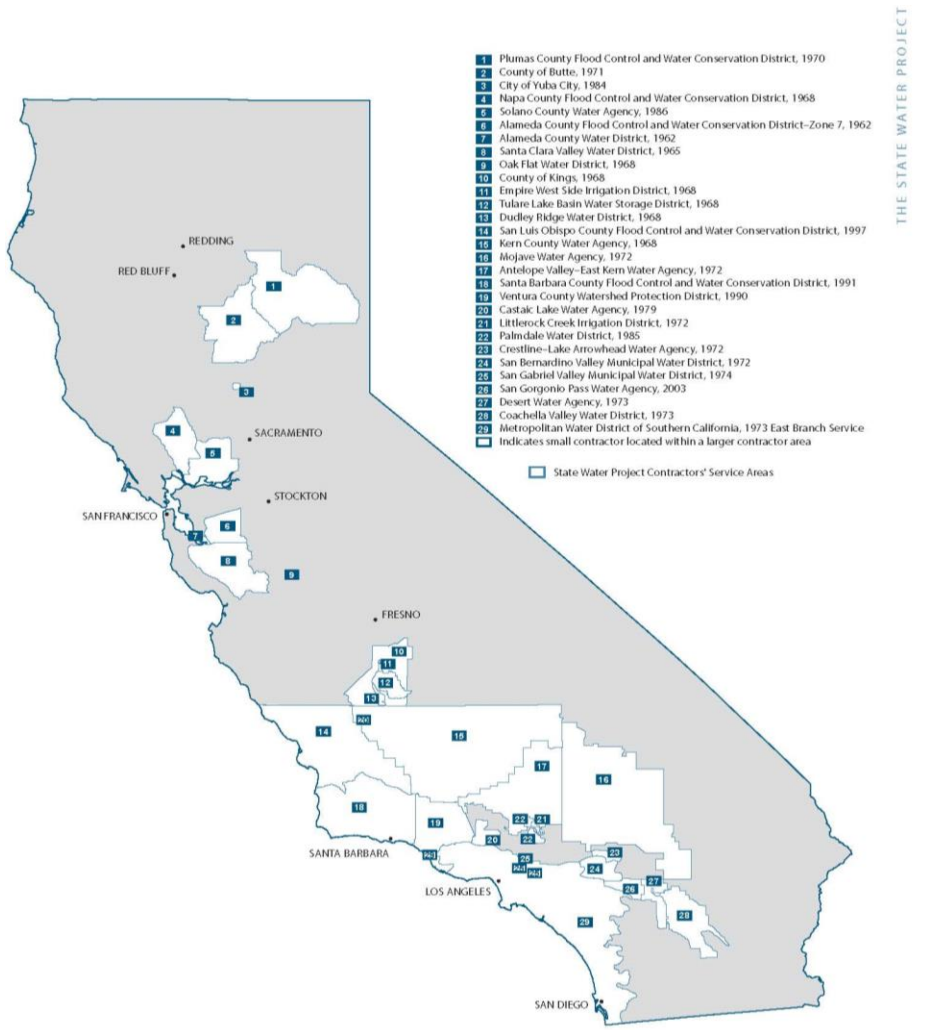

Figure 1C-3: State Water Project Service Area

The SWP's long-term water supply contracts define the terms and conditions governing water delivery and repayment of project costs. Each of the 29 SWP contractors receive specified amounts of water from the SWP each year, called "annual allocations." Not all SWP contractors receive Delta exports. "Delta exports" refers to water supplies that are transferred ("exported") to SWP contractors or San Luis Reservoir via the Banks Pumping Plant near Tracy. SWP Delta exports do not include deliveries of SWP water to the two North Bay Area contractors that receive SWP water pumped by the Barker Slough Pumping Plant and conveyed by the North Bay Aqueduct. SWP's three Upper Feather River Area contractors receive their water from Oroville Dam.

In return for the allocated water, the SWP contractors repay principal and interest on both the bonds that initially funded construction of the SWP and the bonds that paid for additional facilities. The contractors also pay all costs, including labor and power, to maintain and operate project facilities, and transportation charges based on the distance between the Delta and each contractor's water delivery point.

1C.2.3 Central Valley Project Reliability

Reclamation allocates CVP water supplies for agricultural, environmental, and municipal and industrial (M&I) uses. The complex allocation process is driven by numerous factors, including hydrology, water rights, biological opinions, regulatory constraints, capacity of CVP facilities, and various federal laws such as the Central Valley Project Improvement Act (CVPIA).

Pumping data indicates that CVP exports have declined by 11.4% from the period 2000-2005 compared to 2006-2011. However, this comparison is extremely general and does not take into account the varying water year classifications for the Sacramento Valley. When data from 1990-2011 is compared by water year type, CVP exports from 1990-2005, compared to 2006-2011 have declined by 21% in below normal years and by 9% in dry years. Critical, above normal, and wet year exports remain the same (less than a 2% change). No above normal years have occurred since 2006 for comparison to historical exports in this year type. When modeling water supply in the future, the unknowns are considerable and many assumptions must be made. Modeling of future CVP deliveries takes into account continuation of operations of the SWP and CVP as described in the 2008 USFWS and 2009 NMFS BiOps, climate change, and other relevant plans and projects that would likely occur in the absence of BDCP actions and which are well-defined enough to allow for meaningful analysis. Future demands for CVP South of Delta water users were assumed to be the maximum possible annual amount of 3,450 TAF. Modeling data from the BDCP EIR/EIS indicates that under existing conditions, the CVP can deliver an average of 68% of contracted supplies to South of Delta users. When taking into account future conditions and climate change, Reclamation can deliver, on average 66% ELT (2025) and 62% LLT (2060).

In 1992, Title 34 the Central Valley Project Improvement Act (CVPIA) became law. It mandates changes in the management of the CVP, particularly for the protection, restoration, and enhancement of fish and wildlife.

Changes required by the CVPIA included:

- Dedication of 800,000 acre-feet of water to fish and wildlife on an annual basis;
- Implementation of tiered water pricing for new and renewed contracts;
- Addition of a provision facilitating water transfers - including the sale of water to users outside the CVP service area;
- All reasonable efforts were required to at least double anadromous fish populations by 2002;
- Establishment of a restoration fund financed by water and power users for habitat restoration and enhancement and water and land acquisitions;
- Moratorium on new water contracts until fish and wildlife goals were achieved;
- Moratorium on contract renewals until the completion of a Programmatic Environmental Impact Statement;
- Reduction of agricultural water service contract terms from 40 years to 25 years;
- Assurance of firm water supplies of suitable water quality for Central Valley wildlife refuges; and
- Development of a plan to increase CVP firm yield was required.

Many of the factors affecting the reliability of SWP's water supply also affect the CVP supply. That information is not repeated in the section. The CVPIA and other regulatory decisions that remain in effect impact water use and deliveries in the Central Valley south of the Delta.

1C.2.4 Central Valley Project Contracting Agencies

Reclamation provides water under contracts to water districts, wildlife refuges, and other entities. These contracts commit Reclamation to provide a maximum quantity of water, subject to availability and shortage criteria. The Mid-Pacific Region of Reclamation holds over 270 contracts in 29 of California's 58 counties for the delivery of 9.5 million acre-feet of water on an annual basis. Deliveries by the CVP include providing an annual average of 5 million acre-feet of water for farms; 600,000 acre-feet of water for municipal and industrial uses (enough water to supply about 2.5 million people for a year); and water for wildlife refuges and maintaining water quality in the Sacramento-San Joaquin Delta.

Reclamation has several different types of contracts including Settlement Contracts, the San Joaquin River Exchange Contract, Refuge Water Supply Contracts, Repayment Contracts, and Water Service contracts. Entities that hold contracts with Reclamation are collectively referred to as "Contractors" and the water is generally referred to as CVP Water or Project Water. Several contracts are mixed purpose contracts that include both M&I and irrigation use.

Federal contractors are shown in Figure 1C-4. Each color indicates an individual water user and its district boundaries.

The Central Valley Project Improvement Act (CVPIA), Section 3404, limits Reclamation's contracting actions. Until certain provisions of CVPIA are met, Reclamation cannot enter into any new short-term, temporary, or long-term contracts or agreements for water supply from the CVP for any purpose other than fish and wildlife. (CVPIA does allow exceptions for flood flows, Class II water, and other specific actions outlined in CVPIA, section 3404(b).)

Sacramento River Settlement Contracts- Prior to construction of the CVP, individuals and entities along the Sacramento River were diverting water for irrigation and M&I use under different types of water rights. Some of these individuals and entities (collectively referred to as the Sacramento River Settlement Contractors or Settlement Contractors) have Sacramento River water rights that are senior to the CVP.

After the CVP was authorized, individuals holding water rights on the Sacramento River protested the issuance of CVP water rights. To settle the water rights dispute so that Reclamation could operate the CVP, Reclamation entered into settlement contracts with the Settlement Contractors.

South of Delta Settlement Contracts- After Reclamation began operating Friant Dam, water users at the Mendota Pool began experiencing difficulties in diversion since the San Joaquin River water was no longer reaching the Mendota Pool in quantities necessary to meet their irrigation demands. As a result, Reclamation entered into settlement agreements to provide a quantity of CVP water as "Replacement Water" through the Delta Mendota Canal.

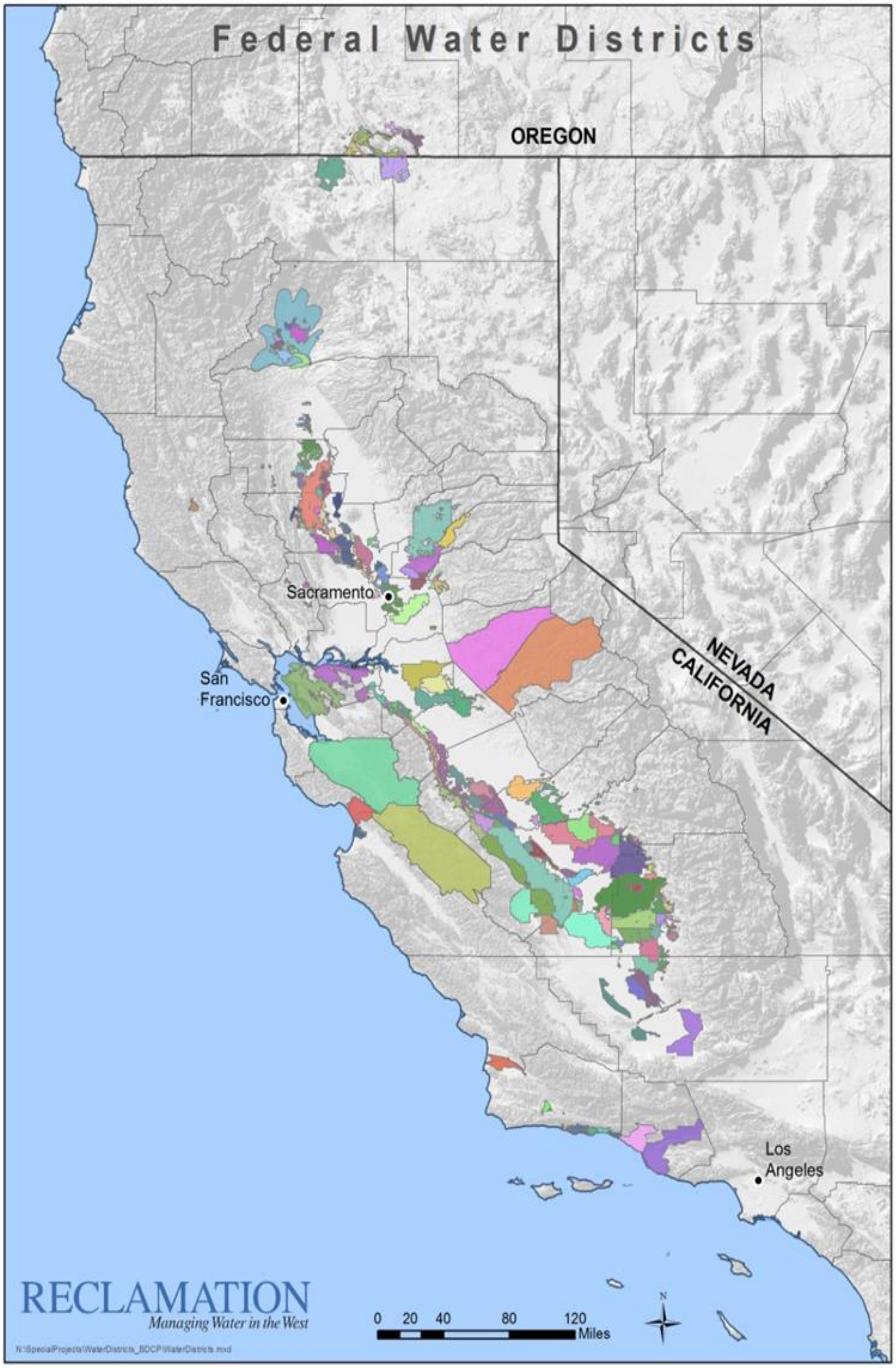

Figure 1C-4: Central Valley Project Service Area

San Joaquin River Exchange Contract- The San Joaquin River Exchange Contractors (Exchange Contractors) consist of the San Luis Canal Company, Central California Irrigation District, Firebaugh Canal Water District, and Columbia Canal Company. These four districts hold some of the oldest water rights in the state, dating back to the late 1800s. Their water rights are for diversion of water from the San Joaquin and Kings Rivers.

The operation of Friant Dam and the Friant Division depended upon water being diverted from the San Joaquin River and conveyed to the east side of the valley via the Friant-Kern and Madera Canals. To accomplish this, Reclamation and the Exchange Contractors entered into an agreement whereby the Exchange Contractors agreed to not exercise their rights to divert from the San Joaquin River in exchange for Reclamation deliveries from the Sacramento River by means of the Delta-Mendota Canal and other facilities of the United States.

