San Diego County Parks and Recreation
Water Conservation Plan

LPA

ARCHITECTURE PLANNING INTERIOR DESIGN LANDSCAPE ARCHITECTURE ENGINEERING GRAPHICS

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Executive Summary

The San Diego County Department of Parks and Recreation (DPR) is resolved to reduce water consumption across its 44,000 acres of service territory. The goals of this Water Conservation Plan are to decrease water consumption and costs, while preserving the environmental quality, cultural heritage and public services that DPR has been committed to since 1946. Although state of the art water conservation technologies and practices are described, an approach was taken to create a flexible and enduring document.

Water conservation methods are broken down into near, medium and long term categories in order to give a sense of what is feasible now and what may become more feasible into the future. Many of the water conservation efforts being conducted at the California State, San Diego County, water district and other public agency levels are described and can serve to provide guidance and coordination in meeting DPR goals. Evolving water use regulations are also described. A very practical component of the Water Conservation Plan evaluates technologies and practices, their associated water savings potential and manufacturers. It is important to note that due to the complexity of factors that influence the economics of water conservation measures, such as dynamic market conditions, including unpredictable but drastically increasing water costs, technological evolution and widely varying water agency rates and fee structures across the 43 such agencies existing within San Diego County, it was not attempted to calculate returns for specific investments. An implementation strategy is provided that prioritizes the water conservation measures that are cost effective and that can be rapidly put in place with relative ease.

In order for the strategies outlined in this plan to best meet their potential and provide ongoing benefits to DPR and the public, it is highly recommended that a Water Manager carry out the tasks of meeting DPR water reduction goals. This approach will not only establish DPR's dedication towards water efficiency, but also streamline and standardize the specifications, training, administration and maintenance of the Plan. In the case of San Diego Community College District, the hiring of a Water Manager led to an annual water cost savings of $296,000.

This Water Conservation Plan serves as a very important component in sustaining the core values of DPR, which are focused on providing opportunities for high quality experiences and to preserve regionally significant natural and cultural resources in a park and recreation system that is the pride of San Diego County.

1. Water Conservation Methods

1.1 Near Term Strategies

Near term strategies for water conservation are those that are deemed realistic within the timeframe of approximately one year.

1.1.1 Water Use Reduction

Education:

Before exploring the various means of reducing water use, it is useful to provide a broad scale background detailing the need for water conservation. These include rising demand, lack of supply-both due to increasing population and drought, increasing costs, increasing regulation and regional water politics. Education will raise awareness of issues surrounding water conservation and inspire support of the cause. Education may perhaps be the most cost-effective way to reduce water use. Here are some near term concepts that will help raise awareness of the need to conserve water:

- Provide necessary training to all new employees so that they are familiar with water conservation goals and strategies.
- Provide updates as in spring and fall, critical times when water issues are at peak times in year.
- Create water conservation videos, showing water conservation strategies and case studies. If possible, visit actual projects that demonstrate goal/objective.
- Provide staff with water conservation survey to gauge understanding of water conservation methods and to solicit ideas for water conservation strategies.
- Train operations and maintenance staff in water conservation methods and awareness. Provide updates on a yearly basis.
- Educate the public though water conservation features in building design, such as visible water supply and waste lines at the building.

- Provide background on San Diego County water supply and the challenges facing securing future supply (For example, see Figure 1).

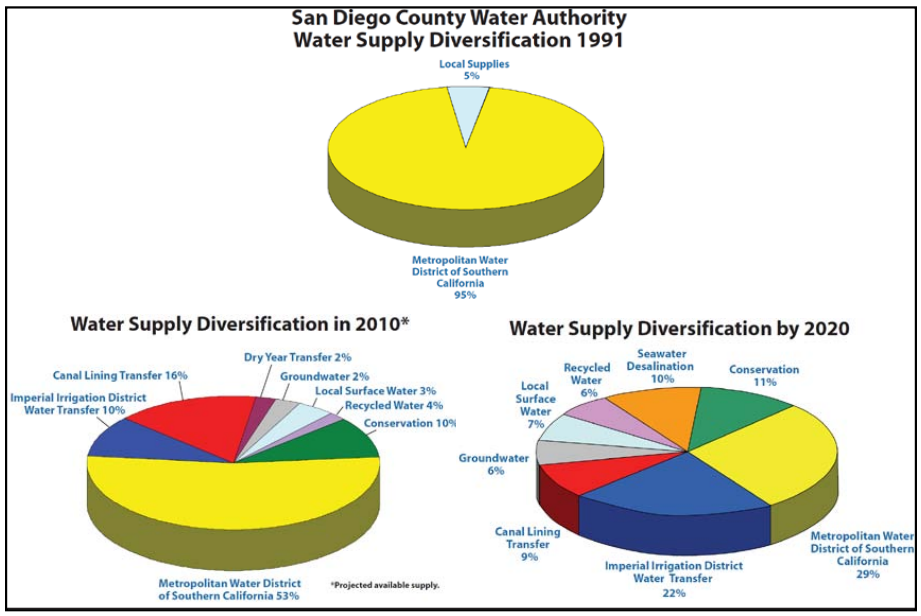


FIGURE 1. SAN DIEGO WATER AUTHORITY REGIONAL WATER SUPPLY SOURCES FOR 1991 AND PROJECTED FOR 2010 AND 2020.

- Provide education related to the cost of securing future supply and how this will impact water costs (For example, see Figure 2).

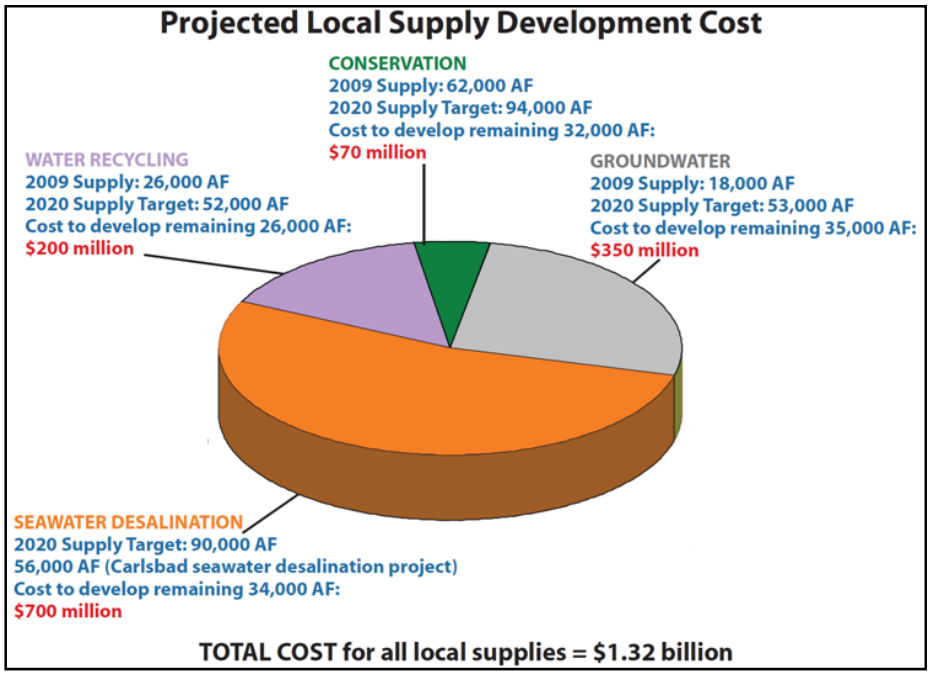


FIGURE 2. PROJECTED COSTS FOR DEVELOPMENT OF NEW SUPPLY FOR SAN DIEGO WATER AUTHORITY.

- Emphasize that water conservation is by far the most cost effective way to secure new supply (For example, see Figure 3).

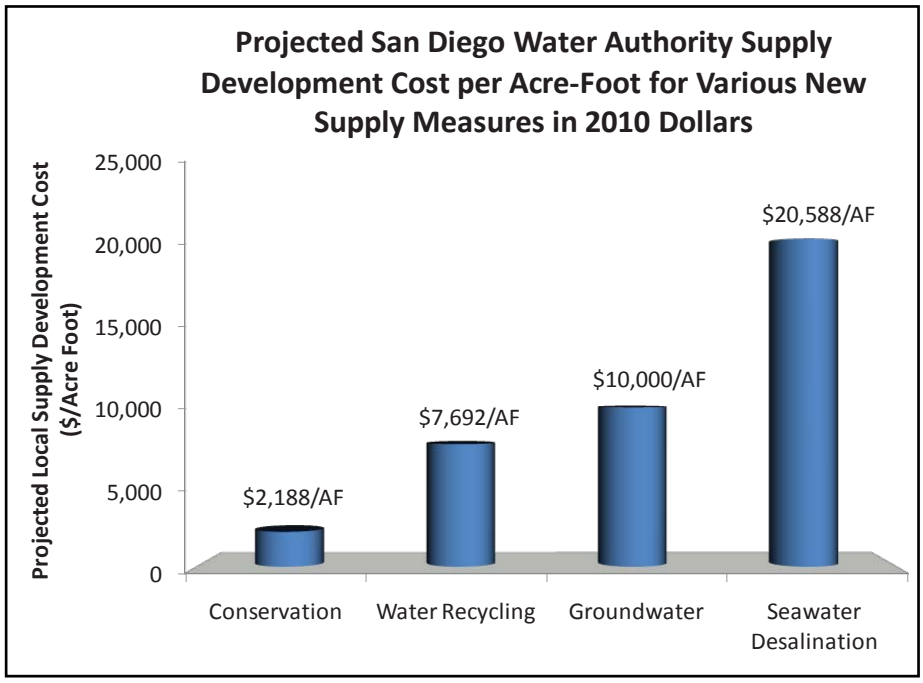


FIGURE 3. PROJECTED DEVELOPMENT COST FOR NEW SAN DIEGO WATER AUTHORITY SUPPLY MEASURES.

- Emphasize that water conservation efforts in San Diego County have been very successful, essentially holding water use constant while population and the economy have grown. Future success will depend on continued diligence (For example, see Figure 4).

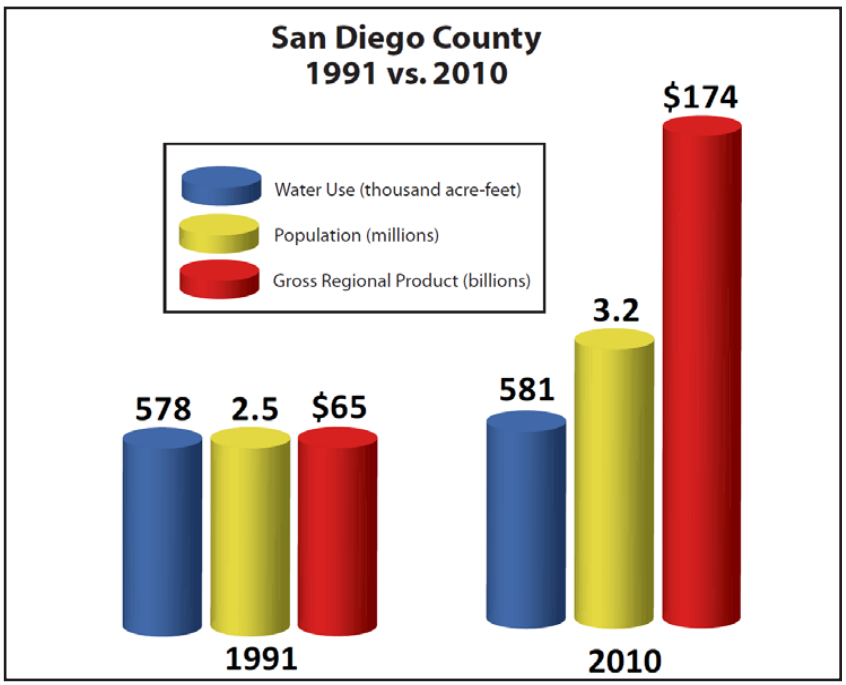


FIGURE 4. CHANGE IN SAN DIEGO WATER AUTHORITY WATER USE, POPULATION AND ECONOMIC OUTPUT FOR SAN DIEGO COUNTY FOR 1991 AND 2010.

- Describe current Southern California water supply constraints (For example, see Figure 5).

FIGURE 5. MUNICIPAL WATER DISTRICT OF SOUTHERN CALIFORNIA ANNOUNCEMENT THAT WATER SUPPLY HAS REACHED CRITICALLY LOW LEVELS.

- Describe current cost trends for water supplies (For example, see Figure 6).

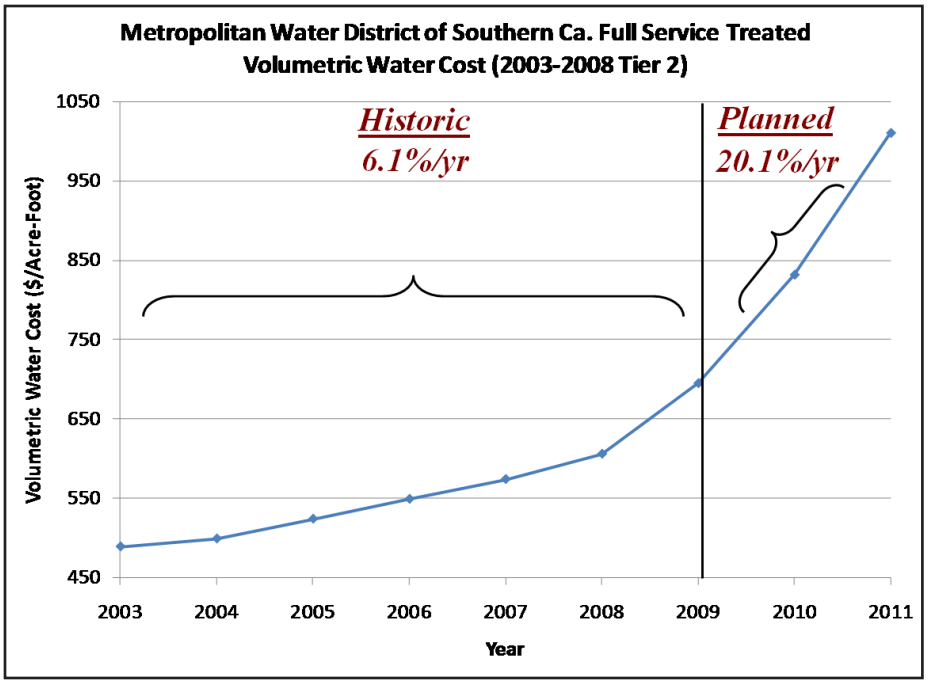


FIGURE 6. HISTORIC AND PROJECTED COST TRENDS FOR WATER SUPPLIED BY THE MUNICIPAL WATER DISTRICT OF SOUTHERN CALIFORNIA.

- Describe current politics and risks to San Diego water supplies (For example, see Figure 7).

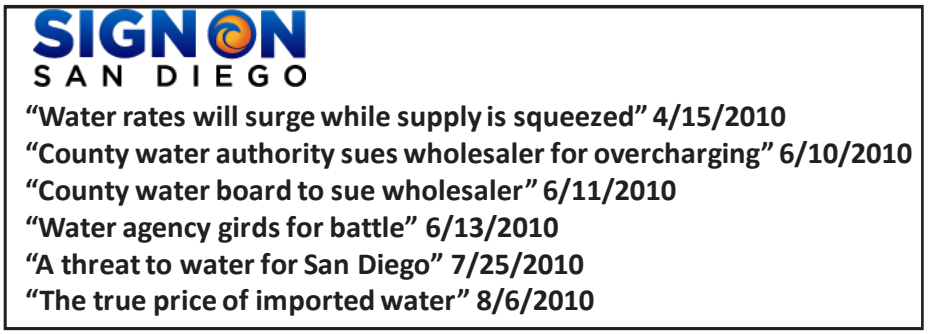


FIGURE 7. PRESS COVERAGE OF SAN DIEGO WATER AUTHORITY'S DECISION TO SUE THE MUNICIPAL WATER DISTRICT OF SOUTHERN CALIFORNIA OVER WATER RATES.

Policy Approaches:

An organized DPR policy structure that outlines goals and processes, as well as provides incentives is necessary for a successful water conservation plan. Here are some near term policy related concepts that will help reduce water use.

- Employ a water manager to spearhead water conservation policy, educate staff, perform audits, monitor use, compile reports, interact with water jurisdictions, research and apply for grants, monitor alerts and relay issues to field staff, and meet budget goals. Manager must have water efficiency credentials. For example, Certified Landscape Irrigation Auditor and central control certifications (For example, see Figure 8).
- Adopt a water master plan policy to gain a uniform understanding of water conservation goals and processes within DPR.
- Use the California Department of Water Resources "20% by 2020" water conservation policy or other policy documents as a guide.
- Conduct site water audits to determine and reduce sources of waste and make necessary adjustments to system. Establish a water audit schedule, for example an audit every five years.
- Enact recommendations for basic system repairs as directed in the water audit reports.
- Prioritize the County park projects to determine the best candidates to implement changes to the landscape and irrigation.

FIGURE 8. EXAMPLE OF AN AUDIT OF EXISTING WATER USE TO DETERMINE WHERE AND HOW CONSERVATION EFFORTS WILL HAVE AN IMPACT.

- Mandate Best Management Practices for landscape irrigation include, but are not limited to:
- Check system for leaks and over all optimal working on a monthly basis.
- Check controller valve operational timing as it relates to seasons, if "smart controller" is not utilized.
- Provide "quick reference" irrigation information as it relates to specific irrigation equipment. This gives contractors an incentive to achieve goals as prescribed by the owner.
- Provide and/or host in-house seminars on drought tolerant plants and the maintenance of such plant types.
- If maintenance is outsourced, employ contractors that have water efficiency credentials. For example, a Certified Landscape Irrigation Auditor on staff.
- Provide or suggest outside training programs for landscape and building maintenance employees on water use efficiency, system maintenance, and improvements (For example, see Figure 9).

FIGURE 9. EXAMPLE OF A TRAINING WORKSHOP RELATED TO WATER CONSERVATION.

- Provide training programs for new employees and update training programs for all maintenance personnel on a yearly basis.
- Host in-house seminars on water conservation, which include presentations by outside water experts as well as DPR staff.
- Base outsourced maintenance contract renewal on performance or include penalty charges in contract if water budget goals are not met.
- Enact water budgeting to meet conservation goals and avoid higher cost water rates, applicable in tiered rate systems.
- Establish water efficiency guidelines for all new landscape and irrigation designs to insure that appropriate plant materials and efficient irrigation systems are selected.
- Seek employee suggestions on water use efficiency; locate suggestion boxes in prominent areas.
- Provide incentives to staff for meeting water savings goals.
- Provide a forum for stakeholder advice on refinement and implementation of water conservation measures.
- Establish water use and cost baselines to allow quantification of future reductions.
- Mandate uniform data collection to ensure a consistent approach towards measurements and verification.

