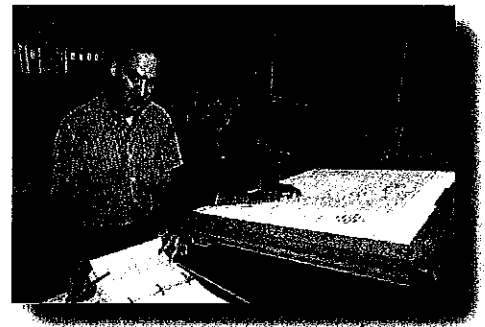


# Orange County Water District

*Orange County Water District (OCWD) is a special district formed in 1933 by an act of the California Legislature. The District was originally created to protect Orange County's rights to Santa Ana River water and to manage the vast groundwater basin that underlies north and central Orange County. In looking to the future and the increased demands for groundwater, it is, and continues to be, the mission of OCWD to provide local water retailers with a reliable, adequate, high-quality water supply at the lowest reasonable cost in an environmentally responsible manner.*

## Orange County's Groundwater

- Orange County's groundwater basin is a large underground reservoir that holds much of northern and central Orange County's water supply. The cities, along with the public and private water agencies that overlie the basin, pump water from the groundwater basin and deliver it by pipeline to their customers.
- Over the years, OCWD has made fiscally-sound investments in the basin that have more than doubled the amount of water able to be produced from the basin.
- Groundwater investments include improving OCWD facilities to send more water into the basin, projects to remove contamination and a proactive water quality monitoring program to ensure groundwater quality and safety.
- Groundwater satisfies approximately 70 percent of the water needs for 2.3 million people in the 21 northern and central Orange County cities overlying the groundwater basin. The remainder of the water demand for these cities is met by importing water from Northern California and the Colorado River through the Metropolitan Water District of Southern California.
- Orange County's groundwater is cost-effective because of the low cost of recharging Santa Ana River water. It costs about one-half the price of imported water per acre-foot (an acre-foot is 326,000 gallons or enough water for two small families for one year).



## Groundwater Recharge



Santa Ana River

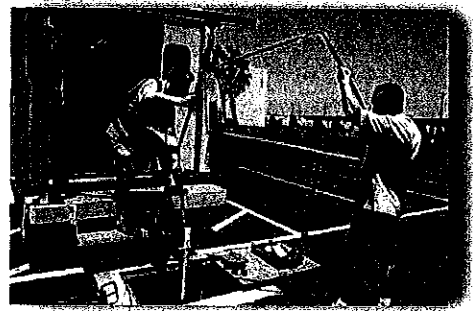
- To replace the groundwater that is pumped out of the basin every year, OCWD has a proactive program to refill the basin and ensure a reliable water supply for the population it serves.
- OCWD refills the basin with water from the Santa Ana River, recycled water and imported water (when available).
- To refill the basin, water is channeled off the Santa Ana River into more than a dozen nearby lakes called settling or percolation ponds located in the cities of Anaheim and Orange. The water is filtered through the bottom and sides of the percolation ponds and enters the deep aquifers, where it is ultimately withdrawn by water retailers for commercial and residential usage.



## Groundwater Monitoring

- OCWD has one of the most sophisticated groundwater monitoring programs in the country. The District runs more than 350,000 analyses of water from more than 650 wells every year. OCWD performs nearly 50 percent more water quality tests than it is required to do in order to ensure the highest water quality possible.

- In 2004, OCWD completed a 10-year, \$10 million Santa Ana River Water Quality and Health Effects Study, which demonstrated the safety of Santa Ana River water as a source for recharging the groundwater basin. A panel of nationally recognized experts provided an independent review of the study and validated its positive results.



## Groundwater Replenishment System



- Building on 30 years of water purification experience from the world-renowned and recently demolished Water Factory 21, OCWD partnered with the Orange County Sanitation District (OCSD) to construct the largest water purification project of its kind in the world, the Groundwater Replenishment (GWR) System.

- The GWR System takes highly treated sewer water from OCSD, currently sent to the ocean, and purifies it to near-distilled quality water. The water is used to expand OCWD's existing seawater barrier, which helps prevent seawater from intruding into the groundwater basin. GWR System water is also sent to percolation ponds where it blends with natural groundwater supplies.