Oakdale Irrigation District and South San Joaquin Irrigation District- When Reclamation began operating New Melones Reservoir on the Stanislaus River in 1980, Reclamation was required to meet prior water right obligations for Oakdale Irrigation District (OID) and South San Joaquin Irrigation District (SSJID). Reclamation entered into the stipulation and settlement Agreement to resolve a water right protest. This stipulation and agreement was noticed in a New Melones water right Decision D-1422 (1973) prior to the construction of New Melones Dam in 1980. OID and SSJID have a settlement agreements which entitles them up to the first 600,000 acre-feet of inflow to New Melones Reservoir on annual basis in recognition of their water rights on the Stanislaus River.

Repayment Contracts- Repayment contracts are authorized under Sections 9c(1) and 9d of the Reclamation Project Act of 1939 respectively for municipal and industrial and irrigation water. Repayment contracts are used when specific cost obligations can be readily assigned to beneficiaries. Repayment contracts generally provide for 40 fixed annual payments to repay the fixed cost obligation.

Water Service Contracts- Water service contracts are authorized under Sections 9c(2) and 9e of the Reclamation Project Act of 1939 Act for M&I and irrigation water. Water service contracts are used in instances where the water project includes multipurpose facilities and benefits several different contractors. For such projects, costs are allocated to, and recovered from, appropriate beneficiaries based on the amount of water received (i.e., water service). The basic unit of measurement for water deliveries and, consequently for cost recovery, is acre-feet of water.

For water service contracts, the Act requires the Secretary of the Interior to establish water rates for the sale of water to "produce revenue at least sufficient to cover annual operations and maintenance (O&M) costs and the appropriate share of fixed charges (construction costs) of the project." Reclamation has broad discretion under the Reclamation Project Act of 1939 Act for developing and implementing rate setting policies. Rate setting policies can be either (1) negotiated as a specific provision of individual water service contracts; or (2) set forth into a formal policy applicable to multiple contractors.

Cross Valley Contracts- Beginning in 1975, the Cross Valley (CV) contractor(s) entered into contracts with Reclamation and DWR for delivery of excess CVP water utilizing excess conveyance capacity in DWR facilities. Reclamation provided the water supply and DWR provided conveyance for the CV contractors. CV water is delivered either by the California Aqueduct to the CV Canal or through exchange.

1C.3 Demand Management Measures

Demand management is a tool that is used by water agencies and individual water users as part of an integrated water management approach to water supply reliability. Existing regulatory mandates as well as economic and environmental imperatives will require continued State, regional and local efforts to improve water use efficiency beyond the gains of the past few decades. Groundwater overdraft (estimated at 1 to 2 million acre-feet annually in California reflects the current imbalance of supply and demand. In the future population growth, regulatory restrictions, and climate change will put even greater pressure on existing supplies and drive the need for demand management and other water management actions.

Senate Bill X7-7 (SBx7-7, Steinberg 2009) (water supplier bill) set broad and ambitious goals for improving agricultural and urban water use efficiency. SBx7-7 sets specific goals for reducing agricultural water use; the goals and implementation status are listed below:

- Agricultural water suppliers must prepare and adopt agricultural water management plans by December 31, 2012, and update those plans by December 31, 2015, and every 5 years thereafter.
- On or before July 31, 2012, agricultural water suppliers shall measure the volume of water delivered to customers in accordance with regulations developed by DWR. The Office of Administrative Law approved the regulations in July 2012. Consultation between DWR academia and other stakeholders to propose a methodology for quantifying efficiency of agricultural water use. DWR completed the methodology and submitted it in a report to the legislature in June 2012 (California Department of Water Resources 2012b).Development of an updated list of efficient water management practices. DWR has initiated a public process to consider updates.
- Adoption of a pricing structure for water customers based, at least in part, on quantity delivered.
- Requires water suppliers to implementation of efficient water management practices that are locally cost effective.
- Effective 2013, agricultural water suppliers who do not meet the water management planning requirements established by this bill will not be eligible for state water grants or loans.

SBx7-7 required urban water suppliers to implement and meet the following requirements.

- Each urban retail water supplier shall develop water use targets and an interim water use target by July 1, 2011.
- As required by the water supplier bill in July 2011 DWR adopted regulations for implementation of the provisions relating to process water (California Department of Water Resources 2011).
- A Commercial, Institutional and Industrial (CII) task force was established to study new CII best management practices. The Task Force Legislative Report is planned for release in 2013.

Effective 2016, urban retail water suppliers who do not meet their water use targets are not eligible for state water grants or loans. In order to ensure that progress toward the bill's goals can be measured, the bill directs DWR to develop standardized forms for both agricultural and urban water use reporting. Implementation of the water bill can be tracked on DWR's website at: http://www.water.ca.gov/wateruseefficiency/sb7/.

1C.3.1.1 Integrated Water Management

As indicated by its title, the *California Water Plan Update 2009: Integrated Water Management* (California Department of Water Resources 2009) focused on integrated water management by preparing a strategic plan for California water management through 2050. Integrated water management recognizes the interrelated nature of various water management tools and how combinations of these tools may need to vary within a given region, among regions, or statewide. The focus is on the interrelation of the different water management tools with the understanding that changes in the use of one tool will affect the use of other tools.

California Water Plan Update 2013 (Update 2013) is currently being developed by DWR and other agencies with public involvement and State and federal agency coordination. It will build on the contents of the previous update and will introduce a number of key additions and enhancements in response to stakeholder recommendations and to better serve those making decisions regarding water management in California. Integrated water management relies on a diversified portfolio of water management tools. These tools are presented as resource management strategies in the *California Water Plan Update 2013*. Having a range of tools available provides the flexibility needed to cope with changing and uncertain future conditions. Integrated regional water management provides a mechanism for tailoring management strategies to each of California's unique regions – no single package of management tools can address the needs of all regions. Each region has its portfolio of water management strategies that may include demand management, water supply [diversification], flood management, water quality and resource stewardship.

Grant funding for IRWM is provided by the Integrated Regional Water Management (IRWM) Proposition 84 Grant Program. Senate Bill 855 [2010] requires applicants that receive water supplied from the Sacramento-San Joaquin Delta to have an IRWM Plan that helps reduce dependence on the Delta for water supply. As a result projects that diversify the water supply portfolios of the IRWM regions have been developed and implemented in order to reduce dependence on the Delta.

Through the initial round of Proposition 84 Implementation Grant funding, DWR awarded more than $80 million to fund close to 50 projects and programs located in 17 IRWM regions that receive water supplied from the Delta. Upon completion, these projects will provide approximately 150 Thousand Acre-Feet/year (TAFY) of enhanced water supply/storage reducing the IRWM regions' dependence on the Delta. The list below provides example projects that support this effort.

West Basin Municipal Water District (West Basin) in Southern California provides an example of a water supplier that has used a water management portfolio approach to reduce its dependence on imported supply. West Basin has been able to support the diversification of supplies available to its customer agencies by emphasizing recycled water, conservation and the future development of a desalination plant.

Most significantly West Basin has the following projects planned to be implemented by 2035

- increase recycled water to meet up to 19 percent of total water supplies by 2035
- permitting, financing, and constructing a full-scale desalination facility by 2017 that is capable of providing up to 20,000 AFY, or enough to supply 40,000 families for a year,
- double the water conserved through water use efficiency programs

The impact of these three programs is expected to cut imported water nearly in half by 2035 as shown in Figure 1C-4.

Table 1C-1. Examples of IRWM Water Management Portfolio Projects

Funding Area	Grantee	Project Title	Total Project Cost	Grant Amount	Project Type	Quantity of Enhanced Supply/ Storage (AFY)
Central Coast	Santa Barbara County Water Agency	City of Santa Maria Leak Watch Project	$1, 357, 696	$191,428	Water Use Efficiency	210
Lahontan	Antelope Valley-East Kern Water Agency	Water Supply Stabilization Project No. 2 (WSSP2)	$24,146,000	$5,400,000	Conjunctive Water Supply	20,000
Los Angeles – Ventura	Los Angeles County Flood Control District	San Antonio Spreading Grounds Improvements	$5,587,308	$2,876,020	Groundwater Storage	8,200
San Diego	San Diego County Water Authority	North San Diego County Regional Recycled Water Project	$2,970,000	$1,455,000	Recycled Water	4,400
Santa Ana	Santa Ana Watershed Project Authority	Inland Empire Brine Line Rehabilitation and Enhancement	$6,932,729	$1,000,000	Desalination	23,300
Tulare Lake	Upper Kings Basin IRWM Authority	City of Clovis Surface Water Treatment Plant Expansion	$4,250,000	$3,000,000	Treatment Plan Expansion	7,700

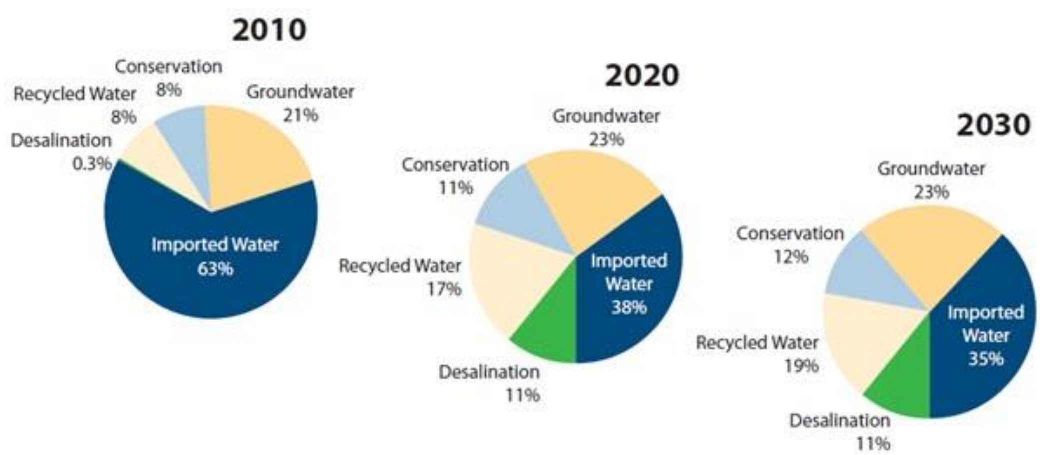

Figure 1C-4: West Basin Municipal Water District Water Sources 2010 to 2030

The BDCP considers various alternatives that cover a wide range of average annual Delta exports, compared to existing conditions. The impacts of alternatives that would divert less water depend on the location of affected water users. In response to smaller exports San Joaquin Valley water agencies might increase water use efficiency, increase groundwater use (potentially contributing to overdraft or subsidence) and develop alternative surface supplies. Eventually some farms might permanently cease production.

In the Bay Area and Southern California, users would be expected to respond to reduced Delta exports by increasing water use efficiency, using more recycled wastewater and desalted sea water and groundwater, and implementing other water management techniques.

1C.3.1.2 Examples of State Accomplishments

Following are a few additional examples of how DMM have become embedded in California's water management and how the State continues to promote increases in efficiency:

- **Legislation**. Since at least the early 1980s, the California Legislature has passed a series of bills aimed at using water more efficiently While these bills have provided various guidance and financial incentives for water agencies to implement water use efficiency measures as part of their water management portfolios, the responsibility for efficient use of water rests with these regional/local agencies and their water users.
- **State Water Use Efficiency Grants**. DWR has supported over 150 individual agricultural and urban water projects in California. These projects, funded by Propositions 50 and 13, will conserve about 100 TAF per year when completed at a State Bond cost of about $93 million (California Department of Water Resources 2009). In addition, local water agencies continue to implement water conservation projects that are locally cost-effective.
- **Planning**. The State has promoted local and regional water supply planning by requiring water suppliers to develop plans, such as UWMPs and Agricultural Water Management Plans, that forecast sources of supply and the actions needed (including water conservation and water efficiency measures) to ensure that future water needs are met over the next 25 years.
- **California Water Plan Update 2009 and Update 2013**. Integrated water management relies on a diversified portfolio of water management tools (presented as 27 resource management strategies in the California Water Plan Updated 2009).
- **Integrated Regional Water Management (IRWM) Funding**. Since 2000, the State has also promoted voluntary IRWM planning. Additional grant funding for implementation of Integrated Regional Water Management Plans improves water use efficiency. The California Water Plan Update 2009 identifies over 1.2 MAF of water benefits in combined water supply and demand reductions through $1 billion of investments from State bond funds (Proposition 84) in local and regional IRWM projects (California Department of Water Resources 2009), a portion of which will go towards improving water use efficiency. Some projects have been implemented and more are to come.
- **20% by 2020**. On February 28, 2008, Governor Schwarzenegger wrote to the leadership of the California State Senate, outlining key elements of a comprehensive solution to problems in the Sacramento-San Joaquin Delta. One element on the Governor's list was preparation of "a plan to achieve a 20 percent reduction in per capita water use statewide by 2020." In setting this goal, the Governor said, "I would welcome legislation to incorporate this goal into statute." *Questions and Answers – Achieving Governor Schwarzenegger's New Water Conservation Goal* (California

Department of Water Resources 2008) includes estimates of water savings; "Urban water use in California is about 8.7 million acre-feet per year. Reducing that use by 20% would conserve about 1.74 million acre-feet per year enough water to serve more than 2 million families per year. Population growth—new water users—will tend to increase water uses somewhat, offsetting the savings."