Equipment, Material Selection and Best Practices:

Specifying efficient equipment for new and retrofit projects as well as appropriate material selection and practices that will play a major role in reducing water use. Here are some concepts that will help integrate efficient equipment and material selections:

- Determine the quantity and purpose of water being used.
- Maintain existing equipment in good operating condition.
- Annually aerate soil for better water absorption and to minimize run-off.
- Minimize runoff in all irrigation systems by adjustment of nozzles, throw patterns, pressure, etc., (For example, see Figure 10).

FIGURE 10. EXAMPLE OF IRRIGATION RUNOFF THAT SHOULD BE MINIMIZED.

- Develop a specific plant palette for new projects and renovations that are appropriate for a given geographical region of the County.

- Use drought tolerant or native plant species that require little or no irrigation once established (For example, see Figure 11).

FIGURE 11. EXAMPLE OF A WATER EFFICIENT LANDSCAPE DESIGN USING DROUGHT TOLERANT SPECIES.

- Keep sprinkler heads vertical and at the correct height for good coverage and keep the spray pattern uniform.
- Specify landscape designs that minimize run-off. For example landscapes that allow for the use of drip or bubbler irrigation versus overhead spray systems specify in line check valves on risks for certain head sprays.
- Minimize turf in all new park projects.
- Use synthetic turf for new sports fields.
- Use ornamental grade synthetic turf for passive turf areas (For example, see Figure 12).

FIGURE 12. EXAMPLE OF A SYNTHETIC TURF APPLICATION TO REDUCE WATER USAGE AND MAINTENANCE COSTS.

- Embrace new application and control technologies and educate maintenance staff on their proper maintenance.
- If necessary, use multiple stop/start irrigation settings to allow sufficient soak-in time.
- Instruct clean-up crews to use less water where appropriate. For example, sweep materials from floor instead of washing down whenever possible. Discontinue using water to clean sidewalks, tennis courts, pool decks, driveways, and parking lots.
- If water is used in exterior building cleaning applications use high pressure nozzles to minimize flow.
- Adopt LEED, Cal Green code, CHPS and AB 1881 water reduction strategies for guidance in new landscape, irrigation and plumbing design.

- Require weather based or central control irrigation systems for all new projects. Establish a control system standard for all County projects (For example, see Figure 13).

FIGURE 13. EXAMPLE OF A WEATHER BASED IRRIGATION CONTROLLER, WHICH CAN BE USED TO MODIFY WATERING SCHEDULES RELATIVE TO SEASONS AND RAINFALL.

- Require the use of flow sensors in all new systems for leak detection, better water use management and to meet water budget goals.
- Develop a schematic of all water entry points. Know where your faucets, time clocks, solenoids, booster pumps, sprinklers and bubblers are located. Determine specific use for each entry source.
- Adjust water flows to reduce discharge.
- Accelerate replacement of inefficient showerheads, toilets and urinals.
- Accelerate adoption of proven water saving technologies in new buildings.
- Use lower cost municipal recycled/reclaimed water for toilet flushing.
- Limit water features in or around buildings.
- Replace inefficient fixtures upon renovation of facilities.
- Use covers for swimming pool to reduce evaporative losses as well as energy losses.
- Reuse of water used to cool synthetic turf.

- Post signage on fixtures demonstrating water conservation and asking users to save water resources (For example, see Figure 14).

FIGURE 14. EXAMPLE OF RECLAIMED WATER USE AND SIGNAGE INDICATING ITS USE.

- Use of low flow fixtures for toilets.

- Use of low or no flow fixtures for urinals (For example, see Figure 15).

FIGURE 15. EXAMPLE OF WATERLESS OR LOW FLOW URINALS THAT CAN BE USED TO REDUCE POTABLE WATER CONSUMPTION IN BUILDINGS.

- Use of low flow faucets or aerators.

1.1.2 Reuse of Metered Water (Gray Water Use)

Gray Water Use:

Gray water is the reuse of metered water. For instance, water from showers can be reused to irrigate landscape or for flushing toilets. Santa Barbara was the first County in California to legalize the use of gray water.

In July of 2008, California introduced Senate Bill 1258 to direct the Department of Housing and Community Development (HCD) in developing a more wide-ranging set of standards for residential gray water systems for both indoor and outdoor uses. After extensive debate on the science, these new standards were adopted as code by the California Building Standards Commission (BSC) on July 30, 2009. This rulemaking modifies the California Plumbing Code, Title 24, Part 5, Chapter 16A, Part I. Authority over non-residential gray water systems is under California Department of Water Resources (DWR) jurisdiction. On January 1, 2011, the new HCD code will take effect for residential, and the DWR code for commercial gray water use.

Since gray water use will be regulated at the California State level, it is anticipated that San Diego County and its water agencies will adopt this new code.

Here are some near term gray water strategies that may be employed by DPR.

- Capture and use of gray water from sinks, showers or other sources (For example, see Figure 16).

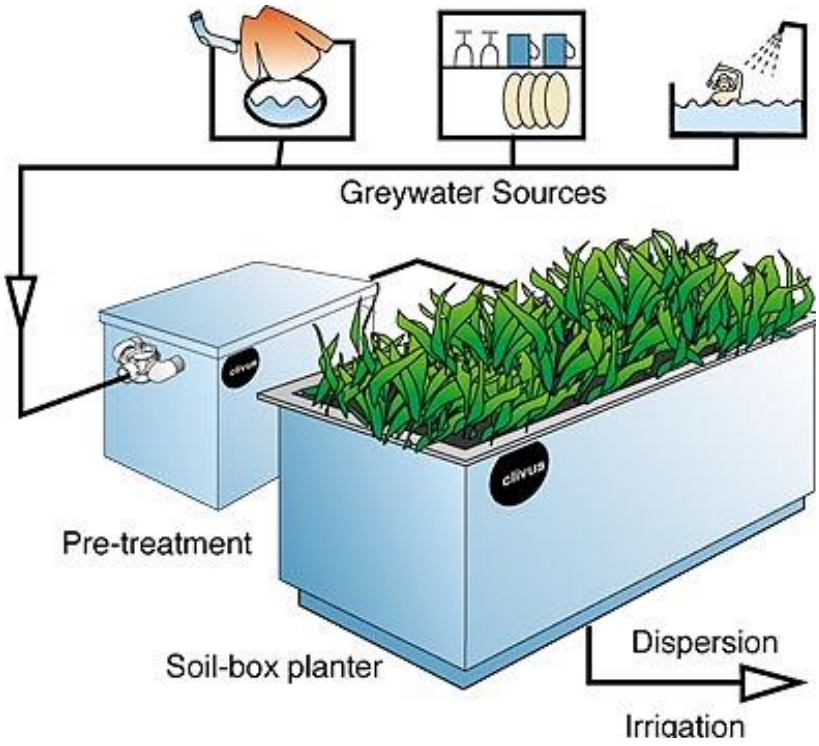


FIGURE 16. EXAMPLE OF A GRAY WATER SYSTEM THAT COULD BE USED TO OFFSET IRRIGATION WATER REQUIREMENTS.

1.1.3 Alternative Sources (Recycled Water)

Recycled water use in San Diego County:

Recycled water use in California typically refers to the reclamation of water from a waste water treatment facility. Hence, it is often referred to as recycled/reclaimed water.

There are very stringent water quality laws that apply to recycled water. The State Department of Health Services standards for recycled water are referred to as "Title 22." These standards are incorporated in Title 22, Chapter 3, Division 4 of the California Code of Regulations, with stipulations applying to various types of reuse and levels of required treatment. The San Diego Regional Water Quality Control Board is involved with respect to the use and application of recycled water and any associated runoff. Title 22 allows for many uses of recycle water. In San Diego, the uses for recycled water include irrigation of food crops, parks, playgrounds, school yards, residential landscaping, cemeteries, freeway landscaping, golf courses, ornamental nurseries, pasture for animals, orchards, and vineyards. In addition, recycled water can be used for fishing or boating recreational impoundments, fish hatcheries, cooling towers and decorative fountains. Other allowable uses include flushing toilets and urinals, industrial process water, commercial laundries, making artificial snow, soil compaction, mixing concrete and flushing sanitary sewers.

Recycled/reclaimed water may not be subject to the water restrictions that apply to potable water use during drought. This will provide a more secure supply for irrigation.

Here are some near term recycled water strategies that may be employed by DPR.

- Increase the use of non-traditional sources of water, including recycled, reclaimed and on-site well water where available.
- Sites adjacent to DPR facilities may also provide opportunities for well water use as underground water sources can be highly localized (For example, see Figure 17).

1.1.4 Storm Water Detention and Retention

New storm water regulation as part of the California Water Code went into effect on July 1, 2010. Under this regulation, construction projects that disturb one or more acres of soil are required to obtain a permit for storm water discharge.

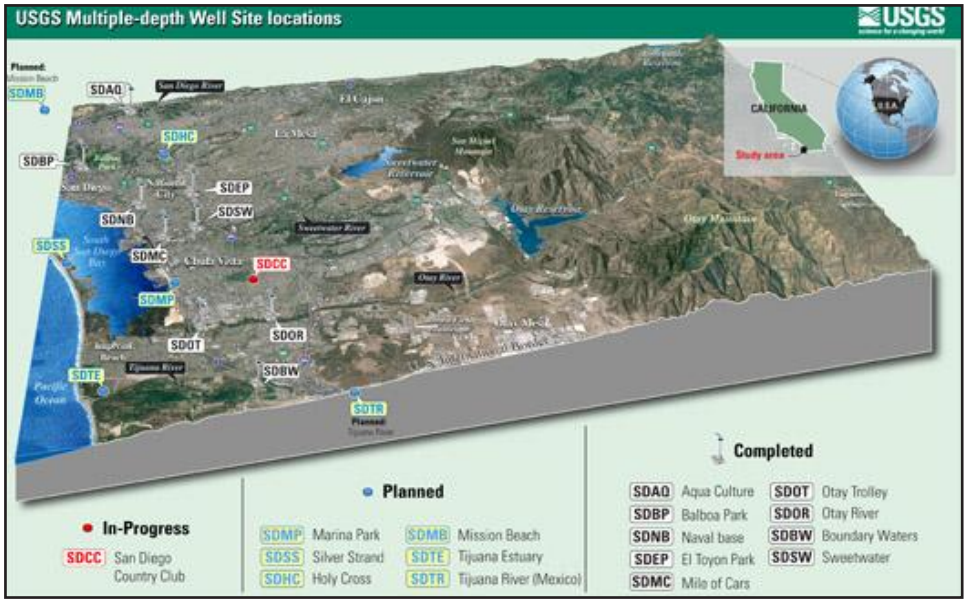


FIGURE 17. MAP OF WELL WATER SITES THAT MAY BE USED FOR IRRIGATION PURPOSES.

The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP should contain a site map(s) which shows the construction site perimeter, existing and proposed buildings, lots, roadways, storm water collection and discharge points, general topography both before and after construction, and drainage patterns across the project. The SWPPP must list the Best Management Practices (BMPs) that the discharger will use to protect storm water runoff and the placement of those BMPs. Additionally, the SWPPP must contain a visual monitoring program; a chemical monitoring program for "non-visible" pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment.

Here are some near term storm water strategies that may be employed by DPR.

- Comply with the California Water Code's Storm Water Pollution Prevention Plan for all new construction.
- Develop a Storm water Management Plan (SWMP? or Water Pollution Control Plan (WPCP) for long term operational discharge and control of storm water .

1.2 Medium Term Strategies

Medium term strategies for water conservation are those that are deemed realistic within the timeframe of approximately two years.

1.2.1 Water Use Reduction

- Provide irrigation design so that high water user areas such as turf and low water use area have separate valves.
- Design dual watering systems with sprinklers for turf and low-volume irrigation for flowers, trees, and shrubs.
  - The best application methods for turf will most likely be high efficiency spray heads (Toro Precision Sprays); multiple stream rotors (Hunter MP Rotator, Toro and Rain Bird versions as well) and high efficiency single stream rotors (Hunter, Toro and Rain Bird). Subsurface drip systems might also be considered, but the costs are considerably higher than overhead spray. Subsurface drip products include KISSS, Toro DL 2000, Netafim and Rain Bird SDI tubing which are all suitable for burial.
  - Install irrigation water meters for any parks that operate on shared water meters to reduce associated sewage charges.
- Modify irrigation application methods. For example:
  - Replace spray heads with MP rotators or other high efficiency heads (For example, see Figure 18).

FIGURE 18. EXAMPLE OF A MP ROTATOR HEAD USED TO MINIMIZE IRRIGATION RUNOFF.

  - Replace old style, inefficient rotor heads with new efficient heads.
  - Replace overhead spray systems with drip tubing systems (For example, see 19).
  - Depending on the budget for conversion, the conversion of shrub and ground cover areas may actually include the use of the same technology as the turf areas. This conversion would be less expensive than a new drip system as the valves and lateral lines could be reused in many applications.

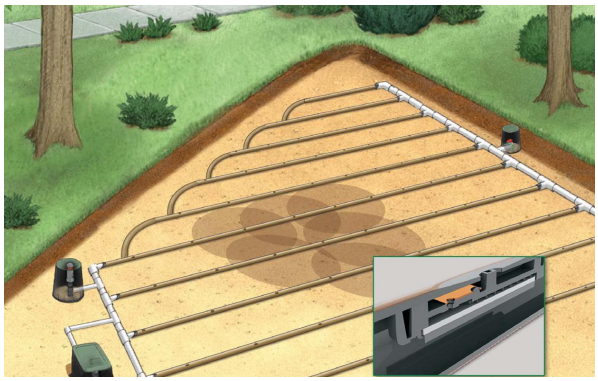


FIGURE 19. EXAMPLE OF A DRIP TUBING SYSTEM THAT MAY BE USED TO REPLACE AN OVERHEAD SPRAY SYSTEM.

  - Shrub areas can also benefit from drip and bubbler solutions.
  - Replace overhead spray systems with bubbler systems.
  - Bubblers and conventional drip emitters are best used where there is little or no ground cover plantings. These types of application methods apply water directly to the plant materials. Closely spaced or continuous coverage ground cover cannot effectively be irrigated with these products. For shrub areas with ground covers, a subsurface, or mulch covered, drip tubing system is recommended.
- Install flow sensors on existing systems for leak detection and better water use management to meet water budget goals.
- Replace existing controllers with weather based or central control units to allow controller to modify system as seasons/climate changes.
- Replace existing turf and high water use plantings with low water use plantings at selected projects. Selected projects shall be those where it is the most expedient to do so and that will generate the highest water conservation benefit. Plant palette selection should be based on regional San Diego County requirements as well as micro climates, exposure, soil types and specific use criteria.
- Use landscape mulch or landscape fabric to minimize evaporation. Drip irrigation in conjunction with mulch is optimum when drought tolerant plant palette is used.
- Use canopies and shading elements to reduce heat gain and minimize evapo-transporation.
- Improve soils to absorb and retain more water.
- Reduce irrigated landscape by mixing with non-irrigated components.
- Replace irrigated landscapes with rock gardens or other non-irrigated components.
- Use incentives from San Diego Water Authority's "Smart Landscape Program" to upgrade irrigation hardware to be more efficient (see Section 3 for details on specific incentives as they relate to various water agencies).

- Apply for incentives at utility, state and federal levels to assist in other water conservation efforts (For example, see Figure 20).

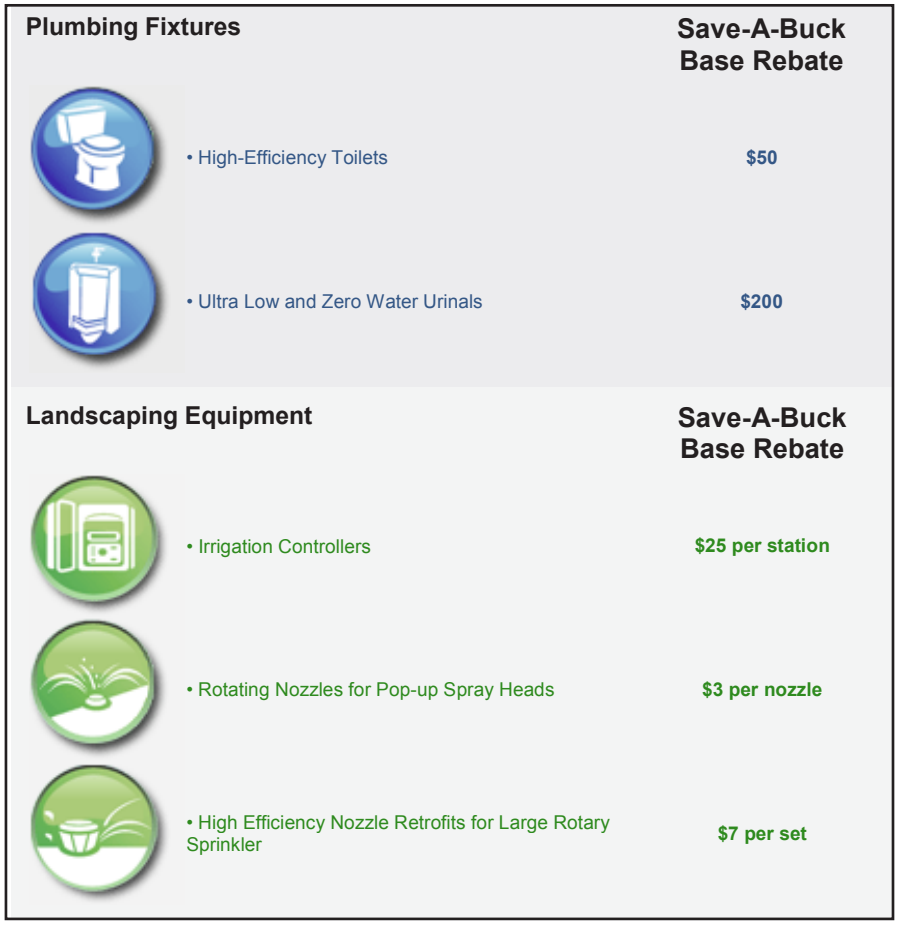


FIGURE 20. INCENTIVES AVAILABLE FOR WATER CONSERVATION AVAILABLE THROUGH THE "SAVE A BUCK" PROGRAM.

- For new design specify separate potable, irrigation and fire water meters.
- Use high efficiency dishwashers in food service applications.
- Use high efficiency washing machines in laundry facilities.
- Encourage the research and development of landscape conservation practices and methods.