- OCWD is committed to decreasing Orange County's dependency on imported water from the Colorado River and Northern California. The current method of moving water through the Delta to the pumps of the California State Water Project and Central Valley Projects is in jeopardy due to recent environmental rulings. The GWR System diminishes the region's reliance on uncertain imported water supplies.

- The water purification facility provides a drought-proof, locally controlled, reliable water supply that serves more than 500,000 residents per year. GWR reduces the amount of outfall during storms to the Pacific Ocean, preserve's the county's vital coast and uses fewer gas emissions than when importing water from the California State Water Project.

## Natural Resources

- OCWD is a leader in water and natural resource development.
- OCWD manages the largest constructed wetlands in Southern California behind Prado Dam to naturally remove nitrates from Santa Ana River flows. The wetlands area is a major stop on the Western flyway and home to more than 200 native species.
- Through water conservation and environmental mitigation measures in the Prado Dam area, OCWD has brought back an endangered California songbird, the least Bells vireo, from less than 19 breeding pairs in the 1980s to 600 pairs today.



*Santa Ana River Watershed*

- Additional environmental programs include watershed removal of the non-native *Arundo donax* plant and study and restoration work in support of both the Santa Ana Sucker fish and the Southwestern Willow Flycatcher bird.

# Recharge Operations

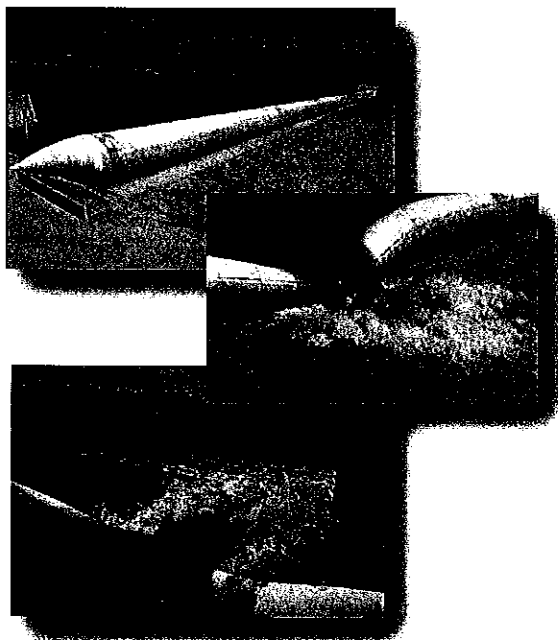
Orange County Water District is responsible for managing the vast groundwater basin that provides approximately 70 percent of northern and central Orange County's drinking water. As part of our groundwater management, OCWD maintains one of the world's most advanced managed aquifer recharge systems to replace the water that is pumped from about 400 wells belonging to local water agencies, cities and other groundwater users.

## History

- Starting in 1936, OCWD began purchasing portions of the Santa Ana River channel for recharge. Today, OCWD owns a six-mile section of the Santa Ana River from Imperial Highway to Ball Road in Anaheim.
- Over the years the District has further expanded its recharge system, which now includes more than 1,000 acres. Within this recharge system are more than two dozen recharge basins that range in depth from five to 150 feet.
- The recharge basins are located in the cities of Anaheim and Orange where the soil is sandy and coarse-grained, which allows water to easily percolate into the deep aquifers.



Recharge Facilities in Anaheim



Rubber Dam

## Rubber Dams

- Along with purchasing land, OCWD has invested heavily in infrastructure to maximize the recharge capacity of its facilities. Key improvements include two inflatable rubber dams on the Santa Ana River.
- The dams steer flows from the Santa Ana River into the District's recharge basins. When the first rubber dam was purchased in 1992, it paid for itself within just a few months by saving water that otherwise would have been lost to the ocean.
- Other improvements include multiple pumping stations, miles of pipelines, numerous valves, flow meters, water level sensors, and a sophisticated computerized control system that allows the system to be controlled remotely via a laptop computer.