- **20 by 2020 Water Conservation Plan** (Agency Team 2010). Presents a statewide road map to maximize the State's urban water efficiency and conservation opportunities between 2009 and 2020, and beyond. Activities included in the plan provide for improving an understanding of the variation in water use across California, promoting legislative initiatives that incentivize water agencies to promote water conservation, and creating evaluation and enforcement mechanisms to assure regional and statewide goals are met. The plan addresses only urban water use and conservation. Agricultural water efficiency is beyond the scope of the plan, and is being addressed in other forums. For more information regarding assumptions for future demand used in modeling, please see Appendix 5A.
- **Delta Reform Act of 2009**. SBx7-1 (Simitian 2009) reforms policy and governance for the Sacramento-San Joaquin Delta. The Delta Stewardship Council (Council) was established by SBx7-1 to develop, adopt, and commence implementation of a comprehensive resources management plan for the Delta, referred to as the Delta Plan, on or before January 1, 2012 (Water Code §85300). (The Plan was adopted in May, 2013.) The Act requires that "The Delta Plan shall promote statewide water conservation, water use efficiency, and sustainable use of water" (California Water Code §85303).
- **Delta Plan.** With the passage of the Delta Reform Act and the implementation of the Delta Plan, water suppliers must demonstrate their reduced reliance on water from the Delta or the Delta watershed. *The Delta Plan* (Delta Stewardship Council 2013) includes many references for the need to promote statewide water conservation, water use efficiency and sustainable water use. The need for water conservation is embedded in many of the Council's draft policies and recommendations (see Figure 1C-5).
- **Recent Recognition**. California recently received top marks from the non-profit Environmental Law Institute and Alliance for Water Efficiency (Christiansen, et. al., 2012) in a draft report ranking all 50 states on policies addressing water conservation, conservation planning and program implementation, funding sources for water efficiency and conservation programs, as well as other informational resources. California received a grade of "A-".
- **New Initiatives**. DWR will explore the benefits of developing and participating in a new water reliability initiative to include advancements in urban and agricultural water use efficiency beyond those contained in 20 by 2020 above. DWR will consider the recommendations of the Delta Stewardship Council (see text box on following page) and explore other measures to include in the initiative.
- **Increase Crop Production**. Crop production per unit of applied water (tons/acre-foot) for 32 important crops increased 38 percent from 1980 to 2000 (California Department of Water Resources 2009). Another measure is that inflation-adjusted gross crop revenue per unit of applied water (dollars/acre-foot) increased by 11 percent during this same time period. More productivity is possible, new research on drip irrigation of alfalfa has shown an applied water reduction of two to three percent with yields increasing from 19 to 35 percent, an increase in productivity of 30 percent with the same amount of applied water (California Department of Water Resources 2009).

- **Increased Urban Water Use Efficiency**. Through aggressive water conservation efforts, the City of Los Angeles' water use in 2010 was less than in 1979, even with an increase in population of over 1,000,000 people during that period (Los Angeles Department of Water and Power 2010).
- **Residential Assistance**. For outdoor residential water use, the Coachella Valley Water District has provided voluntary audits for residential customers asking for assistance in improving their water use efficiency. A tiered water budget-based rate system went into effect for residential customers in 2009 and for all urban water customers in 2010. The per capita consumption has decreased significantly since the tiered rates were implemented, going from 580 GPCD in 2008 to 482 GPCD in 2010, a 17 percent savings.
- **Irrigation**. About 75 percent of the irrigated acreage for growing processing tomatoes has converted from furrow irrigation to drip irrigation. This has reduced application rates from a season total of 30 to 48 inches (depending on location) to about 24 inches (Miyao pers. comm.).
- **Incentive Programs**. In 2007 the Reclamation District 108 (48,000 irrigated acres) initiated an incentive program that provided rebates to farmers who reduced or eliminated spills of applied irrigation water (California Department of Water Resources 2009). The farmers' success allowed the District to reduce the volume of water being pumped in and around the District Avoided energy costs funded the rebates By 2009 over 67 percent of the District acreage was enrolled in the program and, drainage water had been reduced by approximately 30 TAF per year.
- **Technology**. Water delivery system improvements such as integrated supervisory control and data acquisition (SCADA) systems, canal automation, regulating reservoirs, and other hardware and operational upgrades, allow growers to apply water in appropriate amounts and timing. Almost all trees and vines established since 1990 are irrigated using micro-irrigation. Between 1990 and 2000, the crop area under micro-irrigation in California grew from 0.8 million to 1.9 million acres, a 138 percent increase (California Department of Water Resources 2009).
- **Investments**. California Farm Water Coalition reports that in the six-year period from 2003 through 2008, San Joaquin Valley farmers invested over $1.5 billion in high efficiency irrigation equipment (not annualized cost) (California Department of Water Resources 2009).

The key recommendations from the Delta Plan related to demand and water management are listed below.

WR R1 Implement Water Efficiency and Water Management Planning Laws

All water suppliers should fully implement applicable water efficiency and water management laws, including Urban Water Management Plans (Water Code section 10610 et seq.), the 20% reduction in statewide urban per capita water usage by 2020 (Water Code section 10608 et seq.), Agricultural Water Management Plans (Water Code section 10608 et seq. and 10800 et seq.), and other applicable water laws, regulations, or rules.

WR R2 Require SWP Contractors to Implement Water Efficiency and Water Management Laws

The Department of Water Resources should include a provision in all State Water Project contracts, contract amendments, contract renewals, and water transfer agreements that require the implementation of all State water efficiency and water management laws, goals and regulations including compliance with Water Code section 85021.

WR R3 Compliance with Reasonable and Beneficial Use

The State Water Resources Control Board should evaluate all applications and petitions for a new water right or a new or changed point of diversion, place of use, or purpose of use that would result in new or increased long-term average use of water from the Delta watershed for consistency with the constitutional principle of reasonable and beneficial use. The State Water Resources Control Board should conduct its evaluation consistent with Water Code sections 85021, 85023, 85031, and other provisions of

California law. An applicant or petitioner should submit to the State Water Resources Control Board sufficient information to support findings of consistency, including, as applicable, its urban water management plan, agricultural water management plan, and environmental documents prepared pursuant to CEQA.

WR R4 Expanded Water Supply Reliability Element

Water suppliers that receive water from the Delta watershed should include an expanded Water Supply Reliability Element, starting in 2015, as part of the update of its Urban Water Management Plan, Agricultural Water Management Plan, Integrated Water Management Plan or other plan that provides equivalent information about the supplier's planned investments in water conservation and water supply development. The expanded Water Supply Reliability Element should detail how water suppliers are reducing reliance on the Delta and improving regional self-reliance consistent with Water Code section 85201 through investments in local and regional programs and projects, and should document achievement of a reduction in net water use, or in percentage of water used from the Delta watershed. At a minimum, these plans should include a plan for possible interruption of water supplies for up to 36 months due to catastrophic events impacting the Delta, evaluation of the regional water balance, a climate change vulnerability assessment and an evaluation of the extent to which the supplier's rate structure promotes and sustains efficient water use.

WR R5 Develop Water Supply Reliability Element Guidelines

The Department of Water Resources, in consultation with the Delta Stewardship Council, the State Water Resources Control Board, and others, should develop and approve, by December 1, 2014, guidelines for the preparation of a Water Supply Reliability Element so that water suppliers can implement WR R4 by 2015.

WR R6 Update Water Efficiency Goals

The Department of Water Resources and the State Water Resources Control Board should establish an advisory group with other state agencies and stakeholders to identify and implement measures to reduce impediments to achievement of statewide water conservation, recycled water and stormwater goals by 2014. This group should evaluate and recommend updated goals for additional water efficiency and water resource development by 2018. Issues such as water distribution system leakage should be addressed. Evaluation should include an assessment of how regions are achieving their proportional share of these goals.

WR R7 Revise State Grant and Loan Priorities

The Department of Water Resources, the State Water Resources Control Board, the Department of Public Health, and other agencies, in consultation with the Delta Stewardship Council, should revise State grant and loan ranking criteria by December 31, 2013, to be consistent with Water Code section 85201 and to provide a priority for water suppliers that includes an expanded Water Supply Reliability Element in their adopted Urban Water Management Plans, Agricultural Water Management Plans, and/or Integrated Regional Water Management Plans.

WR R8 Demonstrate State Leadership

All State agencies should take a leadership role in designing new and retrofitted State owned and leased facilities, including buildings and Caltrans facilities, to increase water efficiency, use recycled water, and incorporate stormwater runoff capture and low impact development strategies.

WR R9 Update Bulletin 118, California's Groundwater Plan

The Department of Water Resources, in consultation with the Bureau of Reclamation, U.S. Geological Survey, the State Water Resources Control Board, and other agencies and stakeholders, should update Bulletin 118 information using field data, California Statewide Groundwater Elevation Monitoring (CASGEM), groundwater agency reports, satellite imagery, and other best available science by December 31, 2014, so that this information can be included in the next California Water Plan Update and be available for inclusion in 2015 urban water management plans and agricultural water management plans. The Bulletin 118 update should include a systematic evaluation of major groundwater basins to determine sustainable yield and overdraft status, a projection of California's groundwater resources in 20 years if current groundwater management trends remain unchanged, anticipated impacts of climate change on surface water and groundwater resources, and recommendations for State, federal, and local actions to improve groundwater management. In addition, the Bulletin 118 update should identify groundwater basins in a critical condition of overdraft.

WR R10 Implement Groundwater Management Plans in Areas that Receive Water from the Delta Watershed

Water suppliers that receive water from the Delta watershed and that obtain a significant percentage of their long-term average water supplies from groundwater sources should develop and implement sustainable groundwater management plans that are consistent with both the required and recommended components of local groundwater management plans identified by the Department of Water Resources Bulletin 118 (Update 2003) by December 31, 2014.

WR R11 Recover and Manage Critically Overdrafted Groundwater Basins

Local and regional agencies in groundwater basins that have been identified by the Department of Water Resources as being in a critical condition of overdraft should develop and implement a sustainable groundwater management plan, consistent with both the required and recommended components of local groundwater management plans identified by the Department of Water Resources Bulletin 118 (Update 2003), by December 31, 2014. If local or regional agencies fail to develop and implement these plans, the State Water Resources Control Board should take action to determine if the continued overuse of a groundwater basin constitutes a violation of the State's Constitution Article X, Section 2, prohibition on unreasonable use of water and whether a groundwater adjudication is necessary to prevent the destruction of or irreparable injury to the quality of the groundwater, consistent with Water Code sections 2100–2101.

WR R12 Complete Bay Delta Conservation Plan

The relevant federal, State, and local agencies should complete the Bay Delta Conservation Plan, consistent with the provisions of the Delta Reform Act, and receive required incidental take permits by December 31, 2014.

WR R13 Complete Surface Water Storage Studies

The Department of Water Resources should complete surface water storage investigations of proposed off-stream surface storage projects by December 31, 2012, including an evaluation of potential additional benefits of integrating operations of new storage with proposed Delta conveyance improvements, and recommend the critical projects that need to be implemented to expand the State's surface storage.

WR R14 Identify Near-term Opportunities for Storage, Use, and Water Transfer Projects

The Department of Water Resources, in coordination with the California Water Commission, Bureau of Reclamation, State Water Resources Control Board, California Department of Public Health, the Delta Stewardship Council, and other agencies and stakeholders, should conduct a survey to identify projects throughout California that could be implemented within the next 5 to 10 years to expand existing surface and groundwater storage facilities, create new storage, improve operation of existing Delta conveyance facilities, and enhance opportunities for conjunctive use programs and water transfers in furtherance of the coequal goals. The California Water Commission should hold hearings and provide recommendations to DWR on priority projects and funding.

WR R15 Improve Water Transfer Procedures

The Department of Water Resources and the State Water Resources Control Board should work with stakeholders to identify and recommend measures to reduce procedural and administrative impediments to water transfers and protect water rights and environmental resources by December 31, 2016. These recommendations should include measures to address potential issues with recurring transfers of up to 1 year in duration and improved public notification for proposed water transfers.

WR R16 Supplemental Water Use Reporting

The Department of Water Resources, in coordination with the State Water Resources Control Board, the Department of Public Health, Public Utilities Commission, Energy Commission, Bureau of Reclamation, California Urban Water Conservation Council, and other stakeholders, should develop a coordinated statewide system for water use reporting. This system should incorporate recommendations for inclusion of data needed to better manage California's water resources. The system should be designed to simplify reporting, reduce the number of required reports where possible, be made available to the public online and be integrated with the reporting requirements for the urban water management plans, agricultural water management plans, and integrated regional water management plans. Water suppliers that export water from, transfer water through, or use water in the Delta watershed should be full participants in the data base.

WR R17 Integrated Statewide System for Water Use Reporting

The Department of Water Resources, in coordination with the State Water Resources Control Board, the Department of Public Health, Public Utilities Commission, Energy Commission, Bureau of Reclamation, California Urban Water Conservation Council, and other stakeholders, should develop a coordinated statewide system for water use reporting. This system should incorporate recommendations for inclusion of data needed to better manage California's water resources. The system should be designed to simplify reporting, reduce the number of required reports where possible, be made available to the public online and be integrated with the reporting requirements for the urban water management plans, agricultural water management plans, and integrated regional water management plans. Water suppliers that export water from, transfer water through, or use water in the Delta watershed should be full participants in the data base.

WR R18 California Water Plan

The Department of Water Resources, in consultation with the State Water Resources Control Board, and other agencies and stakeholders, should evaluate and include in the next and all future California Water Plan updates information needed to track water supply reliability performance measures identified in the Delta Plan, including an assessment of water efficiency and new water supply development, regional water balances, improvements in regional self-reliance, reduced regional reliance on the Delta, and reliability of Delta exports, and an overall assessment of progress in achieving the coequal goals.

WR R19 Financial Needs Assessment

As part of the California Water Plan Update, the Department of Water Resources should prepare an assessment of the State's water infrastructure. This should include the costs of rehabilitating/replacing existing infrastructure, an assessment of the costs of new infrastructure, and an assessment of needed resources for monitoring and adaptive management for these projects. The department should also consider a survey of agencies that may be planning small-scale projects (such as storage or conveyance) that improve water supply reliability.