1.2.2 Reuse of Metered Water (Gray Water Use)

- Use gray water from sinks or showers for toilet flushing.

1.2.3 Alternative Sources (Recycled Water)

- Use of raw water from irrigation canals, etc.
- Capture and use of condensate from package air conditioning units.

1.2.4 Storm Water Detention and Retention

- Divert site drainage to landscape areas.
- Use green roofs. This retains storm water, while promoting evapo-transportation that also offers energy savings. (For example, see Figure 21).

FIGURE 21. EXAMPLE OF A GREEN ROOF WITH DROUGHT TOLERANT SPECIES.

- Use vegetated bio-retention area and bio-swales in open areas where feasible.
- Reduce impervious surface and use permeable pavement in various hardscape applications.
- Use ground water recharge with low impact development.
- Use detention and retention ponds for irrigation purposes.
- Set standards for storm water low impact design.
- Divert roof drainage into landscape areas.

1.3 Long Term Strategies

Long term strategies for water conservation are those that are deemed realistic within the timeframe of greater than two years.

1.3.1 Water Use Reduction

- Conduct extensive landscape renovation on projects sites to replace high water use shrubs, ground covers and turf with low water use plantings.
- Conduct extensive landscape renovation on project sites to replace irrigated landscapes with non-irrigated landscapes.
- Conduct extensive irrigation system renovation to replace old systems with modern, efficient irrigation systems.
- For sites on a single master meter consider use of separate water meters for potable and irrigation water to avoid sewer fees that should only apply to potable water use. This will also allow more specific quantification of irrigation and potable flows.
- Commission new and renovated systems to ensure that they are providing the savings benefit expected.
- Consider use of composting toilets.

1.3.2 Reuse of Metered Water (Gray Water Use)

- Use interagency sources of water such as waste water treatment plants, public pools, etc.
- Use of gray water from municipal sources for toilet flushing.

1.3.3 Alternative Sources (Recycled Water)

- Rain water capture and storage (For example, see Figure 22).
- Roof drainage capture. Avoid asphalt or lead laced roofs in these applications.

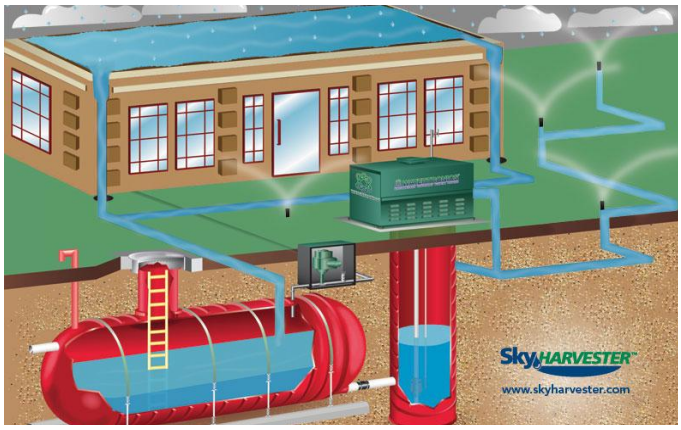


FIGURE 22. EXAMPLE OF RAINWATER HARVESTING FOR IRRIGATION USE.

- Combined power and water production using fuel cells.
- Develop dedicated reservoirs for DPR use.
- Use alternative sources, such as well water, in exterior site cleaning applications.
- Use alternative sources, such as well water or recycled/ reclaimed water, for toilet flushing.

1.3.4 Storm Water Detention and Retention

- Develop a master plan to see if there are any low impact designs that could reduce the use of water.

2. Water Conservation Programs, Codes and Regulations

This section outlines water conservation strategies that are either part of new water use regulations, such as the California "Model Water Efficient Landscape Ordinance," also known as AB 1881, or best practice programs, such as the California State's "20% by 2020" water conservation plan, the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program, the California Green Building Code (Cal Green) and the California High Performance Schools (CHPS) program. These descriptions will help to outline new regulatory realities and some of the suggested strategies for meeting them.

2.1 California State Assembly Bill 1881 (AB 1881)

The California "Model Water Efficient Landscape Ordinance," also known as AB 1881 will regulate landscape design for new facilities. Ultimately, Counties and Cities will either have to adopt and enforce AB 1881 regulations or create a similar protocol that meets or exceeds AB 1881. The following link provides information related to individual City and County compliance with AB 1881:

ftp://ftp.water.ca.gov/Model-Water-Efficient-Landscape-Ordinance/Local-Ordinances/

Cities and Counties have taken different approaches to meeting AB 1881 requirements and therefore DPR facilities will be subjected to varying regulations. Below is a list of the table of contents for AB 1881. Much greater detail can be found in the original document:

http://www.water.ca.gov/wateruseefficiency/landscapeordinance/

Provisions for New Construction or Rehabilitated Landscapes

- Compliance with Landscape Documentation Package
- Penalties
- Elements of the Landscape Documentation Package
- Water Efficient Landscape Worksheet
- Soil Management Report
- Landscape Design Plan
- Irrigation Design Plan
- Grading Design Plan
- Certificate of Completion
- Irrigation Scheduling
- Landscape and Irrigation Maintenance Schedule
- Irrigation Audit, Irrigation Survey, and Irrigation Water Use Analysis
- Irrigation Efficiency
- Recycled Water
- Stormwater Management
- Public Education
- Environmental Review

Provisions for Existing Landscapes

- Irrigation Audit, Irrigation Survey, and Irrigation Water Use Analysis
- Water Waste Prevention

Effective Precipitation

2.2 California State "20% by 2020" Program

The State of California released the 20% by 2020 water conservation plan in February 2010. The goal is to achieve a 20 percent reduction in per capita water use statewide by 2020. Recommendations from the 20% by 2020 plan are given below:

1. Establish a foundation for a statewide Conservation Strategy.
   a. Establish targets and goals in statute.
   b. Establish a state agency leadership and coordination framework.
   c. Provide a forum for stakeholder advice on refinement and implementation.
   d. Mandate uniform data collection and establish a statewide database.
   e. Maintain existing programs and institutions.

2. Reduce landscape irrigation demand.
   a. Require water-efficient landscapes at state-owned properties.
   b. Support the implementation and enforcement of landscape design and irrigation programs and the development of new landscape programs.
   c. Mandate the landscape irrigation Best Management Practices (BMP).

3. Reduce water waste.
   a. Accelerate installation of water meters.
   b. Establish a state standard for water meter accuracy.
   c. Revise the water loss BMP to incorporate improved methodologies and accelerate coverage goals.

4. Reinforce efficiency codes and related BMPs.
   a. Obtain authorization for state standards for high efficiency clothes washers.
   b. Support landscape irrigation equipment standards.
   c. Accelerate replacement of inefficient showerheads, toilets and urinals.
   d. Accelerate adoption of proven water saving technologies in new businesses.

5. Provide financial incentives.
   a. Encourage or mandate conservation water pricing.
   b. Provide grants, loans, and rebates to wholesale and retail water suppliers and customers.
   c. Establish a public goods charge for water.
   d. Fund the installation of water meters.

6. Implement a statewide conservation public information and outreach campaign.

7. Provide new or exercise existing enforcement mechanisms to facilitate water conservation.
   a. Require implementation of water conservation as a condition to receive state financial assistance.
   b. Take enforcement actions to prevent waste and unreasonable use of water.
   c. Provide additional enforcement tools for water suppliers.

8. Investigate potential flexible implementation measures.
   a. Investigate requiring conservation offsets for water demand generated by new development.
   b. Investigate establishment of a cap-and-trade regime.

9. Increase the use of recycled water and non-traditional sources of water.

2.3 Leadership in Energy and Environmental Design (LEED)

The U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program provides best practice guidelines for reducing water use in and around buildings. Below are water efficiency and stormwater control criteria for LEED credits.

Water Efficiency

- Prerequisite 1 — Water Use Reduction—20% Reduction
- Credit 1 — Water Efficient Landscaping
  - **Reduce by 50%**
  - **No Potable Water Use or Irrigation**
- Credit 2 — Innovative Wastewater Technologies
- Credit 3 — Water Use Reduction
  - Reduce by 30%
  - Reduce by 35%
  - Reduce by 40%

Below are sustainable site criteria for LEED.

Sustainable Sites

- Credit 6.1 — Stormwater Design—Quantity Control
- Credit 6.2 — Stormwater Design—Quality Control

2.4 California Green Building Code (Cal Green)

This new component of the California Building Code will take effect on January 1, 2011 and will evolve over time to incorporate best practices associated with water conservation. Below are water efficiency and stormwater control criteria for Cal Green code requirements.

Water Efficiency

- Indoor Water Use - 20% Reduction

- Outdoor Water Use - Potable Water Reduction
- Outdoor Water Use - Potable Elimination
- Outdoor Water Use - Greywater Irrigation System

- Indoor Water Use - 30% Reduction - Tier 1
- Indoor Water Use - 35% Reduction - Tier 2
- Indoor Water Use - 40% Reduction - Tier 2

Sustainable Sites

- Storm Water Pollution Prevention Plan
- Storm Water Rate & Quantity
- Storm Water Runoff Quality

2.5 California High Performance Schools (CHPS)

The California High Performance Schools (CHPS) program provides best practice water conservation strategies for K-12 schools. Below are water efficiency and stormwater control criteria for CHPS credits.

Water Efficiency

• Outdoor Systems	Create Water Use Budget
	Reduce Potable Water for Non-Recreational Area Landscaping
	Reduce Potable Water for Recreational Area Landscaping
	Irrigation system Testing and Training
• Indoor Systems	Reduce Indoor Potable Water Use
	Sewage Conveyance from Toilets and Urinals
• Water Efficiency	Water Management System

Below are sustainable site criteria for CHPS.

Sustainable Sites

• Storm Water Management	Construction Site Runoff Control
	Limit Storm Water Runoff
	Treat Storm Water Runoff

3. Water Conservation Strategies Utilized by Other Agencies

This section focuses on water conservation efforts that other agencies have undertaken. First, efforts by water agencies that serve or operate within San Diego County are described. These include the Municipal Water District of Southern California, San Diego Water Authority and the many local water agencies that serve within the County. Next, water conservation efforts at the San Diego County and City level are described. This is followed by descriptions of actions taken by other Parks and Recreation Departments within Southern California. Finally, descriptions of water conservation efforts that are being implemented in the field by the sustainable design firm LPA Inc. are described. These field applications span facilities for a variety of public entities within Southern California.

3.1 California Water Agencies

3.1.1 Municipal Water District of Southern California

The Municipal Water District of Southern California (MWD) was established in 1928 to provide water to Los Angeles, Orange, San Diego, Riverside, San Bernardino and Ventura counties. MWD water is primarily sourced from the Colorado River and Northern California. According to the San Diego Water Authority (SDWA), 53% of their water was projected to come from MWD in 2010 (Figure 1). SDWA provides water to 24 member agencies in San Diego County. Water delivery from MWD has been strained recently due to drought affecting the Colorado River supply and pumping restrictions in Northern California due to various endangered fish species in the Sacramento Delta. Currently, MWD water reserves are down by 50%. This lack of reserves can be seen in the Diamond Valley Lake Reservoir's drop in water level between 2003 and 2010 (Figure 23). This is Southern California's largest reservoir.

FIGURE 23. DIAMOND VALLEY LAKE RESERVOIR WATER LEVELS IN 2003 AND 2010.

The Lake Mead Reservoir on the Colorado River has experienced a water level drop of approximately 100 feet from 2001 to 2009 and is currently at 39% of capacity (Figure 24).

FIGURE 24. LAKE MEAD RESERVOIR WATER LEVELS IN 2001 AND 2009.

Conservation Efforts

The MWD has embarked on a multifaceted approach to maintaining sufficient supply. Some of the key results of these efforts include:

- Conservation: $205 million spent, resulting in a savings of 977,000 acre feet.
- Water Recycling: $173 million spent, resulting in a savings of 912,000 acre feet.
- Groundwater Recovery: $71 million spent, resulting in a savings of 381,000 acre feet.

"Be Water Wise" is a MWD administered water conservation effort aimed at providing the public with water conservation tips, education and incentives. More information on this program can be found here:

http://www.bewaterwise.com/tips01.html

"Save Water, Save a Buck" is MWD's main incentive program. These incentives are also listed on SDWA and member agency websites. This is the main incentive program for water conservation in San Diego County. However, some San Diego County water agencies have additional incentives. More information on this program can be found here:

http://www.mwdsaveabuck.com/download-documents.php

3.1.2 San Diego Water Authority

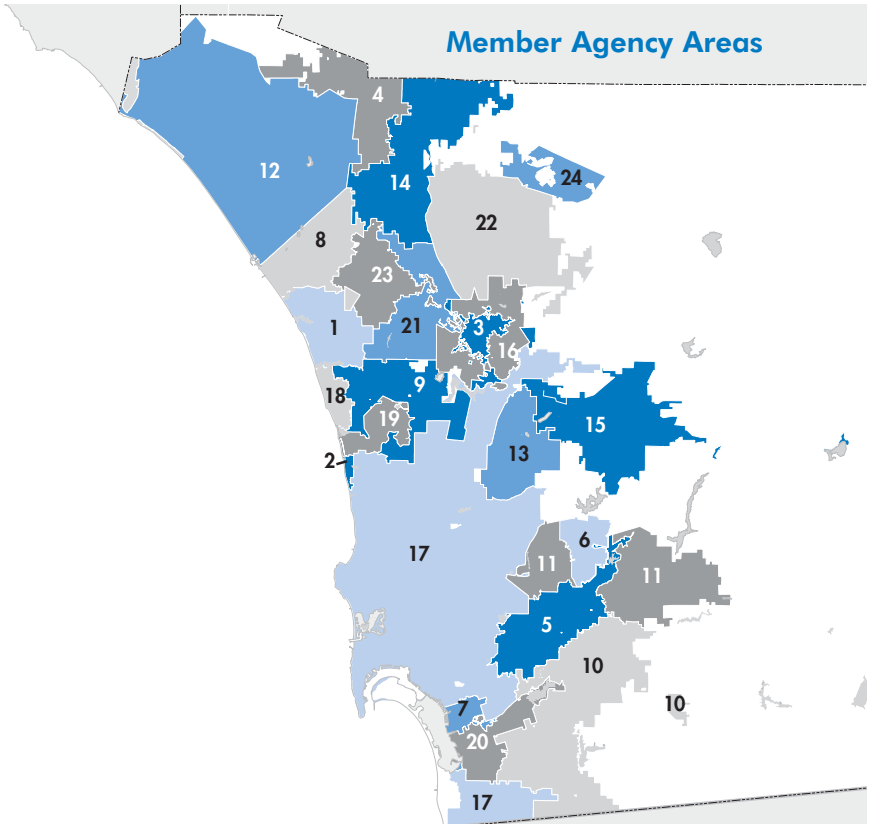
The San Diego Water Authority (SDWA) is a water wholesaler that supplies water to 24 member agencies in the San Diego region (see Figure 25). The Water Authority was formed in 1944 by the California State Legislature, and operates under the County Water Authority Act, part of the California State Water Code. The Water Authority is one member of the Metropolitan Water District of Southern California (MWD). In the SDWA's 60-year history, it has come to supply up to 90% of San Diego County's water.

There are 19 additional water agencies not served by the SDWA. In total there are 43 water agencies within San Diego County (see Figure 26). DPR facilities may or may not be served by SDWA affiliated agencies.

Water Authority Member Agencies

San Diego County Water Authority

CONTACT YOUR LOCAL WATER AGENCY FOR INFORMATION ON RESTRICTIONS, RATES



1 Carlsbad Municipal Water District
www.carlsbadca.gov/water
Ph: 760-438-2722

2 City of Del Mar
www.delmar.ca.us
Ph: 858-755-3294

3 City of Escondido
www.ci.escondido.ca.us
Ph: 760-839-4658

4 Fallbrook Public Utility District
www.fpud.com
Ph: 760-728-1125

5 Helix Water District
www.hwd.com
Ph: 619-466-0585

6 Lakeside Water District
www.lakesidewaterdistrict.com
Ph: 619-443-3805

7 City of National City*
www.sweetwater.org
Ph: 619-420-1413

8 City of Oceanside
www.ci.oceanside.ca.us
Ph: 760-435-5800

9 Olivenhain Municipal Water District
www.olivenhain.com
Ph: 760-753-6466

10 Otay Water District
http://www.otaywater.gov
Ph: 619-670-2222

11 Padre Dam Municipal Water District
www.padredam.org
Ph: 619 448-3111

12 Camp Pendleton Marine Corps Base
www.cpp.usmc.mil
Ph: 760-725-0602

13 City of Poway
www.poway.org
Ph: 858-668-1215

14 Rainbow Municipal Water District
www.rainbowmwd.com
Ph: 760-728-1178

15 Ramona Municipal Water District
www.rmwd.org
Ph: 760-789-1330

16 Rincon del Diablo Municipal Water District
www.rinconwater.org
Ph: 760-745-5522

17 City of San Diego
www.sandiego.gov/water
Ph: 619-515-3500

18 San Dieguito Water District
www.ci.encinitas.ca.us
Ph: 760-633-2810

19 Santa Fe Irrigation District
www.sfidwater.org
Ph: 858-756-2424

20 South Bay Irrigation District*
www.sweetwater.org
Ph: 619-420-1413

21 Vallecitos Water District
www.vwd.org
Ph: 760-744-0460

22 Valley Center Municipal Water District
www.vcmwd.org
Ph: 760-749-1600

23 Vista Irrigation District
www.vid-h2o.org
Ph: 760-597-3100

24 Yuima Municipal Water District
www.yuimamwd.com
Ph: 760-742-3704

*Sweetwater Authority manages City of National City and South Bay Irrigation District.

JULY 2009

FIGURE 25. SAN DIEGO WATER AUTHORITY MEMBER AGENCIES.