## Basin Cleaning Vehicles

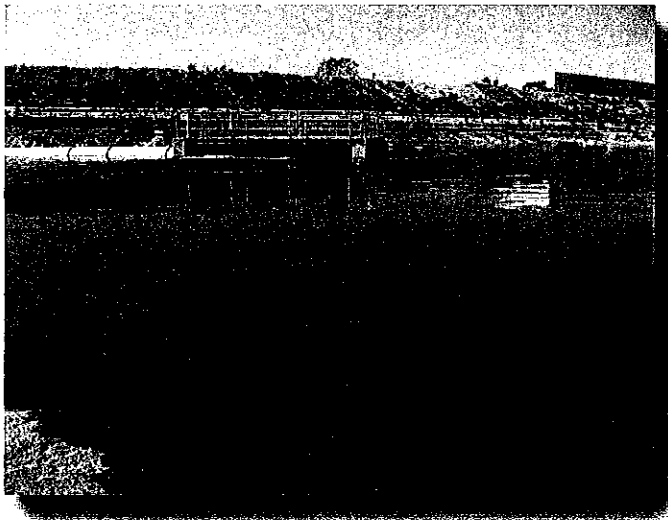
- Recharge basins require constant maintenance and cleaning to effectively percolate water. OCWD recently invented a basin cleaning vehicle (BCV). The BCV attempts to clean the basins while water remains in them versus the traditional method of draining, drying and cleaning basins with heavy equipment.

- The BCVs stir up clogging layers at the bottom of lakes, pump clay and silt ashore and redeposit sand to lake bottoms. The patented BCV technology has global significance as percolation lakes are used around the world to replenish groundwater basins.



*Basin Cleaning Vehicle*

## Groundwater Replenishment System Water



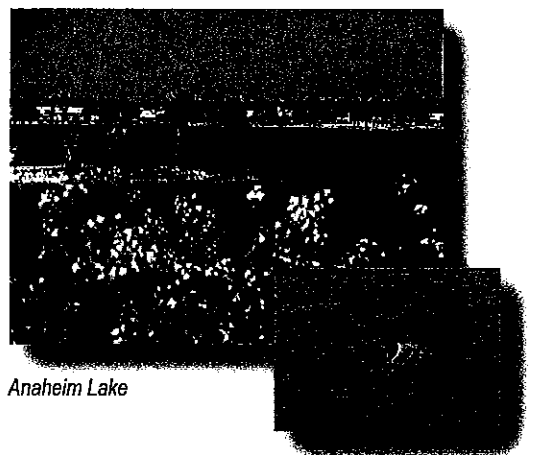
*Ultra-pure Groundwater Replenishment System Water Being Recharged in Miller Basin*

- The most recent improvement to the District's recharge system is the completion of the Groundwater Replenishment System. The new system sends purified sewer water from OCWD's purification facility in Fountain Valley through a 13-mile long pipeline that releases water to two of OCWD's recharge basins in Anaheim.

- This project, which began producing water for recharge in January 2008, provides a new source of high-quality water for year-round recharge. This new source is increasingly important in today's water climate where sources of imported water that have historically been relied upon for recharge (such as the Colorado River and the State Water Project) are becoming increasingly scarce.

## Environment

More than 100 species of wildlife are found on District lands, and OCWD cooperates with environmental organizations to preserve the natural habitat of these animals. In addition, recreational opportunities include river trails for horseback riding, bicycling and jogging; and several of the recharge basins are stocked for sport fishing.



*Anaheim Lake*

# Prado Wetlands

The citizens of northern and central Orange County are fortunate to have a huge groundwater basin that provides a reliable source of drinking water for the area. The groundwater basin, managed by the Orange County Water District (OCWD), provides a vast natural reservoir of over one million acre-feet of high quality water to this dry, arid region. An acre-foot of water can support the needs of two average-sized families for one year.

## Groundwater Management

- A natural reservoir in times of sparse rainfall, this underground resource provides nearly 70 percent of the water consumed by 2.3 million residents of Orange County. As the water in this groundwater basin is withdrawn to satisfy Orange County's water needs, OCWD uses water from the Santa Ana River, comprised of storm-water runoff, recycled water and other natural sources to replenish this valuable groundwater basin.
- A significant portion of the Santa Ana River flow is directed through OCWD's wetland area to naturally improve water quality. The various river flows support fish and bird habitats in the Prado basin as they travel to Orange County's groundwater basin.