Figure 1C-5: Delta Stewardship Council Water Efficiency and Reliability Recommendations

1C.3.1.3 Agricultural Water Use Efficiency

Water is seldom used only once in California agriculture. Applied water is often reused multiple times on the same farm or in the same region (*California Water Plan Update*, DWR 2013). Simply reducing applied water does not necessarily result in net water savings because recoverable flows also may be reduced. Net water savings are achieved by reducing the quantity of irrecoverable applied water that flows to salt sinks (such as the ocean) or evaporates to the atmosphere. Additionally, in California, much of the tailwater that flows from agricultural lands provide valuable habitat benefits along ditch and stream banks and as a source of water for wetlands and wildlife preserves.

1C.3.1.3.1 Voluntary Efforts to Increase Efficiency

In 1996 a memorandum of understanding (MOU) was established between agricultural, environmental and public interest communities to advance agricultural efficient water management in California. The MOU established the Agricultural Water Management Council and provided guidance for the development and adoption of agricultural water management plans. The MOU provided specific list of efficient water management practices that water suppliers committed to implement at the highest feasible level (CALFED 1996). With the passage of SBx7-7 and the requirement that water suppliers submit agricultural water management plans to DWR, the Agricultural Water Management Council voted to dissolve in March 2013. Beginning in 2000, the State has issued several cycles of loan and grant programs to improve agricultural water use efficiency. The funds have been awarded based on competitive proposal solicitation packages to fund projects that may not be locally cost-effective, but provide broader water management benefits to the State. State funds committed from 2000 to 2007 totaled $25.2 million for 84 projects. The 2009 Legislative initiative SBx7-2 (anticipated for public vote in November 2014) included $125 million for agricultural water use efficiency projects. Measurement and evaluation will be an important part of future investments in water use efficiency.

1C.3.1.4 Agricultural Water Use Directives

The following legislation provides important State and federal directives affecting agricultural water use efficiency:

- The Agricultural Water Suppliers Efficient Water Management Practices Act of 1990 (AB 3616; Cal. Water Code Section 10903) and the federal CVPIA (1992) established early guidance for improving agricultural water use efficiency.
- [AB 3616]. Agricultural Water Suppliers Efficient Water Management Practices Act of 1990. Water Code, sections 10900-10904 (1990). Authorized development of efficient water management practices
- [CVPIA]. Federal Central Valley Project Improvement Act of 1992. H.R. 429. Public Law 102-575. 44 Code of Federal Regulations part 3401 (1992). Required preparation of water management plans.
- [Prop. 204]. Safe, Clean, Reliable Water Supply Act. Bond Act. Legislative initiative (SB 900) passed by voters. Statutes 1996, chapter 135. Water Code, sections 13459.5, 14058, 78500 - 78702 (1996). Provided funding for projects including drainage reduction.
- [Prop. 13]. Safe Drinking Water, Clean Water, Watershed Protection, and Flood Protection Bond Act. Legislative initiative (AB 1584) passed by voters. Statutes 1999, chapter 725. Water Code, section 79000 et seq. (2000). Provided state loans for agricultural water conservation projects.
- [SB 23]. CALFED funds: Bay-Delta Program. Statutes 2001, chapter 7. Water Code, section 138.9 (2001). Provided funding for water conservation grants.
- [Prop. 50]. Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002. Legislative initiative (AB 1473) approved by voters. Statutes 2002, chapter 618. Water Code, section 79500 et seq. (2002). Provided funding for agricultural and urban water conservation and water recycling projects.
- [AB 1404]. Water Measurement Information. Statutes 2007, chapter 675. Water Code, section 531 et seq. (2007). Requires certain agricultural water suppliers to measure water delivery to customers and report aggregate deliveries to DWR annually.
- [SBX7-2]. Safe, Clean, and Reliable Drinking Water Supply Act of 2010. Passed by the Legislature and signed by the Governor. The bond bill must be submitted for approval by voters (as a proposition). Statutes 2009-10 Seventh Extraordinary Session, chapter 3. (2009).
- [SBX7-7]. Agricultural Water Management Planning Act. Statutes 2009-10 Seventh Extraordinary Session, chapter 4. Water Code, section 10800 (2009). Requires agricultural water suppliers to implement EWMPS and prepare and submit AWMPs to DWR.

1C.3.1.4.1 Mechanisms for Achieving Agricultural Water Savings

Improvements in agricultural water use efficiency primarily occur from three management activities:

- Improving Hardware – This includes improving on-farm irrigation systems and water supplier delivery systems
- Improving Water Management – Improving management of on-farm irrigation and water supplier delivery systems
- Reducing Crop Water Consumption – Reducing non-beneficial evaporation

In dry years, agriculture is often faced with a reduction in water deliveries requiring more extreme measures such as reducing irrigated acreage (land fallowing) or deficit irrigation (applying less water than what the crop needs to be fully productive).

Most growers invest in cost-effective on-farm water use efficiency measures to stay economically competitive. Many use advanced irrigation systems, fertilizer application, and pest management to minimize water use. Global positioning systems, geographic information systems, satellite crop and soil moisture sensing systems, mobile laboratories, data in the California Irrigation Management Information System (CIMIS), and university research all help manage water application. These measures do not reduce overall crop water consumption, but reduce evaporation and runoff. Local water suppliers invest in cost-effective system improvements to provide service at a fair price to water users.

SBx7-7 created a new list of efficient water management practices (EWMPs). The legislation had two critical EWMPs that agricultural water suppliers are required to implement:

1. Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2).
2. Adopt a pricing structure for water customers based at least in part on quantity delivered.

The legislation listed an additional 14 conditional EWMPs that agricultural water suppliers are required to implement if the practices are locally cost effective and technically feasible.

3. Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.
4. Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.
5. Facilitate the financing of capital improvements for on-farm irrigation systems.
6. Implement an incentive pricing structure that promotes one or more of the following goals:
    a. More efficient water use at the farm level.
    b. Conjunctive use of groundwater.
    c. Appropriate increase of groundwater recharge.
    d. Reduction in problem drainage.
    e. Improved management of environmental resources.

f. Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.

g. Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance, and reduce seepage.

h. Increase flexibility in water ordering by, and delivery to, water customers within operational limits.

i. Construct and operate supplier spill and tailwater recovery systems.

j. Increase planned conjunctive use of surface water and groundwater within the supplier service area.

k. Automate canal control structures.

l. Facilitate or promote customer pump testing and evaluation.

m. Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.

n. Provide for the availability of water management services to water users. These services may include, but are not limited to, all of the following:

    1) On-farm irrigation and drainage system evaluations.

    2) Normal year and real-time irrigation scheduling and crop evapotranspiration information.

    3) Surface water, groundwater, and drainage water quantity and quality data.

    4) Agricultural water management educational programs and materials for farmers, staff, and the public.

o. Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.

p. Evaluate and improve the efficiencies of the supplier’s pumps.

1C.3.1.4.2 Differing Opinions Regarding Potential Water Savings

The California Water Plan Update 2013 presented estimates of potential water savings based on the CALFED Programmatic Record of Decision (CALFED 2000). Based on CALFED studies, agricultural water use efficiency improvements could result in net water savings (reduction in irrecoverable flows) ranging from 120 TAF to 563 TAF per year by 2030 at a cost ranging from $35 to $900 per acre-foot for a total cost of 2.7 to 3 billion dollars. These estimates were based on improving on-farm efficiency up to 85 percent and lining projects on the All-American Canal and Coachella Branch Canal. Efficiencies greater than 85 percent could result in soil salinity degradation and loss of productivity because less leaching of salts would occur. The CALFED evaluations also estimated a 1.6 MAF per year reduction in applied water (recoverable flows).

The 2006 CALFED Water Use Efficiency Comprehensive Evaluation (CALFED 2006b) estimated agricultural water use efficiency for various levels of implementation through year 2030. The evaluation considered seven different levels of investment from local agencies and State. For each level of investment, the study estimated (projected) potential recoverable and irrecoverable flows as shown in Table 1C-3. Each level of investment was referred to as a “projection level” and it is immediately evident that water use efficiency becomes much more costly in order to achieve additional reductions.

Table 1C-3. On-Farm and Water Supplier Recoverable and Irrecoverable Flow Reductions

Projection Level (PL)	Local Agency Investment Assumption	CALFED Grant Funding Assumptions	Recoverable Flows (TAF/year)	Irrecoverable Flows (TAF/year)
PL-1	Historic Rate	Proposition 50 only	150	34
PL-2	Locally Cost-Effective	Proposition 50 only	150	34
PL-3	Historic Rate	Proposition 50 + $15 million/year	565	103
PL-4	Locally Cost-Effective	Proposition 50 + $15 million/year	150	34
PL-5	Locally Cost-Effective	Proposition 50 + $40 million/year (2005-14) $10 million/year (2015-30)	947	190
PL-150	Locally Cost-Effective	Proposition 50 + $150 million/year (2006-2030)	2,006	620
PL-500	Locally Cost-Effective	Proposition 50 + $500 million/year (2006-2030)	2,930	888

Source: California Water Plan Update 2009, Agricultural Water Use Efficiency Resource Management Strategy.

Davenport and Hagan's (1982) study on *Agricultural Water Conservation in California with Emphasis on the San Joaquin Valley* ("DH Report") stated that:

> "Water conservation is suggested by some as being a totally adequate solution to overcoming the state's water deficit (now reflected mainly as groundwater overdraft). Others feel conservation is only a partial solution, and still others believe that past and present conservation practices have reached their practical limits, so the state's projected deficit can only be met by further development and diversion southward of northern California water. These divergent views occur partly because of special interests, but mainly because of 1) misunderstandings over the uses, reuses, and final destinations of water, and 2) disregard for the impacts of water conservation/ development actions on economic and environmental factors. This report attempts to clarify some of these issues."

The 1982 study analyzed the potential for improved on-farm irrigation efficiency to decrease diversions to agricultural areas. Specifically, the 1982 analysis concludes that much of agricultural "waste" was recovered and reused by other agricultural interests, municipal/industrial users, or the environment.

In a 2011 revision to the DH Report, Canessa, et. al., 2011, reviewed published research and technical data as well as State of California publications to assess the overall potential for agricultural water use efficiency to provide new water supplies. The purposes of the 2011 Update were twofold: (1) to re-introduce the concept of recoverable and irrecoverable inefficiencies discussed in the 1982 report; and (2) to provide a summary discussion of the major issues and impacts regarding agricultural water use in California and, in so doing, provide a broader perspective of the role agricultural DMM can play to help solve the pressing water issues facing California.

The 2011 Update reiterated the point that agricultural water conservation can produce modest amounts of recoverable water but it cannot result in significant amounts of new water. The major findings of the 2011 Update related to agricultural DMM were:

- The estimated potential new water from agricultural water use efficiency is 1.3 percent of annual usage - about 330,000 acre-feet per year. The estimate is based on the availability of State grant funding for projects that were not locally cost effective
- Groundwater overdraft of about 2 million acre-feet (MAF) per year continues to be a serious problem in certain regions of California because of inconsistent and uncertain surface water supplies.
- Changes in irrigation practices, such as switching from flood irrigation to drip, have the effect of rerouting flows within a region (or basin) but generally do not create new water outside of the basin because the water is typically reused locally for agricultural or environmental purposes.
- On-farm water conservation efforts can affect downstream water distribution patterns, with potential impacts on plants and animals, recreation, and municipal/industrial consumptive uses. These effects can be positive or negative, and can also be inconsistent (e.g., on-farm conservation could reduce a city's water supply but improve the nonpoint source situation).
- Deep percolation and surface runoff fractions resulting from irrigation events may be either recoverable or irrecoverable. The recoverable would be reused by other farms, M&I users, and the environment and only reductions in irrecoverable water would represent net savings.
- The major options for reducing water diversions were found to be reducing cropped acreage and improving seasonal irrigation efficiency. The role of agricultural water suppliers in helping to improve on farm efficiencies as well as improve agricultural operations (reduce spill and seepage losses) were also identified as ways to reduce usage.
- Major shifts have occurred in cropping patterns and irrigation system types (e.g., orchard acreage) increased 150 percent from 1978-2007 while cotton acreage decreased by 69 percent and drip irrigated acreage increased by 150 percent from 1994-2008 while gravity system acreage decreased by 19 percent. It was pointed out that these shifts were market-driven and occurred over time.
- The most important impacts from the implementation of irrigation DMM are the potential for reducing nonpoint source pollution (NPS) and the loss of productive soils. The current Conditional Waiver for agriculture issued by the Central Valley Regional Water Quality Control Board is an example of efforts being implemented to reduce and curtail NPS from agriculture.

The Pacific Institute has also completed a series of reports which present a very different estimate for potential agricultural demand reductions from DMM implementation (Gleick, et al., 2003, 2005; Cooley, et al., 2006, 2008, 2009; Christian-Smith, et al., 2010). Their studies found that existing, cost-effective technologies and practices could potentially reduce the demand for water by six-million to eight-million acre-feet per year, or around 20 percent statewide, as is now required for urban suppliers by 2020.

A July 2009 report by the Pacific Institute, *Sustaining California Agriculture in an Uncertain Future* (Cooley, et al. 2009), provides another analysis to estimate agricultural water savings. The estimates are based on water savings from efficient irrigation technologies, improved irrigation scheduling, and regulated deficit irrigation. The authors report the total water savings are 4.5 MAF, 5.5 MAF, and 5.9 MAF per year for wet, average and dry years, respectively. However, the report does not separate its estimates between recoverable and irrecoverable water savings.

In 2010, the Pacific Institute published another report entitled California's Next Million Acre-Feet: Saving Water, Energy, and Money (Cooley, et. al. 2010). This report concluded that there continue to be vast opportunities to reduce our demand for water without affecting the services and benefits that the water provides. According to the Pacific Institute, conserved water can easily be: (1) reallocated to other uses by the same user (such as growing more food on a farm), (2) left for (or returned to) ecosystems to help restore natural water flow levels; or (3) moved from one user to another, as part of an economic arrangement or transfer. In addition, the report notes that reducing the application of water can also reduce energy consumption as well as reduce wastewater and its associated treatment costs.