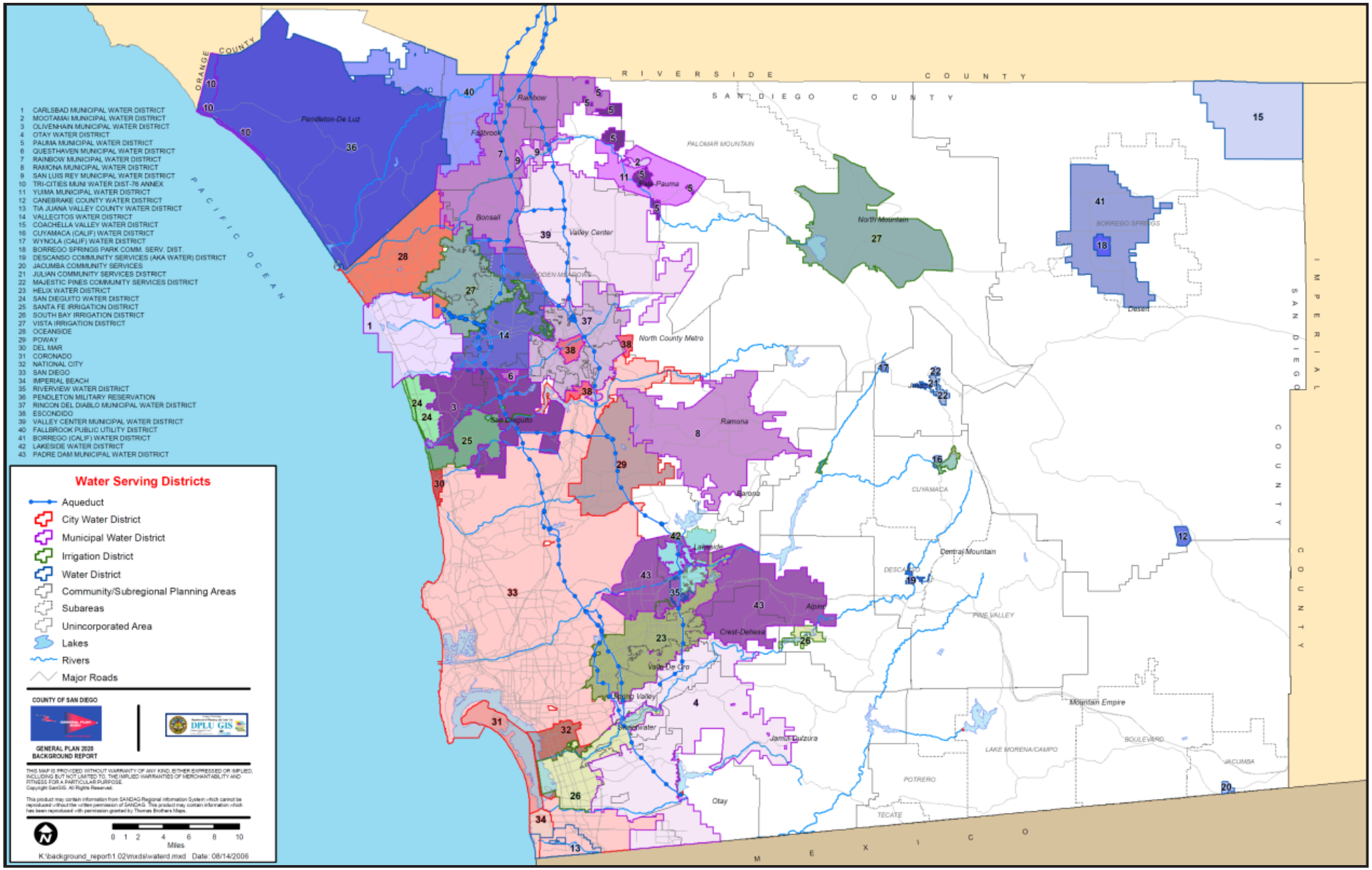


FIGURE 26. WATER AGENCIES WITHIN SAN DIEGO COUNTY.

Conservation Efforts

SDWA is very active in water conservation efforts. A description of conservation achievements claims that "Since 1990, the Water Authority and its member agencies have saved approximately 430,000 acre-feet of water with conservation programs." An acre-foot is approximately 326,000 gallons of water, enough to supply two average families of four for a year.

SDWA conservation achievements include:

- Installation of 518,000 ultra-low-flush toilets.
- Installation of 600,000 water-saving showerheads.
- Installation of 53,000 high-efficiency clothes washers.
- 7,200 acre-feet of water saved through commercial-industrial-institutional hardware replacements.
- Conservation-themed presentations to more than 75,000 local students annually.

SDWA's major conservation efforts and links to the programs are shown below:

1. The 20 Gallon Challenge

   http://www.20gallonchallenge.com/

2. The Blueprint for Water Conservation

   http://www.sdcwa.org/manage/pdf/Conservation/BlueprintDraft.pdf

3. Evapotranspiration CIMIS

   http://wwwcimis.water.ca.gov/cimis/welcome.jsp

4. Xeriscape Principles

   http://www.sdcwa.org/manage/conservation-xeriscape.phtml

5. Landscape Watering Calculator

   http://apps.sandiego.gov/landcalc/

3.1.2.1 Helix Water District

A sample of 5 of the 24 member agencies within the San Diego Water Authority (SDWA) were chosen to explore current water conservation efforts, available incentives, water use restrictions and recycled water use practices. These 5 examples serve to give a general sense of the local efforts being made and how they may provide resources for or requirements of DPR. As these efforts are dynamic it is important to track future developments. Also, other agencies not highlighted in this section may have different goals and requirements. The content of this section can serve as a current basis of comparison with the other agencies and as a baseline to compare evolving water use practices against.

Water Conservation Efforts

Helix Water District (HWD) serves the cities of La Mesa, El Cajon, Lemon Grove, the community of Spring Valley, and various unincorporated areas near El Cajon. HWD generally promotes the water conservation goals and guidelines of the 20 Gallon Challenge.

Resources available to the public include:

- A video outlining numerous water conservation tips.
- Programs for installing water efficient devices.
- Programs aimed at changing water use habits.
- Appointments for a Certified Landscape Irrigation Auditor to visit a customer's property, review irrigation patterns, and give suggestions on how to give the landscape just the water it needs.

Water Budgets

HWD has been very aggressive in working with Cities within its service territory to adopt and enforce the requirements of the "Model Water Efficient Landscape Ordinance" (AB 1881). Many of the Cities within HWD are enforcing water budgets not only for new construction but also for existing facilities. If an existing facility cannot meet the requirements of the Water Budget it will either have to modify the existing landscape or pay higher water rates. It is anticipated that sites with significant turf area will not be able to comply with water budget requirements. Below is information related to the specifics of HWD's water budget process:

- Water budgets have been assigned to all Irrigation Classes.
- A water budget is a tool to encourage appropriate water use during all seasons.

Water budgets assign target usage for each billing cycle. Water budgets are tied to a tiered rate billing structure. Accounts with water budgets are billed accordingly. Accounts that use more water than their assigned budget are billed at a higher tier or tiers than the target usage tier. These higher tiers are referred to as water conservation rates.

Water Use Restrictions

Due to the 8% water allocation cutback from the SDWA and the continuing regional water shortage, Helix Water District's board of directors approved raising the Water Shortage to Level 2. As a result, mandatory water restrictions were implemented as of July 1, 2009. HWD requires customers to "Pick Three Days and Water Ten Minutes."

- The "Pick 3 – Water 10" program allows customers to determine the three best days to water on their property and requires that they only water 10 minutes per irrigation station. These restrictions apply June through October, with two days of watering per week from November to May.
- The 10-minute provision does not apply to landscape irrigation systems using water efficient devices, including, but not limited to: weather-based controllers, drip/micro-irrigation systems, and stream rotor sprinklers.
- Leaks must be repaired within 72 hours of notification by the District, unless other arrangements are made with the Chief.

In addition, all provisions of Water Shortage Level 1 become mandatory:

- Stop washing down paved surfaces, including but not limited to sidewalks, driveways, parking lots, tennis courts, or patios, except when it is necessary to alleviate safety or sanitation hazards.
- Stop water waste resulting from inefficient landscape irrigation, such as runoff, low head drainage, overspray, etc. Similarly, stop water flows onto non-targeted areas, such as adjacent property, non-irrigated areas, hardscapes, roadways or structures.
- Irrigate residential and commercial landscape before 10 a.m. and after 6 p.m. only. Irrigation run time should be adjusted to avoid runoff.
- Use a hand-held hose equipped with a positive shut-off nozzle or bucket to water landscaped areas, including trees and shrubs located on residential and commercial properties that are not irrigated by a landscape irrigation system.

- Irrigate nursery and commercial growers' products before 10 a.m. and after 6 p.m. only. Irrigation of nursery propagation beds is permitted at any time. Watering of livestock is permitted at any time.
- Use re-circulated water to operate ornamental fountains.
- Wash vehicles using a bucket and a hand-held hose with positive shut-off nozzle, mobile high-pressure/ low volume wash system, or at a commercial site that reclaims water on-site. Avoid washing during hot conditions when additional water is required due to evaporation.
- Serve and refill water in restaurants and other food service establishments only upon request.
- Offer guests in hotels, motels, and other commercial lodging establishments the option of not laundering towels and linens daily.

Incentives

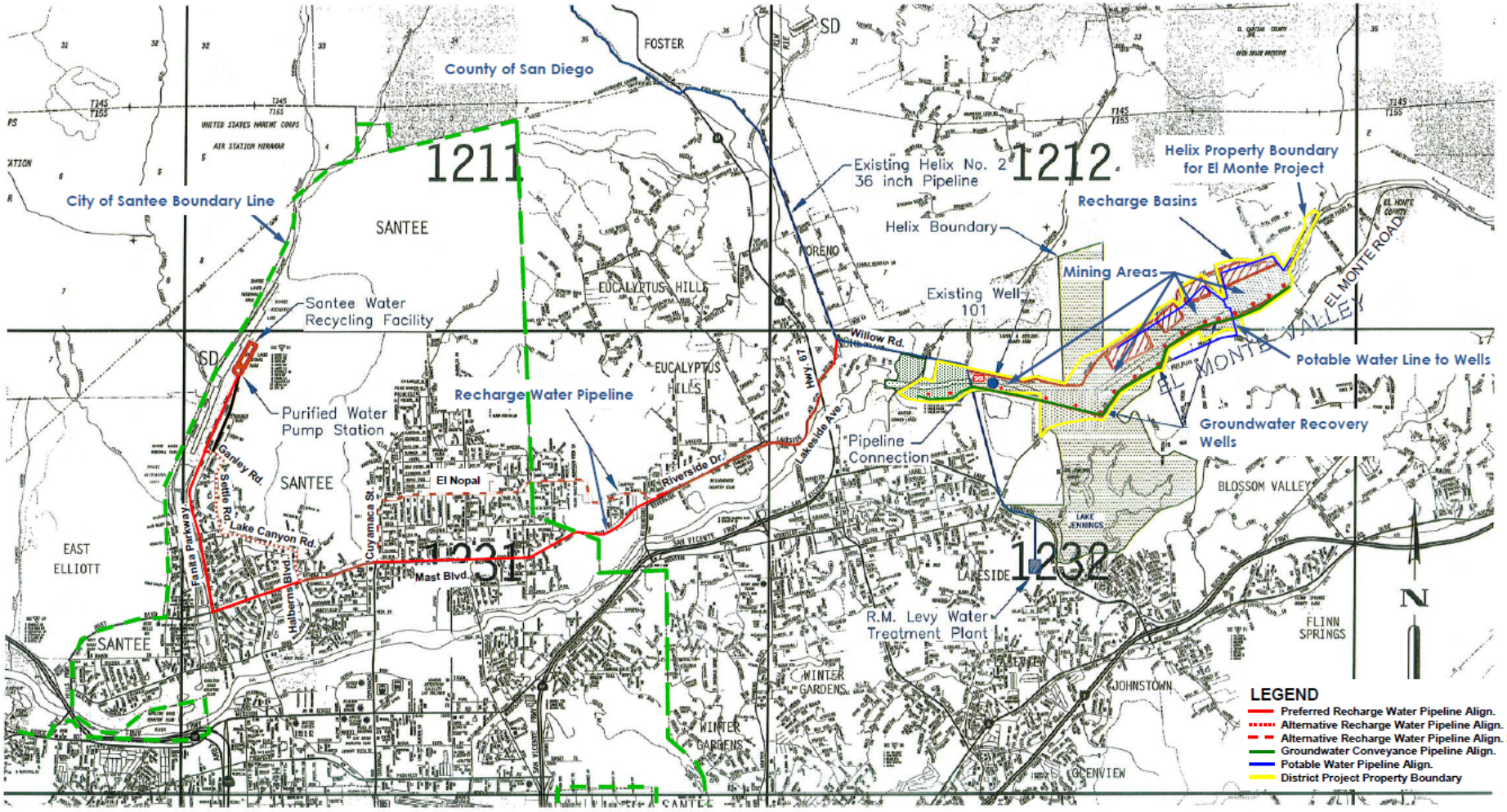
All HWD incentives are available through the Municipal Water District's "Save A Buck" program.

Commercial, industrial and institutional rebates (as of June 1, 2010) consist of:

- Connectionless food steamer - $485.00
- Cooling tower conductivity controller - $625.00-$1,750.00
- Dry vacuum pump - $125.00 per 0.5 horsepower (up to 2hp)
- High-efficiency toilet (1.28 gpf) - $50.00
- High-efficiency toilet (1.28 gpf; new construction) - $30.00
- Zero water and ultra low flow urinal - $200.00
- Zero water and ultra low flow urinal (new construction) - $60.00
- Air cooled ice machine - $300.00
- Waterbroom - $110.00
- Weather-based or 'Smart' irrigation controller - $25.00 per station
- High-efficiency rotating sprinkler nozzles - $3.00 per nozzle
- High-efficiency nozzles for large rotary sprinklers (minimum 8 sets) - $7.00 per set

Recycled Water Use

Helix Water District is pursuing a new, permanent water supply source by augmenting the water in the El Monte Valley underground basin with highly purified, recycled water, which will supply about 15% of the district's total demand. The El Monte Valley Mining, Reclamation, and Groundwater Recharge Project (Figure 27) will use recycled water that has gone through standard tertiary treatment, plus additional microfiltration, 100 percent reverse osmosis, hydrogen peroxide, and ultraviolet treatment. Additionally, this new water source will support habitat restoration along two-miles of the San Diego riverbed.



		BLACK & VEATCH PROJECT 167257	EL MONTE VALLEY MINING, RECLAMATION, AND GROUNDWATER RECHARGE PROJECT PROJECT VICINITY MAP	FIGURE NO. 1

FIGURE 27. HELIX WATER DISTRICT'S EL MONTE VALLEY MINING, RECLAMATION AND GROUNDWATER RECHARGE PROJECT.

3.1.2.2 Olivenhain Municipal Water District

Water Conservation Efforts

Olivenhain Municipal Water District (OMWD) serves the water needs of portions of Encinitas, Carlsbad, San Diego, Solana Beach, and San Marcos, as well as the communities of Olivenhain, Leucadia, Elfin Forest, Rancho Santa Fe, Fairbanks Ranch, Santa Fe Valley and 4S Ranch. A list of water conservation tips for commercial customers and projected water savings is given below:

Landscape Irrigation

- Water only before 6 a.m. and after 8 p.m. to reduce evaporation and interference from wind. (Savings potential: 20-25 gallons per day per valve).
- Don't over-water landscaping: (Savings potential: 25-50 gallons per valve for each minute of irrigation eliminated).

    1. Cut irrigation to 2 or 3 days per week or use the landscape calculator at BeWaterWise.com to learn how much and often to water.
    2. Water only after the top inch of soil is dry.
    3. Reset irrigation controllers and replace batteries in the spring and fall.

- Use a broom or blower instead of a hose to clean driveways and sidewalks. (Savings potential: 150 gallons or more per use). Adjust sprinklers to prevent overspray and run-off. (Savings potential: 15-20 gallons per day per valve).
- Repair leaks and broken sprinkler heads. (Savings potential: 20 gallons per day per leak).
- Add 2'' to 3'' of mulch around trees and plants to reduce evaporation. (Savings potential: 40 gallons per day per valve/hydrozone).
- Install water-efficient drip irrigation system for trees, shrubs, and flowers to get water to the plant's roots more efficiently. (Savings potential: 20-25 gallons over day per valve/hydrozone).
- Upgrade to a "smart irrigation controller" that automatically adjusts watering times for hotter weather, and shuts down the system when it rains. (Savings potential: 525 gallons/30-station controller).
- Replace a portion of lawn with beautiful native and California friendly plants. These plants do best when planted after winter rains begin. (Savings potential: 33-60 gallons per day per valve).
- Utilize the Save-a-Buck multi-family and commercial program to upgrade irrigation hardware and equipment to stop leaks, reduce water use, and otherwise improve irrigation efficiency. (Savings potential: Varies by device).

Water Use Restrictions

Water use restrictions previously enforced as mandatory under a Level 2 Drought Alert are strictly voluntary with the move to a Level 1 Water Supply Shortage. Voluntary restrictions a customer may choose to continue after July 1, 2010 include:

- Refraining from washing down paved surfaces.
- Stopping water waste as a result of inefficient landscape irrigation.
- Irrigating residential properties only between 6 p.m. and 8 a.m.
- Irrigating nursery or commercial grower's products only before 10 a.m. and after 6 p.m.
- Using shut-off nozzles or buckets to irrigate with hoses.
- Promptly repairing all leaks.

Restrictions no longer in place with the lifting of the Level 2 Drought Alert condition include limiting irrigation to three days per week and restricting irrigation to ten minutes per station.

Even though OMWD's Board of Directors declared the Level 2 Drought Alert in 2009, the Board of Directors chose to remain at Level 1 pricing, confident that water use restrictions would prompt sufficient conservation by which to meet OMWD's cutback as mandated by SDCWA. OMWD customers, therefore, did not experience an increase in their water bills due to the Level 2 Drought Alert. Similarly, customers will not experience a decrease in their water bills upon OMWD's return to a Level 1 Water Supply Shortage.

Incentives

OMWD provides the following incentives for water conservation:

Turf Removal Program: Customers planning to remove at least 250 square feet of landscape during October and November, and replace their lawn with a qualifying substitute such as permeable hardscape, synthetic turf, mulch, or water-efficient plants can receive $1 per square foot of replaced lawn.

Free Water Use Evaluation ($200 Value): Sign up for a free-water use evaluation that can identify ways to save water at your home or business.

Save a Buck Regional Program: This program is available through MWD for commercial, industrial, institutional, and multi-family customers.

Recycled Water Use

Olivenhain Municipal Water District serves nearly two million gallons of recycled water every day, continuing a tradition that began in California in 1929. The recycled water is used for irrigation throughout OMWD as well as in the City of Carlsbad. A map of the OMWD's recycled water system is shown in Figure 28.

OMWD's 4S Ranch Water Reclamation Project consists of the two million gallons per day 4S Ranch Water Reclamation Facility, the 410 acre feet 4S Ranch Recycled Water Storage Pond, the Thelma Miller Recycled Water Reservoir and more than 50,000 feet of pipeline.

OMWD provides approximately one million gallons of recycled water per day to irrigation customers in the 4S Ranch community. This water is used on HOA common areas, schools, parks and streetscapes. As development continues in this area, OMWD expects recycled water demands to top 1.5 million gallons per day during the warm weather season.