Aerial View of Prado Wetlands

## Endangered Species Conservation

### Prado Wetlands



least  
Bell's  
vireo

Arundo Donax

- Prado Basin is home to several rare and endangered birds and waterfowl species. As part of a conservation agreement with the Army Corps of Engineers (the Corps) and the U.S. Fish and Wildlife Service (USFWS), OCWD has created more than 800 acres of habitat for the endangered least Bell's vireo and Southwestern Willow Flycatcher, and funded more than \$3 million in mitigation and monitoring measures for the vireo program.
- OCWD's vireo mitigation program has been one of California's great environmental success stories. The program includes restoration of vireo habitat and the trapping of cowbirds that invade the vireo nests. When the three agencies first began negotiating in 1986, there were only 19 pairs of vireo song birds in the Prado Basin. Today, the number of male territories is approaching 1,000 and continues to grow as more fledglings are produced and reach maturity.
- OCWD contributed \$1 million to the USFWS as seed money to create the Santa Ana Watershed Association (SAWA) to lead the removal of a non-native plant, Arundo donax, that has overrun the area. Arundo is a major threat to the ecosystem of the entire Santa Ana River watershed. Its removal effectively restores and enhances the environment. Since its inception, SAWA has raised more than \$30 million and removed 3,500 acres of Arundo.



## Restoring Water Quality

- The Santa Ana River flow (during non-storm seasons) consists primarily of highly treated wastewater from upstream communities, resulting in water with high nitrate levels. Part of the Santa Ana River flow that is captured behind Prado Dam is routed through a specially constructed wetland area. By putting the river water through this network of ponds behind Prado Dam, OCWD has created a natural, cost-effective process for reducing nitrate levels and purifying the water for future percolation into the groundwater basin.



*OCWD Wetlands*

- Within the 2,150 acres of land OCWD owns behind Prado Dam lies 465 acres of constructed wetlands, including a system of 50 shallow ponds. Originally, the wetland area was used for farming barley. In the mid-1970s, the fields were turned into ponds used for duck hunting.



*Native Marigold Habitat*

- In the early 1990s, research was conducted to determine what water quality benefits, if any, would occur if part of the Santa Ana River flow passed through the wetlands. Research conducted by scientists from Northwestern University and University of California Berkeley investigated the effectiveness of the wetlands naturally removing nitrate, the fate of the nitrogen removed, and the effects of various wetland manipulations upon nitrate removal rates. The results from the studies indicated that the wetlands are a very effective and economical means for nitrate removal currently removing nearly 360 tons per year from the Santa Ana River.

- The wetlands are an extremely cost-effective treatment process. Nitrate removal at a conventional treatment plant would cost approximately \$15.00 per pound, compared to about \$0.50 per pound using the natural wetlands process. The wetlands project allows OCWD to improve water quality beyond regulatory requirements so that Orange County has the best source of water quality possible. By taking this innovative approach to water quality issues, OCWD improves groundwater quality, enhances the environment and minimizes treatment costs. A permit from the Corps allows half of the flow of the Santa Ana River, about 80 cubic feet per second (cfs), to be diverted through the wetlands. In the late-1990s, OCWD reconstructed its wetlands to maximize the capability of captured river flows and to improve operational efficiency.

## Storm Water Capture

- OCWD's Prado wetlands are the largest constructed wetlands on the west coast of the United States. Prado Dam is the primary flood control facility along the Santa Ana River. When the Dam was built, the Corps, which owns and manages the Dam, considered conservation an incidental function of the dam. Initially, the water conservation level behind the Dam was limited to a storage capacity of 8,000 acre-feet.



*View of Prado Wetlands from San Bernadino Mountains*

- Later, an agreement with OCWD, the Corps and USFWS allowed for increased conservation from March 1 to September 30 each year to store up to 26,000 acre-feet. In 2004, a temporary agreement was reached between OCWD and the Corps to store more water from November to March each year. The additional water captured behind the Dam is used to recharge the groundwater basin. The added storage capacity allows OCWD to increase its use of local water resources, saving water users millions of dollars in imported water purchases.