1C.3.2 Urban Water Use Efficiency

The primary benefit of improving urban water use efficiency is to lower water demand and cost-effectively stretch existing water supplies, and to conserve energy and reduce the emission of air pollutants, including greenhouse gases. Most water savings from urban water use efficiency takes place at the individual household level. Water agencies also have conservation programs focused on commercial/industrial users. Saving a few gallons per flush by installation of low flow toilets or reducing turf grass area are examples of the scale of urban water use efficiency measures. These seemingly small individual water savings are substantial when accumulated over all households served by urban water agencies.

A recent paper by Cahill and Lund (2011) analyzed Australia's progress in residential water conservation and used that information to estimate the water conservation potential for California. The study documented several ways in which Australia had reduced residential water use, including outdoor water restrictions, substantial and accessible rebates for water-saving devices, and increased water prices. They found that if California's per capita use equaled Australia's, California's urban water use would have been reduced nearly 2.1 MAF in 2009, with about 1.5 MAF more water possibly available for other uses. Australia's path to water conservation has not been entirely smooth, but their experience identifies realistic targets for residential water conservation beyond current levels. The paper concludes opportunities for more conservation exist in California, primarily in outdoor use.

1C.3.3 Urban Water Use Directives

The California Legislature has passed a series of bills over the past few decades related to urban water use DMM that have ranged from providing guidance through regulations. The following legislation provides important State and federal directives towards improving urban water use efficiency:

- [AB 797]. Urban Water Management Planning Act, as amended through 2004. Water Code, section 10610 et seq. (1983). Requires urban water suppliers to prepare and submit UWMPs to DWR.
- [AB 325]. Water Conservation in Landscaping Act. Government Code, section 65591 et seq. (1990). Required cities and counties to adopt a landscape ordinance

- Federal Energy Policy Act of 1992. H.R. 776. (1992). Required water conservation measures for federal facilities
- [Prop. 218]. The Right to Vote on Taxes Initiative. Citizen's initiative passed by voters. Added Article XIII C and D to the California Constitution. (1996). Limited. Ensures that all taxes and most charges on property owners are subject to voter approval.
- [SB 221]. Land use: water supplies. Statutes 2001, chapter 642. (2001). Approval by a city or county of certain residential subdivisions requires an affirmative written verification of sufficient water supply
- [SB 610]. Water supply planning. Statutes 2001, chapter 643. (2001). Water supply assessments must be furnished to local governments for inclusion in any environmental documentation for certain projects subject to the California Environmental Quality Act.
- [Prop. 50]. Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002. Legislative initiative (AB 1473) approved by voters. Statutes 2002, chapter 618. Water Code, section 79500 et seq. (2002). Authorized bonds for a variety of water projects including coastal protection, the CALFED Bay-Delta Program, integrated regional water management, safe drinking water, and water quality
- [AB 2717]. California Urban Water Conservation Council: stakeholders. Statutes 2004, chapter 682. (2004). Authorized the California Urban Water Conservation Council to convene a stakeholder workgroup to evaluate and recommend proposals for improving the efficiency of water use in new and existing urban irrigated landscapes in the state.
- [AB 371]. Water Recycling Act of 2006. Statutes 2006, chapter 541. Water Code, sections 13555.5 and 13557 (2006). Required DWR to adopt and submit to the Building Standards Commission regulations to establish a State version of Appendix J of the Uniform Plumbing Code to provide design standards to safely plumb buildings with both potable and recycled water systems.
- [AB 1881]. Water Conservation in Landscaping Act of 2006. Statutes 2006, chapter 559. (2006). Required DWR to update the model landscape ordinance, reflecting the provisions of AB 2717 and requires local agencies to adopt the updated model ordinance or equivalent or it will be automatically adopted by statute.
- [Prop. 84]. The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006. Legislative initiative (AB 2406) approved by voters. Public Resources Code, section 75001 et. seq. (2006). Authorized $5.388 billion to fund safe drinking water, water quality and supply, flood control, waterway and natural resource protection, water pollution and contamination control, state and local park improvements, public access to natural resources, and water conservation efforts.
- [AB 1404]. Water Measurement Information. Statutes 2007, chapter 675. Water Code, section 531 et seq. (2007). Determine the feasibility, estimated costs, and potential means of financing a database that would provide coordinated Ag water measurement reporting, and would also support water management planning and decision making, and require State Agencies to develop a coordinated water use database.
- [AB 715). Water conservation: low-flush water closets and urinals. Statutes 2007, chapter 499. Amends and renumbers Section 17921.5 of Health and Safety Code, to add Sections 17921.4 and 18944.11 to, and to repeal and add Section 17921.3 of, the Health and Safety Code. (2007). Requires that all water closets sold or installed in California shall use no more than an average

of 1.6 gallons per flush and that all urinals sold or installed in this state use no more than an average of one gallon per flush.

- [AB 1420]. Water demand management measures: water management grant or loan funds. Statutes 2007, chapter 628. Water Code, section 10631.7 et seq. (2007). Requires that the terms of, and eligibility for, any water management grant or loan made to an urban water supplier and awarded or administered by DWR, SWRCB, or California Bay-Delta Authority (CBDA) or its successor agency be conditioned on the implementation of Demand Management Measures.
- [AB 811]. Contractual assessments: energy efficiency improvements. Statutes 2007, chapter 367. (2008). Authorized all California cities and to designate areas within which willing property owners could enter into contractual assessments to finance the installation of distributed renewable energy as well as energy efficiency improvements, that are permanently fixed to the property owner's residential, commercial, industrial, or other real property.
- [AB 2882]. Allocation-based conservation water pricing. Statutes 2008, chapter 610. Water Code, chapter 3.4 (2008). Added new requirements for implementing tiered water rates to effectuate the Constitutional mandates of article X, section 2 – to prevent the waste and unreasonable use of water – and article XIII D, section 6(b) – to ensure that water service fees are proportionate to the cost of providing water service.
- [SB 1258]. Building standards: gray water. Statutes 2008, chapter 172. (2008). Required the Department of Housing and Community Development to adopt and submit to the California Building Standards Commission, for approval, building standards for the construction, installation, and alteration of graywater systems for indoor and outdoor use.
- [SB 407]. Property transfers: plumbing fixtures replacement. Statutes 2009, chapter 587. (2009). Established the requirement that for all building alterations or improvements to single-family residential real property that water-conserving plumbing fixtures replace other noncompliant plumbing fixtures as a condition for issuance of a certificate of final completion and occupancy or final permit approval by the local building department.
- [AB 474]. Contractual assessments: water efficiency improvements. Statutes 2009, chapter 444. (2009). Authorized a public agency to enter into a contractual assessment with a willing property owner to finance the installation of water efficiency measures.
- [AB 1061]. Common interest developments: water-efficient landscapes. Statutes 2009, chapter 503. Civil Code, section 1353.8 (2009). Any provision of the governing documents of a common interest development shall be void and unenforceable if it prohibits, or includes conditions that have the effect of prohibiting, the use of low water-using plants as a group, or if it has the effect of prohibiting or restricting compliance with a local water-efficient landscape ordinance or water conservation measure
- [AB 1366]. Residential Self-Regenerating Water Softeners. Statutes 2009, chapter 527. Water Code, section 13148 (2009). Allows cities and counties, by adoption of an ordinance, to ban the sale of water softeners in their community and to prohibit the use of water softeners previously purchased and in use by residents in their community.
- [AB 1465]. Urban water management planning. Statutes 2009, chapter 534. Water Code, sections 10631 and 10633 (2009). Allows California Urban Water Conservation Council MOU signatories to comply with urban water management planning requirements, and thereby gain access to state grant funding, by way of compliance with the higher water conservation standards contained in the revised MOU.

- California Plumbing Code, title 24, part 5, chapter 16A, part I. Establishes minimum requirements for the installation of graywater systems in occupancies regulated by the Department of Housing and Community Development (HCD) and allows installation or alteration of a graywater system, utilizing only a single domestic clothes washing machine in a one-or-two family dwelling without a construction permit.
- [SBx7-2]. Safe, Clean, and Reliable Drinking Water Supply Act of 2010. Passed by the Legislature and signed by the Governor. The bond bill must be submitted for approval by voters (as a proposition). Statutes 2009-10 Seventh Extraordinary Session, chapter 3. (2009). authorized the issuance of bonds in the amount of $11.14 billion pursuant to the State General Obligation Bond Law to finance a safe drinking water and water supply reliability program.
- [SBx7-7]. Water conservation. Statutes 2009-10 Seventh Extraordinary Session, chapter 4. (2009). Established a statewide water conservation program, in a new "Sustainable Water Use and Demand Reduction" part in the Water Code and reauthorized the Agricultural Water Management Planning Act.
- [SBx7-8]. Water Diversion and Use/Funding. Statutes 2009-10 Seventh Extraordinary Session, chapter 2. (2009). Requires all in-Delta diverters to record and report all diversions, regardless of method or volume of their diversion, to SWRCB.

1C.3.3.1.1 Urban Water Best Management Practices

Significant investments and accomplishments in urban water use efficiency have been achieved by State and local agencies working together. Water use efficiency practices that have been institutionalized through the California Urban Water Conservation Council's (CUWCC) Memorandum of Understanding (MOU) Regarding Urban Water Conservation in California (CUWCC 2011) have contributed greatly to water savings. The united group of water agencies, environmental interests, and the business community joined efforts to plan, implement and track a defined set of urban Best Management Practices (BMPs). As of 2012, there were 470 signatories to the MOU. Signatories include the suppliers of eighty percent of all urban water in California.

Several revisions to the MOU have been adopted. The newest BMPs are reorganized into programmatic groupings and add flexibility to deal with an uncertain water future. The BMPs are now organized into five categories:

- BMP Category 1 – Utility Operation Programs
    - Operations such as using a conservation coordinator, water waste prevention ordinances, and wholesale agency assistance to retailers
    - Water system audits and leak detection and repair
    - Metering and volume-based billing
    - Conservation pricing
- BMP Category 2 – Education Programs (public and school)
- BMP Category 3 – Residential – assistance with leak detections, landscape water surveys, and water-efficient appliances
- BMP Category 4 – Commercial, Industrial, and Institutional – assistance in water demand reductions

- BMP Category 5 – Landscape – water demand reduction for landscapes

1C.3.3.1.2 Statewide Water Use Targets and Conservation Potential

As of May 2013, DWR has received 404 UWMPs with projections of water saving under water use efficiency requirements of SBx7-7. While legislation set a 20 percent target for statewide urban water savings, it provided different methods for water suppliers to determine their individual target water savings. For example, one method allows urban water agencies to set a target of 95 percent of the applicable state hydrologic region target, as set forth in the State's draft *20x2020 Water Conservation Plan* (February 2010). Table 1C-4 shows the population weighted State average per capita water (gallons per capita day [GPCD]) demand reduction by year 2020 and the resultant percent reduction obtained from the plans (California Department of Water Resources 2012c).

Table 1C-4. Summary of Urban Water Management Plans' Targets

Population Weighted State Average Baseline and Target (GPCD)[a]			
10-year Baseline	2015 Target	2020 Target	Percent Reduction
193	178.00	163.00	15.5

[a] Based on data submitted in 2010 UWMPs.

If the State reduces urban per capita uses by 20% by 2020, urban water demand will be reduced by 1.8 MAF from what it would have been without the efficiency improvements. Much of the demand reduction is expected to provide the supply required by the growing population. The net reduction in overall urban demand comparing projections of 2020 water use with 2000 water use is a 0.25 MAF. Table 1C-5 provides estimates of water use in 2000 and in 2020 with and without the 20% reduction.

Table 1C-5. 20x2020 Water Use Reduction

Year	Population	Baseline (GPCD)	Volume of Urban Water Use (MAF)
2000	34 Million	193	7.35
2020 with 20% reduction	40.8	154	7.1
2020 without 20% reduction	40.8	193	8.8

The *20X2020 Water Conservation Plan* (California Department of Water Resources 2010) estimated that the State could achieve a 12.5% or 24 Gallon Per Capita per Day (GPCD) reduction in demand through the implementation of locally cost effective urban BMPs. The implementation of other measures, including many that were not locally cost effective, had the potential to achieve an additional 20% reduction or 38 GPCD. Overall the 20x2020 plan estimates that through the implementation of cost effective and additional measures the state could achieve a 32% reduction in urban demand. Table 1C-6 provides a list of conservation measures and their potential Statewide GPCD savings in 2020.

Table 1C-6. Water Conservation Measures Potential Statewide Savings

CONSERVATION MEASURES	STATEWIDE GPCD SAVINGS
Basic Measures	
More Efficient Plumbing code and statewide water meter requirements	8
Implementation of 80% of locally cost effective BMPs	11
Efficient Clothes Washer Standards	3
Climate- based Irrigation Controllers	3
Total Savings from Basic Measures	24
Additional Measures	
Implementation of Non- Locally Cost Effective BMPs	15
Aggressive Water Loss Control	6
Increased Landscape Irrigation Efficiency	16
New Technologies	2
Total Savings from Additional Measures	39
COMBINED TOTAL SAVINGS FROM BASIC AND ADDITIONAL MEASURES	63

1C.3.3.1.3 Water Conservation Implementation Costs

The Alliance for Water Use Efficiency has estimated that a well implemented set of water conservation programs would cost a water supplier an average of $333 to $500/ac-ft. The Urban Water Use Efficiency Resource Management Strategy in the California Water Plan 2013 Draft Update (California Department of Water Resources 2013) provides a more detailed range of sample costs for California Water Suppliers to implement water use efficiency programs:

- Residential Programs
  - Toilet Rebates: $158 - $475/AF
  - Residential Audits: $236 - $1474/AF
  - Clothes Washer Rebates: $154 - $480/AF
- Commercial, Industrial, Institutional (CII) Programs
  - Toilet Rebates: $242 - $1018/AF
  - Urinal Replacement: $320 - $583/AF
  - Pre-Rinse Spray Valves: $78/AF
- Landscape Programs
  - Landscape Audits: $58 - $896/AF
  - Equipment Rebates: $15 - $181/AF
  - Turf Removal: $274 - $717/AF
  - Water Budgets: $10 - $59/AF

- Utility Operations Programs [d,h]
  - System Audits/Leak Detection: $203-$658/AF

Water suppliers have expressed the concern that the implementation of water use efficiency measures will limit the percentage reduction that can be expected of water customers during drought years. The situation is termed "demand hardening" and is based on the premise that as water use efficiency improves and there is less waste, customers will have less essential water that can be cut or reduced during drought. A recent study (Fryer and Bamazai 2013) looked at the drought response of 7 communities (4 in California) that had aggressively implemented water conservation programs and had reduced their water use over time. The study looked at the communities' response to the most recent drought and found that despite well implemented water conservation programs, the customers in these communities were still able to make significant water use reductions in response to the drought. The study estimated that the communities studied would be able to continue to reduce water use up to 35% without any effect from the improved water use efficiency programs.