OMWD also delivers recycled water to the Crosby Golf Course and the Del Mar and Morgan Run Country Clubs. OMWD hopes to begin delivery of recycled water to the Rancho Santa Fe Farms Golf Club in the near future.

Through an agreement with the Vallecitos Water District, OMWD has converted approximately 110 irrigation services in its northwest quadrant, which includes portions of Encinitas and Carlsbad, from potable water to recycled water, conserving approximately 600,000 gallons per day of potable water. Ultimately, OMWD anticipates serving up to one million gallons per day of recycled water in this area.

OMWD's recycled water is highly treated and used for non-domestic purposes. OMWD has adopted "Best Management Practices" to ensure that this water is used in a safe and responsible manner. First, irrigating with recycled water must take place during the late evening and early morning hours, when public contact is at a minimum. Second, OMWD staff actively oversees the use of the recycled water.

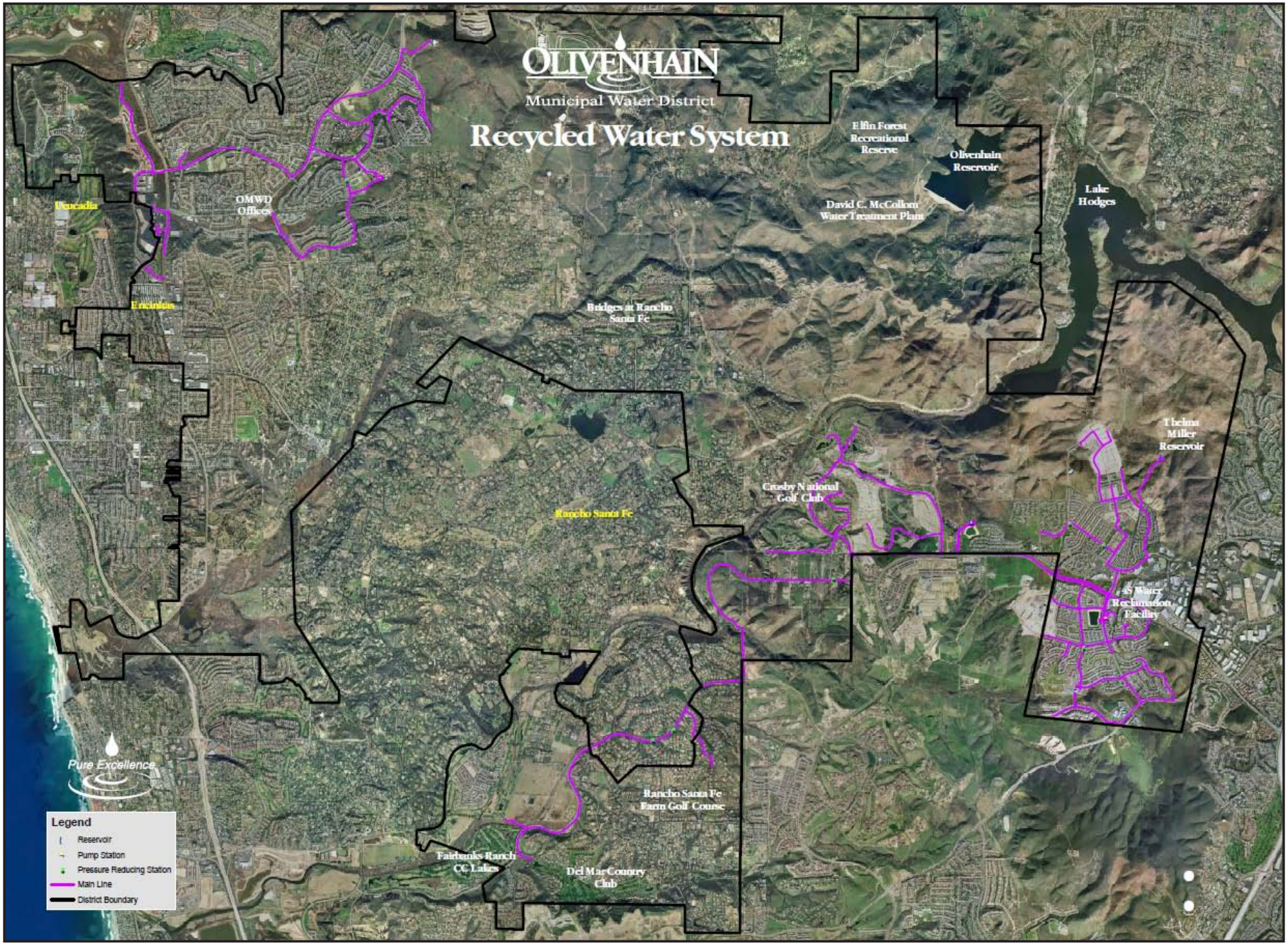


FIGURE 28. OLIVENHAIN WATER DISTRICT RECYCLED WATER SYSTEM MAP.

3.1.2.3 Otay Water District

Otay Water District (OWD) serves the water needs of Spring Valley, La Presa, Rancho San Diego, Jamul, eastern Chula Vista, and eastern Otay Mesa along the international border with Mexico.

Water Conservation Efforts

A list of OWD's water conservation tips applicable to both residential and commercial customers are listed below.

Check your sprinkler system for leaks, breaks, and obstructions: Approximately 60% of household water is used by landscape irrigation. Take a few minutes to turn on your sprinklers and walk around to see if they are aligned correctly. Look for overspray onto your sidewalks, driveway, patio, and adjacent plant material. Ideally, water from one lawn sprinkler should reach the adjacent sprinklers, often referred to as head-to-head coverage. If you have a drip system, make sure that the emitters are still connected, not clogged, and periodically flush the filter.

Regularly adjust your watering schedule: Adjust your irrigation schedule monthly at a minimum. July and August are typically our hottest months, but during the fall the days are shorter and our plants need less water. Typically, plants need a third less water in the fall as compared to the summer. Develop your own watering schedule by using the watering calculator. Pre-sunrise irrigation schedules will allow residue water to evaporate from the soil and plants lessening the potential for moisture related plant diseases. Please keep in mind that the Otay Water District is currently in a Level 1 voluntary "Supply Watch." Also consider installing weather "smart" irrigation controller and let it make the necessary adjustments for you.

Get paid to plant WaterSmart plants: Currently, homeowners can receive a $1.00 per square foot incentive when they replace irrigated front lawns and the Districts commercial customers can receive the same incentive for replacing unused turf grass areas. Homeowners must replace a minimum of 500 square feet of existing irrigated turf grass (3,000 sq ft minimum for commercial sites), have an existing in-ground irrigation system, and receive pre-approval prior to beginning their replacement program. WaterSmart plants often have other beneficial values such as attracting hummingbirds and butterflies, and are available at many local nurseries. You may not even realize you already have WaterSmart plants in your yard and you might be over watering them as a result.

Visit the Water Conservation Garden and see mature examples of WaterSmart plants: The Water Conservation Garden located on the campus of Cuyamaca College is dedicated to saving water in our landscaping. The Garden has more than 400 varieties of water-wise plants on 4.5 beautifully landscaped acres.

Take a class in WaterSmart landscaping: Classes cover topics such as turf grass replacement, landscape design, water-wise, WaterSmart plant choices, and efficient irrigation systems.

Replace your older clothes washer with a high efficiency model: You will save 20 or more gallons per load (9,000 gallons per year for the average family), and use 55% less energy. Currently, a $210 rebate is available for purchasing a qualified high efficiency washer (4.0 water factor).

Check your toilets for leaks and repair them immediately: Many toilet leaks are silent and often go unnoticed. Because of a warped toilet flapper or a high water level within the tank, water may be draining or overflowing into the bowl. As a result, your toilet could be losing 30-50 gallons per day. To spot these types of leaks, put a drop food coloring to the toilet tank. Wait 15 minutes to see if the food coloring has migrated to the toilet bowl.

Water Use Restrictions

No significant water restrictions were described by the OWD.

Incentives

OWD's incentives are provided through the Municipal Water District's "Save A Buck" program.

Recycled Water Use

The Otay Water District is expanding the use of recycled water in order to minimize its overall demand for potable water, and currently has one of the largest recycled water distribution systems in San Diego County (Figure 29). The District operates the Ralph W. Chapman Water Recycling Facility in Rancho San Diego, which produces approximately 1.1 million gallons per day (MGD) of recycled water. In addition, in the fall of 2003, the District signed an agreement with the City of San Diego for the right to receive up to 6 MGD of recycled water from the San Diego's South Bay Water Reclamation Plant (SBWRP), located in San Ysidro. The District also acquired the right to purchase supply from the SBWRP that exceeds 6 MGD if San Diego has the supply available.

Ultimately, recycled water is expected to represent about 15% of the OWD total water supply. As referenced in Section 26.04 of the Districts Code of Ordinances, recycled water uses may include, but are not limited to, the irrigation of greenbelt and agricultural areas, filling of artificial lakes, and appropriate industrial and commercial uses.

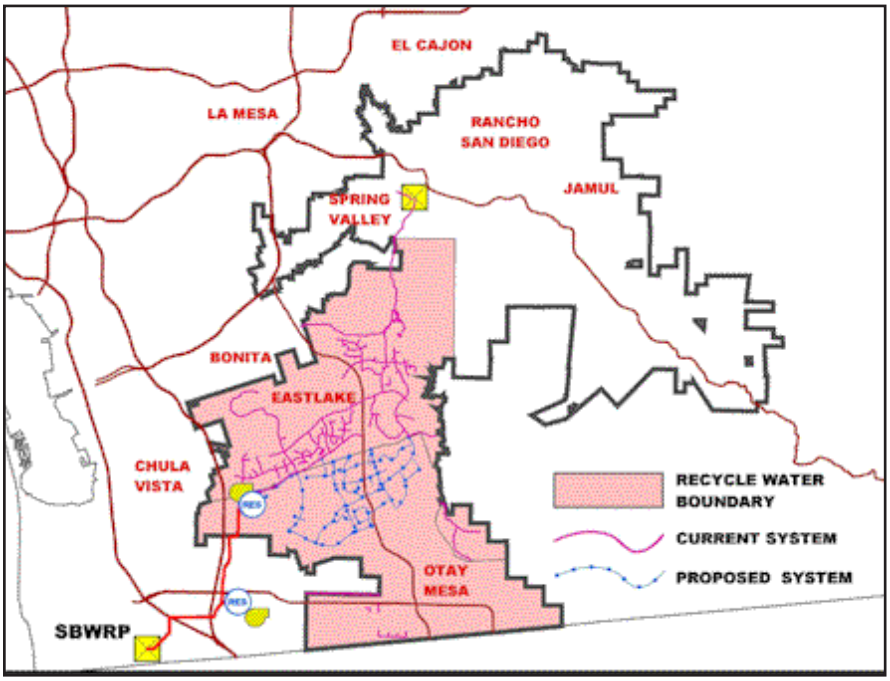


FIGURE 29. OTAY WATER DISTRICT RECYCLED WATER USE MAP.

3.1.2.4 Valley Center Municipal Water District

The Valley Center Municipal Water District (VCMWD) serves the City of Valley Center and a portion of Escondido.

Water Conservation Efforts

Considering that 100% of VCMWD's water supply is imported, water conservation is a top priority. Conservation measures and their estimated water savings are given below:

- Water only before 6 a.m. and after 8 p.m. to reduce evaporation and interference from wind (20–25 gallons per day).
- Don't over water landscaping (15–25 gallons for each minute of irrigation eliminated).
    1. Cut irrigation to 2 or 3 days per week or use the landscape calculator.
    2. Water only after the top inch of soil is dry.
    3. Reset irrigation controllers and replace batteries in the spring and fall.
- Adjust sprinklers to prevent overspray and runoff (15–25 gallons per day).
- Repair leaks and broken sprinkler heads (20 gallons per day per leak).
- Add 2" to 3" of mulch around trees & plants to reduce evaporation (20–30 gallons per day).
- Install water-efficient drip irrigation system for trees, shrubs, and flowers to get water to the plant's roots more efficiently (20–25 gallons per day).
- Upgrade to a "smart irrigation controller" that automatically adjusts watering times for hotter weather, and shuts down the system when it rains (40 gallons per day)
- Replace a portion of lawn with native and California Friendly plants.
- Use a broom instead of a hose to clean driveways and sidewalk (150 gallons or more per use).
- Adjust your pressure reducer (if you have one) to keep pressure between 40 and 60 p.s.i. (Savings vary).
- Don't leave the hose running while washing your car. Get a self-closing nozzle for your hose (20 gallons per minute).
- Repair any leaks around pool and spa pumps (20 gallons per day per leak).
- Repair leaking hose bibs (15–20 gallons per day per leak).
- Install covers on pool and spas to reduce evaporation (30 gallons per day).
- Install pressure reducer if your pressure is greater than 80 p.s.i. (Savings vary).
- Don't use the toilet as a wastebasket (1.6 gallons per flush).
- Fix leaky toilets (30–50 gallons per day per toilet).
- Fix leaky faucets (15–20 gallons per day per leak).
- Install aerators with flow restrictors on kitchen/bathroom faucets (4.7 gallons per day).
- Replace older, high-volume flushing toilets (2.2–3.8 gallons per flush).

Water Use Restrictions

On May 4, 2009, the VCMWD Board acted to implement the Level 2, "Water Supply Shortage Alert Conditions" of its Water Supply Shortage Response Program (Article 230, District Administrative Code) impacting all Full Price Residential and Commercial and Commercial Agricultural Accounts. With this action, the following mandatory water use restrictions will be in place effective in July 2010, to help reduce water consumption at your home and/or business:

- Stop washing down paved surfaces, including but not limited to sidewalks, driveways, parking lots, tennis courts, or patios, except when it is necessary to alleviate safety or sanitation hazards.
- Stop water waste resulting from inefficient landscape irrigation, such as runoff, low head drainage, or overspray, etc. Similarly, stop water flows onto non-targeted areas, such as adjacent property, non-irrigated areas, hardscape, roadways, or structures.
- Irrigate residential and commercial landscape before 10 a.m. and after 4 p.m. only.
- Use a hand-held hose equipped with a positive shut-off nozzle or bucket to water landscaped areas, including trees and shrubs located on residential and commercial properties that are not irrigated by a landscape irrigation system.
- Irrigate nursery and commercial grower's products before 10 a.m. and after 4 p.m. only. Watering is permitted at any time with a hand-held hose equipped with a positive shut-off nozzle, a bucket, or when a drip/micro-irrigation system/ equipment is used. Irrigation of nursery propagation beds is permitted at any time. Watering of livestock is permitted at any time.
- Use re-circulated water to operate ornamental fountains.

- Wash vehicles using a bucket and a hand-held hose with positive shut-off nozzle, mobile high pressure/low volume wash system, or at a commercial site that re-circulates (reclaims) water on-site. Avoid washing during hot conditions when additional water is required due to evaporation.
- Repair all leaks within five (5) days of notification by the District unless other arrangements are made with the Chief.

Incentives

VCMWD incentives are provided through the Municipal Water District's "Save A Buck" program and SDG&E. Product purchases eligible for rebates include the following:

- High Efficiency Clothes Washers (WF 4.0 or less) -- $135.00 + SDG&E rebate, while funds last.
- Rotating Sprinkler Nozzles -- $3.00 per nozzle, minimum of 25
- Weather Based Irrigation Controllers (SWAT tested):
  - $80.00 per controller for properties less than 1 acre
  - $25.00 per station for properties larger than 1 acre

Recycled Water Use

VCMWD provides reclaimed water to the Woods Valley Ranch Golf Course for irrigation. Over the next three to five years, there is the potential for the District to operate several more wastewater reclamation systems to serve planned developments, including the Live Oak Ranch Project, the Lilac Ranch Project, as well as development within the North Village Planning Area.

Rules and regulations pertaining to reclaimed water service include:

Sec. 175.1 General Requirements and Conditions
(a) Introduction. The Valley Center Municipal Water District (hereinafter called "District") is primarily dependent on imported water for domestic, agricultural and industrial uses. It is in the best interest of the District to promote and implement innovative water management strategies to conserve water and energy resources while still satisfying water needs of the District's customers.

California Water Code Section 13551 establishes a state policy to encourage the use of reclaimed water. Permission to use reclaimed water is based on the ability to adequately treat municipal wastewater to the point that the reclaimed water (effluent) meets or exceeds the requirements of existing Title 22, Chapter 3, of the California Code of Regulations. Title 22 was promulgated by the California Department of Health Services to ensure adequate health protection and specify the treatment degree to match the intended applications.

The use of water reclaimed from municipal wastewater is also regulated by the California Regional Water Quality Control Board (RWQCB). In accordance with waste discharge requirements for water reclamation projects, the RWQCB requires that Rules and Regulations for facilities using reclaimed water be established.

1. Purpose: The purpose of these Rules and Regulations is to establish procedures, specifications and limitations for the safe and orderly development and operation of reclaimed water facilities and systems in the District's service area.
2. Goals: Achieve conservation of potable water supplies by using reclaimed water for current and future demands. Reclaimed water uses shall be for the maximum public benefit and may include:

- agricultural irrigation
- commercial uses (including flushing toilets and urinals)
- construction use
- groundwater recharge
- industrial processes
- landscape irrigation
- landscape and/or recreational impoundments
- wildlife habitat enhancement

Per Ordinance No. 98-01 Adopted 2/2/98 [Article 175]

3.1.2.5 City of San Diego

The City of San Diego's water department provides water service within its own incorporated boundaries. It also conveys and sells potable water to the City of Del Mar, the Santa Fe and San Dieguito Irrigation Districts, and the California American Water Company, which, in turn, serves the Cities of Coronado and Imperial Beach and portions of south San Diego.

Water Conservation Efforts

The City of San Diego provides a number of water conservation resources including:

- Commercial Landscape Survey Program
- Landscape Watering Calculator
- Model Landscape Ordinance (AB 1881) Information
- Plumbing Retrofit Upon Re-Sale Ordinance
- Rainwater Harvesting Information
- Gray Water Information
- Guaranteed Water Program
- Residential Water Survey Program
- Water Conservation Film Contest
- Water Conservation Tips
- Kids Water Conservation Corner and Poster Contest
- Children's Water Conservation Poster Display Program

Water conservation programs that are the most relevant to DPR are described in more detail below:

Commercial Landscape Survey Program: This program is free of charge to commercial, industrial and institutional customers in the City of San Diego. Qualifying properties must have more than one acre of landscaped property. Properties will receive an audit of the irrigation system, practical advice, water-saving recommendations and a water-use budget. Many properties can expect water savings of between 20 and 40 percent. Skilled surveyors will review the water-use history of the property to determine where water savings are possible. Participants will also receive a written evaluation of the irrigation system's performance, aerial photos of the property, a water-use estimate for the upcoming year and an irrigation controller schedule for each month.