# Groundwater Replenishment System

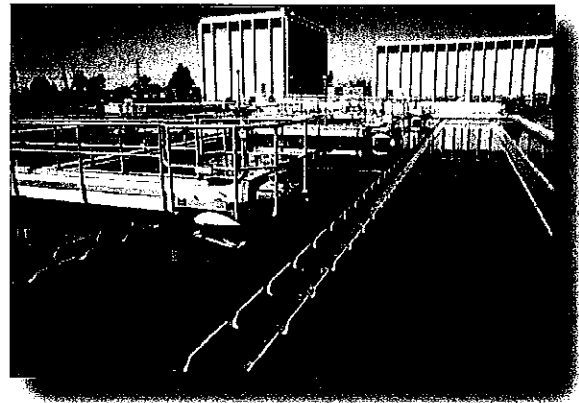
The Groundwater Replenishment (GWR) System is the largest water purification project of its kind and helps increase Orange County's water independence by providing a locally controlled, drought-proof supply of high quality water. The GWR System generates enough near-distilled water to meet the annual needs of 500,000 people and exceeds all state and federal drinking water standards.

## History

- In 1965, years of heavy pumping to sustain Orange County's agricultural economy had lowered the water table below sea level and salt water from the Pacific Ocean had encroached inland. To prevent seawater intrusion, the Orange County Water District (OCWD) began a pilot-scale water reclamation project in the mid-1960s. This project developed into the world renowned Water Factory 21.

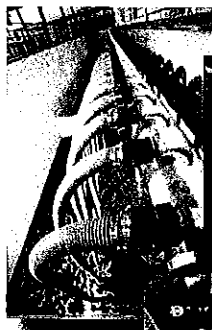
- Water Factory 21 was the first facility to take municipal sewer water and purify it to drinking water standards using reverse osmosis

treatment. The purified water blended with groundwater and was injected into 23 multi-point injection wells located four miles inland to protect the groundwater from seawater contamination. Constructed by OCWD, this project was extremely successful and paved the way for the more advanced Groundwater Replenishment (GWR) System.

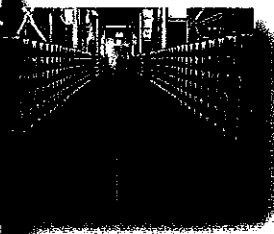


Water Factory 21

Microfiltration



Reverse Osmosis



Ultraviolet Light

## Purification Process

- The GWR System takes highly treated sewer water and purifies it using a state-of-the-art, three-step process – microfiltration, reverse osmosis, and ultraviolet light with hydrogen peroxide.
- Once purified by the three-step process – the water is so pure that minerals are added to stabilize the water. Roughly half of the water from the GWR System is injected into Orange County's seawater barrier. The seawater barrier is an underground pressure ridge of water formed by injection wells along the coast of Orange County.
- The remaining water is piped to recharge lakes in Anaheim where the water takes the natural path of rainwater as it filters through sand and gravel to the deep aquifers of the groundwater basin.

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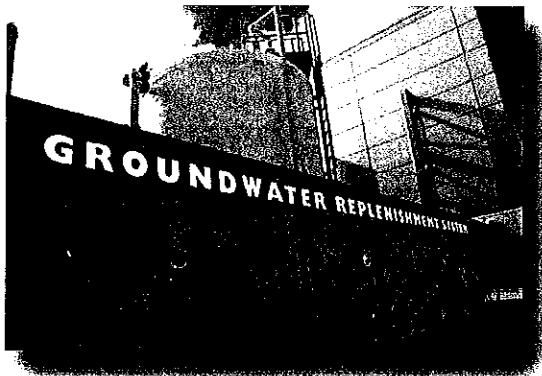


## Project Benefits

- The GWR System helps decrease Orange County's dependency on imported water from the Colorado River and Northern California. It takes a resource that would otherwise be wasted to the ocean, purifies it and provides a new source of water for more than 500,000 people.
- Additionally, the new facility uses approximately one-half the amount of energy required to transport water from Northern California to Southern California. It also minimizes the amount of flow to the Orange County Sanitation District's ocean outfall during storms, preserving the county's vital coast.
- The GWR System maintains "water diversity" in an arid region, provides high-quality water for the groundwater basin and protects the environment by reusing a precious resource.