1C.4 Alternative Water Supplies

Municipal recycled water and desalination are two potential sources of water that can augment local water sources and can reduce dependence on water supplies that require conveyance through the Delta. Other water management options can also augment local supplies. Utilizing recycled, desalinated, and other water supplies does not necessarily reduce water consumption on a per capita basis, but it does enable water suppliers to more efficiently use different types or qualities of water for appropriate uses, as well as reduce dependence on imported supplies. However, if recycled water resources are developed in the future to offset demands that are currently being met with potable water, or is used to develop new areas that would have used potable water, then the use of recycled water can support reduction in a water supplier's per capita potable water demand. Both recycled and desalinated water are resources California water suppliers are utilizing and will continue to use in future years.

Increased use of alternate water supplies outside of the Delta watershed by SWP or CVP contracting agencies directly benefits these agencies. In addition, the use of alternate water supplies by these agencies potentially could result in reduced dependence on Delta exports, resulting in benefits to the Delta.

1C.4.1 Municipal Recycled Water

California beneficially used approximately 669,000 acre-feet of municipal recycled water (municipal wastewater treated to levels appropriate for beneficial reuses identified in Title 22 of the California Water Code) in 2009 (SWRCB and DWR, 2012). This is an increase of about 27 percent from the previous statewide survey in 2001 (525,000 acre-feet). Municipal recycled water is used for many beneficial purposes throughout the state, such as agricultural, landscape, and golf course irrigation, as well as groundwater recharge, seawater intrusion barriers, natural systems restoration, and commercial and industrial applications.

1C.4.1.1 Statewide Municipal Recycled Water Use

Fifty-one of the state's 58 counties have identified recycling projects in the 2009 Survey. In general, the highest countywide volumes of recycled water occur in parts of the state where local water resources are strained, population densities are high, or wastewater disposal is problematic. The majority of the state's recycled water use is in Southern California, with sixty percent of the state's recycling occurring south of the Tehachapi Mountains. In urban areas of southern California and the San Francisco Bay Area, recycled water use is more diverse. Increasingly throughout the state, highly treated recycled water is being used for groundwater recharge, urban irrigation, commercial/industrial applications, environmental enhancement, and other types of end uses.

Recycled water projects in California are being effectively implemented by both large and small scale recyclers (Table 1C-7). Of the 210 direct or joint systems beneficially recycling treated municipal wastewater in California during 2009, 15 produced more than 10,000 acre-feet each. These 15 systems cumulatively produced 447,000 acre-feet, or two-thirds of the estimated 669,000 acre-feet of municipal recycled water in 2009. There were 195 systems with a 2009 production of less than 10,000 acre-feet.

Table 1C-7. 2009 California Recycled Treated Municipal Wastewater, acre feet

		Regional Water Board									
		1	2	3	4	5	6	7	8	9	
		North Coast	San Francisco Bay	Central Coast	Los Angeles	Central Valley	Lahontan	Colorado River Basin	Santa Ana	San Diego	Beneficial Use Total
	Range of Project Size:	12 - 19,077	11 - 10,702	11 - 11,814	23 - 86,185	9 - 34,497	10 - 4,803	172 - 7,565	<50 - 67,613	41 - 13,102	
	# of Systems[a]:	14	33	20	16[b]	82	13	6	10	25	
Beneficial Use	Golf Course Irrigation	564	6,062	2,133	8,062	3,750	856	10,088	5,754	6,363	43,632
	Landscape Irrigation	632	9,210	2,262	25,622	3,143	7,043	1,636	29,391	33,611	112,550
	Agricultural irrigation	8,675	5,387	18,598	18,169	150,735	1,892	1,627	35,826	3,613	244,522
	Commerical	0	114	0	5,310	654	0	0	291	13	6,382
	Industrial	0	8,658	265	25,672	9,296	0	0	2,721	525	47,137
	Geothermal Energy Production	12,665	0	0	0	2,274	0	0	0	0	14,939
	Seawater Intrusion Barrier	0	0	0	11,003	0	0	0	37,749	280	49,032
	Groundwater Recharge	0	0	0	42,626	5,134	0	0	31,954	0	79,714
	Recreational Impoundment	0	0	0	19,920	0	0	420	5,498	0	25,838
	Natural Systems/Restoration	2,045	9,025	0	12,320	1,278	0	172	4,546	236	29,622
	Surface Water Augmentation	0	0	0	0	0	0	0	0	0	0
	Indirect Potable Resuse	0	0	0	0	0	0	0	0	0	0
	Other	1,191	2,563	17	937	1,591	19	147	2,013	7,311	15,789
Regional Water Board Total:		**25,772**	**41,019**	**23,275**	**169,641**	**177,855**	**9,810**	**14,090**	**155,743**	**51,952**	**669,157**

Units are in acre-feet

[a]The total number of systems is greater than 210, because the California State Prisons were split to include the total of each facility within the appropriate county

[b]This number considers the City of Los Angeles and the County Sanitation Districts of Los Angeles County recycled water systems each as one system.

Recycled water projects are implemented by individual municipalities or agencies. The State provides financial support to most of the recycled water projects in the forms of grants and loans applied for through existing California bond funding administered by the State Water Resources Control Board and the Department of Water Resources. The IRWM process allows water suppliers to develop projects that address local water issues.

Projected increases in recycled water use are currently being reviewed by DWR for the 2013 California Water Plan Update. The state's Recycled Water Policy of 2009 includes both mandates and goals for increasing the beneficial use of municipal recycled water. An additional 200,000 acre-feet of recycled water use are mandated to be implemented by 2020 and an additional 200,000 acre-feet by 2030. Based on the trend of increasing recycled water use since 1987, these mandates are achievable. The State Water Board also identified goals of 1 million acre-feet above 2001 recycling by 2020 and 2 million acre-feet above 2001 recycling by 2030 (2001 recycling was 525,000 acre-feet). Given the current rate of increasing water recycling, these goals will likely not be met.

The Recycled Water Task Force provided an estimate in 2003 of capital investment needed to increase state-wide municipal recycling from 0.5 to 2.0 million acre-feet (1.5 million acre-feet increase) by 2030 of between $9.2 and $11 billion (in 2003 dollars). This represents an initial capital investment of about $6,600 per acre-foot per year of project capacity, or $425 per acre-foot when amortized over the life of the project. Operations and maintenance costs, meanwhile, were expected to average $300 per acre-feet (2003 dollars). The Recycled Water Task Force report noted that there was a wide range of costs for municipal recycled water projects, from essentially no extra cost to over $2,000 per acre-feet for capital and operational costs combined (California Department of Water Resources 2003). Evaluation of the cost of recycled water projects presented to the San Diego County Water Authority Board of Directors in 2010 indicated that the annual capital and operating costs of proposed recycled water projects ranged from $1,000 to $2,437 per acre-foot (San Diego County Water Authority 2010).

The Recycled Water Task Force recommended additional funding assistance for local and regional agencies because of the expected high cost of implementing and operating the municipal recycled water projects. This recommendation has been implemented through grants and loans administered by both the State Water Board and the Department of Water Resources, but available funding for these programs is diminishing.

1C.4.1.1.1 Delta Benefits

A key issue for how increasing municipal recycled water use can directly benefit the Delta is the relationships between discharges of treated wastewater, locations of potential reuse, and stream/river flow benefits. Because wastewater discharged within the Delta watershed will generally reach and pass through the Delta, the reuse of treated municipal wastewater generated within the Delta watershed is not presumed to have a net benefit to the Delta. If a CVP or SWP contractor is located outside of the Delta watershed, reuse of municipal wastewater within their service areas is presumed potentially to displace diversions from the Delta, if Delta water is the most expensive supply that can be displaced. However, factors besides costs, such as water quality and reliability, may affect decisions on purchasing imported water. Data on current and projected municipal recycled water use in this section focuses on reuse within service areas of SWP contractors outside of the Delta watershed. When considering the potential benefits to the Delta resulting from increasing municipal recycled water use, both direct benefits from CVP and SWP contractor service areas reducing diversions, and indirect benefits from increasing Delta flows were included. Municipal water recycling by Sacramento and San Joaquin river watershed dischargers was not added because of the high percentage of unplanned reuse that occurs along the rivers and the importance of existing wastewater discharges to the existing river flows and river habitats.

Tables 1C-8 and 1C-9 identify the 2010 municipal wastewater recycling that occurred within the service areas of the existing CVP and SWP contracting agencies outside of the Delta watershed. Over one-half of statewide recycling identified in 2009 (669,000 acre-feet) occurred within the service areas of these contractors[3].

Table 1C-8. Municipal Water Recycling within State Water Project Contacting Agencies, acre feet

Agency	2010 RW Use[a]	2020 Projection[b]	2030 Projection[b]
Upper Feather River Area Contractors			
Butte County	NA[c]		
Yuba City	NA[c]		
Plumas County Flood Control and Water Conservation District	NA[c]		
North Bay Area Contractors			
Napa County Flood Control and Water Conservation District	NA[c]		
Solano County Water Agency	NA[c]		
South Bay Area Contractors			
Alameda County Flood Control and Water Conservation District, Zone 7	2,159	4,512	5,187
Alameda County Water District	3,900	3,900	3,900
Santa Clara Valley Water District	14,470	16,710	21,885
San Joaquin Valley Area Contractors			
Dudley Ridge Water District	NA[c]		
Empire West Side Irrigation District	NA[c]		
Kern County Water Agency	NA[c]		
Kings County	NA[c]		
Oak Flat Water District	NA[c]		
Tulare Lake Basin Water Storage District	NA[c]		
Central Coastal Area Contractors			
San Luis Obispo County Flood Control and Water Conservation District	0.00	1,169	1,380
Santa Barbara County Flood Control and Water Conservation District	1,884	2,186	2,298
Southern California Area Contractors			
Antelope Valley–East Kern Water Agency	20,942	20,942	20,942
Castaic Lake Water Agency	325	2,288	7,200
Coachella Valley Water District	8,382	13,425	20,130
Crestline–Lake Arrowhead Water Agency	127	150	150
Desert Water Agency	4,500	6,100	8,400
Little Rock Creek Irrigation District	0		
Metropolitan Water District of Southern California	308,000	456,000	553,500
Mojave Water Agency	22,066	29,876	46,409
Palmdale Water District	0		
San Bernardino County Municipal Water District	0	5,250	14,700
San Gabriel Valley Municipal Water District	2,015	3,375	4,500
San Gorgonio Pass Water Agency	3	1,686	3,213
Ventura County Flood Control District	532	14,025	14,025
total[d]:	389,000	582,000	728,000

a Recycled water use in the service area, provided either by the SWP contractor or other agencies.
b Projections based on 2010 Urban Water Management Plans, assuming 75 percent of identified amount, and the 2009 Recycled Water Survey.
c Water suppliers within the Delta watershed were not included in this calculation. Many of these agencies include municipal water recycling, but this is not considered to have a direct benefit to the Delta, as explained in the text.
d Totals are rounded to the nearest thousand acre-feet.

[3] Either directly by the contractor or by a wastewater agency within the contractor's service area.

Projections included in 2010 Urban Water Management Plans of 2020 and 2030 municipal recycled water use for the service areas of the agencies shown in Tables 1C-8 and 1C-9 were assessed. Based on past performance of projections versus actual recycled water use, the Urban Water Management Plan projections within the service areas of these agencies were reduced by 25 percent. The Urban Water Management Plan 2020 projections are considered reasonable expectations of 2020 recycled water use because they were prepared by water agencies based on capital improvement and master plans prepared while most water suppliers were facing challenging economic conditions. The 2030 projections are considered less well-developed because they are outside the timeframe of most detailed planning projections and vulnerable to future uncertainties such as drought, public support, economic challenges, water quality issues, and the potential authorization of direct potable reuse. These projections indicate that by 2020 recycled water use within the service areas identified in Tables 1C-8 and 1C-9 is expected to increase over 204,000 acre feet from 413,000 to 616,000 acre-feet.

To achieve the 2020 projection of 616,000 acre-feet per year of recycled water use, a capital investment of approximately $2.2 billion (2013 dollars) will be needed. The annualized capital and operational costs would range between $1,100 per acre-foot and $2,600 per acre-foot (2013 dollars based on San Diego County Water Authority, 2010).

Table 1C-9. Municipal Water Recycling within CVP Contractors, acre feet

	2010 RW Use [a]	2020 Projection [b]	2030 Projection [b]
Central Valley Project			
East Bay Municipal Utilities District	10427	13448	16304
Santa Clara Valley Water District	*included in Table X-2*		
San Benito County Water District	203	2798	3453
Pajaro Valley Water Management Agency	505	3000	3000
Ventura County Watershed	*included in Table X-2*		
Contra Costa Water District	12454	15534	19714
	0		
total [c]:	24,000	35,000	43,000

a Recycled water use in the service area, provided either by agencies not associated with the SWP.

b Projections based on 2010 Urban Water Management Plans, assuming 75 percent of identified amount, and the 2009 Recycled Water Survey.

c Totals are rounded to the nearest thousand acre-feet.