Gray Water Information: See the link below for more information on gray water use:

http://www.sandiego.gov/water/recycled/graywater.shtml

Landscape Watering Calculator: This tool helps estimate the right amount of water to give your landscape or garden. The calculator has been designed to give a weekly schedule for the maximum amount of water which your plants may need each month of the year. Because everyone's landscape is different, the calculator has been simplified by using average numbers for weather, plants, and soils in San Diego.

Rainwater Harvesting Information: See the link below for more information on rain water harvesting use:

http://www.sandiego.gov/water/conservation/rainwater.shtml

Water Conservation Tips: See the link below for more information on water conservation tips:

http://www.sandiego.gov/water/conservation/tips.shtml

Water Use Restrictions

Effective June 1, 2009, San Diego declared a Level 2 Drought Alert. Level 2 includes many mandatory water restrictions. In addition, all voluntary Level 1 conservation practices became mandatory. The Level 2 restrictions include:

- Landscape irrigation is limited to no more than three assigned days per week. Those days are:

  - Homes with odd-numbered addresses: Sunday, Tuesday, and Thursday
  - Homes with even-numbered addresses: Saturday, Monday, and Wednesday
  - Apartments, condos and businesses: Monday, Wednesday, and Friday

- Between June 1 and October 31, on your watering days, you may only water before 10 a.m. or after 6 p.m. Landscape irrigation using sprinklers is limited to no more than ten minutes maximum per watering station per assigned day (does not apply to drip, micro-irrigation, stream rotor, rotary heads, hose end sprinklers with timers or valves operated by a weather-based irrigation controller).

- Between November 1 and May 31, you may only water before 10 a.m. or after 4 p.m. Landscape irrigation using sprinklers is limited to no more than seven minutes maximum per watering station per assigned day (does not apply to drip, micro-irrigation, stream rotor, rotary heads, hose end sprinklers with timers or valves operated by a weather-based irrigation controller).

- Trees and shrubs not irrigated by a landscape irrigation system may be watered no more than three assigned days per week by using a hand-held container, hand-held hose with positive shut-off nozzle, or low-volume soaker hose.

- Irrigation of nursery and commercial growers' products is permitted in the hours between 6 p.m. and 10 a.m. from June 1 to October 31, and between 4 p.m. and 10 a.m. from November 1 to May 31. Watering may be done at any time when using a hand-held hose with a positive shut-off nozzle, hand-held container, or drip, micro-irrigation.

- Irrigation of nursery propagation beds is permitted at any time.

- Non-commercial vegetable gardens, fruit trees and potted plants are exempt from days of the week restrictions. But, between June 1 and October 31 irrigating is permitted only before 10 a.m. and after 6 p.m. From November 1 to May 31, it is permitted only before 10 a.m. and after 4 p.m.

- All irrigation is banned while it is raining.

- Vehicle washing between June 1 and October 31 is permitted only before 10 a.m. and after 6 p.m. From November 1 to May 31, it is permitted only before 10 a.m. and after 4 p.m. Vehicle washing is only allowed with a hand-held container or a hand-held hose with a positive shut-off nozzle for quick rinses, or at any time on the immediate premises of a commercial car wash. Vehicle washing required for public health and safety is exempt.

- Boats and boat engines are permitted to be washed down immediately after use.

- Water use by commercial car washes which do not use partially re-circulated water will be reduced in volume by an amount determined by the City Council.

- All leaks must be stopped or repaired upon discovery or within 72 hours of notification by the City of San Diego.

- Bird baths, koi ponds and any ornamental water feature using a re-circulating pump and which does not shoot water into the air are allowed under Level 2. Water fountains which discharge into the air a jet or stream of water are banned under Level 2 restrictions. However, these fountains may be operated for maintenance purposes. Any water feature that does not re-circulate water is banned.

- Landscape establishment is allowed if required for landscape permits, erosion control, disasters or establishment, repair or renovation of public use fields for schools and parks. Landscape establishment under these conditions authorizes watering any day, and any hour of the day, as necessary, for up to two months. All other landscape establishments that require more irrigation than the established irrigation restrictions requires an approved variance.

- Use of recycled or non-potable water is required for construction purposes when available.
- Water use from fire hydrants is limited to fire fighting, City meter installation as part of the Fire Hydrant Meter Program, and for public health and safety reasons.
- Construction operations will not use water obtained by a fire hydrant meter for uses other than normal construction activity.

In addition to these Level 2 requirements, all Level 1 voluntary restrictions are now mandatory. These include:

- City of San Diego water customers must prohibit excessive irrigation and must immediately correct leaks in their private water systems. The City's regulations now state that customers "shall not allow water to leave their property due to drainage onto adjacent properties or public or private roadways or streets or gutters due to excessive irrigation and/or uncorrected leaks."
- Customers cannot use a running hose to wash down sidewalks, driveways, parking areas, tennis courts, patios or other paved areas, except to alleviate immediate safety or sanitation hazards unless that hose is connected to a water efficient device such as a commercial water broom. City storm water regulations require containment and capture of any runoff.
- Overfilling of swimming pools and spas is strictly prohibited.
- The City will not provide new water service connections for customers using single pass-through cooling systems.
- All new conveyer car wash and commercial laundry systems connections will be required to employ a recirculation water system.
- Restaurants and other food establishments shall only serve and refill water for patrons upon request.
- Guests in hotels, motels, and other commercial lodging establishments will be provided the option of not laundering towels and linens daily

Incentives

The City of San Diego's commercial-multifamily outdoor water conservation rebates & services include Smart Controllers, micro-irrigation, and turf replacement, as described below:

Smart Controller Rebates: Get $25 per irrigation station (up to 68 stations and $1,700 per site) for upgrading an existing irrigation controller to a Smart Controller (also known as a weather based irrigation controller or WBIC) found on the SWAT list of tested devices.

Micro-Irrigation Rebates: Get $0.20 per square foot (up to 5,000 SF and $1,000 per site) for converting an overhead spray sprinkler system to low application rate micro-irrigation (i.e., micro-spray, drip, in-line emitters, etc.)

Sustainable Landscape-Turf Replacement Rebates: $1.50 per SF (up to $9,000 per customer) for replacing living turf grass with sustainable and water wise landscaping. This program is seasonal.

Free Mulch from Miramar Greenery: Applying mulch to the landscape helps reduce the need to water and minimizes runoff. Wood chips can be purchased for a modest fee at the Miramar Landfill.

Free On-Site Commercial Landscape Survey: Qualifying properties must have more than one acre of landscaped property. By getting involved in this program, properties will receive an audit of the irrigation system, practical advice, water-saving recommendations and a water-use budget.

Recycled Water Use

To meet future water demands while reducing dependence on imported water, the City of San Diego has built the North City Water Reclamation Plant (Figure 30) and the South Bay Water Reclamation Plant (Figure 31). These plants treat wastewater to a level that is approved for irrigation, manufacturing and other non-drinking, or non-potable purposes. The North City Plant has the capability to treat 30 million gallons a day and the South Bay Plant can treat 15 million gallons a day. Recycled water gives San Diego a dependable, year-round, locally controlled water resource.

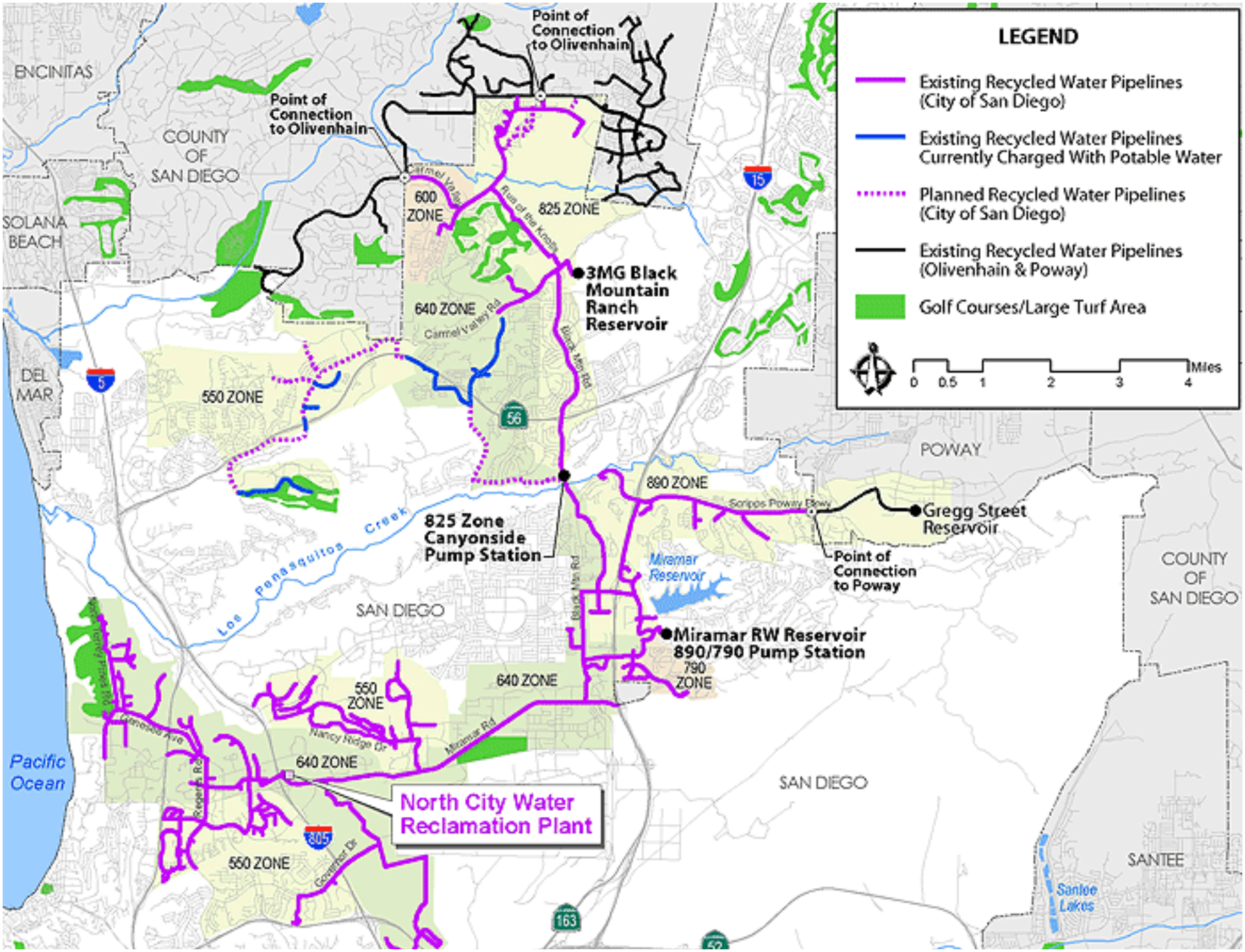


FIGURE 30. CITY OF SAN DIEGO NORTHERN SERVICE AREA RECYCLED WATER USE MAP.

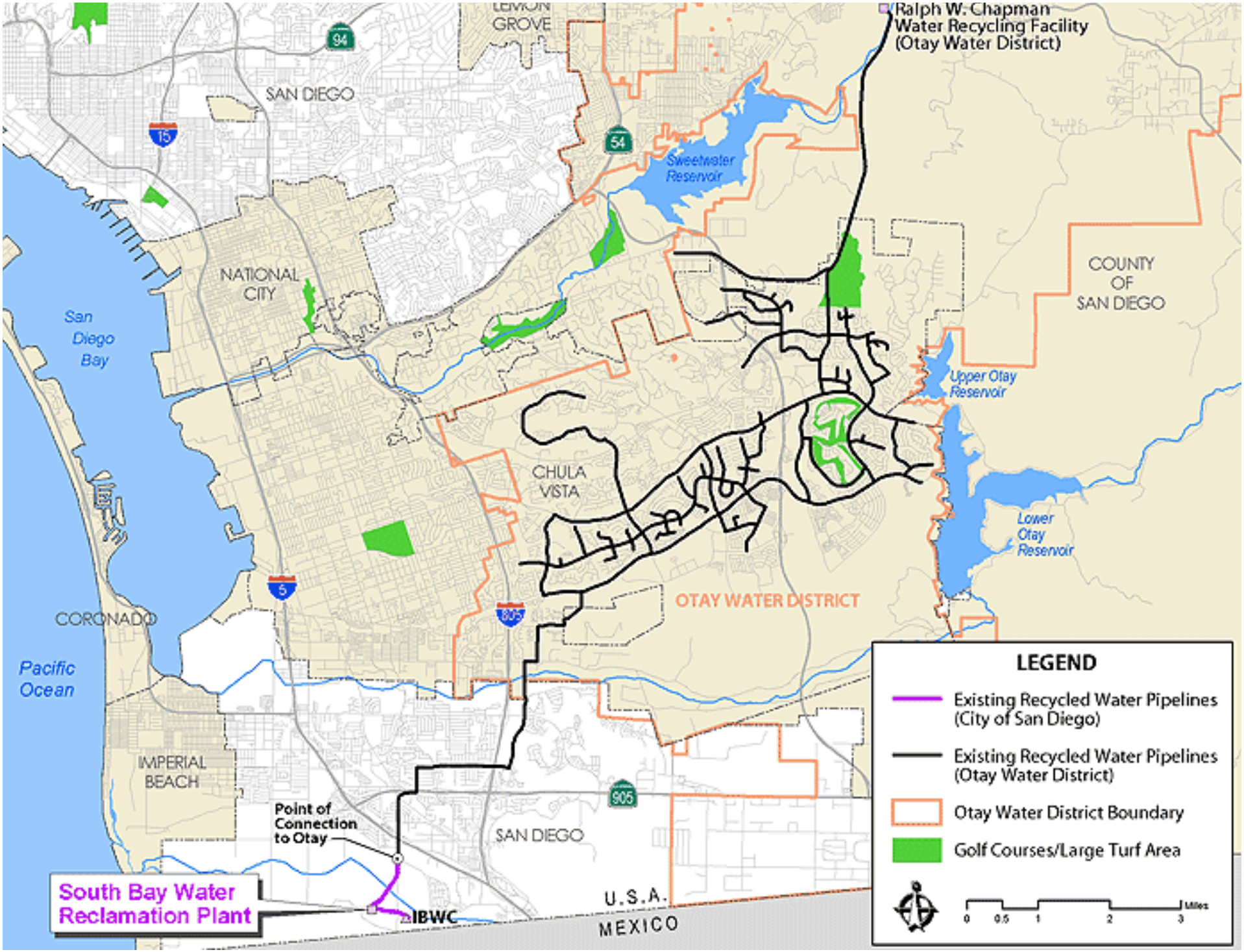


FIGURE 31. CITY OF SAN DIEGO SOUTHERN SERVICE AREA RECYCLED WATER USE MAP.

3.2 San Diego County

3.2.1 San Diego General Plan

San Diego County's General Plan, although still in draft form in 2010, has a strong focus on meeting water conservation goals. These goals and strategies are described below:

- **Sustainable Water Supply.** Conservation of limited water supply supporting all uses including urban, rural, commercial, industrial, and agricultural uses.
- **Sustainable Development Practices.** Require land development, building design, landscaping, and operational practices that minimize water consumption.
- **Recycled Water in New Development.** Require the use of recycled water in development wherever feasible. Restrict the use of recycled water when it increases salt loading in reservoirs. A permit is required from the County Department of Environmental Health for the use of recycled water.
- **Water Management.** A balanced and regionally integrated water management approach to achieve the long-term viability of the County's water quality and supply.
- **Water Conservation.** Require development to reduce the waste of potable water through use of efficient technologies and conservation efforts that minimize the County's dependence on imported water and conserve groundwater resources.
- **Drought-Efficient Landscaping.** Require efficient irrigation systems, and in new development encourage the use of native plant species and non-invasive drought tolerant/low water use plants in landscaping.
- **Stormwater Filtration.** Maximize stormwater filtration and/or infiltration in areas that are not subject to high groundwater by maximizing the natural drainage patterns and the retention of natural vegetation and other pervious surfaces. This policy shall not apply in areas with high groundwater, where raising the water table could cause septic system failures, and/or moisture damage to building slabs, and/or other problems.
- **Groundwater Contamination.** Require land uses with a high potential to contaminate groundwater to take appropriate measures to protect water supply sources.
- **Recycled Water.** Promote the use of recycled water and gray water systems where feasible.
- **Impervious Surfaces.** Require development to minimize the use of directly connected impervious surfaces and to retain stormwater run-off caused from the development footprint at or near the site of generation.

More information regarding the County's General Plan can be found here:

http://www.sdcounty.ca.gov/dplu/gpupdate/docs/draftgp/draftgeneralplan_04022010.pdf

3.2.2 San Diego County Landscape Ordinance

The San Diego County has adopted code regulations related to water conservation in landscaping applications. The Water Efficient Landscape Design Manual explains compliance methods for the new ordinance. A link to the manual can be found here:

http://www.sdcounty.ca.gov/dplu/docs/POD_08-016_Landscape_Design_Manual.pdf

A number of other resources related to water efficiency as it applies to San Diego County can be found here:

http://www.sdcounty.ca.gov/dplu/Landscape-Ordinance_Design_Review_Manual.html

3.3 Cities Within San Diego County

3.3.1 City of Poway

An example of a City within San Diego County that has addressed water conservation within its code is the City of Poway. The City of Poway's Water Conservation Plan can be found in Chapter 8.94 of the Poway Municipal Code. The general topics covered in the Water Conservation Plan include:

- Declaration of necessity and intent.
- Water use efficiency measures.
- Conservation levels.
- City-maintained parks, landscaped areas, and facilities.
- Poway Unified School District-maintained landscaped areas and facilities.
- Golf courses.
- Commercial growers and nurseries.
- Correlation between Drought Management Plan and water shortage response levels.
- New landscaping and postponement of required landscaping.
- Hardship variance.
- Appeals.
- Supersedure.
- Enforcement.

More information can be found here:

http://www.codepublishing.com/ca/poway/html/poway08/poway0894.html#8.94.060

3.4 Southern California Departments of Parks & Recreation

Examples of water conservation efforts employed by other Southern California based Departments of Parks and Recreation can serve to guide DPR in its water conservation efforts. One such case is that of the Los Angeles County Department of Parks and Recreation Strategic Water Conservation Plan.