*Aerial View of Groundwater Replenishment System*



## Regulatory Approvals and Funding

- The GWR System was reviewed, approved and permitted by the California Department of Public Health and the Santa Ana Regional Water Quality Control Board to ensure public health, water quality and environmental compliance prior to starting production of purified water in January 2008.
- A mix of federal, state and local funding paid for the GWR System, estimated at \$480.9 million. Grants of \$92.5 million were received including \$67 million from the State Water Bond (Proposition 13), \$20 million from the Bureau of Reclamation and \$5 million from the State Water Resources Control Board.

## Orange County Water District

- OCWD manages and protects the large groundwater basin underlying north and central Orange County. OCWD is a special district, separate from the County of Orange or any city government. It was created by the California state legislature in 1933 to manage Orange County's groundwater basin. The groundwater basin supplies approximately 70 percent of the water needs for more than 2.3 million residents in Orange County. To learn more about Orange County's water, visit [www.ocwd.com](http://www.ocwd.com).

## Orange County Sanitation District

- The Orange County Sanitation District is a public agency responsible for safely collecting and treating wastewater (sewage) for 2.5 million people. OCSD beneficially reuses and recycles the treated wastewater and other resources resulting from the treatment process. It is a special district established by the California State legislature and governed by a 25-member board of directors. The directors are comprised of elected representatives for each of the sewer agencies or cities within OCSD's 471-square mile service area. Visit [www.ocsd.com](http://www.ocsd.com) for information.



*Elected Officials "turn on" the GWR System in January 2008*

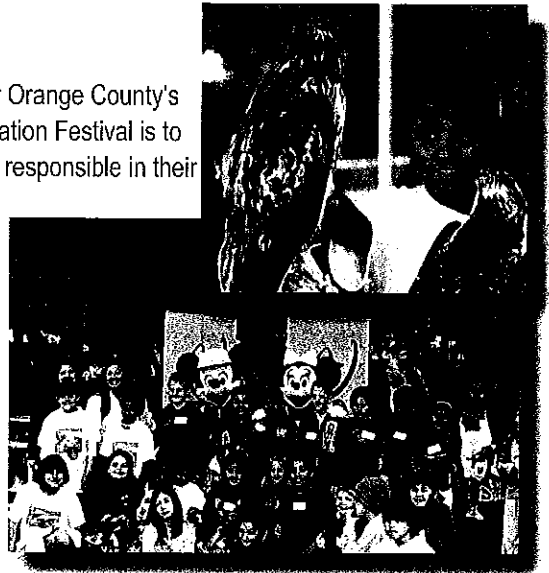
# Water Conservation Programs

*The Orange County region is at the forefront of water conservation. The Orange County Water District has made a commitment to practicing and instilling life-long water saving habits. The District's conservation programs draw families' attention to the state's water needs and crisis, teaching them useful and simple ways to reduce water consumption, respect this natural resource and establish a life-long commitment to conserving water.*

## Children's Water Education Festival

The Children's Water Education Festival is a two-day educational event for Orange County's fourth- and fifth- grade students. The mission of the Children's Water Education Festival is to educate students about the importance of water and to be environmentally responsible in their actions. The Festival is hosted by the Orange County Water District Groundwater Guardian team, comprised of local educators, businesses, government and public agencies, and community volunteers. Disneyland Resort and the National Water Research Institute have been presenting sponsors for more than 10 years. The Festival began in 1997 in the city of Anaheim, serving 1,000 children, and has grown to be the largest of its kind in the nation. In 2008 it served more than 6,100 students.

The environmental issues that precipitated the development of the Festival were the drought-like conditions experienced in the semi-arid region of Orange County, California and the ongoing decrease in Southern California's imported water supplies. Early on, these events prompted a call to action to educate residents, especially children, about water issues. Throughout the years the Festival has empowered children to help protect and preserve our local water supplies and to begin a lifelong path of environmental stewardship.