1C.4.1.1.2 Water Quality Issues

There may be an impact on recycled water use if the importation of Delta water into Metropolitan Water District is significantly reduced. Because of the high salinity of Colorado River water, southern California has relied on SWP imports not only to increase supply but also to improve water quality by reducing the percentage of Colorado River water in delivered water. Recycled water has more salts than the potable water supply, and its uses can be diminished if source water salinity increases. Desalination is used in a few cases to improve recycled water quality, mostly for groundwater recharge and specialized industrial uses, but a more widespread need for desalinating recycled water could make the cost prohibitive.

1C.4.1.2 Desalinated Water

Desalinated water includes desalination of brackish groundwater, ocean water, and agricultural drain water. Brackish groundwater desalination occurs primarily in inland areas of southern California, where local groundwater is higher in salts than potable standards. Ocean desalination occurs along coastal areas adjacent to the ocean. Desalination of agricultural drain water entering the Salton Sea has been proposed.

Water desalination faces challenges, including lengthy permitting, high cost, high energy demands, and environmental impacts. Environmental concerns for ocean desalination include entrainment and impingement of sea life at intake facilities, the potential impact of hypersaline brine disposal on sea life, and energy requirements for plant operation. The State Water Resources Control Board is currently evaluating proposed amendments to the Water Quality Control Plans for Ocean Waters and Enclosed Bays and Estuaries to assess ocean water intake and brine disposal issues. These amendments could apply to both desalination and recycled water facilities, establish a framework for desalination that is protective of the environment, and reduce the time for permitting approval.

There are currently many brackish groundwater desalination facilities and one ocean water desalination facility (at Sand City) operating in California to serve potable water for municipal use. A 50 MGD ocean desalination plant to be constructed and operated by Poseidon Resources Corp. at Carlsbad will begin construction in 2013 and operation in 2016. Other existing ocean water desalination facilities are for industrial or commercial purposes or are only intermittently used.

Additional groundwater and ocean desalination projects are in the planning stages. A 2012 Pacific Institute survey identified 8 potential ocean desalination projects within the SWP service area (including the Poseidon project in Carlsbad) that could collectively deliver 406,000 acre-feet per year if operated at their proposed capacities (Pacific Institute, 2012a). It is unclear if these facilities will be completed and, if they are, how much of that supply would benefit California. Two of these projects would be located in Mexico, and the yield may be shared with Mexico and neighboring states. While many of these ocean desalination projects are reported to be scheduled for at least partial operation by 2020, several of the ocean desalination projects have been in planning and permitting phases for upwards of 10 years.

Reclamation recently completed a high level reconnaissance study on water supply options within the Colorado River Basin (Reclamation 2012). Reclamation has identified a potential for ocean desalination in southern California of 675,000 acre-feet per year, some of which might be shared with Mexico or neighboring states. This potentially overlaps the projects identified by the Pacific Institute and are long-term estimates available in 15 to 30 years. USBR has estimated a potential for brackish groundwater desalination in southern California of 20,000 acre-feet per year. Between 300,000 and 500,000 acre-feet per year of agricultural drain water entering the Salton Sea could be desalinated and returned for agricultural use. While the main objective of recovering the drain water would be to displace Colorado River diversions, there may be an indirect impact on Delta diversions depending on how water rights are exchanged or transferred. It is uncertain whether any of these projects could have an indirect effect on the Delta. Because of the nature of the USBR study, in-depth feasibility analyses on specific projects were not conducted. Issues such as impacts on the Salton Sea would need further evaluation. At this time the USBR estimates should be viewed as upper limit long-range potential estimates, and because of the possible exchanges with Mexico and neighboring states, it is uncertain how much of the yield could benefit the Delta.

Ocean desalination is generally more costly than alternative water supplies. In a survey of 12 ocean desalination plants proposed or completed in Australia, California, and Florida, Pacific Institute found a range of unit costs from $1,100/AF to $6,552/AF, with most over $2,000/AF. These costs were inconsistently reported and represent a variety of assumptions and conditions, but they do serve to illustrate the generally high cost. (Pacific Institute, 2012b) Mitigating this high cost is the added reliability provided by desalination during conditions of drought or major interruptions of other supplies. The desalination of brackish groundwater or agricultural drain water is considerably less, in the range of $600/AF to $950/AF (Reclamation 2012). Technological improvements are expected to result in reduced energy requirements and desalination costs over time.

The initial capital investment can vary significantly due to a number of factors relating to methods of water intake, pretreatment, brine disposal, and distance between point of desalination and community water distribution systems. There are also significant economies of scale, with initial investment reported on one source ranging from $5,800 per acre-foot per year of capacity for a 100 MGD facility to $12,500 per acre-foot per year of capacity for a 0.5 MGD facility (WateReuse Association, 2012). To provide a sense of what the capital cost investment would be for ocean desalination, assuming that an additional 200,000 acre-feet per year of supply could be achievable by 2020, the capital investment could be in the range of $1.2 billion to $1.6 billion.

1C.4.1.3 Other Water Supplies

There are other water supplies that could be implemented at the regional or local level that could directly impact CVP or SWP diversions from the Delta or could have the same effect through exchanges or water transfers with other agencies not served by the CVP or SWP. Examples of these include urban stormwater capture, recovery of polluted groundwater, and local surface and groundwater storage. They are evident in the mix of projects funded through DWR's Integrated Regional Water Management Grant Program. These alternatives have not been systematically analyzed for aggregate potential volumes or costs.

1C.5 Examples of State Water Project Contractors Integrated Water Management Implementation

Water exports to the Metropolitan Water District of Southern California (MWD), the Kern County Water Agency and the Santa Clara Valley Water District account for approximately 75% of the total SWP deliveries each year. For this reason their [conservation efforts] are highlighted in the following subsections of this appendix.

1C.4.2 The Metropolitan Water District of Southern California

Metropolitan was established in 1928 under an act of the state Legislature to provide supplemental water supplies to its member agencies in Southern California. Metropolitan is a public agency and a regional water wholesaler. It is governed by a 37-member board of directors representing 26 member public agencies that purchase some or all of their water from Metropolitan and serve 19 million people across six Southern California counties.

The mission of Metropolitan is to provide its 5,200-square-mile service area with adequate and reliable supplies of high-quality water to meet present and future needs in an environmentally and economically responsible way. Metropolitan draws supplies through the Colorado River Aqueduct, which it owns and operates; from Northern California via the SWP; and from local programs and transfer arrangements. An increasing percentage of Southern California's water supply comes from conservation, water recycling and recovered groundwater. Chart 1C-10 documents Metropolitan's achievements and investments in integrated water management.

Table 1C-10. Metropolitan Water Districts Achievements in Recycled Water, Groundwater Recovery and Replenishment and Conservation Programs

Achievements	
Metropolitan-Assisted Programs	
Conservation	
FY 2011/12 New Water Saved From Conservation Credits Program	8,300 acre-feet
FY 2011/12 Water Saved From New & Existing Conservation Credits Program[1]	156,000 acre-feet
Cumulative Water Saved From Conservation Credits Program[2]	1,720,000 acre-feet
FY 2011/12 Metropolitan Conservation Investment[3]	$12.9 million
FY 2011/12 Member Agency Investment[4]	$9.2 million
Cumulative Conservation Investment (excluding funding by member agencies)	$322 million
Total FY 2011/12 Conservation Investment[5]	$13.4 million
Recycled Water[6]	
FY 2011/12 Production	171,000 acre-feet
FY 2011/12 Investment	$27.5 million
Cumulative Production	1,679,000 acre-feet
Cumulative Investment	$302 million
Groundwater Recovery[6]	
FY 2011/12 Production	40,000 acre-feet
FY 2011/12 Investment	$5.9 million
Cumulative Production	594,000 acre-feet
Cumulative Investment	$111 million
Conjunctive Use Program[7]	
Metropolitan Cumulative Investment	$26.5 million
Proposition 13 Grant Funds Administered by Metropolitan	$45.0 million
Water Stored Since Program Inception through September 2012	271,000 acre-feet
Water Extracted Since Program Inception through September 20127	206,000 acre-feet
Groundwater Replenishment[8]	
Cumulative Investment through September 2012	$347 million
Cumulative Replenishment Delivery through September 2012	3.2 million acre-feet

Metropolitan's water demand projections, as presented in its 2010 Integrated Resource Plan (IRP) Update, are based on the Southern California Association of Governments' (SCAG) 2007 Regional Transportation Plan (RTP-07) and the San Diego Association of Governments' (SANDAG) Series 11 Forecast, both released in 2006. These two agencies use Cohort-Component demographic models to project population, housing, employment, income and other planning variables. National and local trends in birth rates, mortality, domestic migration and immigration are incorporated into their projections, which use the 2000 Census as a base year. Both agencies link their demographic models to economic and job forecasting models. SCAG and SANDAG projections undergo extensive local review and incorporate zoning information from city and county general plans. According to SCAG and SANDAG projections, the Metropolitan service area will grow by about 133,000 people per year from 2010 to 2035. This means that the area's population is projected to grow from 19.2 million people in 2010 to an estimated 22.5 million people in 2035. Total households in Metropolitan's service area are expected to increase from 6.1 million in 2010 to 7.3 million in 2035, or about 44,800 additional households/year.

Economic trends are also important drivers of water demand in Metropolitan's service area and Gross Domestic Product (GDP) within the six-counties served by Metropolitan is more than $1 Trillion (Metropolitan, 2012b). Within Metropolitan's service area, total urban employment, including self-employed, is projected to grow from 8.6 million in 2010 to about 10.3 million in 2035. This is about 66,000 new jobs per year. This 19 percent increase is greater than the projected population growth of 17 percent and corresponding 17 percent in housing growth during this period.

Metropolitan and its member agencies have adopted a policy and planning process for determining the appropriate level of reliability and mix of water supply sources through an Integrated Resources Plan (IRP). The IRP provides for a 25-year water resources strategy with resource targets and timeframes for implementation which seeks to assure a diverse water supply portfolio for Southern California. Metropolitan's water supply strategy has evolved from a portfolio heavily dependent on imported supplies to a diverse portfolio that takes a more balanced approach to developing diverse resources including substantial conservation, local supplies, SWP supplies, Colorado River supplies, groundwater banking, and water transfers. For example, in the 1980s, the region's water supply strategy was heavily reliant on imports from the SWP and the Colorado River, which accounted for 20% and 28% respectively of Metropolitan's supply. As a result of the adaptive IRP process, the strategy now relies less on those two imported sources and much more heavily on water conservation and local water supply management SWP – 12%; Colorado River – 20%; conservation – 16%; and storage and transfers – 16%, with the remainder from local supplies.

Despite this reduced reliance on SWP water, Delta exports remain a critical source of supply for Metropolitan for two fundamental reasons. First, it is of relatively low salinity compared to other sources such as the Colorado River, with low salinity key to emerging local initiatives such as recycling. Second, the Delta is uniquely capable of providing additional supplies in wet years, when diversions are far less sensitive on the ecosystem, enabling Metropolitan to replenish groundwater basins and its surface storage network.

1C.4.2.1.1 Water-Use Efficiency through Conservation and Recycling

Water conservation continues to be a key factor in water resource management for Metropolitan. Its water resource managers balance the need to provide supply reliability with environmental protection and planning strategies today are adaptive, recognizing the challenges that uncertainties of weather, environmental restrictions and economics can present. These strategies also recognize opportunities, such as emerging technologies and social and business trends that are designed to weather-proof; meaning that in drought or wet periods, plans for managing resources can be successful and provide long-term supply reliability. Incentive programs aimed at residential, commercial and industrial water users make a key contribution to the region's conservation achievements. The rebate program is credited with water savings of 156 TAF annually from a cumulative investment of $309 million. Funding provided by Metropolitan to member and retail water agencies for locally- administered conservation programs included rebates for turf removal projects, toilet distribution and replacement programs, high-efficiency clothes washer rebate programs and residential water audits. Training classes have been developed and include landscape and turf courses for the general public, facility managers, landscape professionals and gardeners.

Fiscal year 2010/11 saw the launch of new initiatives. Metropolitan and its member agencies initiated a program called, "Proper Irrigation Control" to provide resources to educate the public on landscape water-use efficiency. With a DWR grant, Metropolitan provided financial incentives to customers to replace their lawns with more water-efficient plants. A newly launched agricultural conservation program offered financial incentives to growers for irrigation system efficiency improvements.

Metropolitan encourages research and development of innovative ways to conserve water in the future. The Innovative Conservation Program (ICP) provided funding to individuals and organizations to test new technologies and devices. In fiscal year 2010/11, four of the five ICP projects completed final reports documenting water-saving opportunities. Two of these projects looked at new sprinkler components, in each study looking at a different type of component the water savings from the improved application efficiency was over 30%. Another study looked at recycled water use and salinity in turfgrass irrigation and concluded that recycled water could be used on turfgrass without salinity issues if management practices were implemented.

Supporting the development of local resources, Metropolitan's Long Range Plan (LRP) offers financial incentives designed to expand water recycling and groundwater recovery. In fiscal year 2010/11, Metropolitan supported with funding the production of 162 TAF of recycled water for non-potable uses and about 43 TAF of groundwater recovered for municipal use. A newly established task force collaborated with member agencies to review the LRP and identify alternative financial mechanisms to support development of local resources with a cost-effective, sustainable approach.

Because of improved water conditions in 2011, Metropolitan began refilling groundwater and surface storage reservoirs that had been depleted during the 2007-2010 drought years. Metropolitan also stored more than 20 TAF in the dry-year conjunctive use program within the service area to maintain reliability during dry, drought and emergency conditions. In fiscal year 2010/11, savings from Metropolitan's active conservation programs was 156 TAF.