3.4.1 Los Angeles County Department of Parks and Recreation Strategic Water Conservation Plan

Conservation Efforts

Los Angeles County Department of Parks and Recreation (LACDPR) implemented a Strategic Water Conservation Plan in 2009 to provide "best management practices for improving water use efficiency in city parks and golf courses." This document covers the following topics and can be found here:

http://www.laparks.org/pdf/strategicWater.pdf

Strategic Water Conservation Plan

I. Introduction

II. Water Conservation Measures

1.0 Smart Irrigation Controllers
1.1 Background
1.2 Goals & Objectives
1.3 Possible funding sources

2.0 Irrigation Infrastructure
2.1 Background
2.2 Goals & Objectives
2.3 Possible Funding Sources

3.0 Recycled Water
3.1 Background
3.2 Goals & Objectives
3.3 Possible Funding Sources

4.0 Turf Area Reduction
4.1 Drought Tolerant Landscaping
4.2 Mulching
4.3 Synthetic Sports Fields

5.0 High Efficiency Plumbing Fixtures
5.1 Background
5.2 Goals & Objectives
5.3 Possible Funding Sources

III. Maintenance and Construction

1.0 Centralized Irrigation and Landscape Infrastructure Division

IV. Design Standards & Best Management Practices

1.0 Irrigation General
1.1 Water Meter(s)
1.2 Backflow Prevention Unit
1.3 Piping
1.4 Valves
1.5 Smart Irrigation Controllers / Rain Sensors
1.6 Sprinkler Heads
1.7 As-built Plans
1.8 Department-Standard Irrigation Equipment

2.0 Landscaping General
2.1 New Building Landscapes
2.2 New and Renovated Park Landscapes

3.0 Restroom Fixtures

4.0 Water Features

5.0 Storm Water Management/Ground Water Re-Charge
5.1 Background
5.2 Best Management Practices
5.2.1 Porous Paving
5.2.2 Bio-Swales
5.2.3 Retention Basins
5.2.4 Storm Water Diversions

V. Landscape/Irrigation Project Approval

VI. Public Education

VII. Summary

3.5 California Public Agencies (LPA Experience)

3.5.1 Laguna Niguel City Hall:

Project consists of a new 40,000 square foot City Hall on 4 acres of land.

- LPA selected a 95% drought tolerant plant palette along with zero use of turf. Our design allows for reduced water delivery once plant material has been established.
- Project incorporated a smart controller which allows for appropriate irrigation timing and adjustment based on climate conditions.
- Project was fortunate to have reclaimed water available to the site and was used for irrigation purposes.
- Project incorporated low flow toilets resulting in significant water savings.
- Project incorporated pint flush urinals resulting in significant water savings.
- Project incorporated automatic flow faucets, which saves water and helps achieve a healthier environment.

3.5.2 Malibu City Hall Renovation:

Project consists of the renovation of a 20,000 square foot office building into a City Hall.

- Project includes the renovation of existing landscaping.
- LPA selected a 95% drought tolerant plant palette along with zero use of turf. Our design allows for reduced water delivery once plant material has been established.
- With the coastal conditions of moist air, the project incorporated a smart controller which allows for appropriate irrigation timing and adjustment based on climate conditions.
- LPA specified a drip system, except fuel mod area. Design allows for water application at each plant or tree.
- Employing these irrigation strategies has led to 20% water reductions making it possible to achieve LEED certification.
- Project incorporated low flow toilets resulting in significant water savings.
- Project incorporated pint flush urinal resulting in significant water savings.
- Project incorporated automatic flow faucets, which saves water and helps achieve a healthier environment.

3.5.3 Malibu Library Renovation:

Project consists of the renovation of a 20,000 square foot Los Angeles County Library along with an exterior reading garden.

- LPA selected a 95% drought tolerant plant palette along with zero use of turf. Our design allows for reduced water delivery once plant material has been established.
- With the coastal conditions of moist air, the project incorporated a Smart controller which allows for appropriate irrigation timing and adjustment based on climate conditions.
- LPA specified a drip irrigation system that allows for water application at each plant or tree.
- Project incorporated low flow toilets resulting in significant water savings.
- Project incorporated pint flush urinal resulting in significant water savings.
- Project incorporated automatic flow faucets, which saves water and helps achieve a healthier environment.

3.5.4 High Desert Government Center, San Bernardino County:

Project consists of a two-story 60,000 square foot office building. Project includes solar panels on the building and on carports in the parking area.

- Due to limited storm sewer capacity, project incorporated an underground storm water retention system.
- Project included 95% drought tolerant shrubs with zero use of turf.
- Project incorporated a Smart controller with moisture sensor which allow controller to adjust watering per valve based on soil moisture level.
- Project incorporated a drip system designed for entire landscape.
- Employing these irrigation strategies has led to 20% water reductions making it possible to achieve LEED certification.
- Project was designed for future use of reclaimed water.
- Project incorporated low flow toilets resulting in significant water savings.
- Project incorporated pint flush urinal resulting in significant water savings.
- Project incorporated automatic flow faucets, which saves water and helps achieve a healthier environment.

3.5.5 City of Brentwood:

Project consists of a 65,000 square foot City Hall, a 30,000 sf Community Center, a 400 car parking structure, all wrapping around a restored park which includes a children's water play area.

- Roof water runoff incorporates a natural water filtration system.
- Project incorporates a smart controller with moisture sensors.
- Project incorporated low flow toilets resulting in significant water savings.
- Project incorporated pint flush urinal resulting in significant water savings.
- Project incorporated automatic flow faucets, which saves water and helps achieve a healthier environment.

3.5.6 Buena Park Police Facility:

Project consists of a 60,000 square foot Police Facility with ancillary uses on the remaining site area.

- LPA designed a police memorial fountain with minimal water on a recirculating pump.
- LPA specified structural soils in landscape area for more effective root growth (and less damage to surrounding hardscape.
- Project incorporated low flow toilets resulting in significant water savings.
- Project incorporated pint flush urinal resulting in significant water savings.
- Project incorporated automatic flow faucets, which saves water and helps achieve a healthier environment.

3.5.7 Watsonville Civic Center:

Project consists of a four story structure including County Library, Superior Courts and City Hall with an adjacent six level parking garage.

- Project incorporated low flow toilets resulting in significant water savings.
- Project incorporated pint flush urinal resulting in significant water savings.
- Project incorporated automatic flow faucets which saves water and helps achieve a more healthy environment.

3.5.8 CSU San Bernardino College of Education:

- Utilized on-site aquifer to irrigate portion of landscape.
- Drought tolerant plant palette reduces irrigation water demand.
- Smart Controller which allows for appropriate irrigation timing and adjustment based on climate conditions.

3.5.9 Newport Beach Learning Center (in DSA):

- Smart Controller.
- Full drip irrigation system, design allows for irrigation of each individual plant, increasing efficiency.
- Underground storm water retention system.
- No turf.
- Drought tolerant plant palette.
- Use of decorative gravel and cobbles to limit area that has to be irrigated.
- Green Roof, reduces peak storm run-off flow, stores rain in drain mat to irrigate plants with capillary action.
- Stormwater flows into planters before entering retention system, allowing for less irrigation and more infiltration.

3.5.10 Pitzer College Landscape Projects, Los Angeles County:

- Drip irrigation system design allows for irrigation of each individual plant, increasing efficiency.
- Extreme drought tolerant plant palette.
- Use of decorative gravel to limit area that has to be irrigated.

4. Water Conservation Equipment, Manufacturers and Associated Range of Water Use Reduction

This section focuses on water efficient equipment, the associated range of water use reduction and the manufacturers that supply this equipment. As water efficiency approaches and technologies evolve, it is important to realize that the information herein may change. However, with this in mind, a broad theoretical approach has been taken in an effort to establish ranges for water savings that should be relevant for some time into the future. It is important to note that due to the complexity of factors that influence the economics of water conservation measures, such as dynamic water agency policies and rates, it was not attempted to calculate returns for specific investments.

4.1 Water Savings Through Various Alternative Irrigation Application Methods

4.1.1 Pressure Regulation

Adding pressure regulation or compensation to a spray head will allow the sprinkler nozzle to operate at its highest efficiency (Usually about 30 PSI). This eliminates the fine mist that can be easily blown away from the target area of the landscape. Since more water lands on the intended landscape area, the efficiency of the system is increased. Increases in efficiency always lead to water savings. Manufacturers: Hunter Industries, Rain Bird, Toro, and others.

Estimated water use was calculated using a hypothetical landscape requiring 1" of water using the high and low efficiencies of the "existing" sprinkler heads. Then the estimated water required to apply the 1" of plant water requirement using the high and low ranges of the more efficient sprinkler heads. Finally, the water savings was converted to a percentage. It was given as a range to allow for the range of efficiencies that could be expected in the existing sprinkler heads as well as the replacement sprinkler heads.

Estimated water savings range between 4% and 39%

FIGURE 32. EXAMPLE OF PRESSURE REGULATION ON SPRAY HEADS.

4.1.2 High Efficiency Nozzles

New advances in sprinkler nozzle design have created high efficiency nozzles that apply water at half the normal rate of a spray nozzle. These high efficiency nozzles can be retrofitted onto existing systems, or used on new systems to gain the maximum advantage of the new technology. This product qualifies for many water district water conservative product rebates. Manufacturer: Toro.

Estimated water savings range between 10% and 43%

FIGURE 33. EXAMPLE OF HIGH EFFICIENCY SPRAY NOZZLES.

4.1.3 Rotator Heads

All three of the major irrigation manufacturers have introduced a multi-stream rotor product onto the market. All produce great increases in efficiency and lower application rates than conventional spray nozzles. These nozzle systems can be retrofitted onto existing sprinkler heads or used in new designs to gain the maximum advantage of the new technology. This product qualifies for many water district water conservative product rebates as well. Manufacturers: Hunter Industries, Rain Bird, and Toro.

Sprinkler heads come in several varieties - fixed arc spray heads, impact rotor heads, and gear driven rotor heads. The word "head" is short hand for a sprinkler head. A rotor head is a sprinkler that applies water through a rotating stream or streams. These heads are generally used in larger applications as they throw water much farther than spray heads. There are older rotor head designs that are very inefficient. Impact rotors are considered inefficient heads. Replacement of any older rotor heads, or impact heads, with modern gear driven rotors will increase efficiency and therefore create water savings.

Estimated water savings range between 10% and 43%

FIGURE 34. EXAMPLE OF A MULTI-STREAM ROTATOR HEAD.

4.1.4 Subsurface Drip Irrigation

Subsurface drip irrigation is one of the least understood irrigation methods in the industry. Although these systems have been successfully in use for over 25 years in the landscape industry, they are often seen as experimental or unproven. This can be attributed to unfamiliarity with the system, poor design of some systems, and the unwillingness of some industry members to change the way things are done. A well designed subsurface system applies water at the rate of a rotor system but at a much higher efficiency. Other advantages include no overspray onto adjacent features, no wet lawns, and you can irrigate while the lawn is in use.

FIGURE 35. EXAMPLE OF SUBSURFACE DRIP IRRIGATION.

Root intrusion has been a major concern. Roots, mainly from turf, can aggressively seek out water in the subsurface tubing. The roots can enter the emitter and block off the water from the emitter. Several methods of root intrusion prevention have been used in the past, primarily the use of Treflan in the emitters or disc filters (Geoflow, Toro and Netafim). These methods have all met with some degree of success. New technology has recently been introduced to prevent root intrusion without the use of chemicals. One, a Rain Bird product, uses a small copper plate inside of each emitter. Through the interaction of the copper plate with the fine root tip, this method will stop root growth in the emitter chamber. Another product, KISSS USA, wraps the entire tubing in a geotextile fabric that not only stops root growth, it spreads out the water from the emitters many times faster than soil alone. This serves to increase the efficiency of the irrigation system.

Estimated water savings range between 30% and 56%

4.1.5 Bubbler Systems

The use of pressure compensating stream and flood bubblers (or drip emitters) can create huge water savings in shrub planting areas. While spray and rotor systems irrigate the entire planting bed, bubblers and drip emitter systems only irrigate the root zones of the shrubs in the landscape. Depending on the plant and spacing, this may be 20% or less than the entire "planting area". This results in an immediate 80% reduction in water requirement. Bubblers and drip emitters are also very efficient. The water is distributed very accurately at the root zone of the shrub. This further reduces the amount of water to be applied. For shrub planted areas, these systems are the most water conservative possible. Bubbler systems can also be very durable as they use traditional PVC pipe in place of small polyethylene tubing. They can even be installed as pop-up heads to make them completely invisible when not irrigating. Manufacturers: Hunter Industries, Rain Bird, Toro and Others.

Estimated water savings range between 58% and 73%

FIGURE 36. EXAMPLE OF A BUBBLER SYSTEM.

4.1.6 Quantitative Analysis of Various Alternative Irrigation Methods

TABLE 1. EFFICIENCIES OF EXISTING IRRIGATION SYSTEMS.

Existing Irrigation Systems	Low Irrig. Efficiency	High Irrig. Efficiency	Water Req. in Inches	W. Applied (Low I.E.)	W. Applied (High I.E.)
Fixed Arc Spray Systems	40.0%	62.5%	1.00	2.50	1.60
Old Style Rotor Systems	50.0%	65.0%	1.00	2.00	1.54

TABLE 2. EFFICIENCIES OF ADVANCED IRRIGATION SYSTEMS AND WATER SAVINGS POTENTIAL COMPARED TO EXISTING SPRAY IRRIGATION SYSTEMS.

Methods to Replace Spray Systems	Irrigation Efficiency	Water Req. in Inches	Water Applied (In.)	Water Saved from Low I.E.	Percentage from Low I.E.	Water Saved from High I.E.	Percentage from High I.E.
PC Fixed Arc Spray Systems	65.0%	1.00	1.54	0.96	38.5%	0.06	3.8%
Specialty Spray Systems (Toro)	70.0%	1.00	1.43	1.07	42.9%	0.17	10.7%
Multistream Rotators	70.0%	1.00	1.43	1.07	42.9%	0.17	10.7%
Drip line Tubing	90.0%	1.00	1.11	1.39	55.6%	0.49	30.6%
Drip Emitters or Bubblers*	90.0%	1.00	0.67	1.83	73.3%	0.93	58.3%

TABLE 3. EFFICIENCIES OF ADVANCED IRRIGATION SYSTEMS AND WATER SAVINGS POTENTIAL COMPARED TO EXISTING ROTOR IRRIGATION SYSTEMS.

Methods to Replace Rotor Systems	Irrigation Efficiency	Water Req. in Inches	Water Applied	Water Saved from Low I.E.	Percentage from Low I.E.	Water Saved from High I.E.	Percentage from High I.E.
High Efficiency Rotor Systems	75.0%	1.00	1.33	0.67	33.3%	0.21	13.3%
Drip line Tubing	90.0%	1.00	1.11	0.89	44.4%	0.43	27.8%
Drip Emitters or Bubblers*	90.0%	1.00	0.67	1.33	66.7%	0.87	56.7%

* DUE TO THE NATURE OF DRIP AND BUBBLER SYSTEMS, THE ENTIRE SQUARE FOOTAGE OF A PLANTING ZONE WOULD NOT BE IRRIGATED WITH THESE SYSTEMS. FOR THIS CALCULATION IT WAS ASSUMED THAT 60% OF THE LANDSCAPED AREA WOULD BE IRRIGATED WITH THE SYSTEM.

Notes:
I.E. = Irrigation Efficiency
In. = Inches

4.2 Water Savings Through Various Irrigation Technologies

4.2.1 Flow Sensors and Master Valves

Flow sensors are installed at the irrigation point of connection to monitor actual water use through the irrigation system. Flow sensors can be used in conjunction with a smart controller and master valve to save a significant amount of water, especially in the case of a leak or break. These devices can shut off the irrigation system when overflow conditions are detected. Overflows could indicate mainline breaks, lateral line breaks or even broken sprinkler heads that are wasting water. Coupled with a master valve, these sensors can save a substantial amount of nuisance water waste. Flow sensors can also be used to track water usage and eliminate irrigation when agency imposed rationing or tiered billing is implemented. Since a master valve shuts off the water to a mainline when it is not in use, any leaks in the system from valves or pipes are stopped when the system is off (Usually 60% to 80% of the time). Manufacturers: Data Industrial, Hunter Industries, Rain Bird, Rainmaster, Toro, and Others.

Estimated water savings range will vary depending on circumstances.

FIGURE 37. EXAMPLE OF A FLOW SENSOR.

4.2.2 Weather Based Control Systems or "Smart Controllers"

Weather based control systems are designed with internal programming to respond to local weather conditions by adjusting the irrigation schedules. This process involves a weather data source, either an onsite or local weather station, or a subscription service to a manufacturer who compiles the data from multiple sources. The advantage to these systems is that the irrigation programming is adjusted daily to irrigate when the plants need the water based on the current weather conditions. Often, irrigation controllers are scheduled seasonally, or four times a year. Daily variation from the historical averages can be substantial, so daily programming of controllers can save between 20% and 50% over the average conventionally programmed irrigation controller. Manufacturers: Calsense, Hunter Industries, Rain Bird, Rainmaster, Toro, Weathertrak, and Others.

Estimated water savings range between 20% and 50%

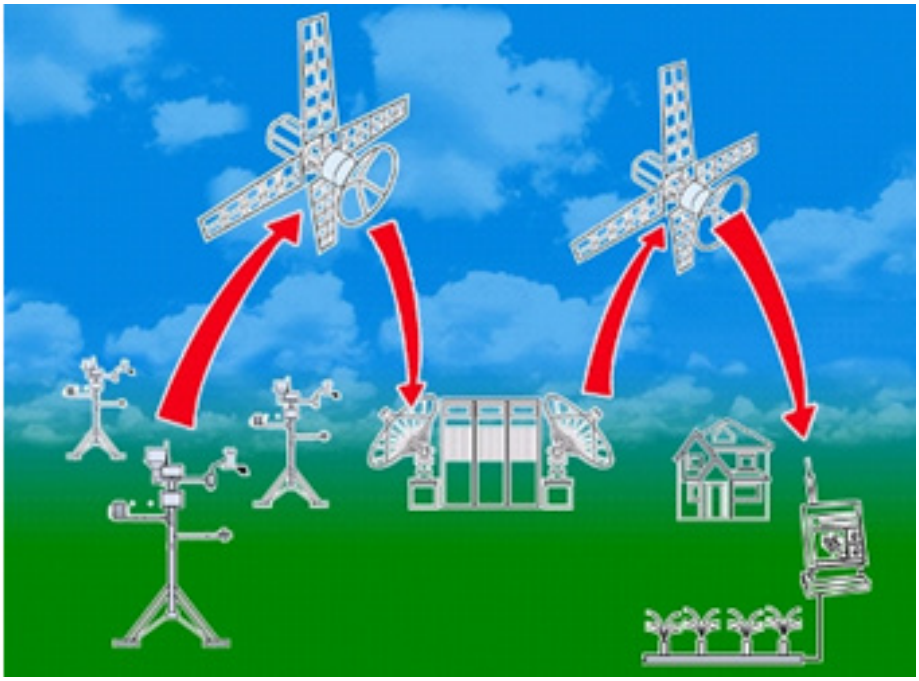


FIGURE 38. EXAMPLE OF A WEATHER BASED SMART CONTROLLER.