## O.C. Water Summit

The summit provides a platform for individuals to engage with business, community and civic leaders to learn where our water comes from, information about the water supply crisis and water quality challenges we face. The event educates the public on what temporary measures are in place to address these issues as well as possible solutions to water reliability and preserving the Bay-Delta River, California's main source of water.

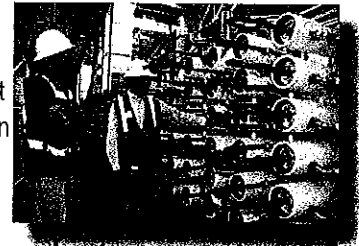
A collaborative effort between businesses, water agencies and local governments, the summit provides a platform for individuals in the community to work with water utilities and legislators on creating and implementing solutions that will see Orange County through future water challenges. Topics for each summit are determined according to the water climate each year.

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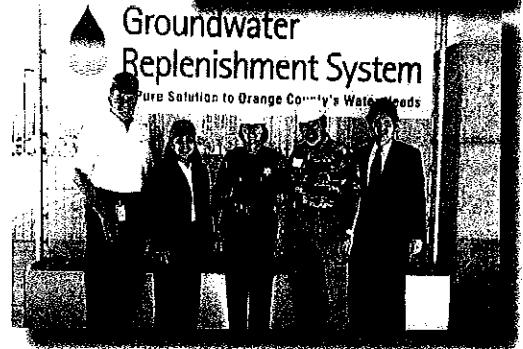


## Facility Tours and Water 101

Orange County Water District (OCWD) offers public tours of the Groundwater Replenishment System, the world's largest indirect potable use facility. Throughout the tour, participants learn about the dire water situation and the need for large scale water reuse as well as individual water conservation. In addition, OCWD offers bi-yearly tours of its groundwater recharge facilities and wetlands at Prado Dam. Guests learn about Orange County's current and future water supplies.



O.C. Water 101 is a free water education class that is offered to the public. The class focuses on the global water crisis, how water affects health, California's unique water situation, what the future holds for water supplies in Orange County and what water agencies are doing to help conserve available water resources. The class also includes discussions on high-tech solutions to help alleviate water shortages today and in the future, as well as providing individuals with the resources and information necessary to save water. Class attendees include college students, business professionals and parents participating through their children's involvement in the Water Hero, Water Camp, Children's Water Festival and School Water Education components of OCWD's conservation programs.



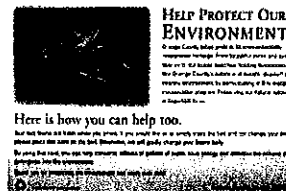
## Water Hero

The O.C. Water Hero program is designed to make water conservation fun while helping children and parents develop effective water-use efficiency habits that will last a lifetime. When a student signs up to commit to saving 20 gallons of water a day, the District sends them a letter announcing that he/she is a Water Hero along with a Water Hero Kit: a Water Hero Badge, a Water Waster "Fix It Ticket" Pad, conservation stickers, a shower timer, activity pages based on California state teaching standards and a water saving pledge card for parents to sign and return. When we receive a pledge card from a child and a parent pledging to each save 20 gallons of water a day, the child then becomes a Water Superhero.

The Superhero kits include a certificate, indoor/outdoor water saving tips and a t-shirt. Our goal is to raise awareness of the need to conserve water and motivate County residents to reduce their water consumption by 20 gallons per person per day. Since its inception in 2007, more than 4,000 Water Heroes and Super Heroes have enrolled in the program. They have successfully engaged 4,000

## Hotel/Motel Water Conservation Program

OCWD maintains a water conservation effort designed specifically for hotels and motels in Orange County. At no cost, hotels and motels can order laminated towel rack hangers, bed cards or combination cards, which ask guests to consider using their towels and bed linens more than once. The cards, which gently encourage guests to be environmentally aware, help hotels and motels save water and ultimately money. 232 hotels are currently enrolled in the program. Orange County has many tourist destinations, most notably the Disney® parks and resorts. These cards encourage visitors to protect our local water supplies.



### HELP PROTECT OUR ENVIRONMENT