Metropolitan's service area is currently conserving over 700 TAF annually and the IRP provides strategies and programs to increase conservation to approximately 865 TAF annually by 2010, and to approximately 1,027 TAF by 2020. Metropolitan is a signatory to the California Urban Water Conservation Council's Memorandum of Understanding Regarding Urban Water Conservation in California (Water Conservation MOU). Under the Water Conservation MOU, Metropolitan co-funds member agency conservation programs that increase water use efficiency. Direct spending by Metropolitan on conservation activities between 1989/1990 and 2005/2006 was more than $205 million. A large part of these funds were spent retrofitting more than 2.5 million toilets with ultra low-flow devices. Because of significant investments in water use efficiency, recycling of wastewater, and recovery of contaminated groundwater, Metropolitan's service area imports about the same amount of water that it did 15 years ago despite a 30 percent increase in population.

Metropolitan estimates that its service area is currently achieving a water use reduction of over 17% through DMM. More importantly, these reductions have already been accounted for in Metropolitan's assessment of imported water needs. This success has taken over 20 years as a result of implementation by individual water users encouraged by code enforcement, direct incentive programs for device installations, education, and advertising at a total regional cost of roughly $500 million region-wide with $205 million funded by Metropolitan entirely.

In addition to traditional water use efficiency, Metropolitan's service area has created over 319 TAF of recycled and recovered water annually, or an additional 7%. These projects are expensive and take years to permit, construct and bring on-line. Many of the projects that create this water are not operating at their maximum capacity, because the demand for this water is limited by State regulations allowing its use and lack of public acceptance.

Metropolitan voluntarily set a goal for to achieve the 20% reduction in urban per capita use by 2020 in its service area. Metropolitan being a wholesaler was not required by the legislation to set a target, but enacted the savings goal as the demand reduction were important for water supply reliability.

Water demand offsets can occur through direct reuse of recycled water, such as for irrigation, or indirect reuse through groundwater recharge and reservoir augmentation. Retail water suppliers receive partial credit for past efforts in conservation and recycled water; therefore, not all agencies need to reduce demand by 20 percent in order to comply with the new law. Based on Metropolitan's analysis of population and demand, compliance with 20x2020 on an individual retail agency basis throughout the region would result in reduced potable demand of 190 TAF in 2015 and 380 TAF in 2020 (Metropolitan, 2010). These savings due to DMM, along with an assumption that south of Delta exports are returned to pre-BiOp levels, are factored into Metropolitan's long-term plans for providing a reliable water supply to its customers (Metropolitan, 2010).

1C.4.2.2 Kern County Water Agency

The Kern County Water Agency (KCWA) was created in 1961 by a special act of the State Legislature and serves as the local contracting entity for the SWP. The KCWA is the second largest participant in the SWP, and has long-term contracts to provide SWP water to 14 local districts. Due to the arid or semi-arid nature of much of its service area, the KCWA also manages an extensive groundwater banking system that can store approximately 5.7 MAF for use during dry years. The KCWA also participates in management activities related to flood control, water quality and water conservation, with the overall goal of preserving and enhancing Kern County's water supply. Related major facilities managed/operated by the KCWA include: (1) the Cross Valley Canal, which conveys water from the SWP California Aqueduct to urban Bakersfield and groundwater banking recharge sites; (2) the Henry C. Garnett Water Purification Plant, which provides up to 72 million gallons per day (MGD) of treated (potable) water to retail water purveyors; and (3) the East and North Feeder (and related) facilities, which provide conveyance and pumping capacity for water distribution to KCWA member districts.

Due to limited annual precipitation in much of the KCWA service area, extensive management and conservation measures are implemented for both agricultural and urban water use. Specifically, this includes the noted groundwater banking system and additional efforts, as summarized below by KCWA:

- Groundwater Banking – This program is widespread across the KCWA, with all local districts participating (even those not overlying groundwater basins). Generally, groundwater banking involves recharging groundwater basins through infiltration in large percolation (or spreading) basins during wet years (when excess water is available), and withdrawing the "banked" water in dry years when the availability of water is more limited. To effectively manage this program, the KCWA and member districts operate approximately 800 production wells and 200 monitoring wells (to track aquifer levels) in the Kern subbasin of the San Joaquin Valley Groundwater Basin, as well as 350 production and monitoring wells in the Kern River Alluvial Fan area. The use of groundwater banking allows the KCWA to effectively manage and correlate water use with climatic and seasonal variations in available supply.

- Agricultural Water Conservation – Kern County is the fourth most productive agricultural county in California, with nearly $5 billion of gross revenue in 2010. Local agricultural operations are dependent on imported water supplies, with Kern County agricultural operators implementing a number of innovative management practices to reduce water use and conserve water resources. Specifically, these include the use of: (1) highly efficient irrigation methods to maximize the amount of irrigation water actually used to meet crop requirements (i.e., as opposed to water loss from effects such as evaporation); (2) drip and low-volume application methods to reduce waste from excess runoff and infiltration; and (3) the use of laser land-leveling to achieve more uniform water distribution.

- Urban Water Conservation – As noted above for agriculture, urban water use in Kern County is dependent on imported supplies due to the arid climate and limited local resources. The KCWA has implemented educational outreach programs regarding the importance of water resources and conservation for over 20 years. These efforts are focused on students in first through twelfth grades, with programs designed to complement local classroom curricula that are offered free of charge to all public and private schools in Kern County. Specific topics covered in the outreach programs include water treatment, water supply, groundwater, and the use of water for agricultural operations. The KCWA also facilitates Project WET (Water Education for Teachers), which provides environmental education to promote awareness, appreciation, knowledge and stewardship of water resources. Annual Project WET workshops are offered free of charge to all Kern County first through twelfth grade teachers.

- Kern County Case Study – Lost Hills Water District: As the reliability of the SWP has decreased over time, it has become increasingly important for Kern County water districts to implement demand management measures to ensure that water is used efficiently throughout the region. Lost Hills Water District (LHWD), one of the local districts that receive SWP water from KCWA, provides an example of the efforts being implemented in Kern County. LHWD encompasses approximately 70,000 acres, of which approximately 32,000 acres have been consistently farmed in the last five years. LHWD does not overlie the useable groundwater basin, and therefore, is reliant upon SWP deliveries to supply crops with water. In 1990, approximately 42 percent of crops grown in LHWD utilized furrow irrigation. As of 2009, the use of furrow irrigation had been eliminated and 98 percent of irrigation systems had been converted to micro-irrigation systems. It is estimated that growers invested nearly $43 million to convert their irrigation systems. Additionally, LHWD has invested approximately $6 million on lining 17.4 miles of delivery canals within the district. This has resulted in an annual water conservation of approximately 4,300 AF per year.

1C.4.2.3 Santa Clara Valley Water District

The Santa Clara Valley Water District (SCVWD) is an independent special district with jurisdiction throughout Santa Clara County and is the county's primary water resources agency. First formed as the Santa Clara Valley Water Conservation District in 1929, the SCVWD is the county's principal water wholesaler, flood protection agency and watersheds steward. The SCVWD manages groundwater and provides comprehensive water management as authorized by the Santa Clara Valley Water District Act (District Act). The SCVWD manages 10 local surface reservoirs and associated creeks, recharge facilities, the county's groundwater basins, and three water treatment plants. In addition, the SCVWD imports water from both the CVP and the SWP and delivers recycled water throughout the county.

Water imported from the CVP and SWP provides, on average, 40% of the supplies used annually in the county and the SCVWD works to safeguard its access to these supplies. The SCVWD supplies water to local water retail agencies, which in turn provide it to their customers in Santa Clara County. SCVWD-imported water is conveyed through the Sacramento-San Joaquin Delta and then pumped and delivered to the county through three main pipelines: the South Bay Aqueduct, which carries water from the SWP, as well as from the Santa Clara Conduit and Pacheco Conduit, both of which bring water from the CVP. M&I water use, which includes residential, commercial, industrial, and institutional water use, has grown in Santa Clara County as a result of urbanization. Conversely, agricultural water use has declined as irrigated agricultural land has been converted to other uses. SCVWD records show that the water use in the county is greater than 90 percent municipal and industrial and less than 10 percent agricultural.

The SCVWD has a contract for 100 TAF per year from the SWP, and nearly all of this supply is used for M&I needs. The SCVWD's CVP contract amount is 152.5 TAF per year. On a long-term historical average basis, 83 percent of the CVP supply is delivered for M&I use, and 17 percent is delivered for irrigation use. The actual amount of water delivered is typically less than these contractual amounts and depends on hydrology, conveyance limitations, and environmental regulations. The SCVWD routinely acquires supplemental imported water to meet the county's needs from the water transfer market, water exchanges, and groundwater banking activities.

The SCVWD's Urban Water Management Plan (UWMP) recognizes that there are threats to water supply reliability which can affect its ability to meet the county's needs. In addition to maintaining a diverse water supply portfolio, infrastructure reliability is essential to providing adequate water supply. Thus, the SCVWD has invested in asset management, including rehabilitating more than 72 miles of raw and treated water pipelines and performing maintenance at its Pacheco and Coyote Pumping Plants. Similarly, the SCVWD believes that reliability of Delta supplies and infrastructure is an important part of maintaining its ability to meet future demands.

Total water usage in Santa Clara County is estimated to be 332.9 TAF in calendar year 2010. The most dramatic historic variations in usage were the drops during the droughts of 1976–1977, 1987-1992 and 2007–2009. Due to supply limitations, either voluntary or mandatory use reduction measures were enacted during these periods, resulting in decreased water use.

The SCVWD is a leader in water conservation with programs that are innovative and comprehensive in scope and it desires to maximize water use efficiency, water conservation and demand management opportunities. As one of the initial signatories to the CUWCC 1991 MOU Regarding Urban Water Conservation BMPs, the SCVWD is firmly committed to the implementation of BMPs and DMM.

Reducing water consumption during water shortages is generally achieved through behavioral changes. Water conservation programs and policies implemented since 1992 have been the largest influence in long-term, or permanent, demand reductions. This can be seen in the relative stability of demands since the late 1990s, even though population has increased significantly during the same period. The steep reduction in water use for the period between 2007 and 2010 was probably a result of the combined effects of a lingering economic recession, a wet spring in 2010, and success of the SCVWD's water conservation outreach and coordination efforts with cities, the retailers, and the media. The community exceeded the Board's conservation goal and reduced water use by 19 percent for the period from March 2009 through October 2010.

The SCVWD and its major water retailers enjoy a special cooperative partnership in the regional implementation of a variety of water conservation programs in an effort to permanently reduce water use in Santa Clara County. In addition to the five water agencies that participate under the umbrella of the SCVWD, eight agencies have independently signed the MOU. In 2008, the CUWCC updated the DMM/BMPs, organizing them into five categories rather than fourteen. Foundational DMM, which include Utility Operations and Education, are essential water conservation activities that all signatories to the MOU are required to implement. The other three DMM are the Programmatic DMM and include Residential; CII; and Landscape categories.

The SCVWD, through a unique cooperative partnership with its retailers, offers regional implementation of a variety of water conservation programs as an integral part of its water management efforts. Although the SCVWD is only responsible for implementation of the Foundational DMM, it continues to collaborate with its water retailers to implement various water conservation programs on a regional basis. By taking the lead on implementing many of the various DMM components, the SCVWD is assisting its water retailers in meeting their goals, including compliance with recent legislation calling for 20 percent reduction in per capita water use by 2020. The SCVWD's urban demand management measures are estimated to save more than 92 TAF per year by the year 2030, using 1992 as a base year. Combined with 6 TAF per year in savings from agriculture water conservation, the total of nearly 100 TAF per year by 2030 accounts for almost 20 percent of pre-savings demand and is a crucial water supply management program, now and into the future.

Although SCVWD's conservation program has been successful and continues to develop, demand management cannot compensate for unreliable Delta conveyance. On average, 40% of the Santa Clara County's water supply is conveyed through the Delta. With further implementation of demand management through 2035, these percentages will drop somewhat, but will still be significant. Delta deliveries will still make up more than 30% of the County's water supply on average. Because of this dependence on Delta supplies, demand management is not sufficient to off-set the risks associated with this unreliability.

1C.5 Conclusions

Our society is entering an age where the limits of both our natural and economic resources have been stretched thin. California is dealing with several critical resource management issues at the same time including energy supply and costs, air quality, water quality, and the overall water supply, not to mention the unknown future effects of climate change. It is imperative that solving these issues be done in an integrated manner.

Water conservation will continue to play an important part in addressing our state's water supply needs. As discussed above, additional reductions in net water use are both possible and essential for California and such reductions are planned and have been legislated. It is also important to note that more progress has been made in some areas compared with others so water use reductions cannot be expected to be uniformly achieved. Agricultural water use reductions are likely to arise from increases in the efficiency of irrigation (where less net water use provides a similar or greater level of service, e.g., "more crop per drop") combined with reductions in water use and service levels (e.g., from fallowing irrigated land). Additional reductions in urban areas by residents and businesses in coastal communities are also possible but much progress is planned and has already been made in these areas. It is clear that DMM will need to be part of a portfolio approach to water conservation that will not be achieved without significant expenditures.

Demand for water in the State continues to be much greater than available supplies if only because, many groundwater basins south of the Delta are in overdraft. Aggressive implementation of DMM could contribute towards reducing this imbalance, but the reductions from even the most aggressive conservation programs will not be enough to eliminate the water supply deficit. In addition to implementing the DMMs, meeting the water supply and environmental objectives of the BDCP will require the implementation of a wide range of environmental and water management programs. Water conservation is a critical element in the portfolio of programs, and the objectives of the BDCP will only be achieved through implementing a comprehensive water supply and environmental management plan, not solely through water conservation.

1C.6 References

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1C.7 Personal Communications

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