4.2.3 Soil Moisture Based Control Systems or "Smart Controllers"

While weather based controllers estimate the soil water conditions through complicated algorithms, soil moisture based control systems actually measure the moisture available in the soil to the plants. Modern moisture sensors are unaffected by soil and water salinity, fertilizer usage, and heat and temperature variations. Solid state design and modern waterproofing have made these sensors viable solutions in a water conservation tool box. Unlike weather based control systems, sensor based systems can very accurately adjust programming to contend with rainfall events. Because the system is calibrated to recharge to field capacity and only irrigate at the allowable depletion levels, longer and less frequent irrigation takes place. Long and infrequent irrigation is universally agreed to developed the best root systems in turf and woody plants. A strong root system allows plants to better use the water available to them and increases their resistance to drought. Soil moisture based systems can save between 30% and 60% of irrigation water use. Manufacturers: Baseline, Calsense, Irrometer, and Others.

Estimated water savings range between 30% and 60%

FIGURE 39. EXAMPLE OF A SOIL MOISTURE BASED SMART CONTROLLER.

FIGURE 40. EXAMPLE OF A CENTRALIZED CONTROL SYSTEM.

4.2.4 Centralized Control Systems

Central control systems link up multiple field irrigation controllers to a single computer for control, management and programming adjustment. These systems allow for shared resources such as weather station and rainfall data. Multiple weather stations can be integrated into a large scale centralized irrigation control system. Many centralized control systems offer weather based or moisture sensor based programming assistance. All central systems include the monitoring of individual site conditions and problems such as leaks and broken equipment can be reported back to the main computers. Once problems are identified, the central system can alert maintenance teams of the problem for repair. Centralized control systems can achieve similar water conservation levels as weather based and soil moisture sensor based systems. Centralized control systems can save a tremendous amount of labor as well. Since monitoring and programming tasks take place in one location, there is no need to send a controller technician out to each site. Many central systems also have advanced flow management software that allow for accurate scheduling of irrigation to assist in managing pump usage. Tremendous electricity savings can result from these systems. Manufacturers: Baseline, Calsense, Hunter Industries, Rain Bird, Rainmaster, Toro, and Others.

Estimated water savings range between 20% and 60%

4.3 Water Saving Through Turf Replacement

4.3.1 Switching Turf Species

One of the largest savings in water in the landscape can be achieved by reducing the amount of vegetation that require irrigation. Turf grass is the obvious highest water use planting in the landscape. Cool season turf requires as much as 80% of ET while warm season turf can survive at 60% of ET. Switching turf species can result in a water savings of over 25%. Replacing of passive turf areas in medians, parking lots and other areas where it is not used for active play can result in tremendous water savings. As an example, a cool season turf area replaced with low water use native shrubs can result in an 83% water use reduction if a bubbler or drip system is installed with the conversion. In San Diego County, that could mean as much as a 2 million gallon savings per year per acre converted. Converting landscape can also reduce labor costs by reducing mowing and it can also reduce green waste from grass clippings.

Estimated water savings range between 13% and 83%

TABLE 4. WATER SAVINGS POTENTIAL OF TURF SPECIES REPLACEMENT

Savings to be Gained from Turf Species Replacement	Plant Factor	Eto in Inches	Water Req. in Inches		
Cool Season Turf	80%	45.0	36.0		
Warm Season Turf	60%	45.0	27.0	25%	Water Savings from Converting Cool Season Turf to Warm Season Turf
High Water Use Shrubs	70%	45.0	31.5	13%	Water Savings from Converting Cool Season Turf to High Water Use Shrubs
Medium Water Use Shrubs	50%	45.0	22.5	38%	Water Savings from Converting Cool Season Turf to Medium Water Use Shrubs
Low Water Use Shrubs	30%	45.0	13.5	63%	Water Savings from Converting Cool Season Turf to Low Water Use Shrubs

90.00	Inches of Irrigation Water (Cool Season Turf Irrigated with a Low Efficiency Fixed Arc Spray System)
2,443,886	Gallons per Year per Acre Used
15.00	Inches of Irrigation Water (Low Water Use Shrubs Irrigated with a Bubbler Head System)
407,314	Gallons per Year per Acre Used
83%	***Water Savings for this Replacement***
2,036,572	***Gallons per Year per Acre Saved***

Notes:
Eto = Evapo-transpiration

FIGURE 41. SANTA FE SPRINGS CITY LIBRARY BEFORE TURF REPLACEMENT.

FIGURE 42. SANTA FE SPRINGS CITY LIBRARY AFTER REPLACEMENT OF TURF WITH 95% DROUGHT TOLERANT SPECIES.

An example of a recent turf removal program can be seen in Table 4 and Table 5. This project at Santa Fe Springs City Library consisted of removing existing turf and replacing it with 95% drought tolerant shrubs. In addition, a new drip irrigation system and a separate bubbler system for each existing tree was installed. The existing controller was also replaced with a more efficient Smart controller.

4.3.2 Switching to Synthetic Turf

Synthetic turf can be used to replace natural turf in sports field as well as in other passive applications, such as road medians. Some of the benefits possible with synthetic turf include reduced maintenance cost, reduced water use, no mowing, fertilizers, or pesticides required, increased playability, abd surfaces not affected by frequent field events. Some of the drawbacks of synthetic turf include potential for heat hazard without wetting systems and possible need for specialized equipment to meet the manufacturer's maintenance specifications.

The City of San Diego is working to incorporate synthetic turf in public parks and joint use recreational facilities. Their draft policy on synthetic turf states, "synthetic turf systems may be considered for use in public park facilities if they are installed for permitted, active sports-related recreational activities or to replace small, high use natural turf areas that are difficult to maintain as determined by the Park and Recreation Director."

Synthetic turf can also significantly reduce water usage when compared to natural turf. For example, a cool season natural turf area replaced with synthetic turf using the same high efficiency rotor system can result in a 91% water use reduction. In San Diego County, that could mean as much as a 1.2 million gallon savings per year per acre converted. A warm season natural turf area replaced with synthetic turf using the same high efficiency rotor system can result in an 88% water use reduction. In San Diego County, that could mean as much as a 0.9 million gallon savings per year per acre converted.

Manufacturers that provide synthetic turf include Field Turf, Mondo, Sprint Turf and Sportexe. Manufacturers that provide sprinkler systems for synthetic turf include Toro and Underhill

Estimated water savings range between 88% and 91%

TABLE 5. WATER SAVINGS POTENTIAL OF NATURAL TURF REPLACED WITH SYNTHETIC TURF.

Savings to be Gained from Synthetic Turf Replacement	Plant Factor	Eto in Inches	Water Req. in Inches	Irrigation Efficiency
Cool Season Turf	80%	45.0	36.0	75%
Warm Season Turf	60%	45.0	27.0	75%
Synthetic Turf	7.0%	45.0	3.2	75%

48.00	Inches of Irrigation Water (Cool Season Turf Irrigated with a High Efficiency Rotor System)
1,303,406	Gallons per Year per Acre Used

36.00	Inches of Irrigation Water (Warm Season Turf Irrigated with a High Efficiency Rotor System)
977,554	Gallons per Year per Acre Used

4.20	Inches of Irrigation Water (Synthetic Turf Irrigated with a High Efficiency Rotor System)
114,048	Gallons per Year per Acre Used

91%	***Water Savings for replacement of cool season turf with synthetic turf***
1,189,358	***Gallons per Year per Acre Saved***
88%	***Water Savings for replacement of warm season turf with synthetic turf***
863,506	***Gallons per Year per Acre Saved***

Notes:
Eto = Evapo-transpiration

4.4 Water Saving Through Various Plumbing Fixture Replacements

Water savings associated with building plumbing systems can be achieved by use of more efficient fixtures and valves. A quick and relatively cost-effective method of reducing building water use is to replace aerators in faucets to limit the flow rate coming from them. Aerators applied to lavatories and kitchen and janitorial sinks can reduce flow by 32-77%. Manufacturers of aerators include Chicago, Delta and Omni.

Another relatively cheap strategy is to replace existing shower heads with high efficiency heads. This practice can lead to up to 40% water savings. Manufacturers of low flow shower heads include Bradley, Acorn and Symmons.

More involved plumbing retrofits include replacing existing toilets with low flow models and urinals with low and no flow options. In addition to the flush valves, the existing toilet and urinal china will need to be replaced in these instances. Low flow toilets can save up to 20% of water use compared to standard units and low and no flow urinals can save between 88-100% of water use compared to standard units.
Manufacturers of low flow toilets include Kohler or American Standard china fixtures with Sloan or Zurn flush valves. Manufacturers of integrated low flow urinals (urinal + flush valve) include Sloan, Kohler, American Standard and Zurn, or use Kohler or American Standard china fixtures with Sloan or Zurn flush valves. Manufacturers of no flow urinals include Falcon Waterfree, Waterless Co., Sloan and Kohler.

Another lower cost option for toilets is to replace the existing flush valve with a dual flush option. This does not require replacement of the china but depends on the user's participation for effective water use reduction. A summary of water savings associated with replacement of plumbing systems can be found in Table 6.

Estimated water savings for low flow toilets up to 20%

Estimated water savings for dual flush valve on toilets up to 21%

Estimated water savings for low flow urinals up to 88%

Estimated water savings for no flow urinals up to 100%

Estimated water savings for high efficiency sink aerators up to 32%

Estimated water savings for high efficiency lavatory aerators up to 77%

Estimated water savings for high efficiency shower heads up to 40%

TABLE 6. WATER SAVINGS POTENTIAL ASSOCIATED WITH REPLACEMENT OF PLUMBING SYSTEMS.

Methods to Replace Plumbing Systems	High Efficiency Fixture Water Use	Fixture Water Use	Units	Percent Water Savings
Low Flow Toilets	1.28	1.60	Gallon per Flush	20%
Dual Flush Toilet Valves	1.27	1.60	Gallon per Flush	21%
Low Flow Urinals	0.125	1.00	Gallon per Flush	88%
No Flow Urinals	0	1.00	Gallon per Flush	100%
High Efficiency Faucets	1.5	2.20	Gallon per Minute	32%
High Efficiency Faucet Aerators	0.5	2.20	Gallon per Minute	77%
Shower Heads	1.5	2.50	Gallon per Minute	40%

Notes:
Eto = Evapo-transpiration

4.5 Employing a Water Manager

A Water Manager is an individual staff member who can focus on the efforts required to achieve broad water conservation goals. In order for the strategies outlined in this Plan to best meet their potential and provide ongoing benefits to DPR and the public, it is highly recommended that a Water Manager carry out the tasks of meeting DPR water reduction goals. The Water Manager will have the knowledge of the systems in place and the ability to enforce rules on an ongoing basis so that the Water Conservation Plan continues to deliver its full potential. This approach will not only establish DPR's dedication towards water efficiency but also streamline and standardize the specifications, training, education, administration, enforcement compile reports, interact with water jurisdictions and other agencies, research and apply for grants, monitor alerts and relay issues to field staff, and maintenance of the Plan.

Although no comprehensive analysis has been performed to quantify the benefits of an on-staff Water Manager, examples exist. The effectiveness of hiring a Water Manager was demonstrated by the San Diego Community College District. After this hire, the District achieved water savings of over 50% and subsequent results have remained at this level. An annual water reduction of approximately 37 million gallons was achieved, and at $0.008 per gallon, this equates to an annual cost savings of $296,000. These savings were largely attributed to application of better controls and their continued maintenance.

5. Implementation Strategy

In order to choose initial projects from the many outlined in this document it is recommended that an implementation strategy be put in place. The projects that are the most cost effective and can be put into practice with relative ease in a short time period were chosen. Project recommendations meeting these criteria are listed in descending order.

1. Educate Landscape personnel. This may be through internal DPR training programs or through water conservation programs offered by outside agencies such as water districts.
2. Visit sites and repairs all leaks and/or broken equipment.
3. Add aerators to faucets to limit flow rate.
4. Replace existing shower heads with low flow heads.
5. Use various water agencies' free Certified Landscape Irrigation Auditor service. Schedule DPR property site visits to review irrigation spray patterns and give suggestions on how to adjust irrigation system to properly apply water to landscaped areas.
6. Where free water agency auditor programs are unavailable, choose sites, evaluate systems and implement best practice water conservation measures. Prioritize an implementation strategy starting with low and no cost options first. For instance, start with adjustments to existing equipment to reduce water use. Utilize water agency rebates and incentives where applicable.
7. Properly program existing irrigation controllers.
8. Replace inefficient nozzles and equipment with high efficiency types.
9. Convert existing toilet flush valves to dual flush option.
10. Convert existing urinals to low or no flush options.
11. Convert existing toilets to low flow option.
12. Replace existing irrigation controller with more efficient Smart controller and adjust station duration times accordingly.

The following projects will also provide a large magnitude of water use reduction but at higher costs than those previously listed. These recommendations represent the next phase of the implementations strategy:

13. Hire a Water Manager.
14. Convert turf or other irrigated plantings to non-irrigated elements.
15. Convert turf from cool season to warm season species.
16. Convert turf to lower water use shrubs.
17. Convert natural turf to synthetic turf.
18. Integrate gray water use into irrigation and/or indoor plumbing applications.
19. Convert potable water based irrigation systems to reclaimed water if available.
20. Incorporate the majority of the above strategies into new design where feasible.

6. Conclusions

Water use management has become a growing concern for DPR and the County at large. A focus on water conservation is needed and is driven by supply constraints, evolving regulations and highly volatile and increasing water rates. As these supply constraints for the County exist at all levels, including limited availability from the Colorado River, Northern California and locally, it is imperative that conservation play a greater role in effectively securing new supply.

As water costs consume an ever increasing portion of the DRP budget, it is necessary to take action to address water use. This Water Conservation Plan (WCP) lays the foundation for taking these actions and serves as a very important component in sustaining the core values of DPR. The broad approach taken will allow the WCP to serve as an enduring document, while the focused implementation strategy will allow prioritized water use reduction efforts to make an immediate impact.

7. Appendix

7.1 Quantitative Analysis of Water Savings Methods

TABLE 1. EFFICIENCIES OF EXISTING IRRIGATION SYSTEMS.

Existing Irrigation Systems	Low Irrig. Efficiency	High Irrig. Efficiency	Water Req. in Inches	W. Applied (Low I.E.)	W. Applied (High I.E.)
Fixed Arc Spray Systems	40.0%	62.5%	1.00	2.50	1.60
Old Style Rotor Systems	50.0%	65.0%	1.00	2.00	1.54

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Methods to Replace Spray Systems	Irrigation Efficiency	Water Req. in Inches	Water Applied (In.)	Water Saved from Low I.E.	Percentage from Low I.E.	Water Saved from High I.E.	Percentage from High I.E.
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Specialty Spray Systems (Toro)	70.0%	1.00	1.43	1.07	42.9%	0.17	10.7%
Multistream Rotators	70.0%	1.00	1.43	1.07	42.9%	0.17	10.7%
Drip line Tubing	90.0%	1.00	1.11	1.39	55.6%	0.49	30.6%
Drip Emitters or Bubblers*	90.0%	1.00	0.67	1.83	73.3%	0.93	58.3%

TABLE 3. EFFICIENCIES OF ADVANCED IRRIGATION SYSTEMS AND WATER SAVINGS POTENTIAL COMPARED TO EXISTING ROTOR IRRIGATION SYSTEMS.

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High Efficiency Rotor Systems	75.0%	1.00	1.33	0.67	33.3%	0.21	13.3%
Drip line Tubing	90.0%	1.00	1.11	0.89	44.4%	0.43	27.8%
Drip Emitters or Bubblers*	90.0%	1.00	0.67	1.33	66.7%	0.87	56.7%

* DUE TO THE NATURE OF DRIP AND BUBBLER SYSTEMS, THE ENTIRE SQUARE FOOTAGE OF A PLANTING ZONE WOULD NOT BE IRRIGATED WITH THESE SYSTEMS. FOR THIS CALCULATION IT WAS ASSUMED THAT 60% OF THE LANDSCAPED AREA WOULD BE IRRIGATED WITH THE SYSTEM.

Notes:
I.E. = Irrigation Efficiency
In. = Inches

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Warm Season Turf	60%	45.0	27.0	25%	Water Savings from Converting Cool Season Turf to Warm Season Turf
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Medium Water Use Shrubs	50%	45.0	22.5	38%	Water Savings from Converting Cool Season Turf to Medium Water Use Shrubs
Low Water Use Shrubs	30%	45.0	13.5	63%	Water Savings from Converting Cool Season Turf to Low Water Use Shrubs

90.00	Inches of Irrigation Water (Cool Season Turf Irrigated with a Low Efficiency Fixed Arc Spray System)
2,443,886	Gallons per Year per Acre Used
15.00	Inches of Irrigation Water (Low Water Use Shrubs Irrigated with a Bubbler Head System)
407,314	Gallons per Year per Acre Used
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Cool Season Turf	80%	45.0	36.0	75%
Warm Season Turf	60%	45.0	27.0	75%
Synthetic Turf	7.0%	45.0	3.2	75%

48.00	Inches of Irrigation Water (Cool Season Turf Irrigated with a High Efficiency Rotor System)
1,303,406	Gallons per Year per Acre Used
36.00	Inches of Irrigation Water (Warm Season Turf Irrigated with a High Efficiency Rotor System)
977,554	Gallons per Year per Acre Used
4.20	Inches of Irrigation Water (Synthetic Turf Irrigated with a High Efficiency Rotor System)
114,048	Gallons per Year per Acre Used
91%	***Water Savings for replacement of cool season turf with synthetic turf***
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Methods to Replace Plumbing Systems	High Efficiency Fixture Water Use	Fixture Water Use	Units	Percent Water Savings
Low Flow Toilets	1.28	1.60	Gallon per Flush	20%
Dual Flush Toilet Valves	1.27	1.60	Gallon per Flush	21%
Low Flow Urinals	0.125	1.00	Gallon per Flush	88%
No Flow Urinals	0	1.00	Gallon per Flush	100%
High Efficiency Faucets	1.5	2.20	Gallon per Minute	32%
High Efficiency Faucet Aerators	0.5	2.20	Gallon per Minute	77%
Shower Heads	1.5	2.50	Gallon per Minute	40%

Notes:
Eto = Evapo-transpiration